THE CONTRIBUTION OF MEDICINAL AND WILD FOOD PLANTS TO THE WELL-BEING OF RURAL COMMUNITIES IN LINDI RURAL DISTRICT, TANZANIA

BY

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ABSTRACT

A study was undertaken to assess the contribution of medicinal and wild food plants to the well-being of rural communities in Lindi Rural District, Tanzania. Structured and semi structured questionnaires and Participatory Rural Appraisal were used for socio-economic data collection. Systematic sampling design was used for the inventory of medicinal plants, wild food plants and other non-timber forest products. Statistical Package for Social Science Programme (SPSS), pair wise and preference ranking, content and structural methods were used in data analysis. It was found that medicinal and wild food plants contributed about 4% to household food security and 5.5% to household income. The percentage contribution of medicinal and wild food plants to the household food security and income seems to be small probably due to their low monetary value in Lindi. However, the study revealed that 79.7% of people in the study area relied on medicinal plants and 81.7% used wild plant foods. It was concluded that medicinal and wild food plants play a big role to the rural communities in Lindi Rural District but overharvesting of these plants especially the roots could endanger their sustainability in the forests. It is recommended that to ensure their sustainable supply, medicinal and wild food plants be domesticated and restrictions be formulated and enforced to minimize overharvesting of medicinal and wild food plants to enable sustainability of these plants in the forests. It is also recommended that medicinal plants be integrated with the modern health care systems as well as wild plant foods be integrated in the national food security programme. Also efforts should be made to add value to medicinal and wild food plants by developing and disseminating simple appropriate technologies for processing of these products. It was further recommended that more research be carried out on processing, marketing and domestication of these plants.

DECLARATION

I, Mandalo Abeid Salum, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my original work and that it has not been submitted for a higher degree at any other University.

Signature: .....

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This work is dedicated to my beloved father Mr. Abeid Salum Dangi and my mother Mayasa Jackson Mawopc who tirelessly built my foundation in education. May Allah, the Almighty bless them indefinitely, AMIN.

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DANIDA	Danish international Development Agency
DED	District Executive Director
DFO	District Forest Officer
DNRO	District Natural Resources Officer
FAO	Food and Agriculture Organization
FBD	Forestry and Beekeeping Division
MNRT	Ministry of Natural Resources and Tourism
MO	Manpower Officer
NGO's	Non Governmental Organizations
NTFPs	Non-Timber Forest Products
PFM	Participatory Forest Management
PRA	Participatory Rural Appraisal
SPSS	Statistical Packages for Social Sciences
SUA	Sokoine University of Agriculture
Tsh	Tanzania shillings
UNESCO	United Nations Educational, Scientific and Cultural Organization
US $	United States Dollar
USAID	United States Agency for International Developments
UTUMI	Utunzaji wa Misitu
VNRC	Village Natural Resources Commettee
WHO	World Health Organization
WWF	Worldwide Funds for Nature

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background information

Medicinal plants refer to plant species used to treat physiological or psychological ailments for patients (Abdallah, 2001). Rainforests contain about 60% of all higher plant species known on earth and they provide all that is needed for human survival, including remedies against diseases (FAO, 1997). More than 35 000 plant species are being used in various cultures for medical purposes in Tanzania and many of them are subjected to uncontrolled local and external trade (Liwenga, 1995). Plants have contributed hugely to western medicine, through providing ingredients for drugs and played central roles in drug discovery (RITAM, 1999). Twenty five percent of present prescription drugs are derived from plants. The best known are quinine from the cinchona tree, morphine from the poppy, aspirin from the willow, digitalis from foxglove, vinblastine and vincristine (first choice drugs treating hodgkin's disease, acute leukaemia, various lymphomas, advanced breast cancer, and now HIV related kaposi's sarcoma) from the rosy periwinkle and cotexin from Artemisia for treating malaria (RITAM, 1999).

Medicinal plants constitute one of the most important groups of wild plants in terms of their contribution to the economy and well-being of rural households (Cole, 1996). They are used by a large segment of the population. Collecting and selling of medicinal plants are among the most important ways of making a livelihood for those who have no other means of income. Using medicinal plants is also the most important way of getting relief from various diseases. World Health Organization (WHO) estimated that four billion people (about two third of the world population) depended on traditional medicine for their

primary health care needs (Michael *et al.*, 1996). A large part of traditional therapy involves the use of medicinal plants or their extracts and active compounds. Medicinal plants are a source of inexpensive medicine and used by the under-served populations of the world (WHO, 1978; Ayensu, 1981 and Michael *et al.*, 1996).

More than 80 percent of the people in South Asia rely on herbal remedies as a principle means of preventing and curing illness, and several traditional medical systems are based on the use of plants. There are several advantages to such systems: the plants involved are readily available, are easy to transport, and do not spoil quickly (FAO, 2000). Remedies based on medicinal plants often have minimal side effects, and the relatively high cost of synthetic medicines in developing countries often makes traditional herbal medicines an affordable option for the poor in these lands (FAO, 2000).

The use of plant medicines is currently increasing compared to the past in Ethiopia (Dessisa, 1997). This is due to the fact that modern medicine has become very expensive and beyond the reach of most people. The value and role of traditional health care systems will not diminish in the future because they are both culturally viable and expected to remain affordable (Dessisa, 1997). A similar situation exists in Tanzania where an estimated 80% of the Tanzanian rural population still depends on traditional healers and medicinal plants for primary health care (Dery *et al.*, 1999). This has been triggered by an extremely low number of doctors, costs involved in hospitals, little funds allocated to the health sector and difficulties in curing some of the diseases.

Traditional societies use various wild plants during both times of bumper harvest and food deficit (Zinyama *et al.*, 1990) and utilization of wild foods is one of the adopted strategies

for coping with food deficit. According to Ruffo *et al.* (2002), wild food plants are those plants with edible parts, which are found growing naturally on farms, fallow, uncultivated land, in forests and woodlands. Examples of foods from wild food plants include wild fruits, mushrooms, wild roots and tubers, wild grains, wild vegetables, wild legumes, and extracts. Wild foods contain essential carbohydrates, fats, vitamins, minerals and proteins that are essential for human consumption.

The contribution of wild food plants to household economies varies among households. Although no household depends entirely on wild sources throughout the year in terms of food, wild plants help to meet minimal subsistence needs or may be used as luxuries. If collected in surplus, they can be bartered or sold in local markets. In Turkey, for example, widely diverse wild food plants are collected for personal and home consumption, and any surplus is sold on the street or in city markets, usually by women in what are known as "women's markets" (FAO, 2000). Wild food plants contribute significantly in supplementing nutritional deficiencies common in Tanzania (Makonda, 1997).

Many plant species are taken as medicine or tonic and are added to cooked meals or are consumed daily. Plants also provide medicines for livestock diseases and thus are important for maintaining livestock production and hence improve food security. However, for many years the importance of medicinal and wild food plants in subsistence agriculture in the developing world as a food supplement and as a means of survival during times of drought and famine has been overlooked (Bell, 1995).

1.2 Problem statement and justification

1.2.1 Problem statement

In Tanzania like most other third world countries, poverty, as measured by income, tends to be at its worst in rural areas (World Bank, 1990). In these rural areas, income is low while poverty is more widespread and deep rooted. According to the World Bank (1993), Lindi region is one of the poorest parts of Tanzania in terms of average per capital income, and more than 90% of its population lives in poorest households.

Lindi Rural District is among the six districts of Lindi region. The majority of people in the district are still living under appalling conditions such as poor access to health care services, food insecurity (one to two meals a day), poor housing, and access to vital resources (personal communication). The source of revenue options in the area includes farming, gathering, fishing, hunting, craft making and civil service. Majority of rural people in the area depend on agriculture, which is at subsistence level and not enough to keep pace with the population because of low soil fertility, which could support production of cassava and cashew nut only.

Lindi Rural District is endowed with forests and woodlands that provide a lot of NTFPs that includes medicinal and wild food plants, which have a potential to contribute directly in improving the well-being of villagers. Some products are either consumed as subsistence or sold to contribute to household economy. On daily subsistence, poor households residing in or around forest areas depend to a varying extent on utilization of medicinal and wild food plants, which are particularly important in reducing the shortage suffered during the "hunger periods" of the agriculture cycle. They help to balance-out

seasonal fluctuations in availability of food and supplement the diet and contribute essential inputs for household nutrition (FAO, 1997).

Despite the fact that medicinal and wild food plants contribute substantially to rural people's well-being, little has been done in Lindi Rural District to assess their contribution to the well-being of rural communities. As a result it is not known to what extent medicinal and wild food plants contribute to household well-being of community in the area and there is poor organization in utilizing medicinal and wild food plants, which in turn result into unsustainable utilization of these products.

1.2.2 Justification

Given the role played by medicinal and wild food plants it is worth to study the contribution of medicinal and wild food plants to the well-being of rural communities. Results from this study will form a basis for recommendations on sustainable harvesting, processing, storage, utilization and marketing of medicinal and wild food plants. The study will also give recommendations on integration of medicinal plants into the conventional health care systems and integration of wild foods in the national food security programme. This will in turn raise the living standards of the communities thus reducing poverty.

1.3 Objectives of the study

1.3.1 Overall objective

The overall objective of this study was to assess the contribution of medicinal and wild food plants to the well-being of rural communities in Lindi Rural District, Tanzania.

1.3.2 Specific objectives

The specific objectives of this study were:

(i) To identify medicinal and wild food plants in the study area.

(ii) To identify and assess methods of collection/harvesting, processing, storage, and utilization of medicinal and wild food plants.

(iii) To determine the proportion of population relying on medicinal and wild food plants.

(iv) To determine the share of medicinal and wild food plants to household income, primary health care and food security.

1.4 Research questions

(i) What are the medicinal and wild food plants available in the study area?

(ii) What are the methods of collection/harvesting, processing, storage/preservation, and utilization of medicinal and wild food plants in the study area?

(iii) What is the proportion of population relying on medicinal and wild food plants in the study area?

(iv) What is the contribution of medicinal and wild food plants to household income, primary health care and food security?

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview

Forest resources contribute to the well-being of mankind by providing timber and non-timber forest products. The livelihood of the majority of rural people in African dry lands depends on the forests and woodlands as sources of agricultural land, firewood and charcoal, as well as non-timber products such as food, fibre and medicines. It is also in these forests where various plant species for medicine and other products can be found (DANIDA, 1989). About 38% of the Tanzania's 886 000 km^2 total land area is covered by forests and woodlands (URT, 2001). The forestry industry as well as rural population living around these forest areas has been relying heavily on the use of material from the natural forests. The Utunzaji wa Misitu (UTUMI) project conducted some survey on some NTFPs including medicines and wild foods. However, the study was not comprehensive enough to determine the contribution of medicinal and wild food plants to the well-being of rural communities.

Trees and forests contribute in many ways in providing diets and combating hunger in local communities and rural households. Trees and forests do not only provide food and medicine but also income. Hunger and malnutrition would have been rampant if it was not for the contribution of trees and forests to household food security (FAO, 2000). Forest make a particularly important contribution to the nutrition of the rural poor, who, more than others, are likely to depend on trees for a significant part of their income and food supply (FAO, 2000).

2.2 Medicinal plants

Medicinal plants are plants used in treating and preventing specific ailments and diseases (Abdallah, 2001). Medicinal plants are found in a wide range of habitats: tropical forests, temperate forest, secondary forest, scrublands, meadows, swidden fallows, agricultural fields, home and house gardens, in fact any area where human societies, both urban and rural harvest, manage or grow useful plants (Cole, 1996).

2.2.1 Current status and global overview of medicinal plants

It is world widely estimated that about four billion people (about two third of the world population) depend on plants medicine for their primary health care needs (Michael *et al.* 1996). According to Hamza (1997), plant remedies account for about 90 percent of all used treatment worldwide and a good amount of income is being made from the sale of traditional medicines. In China, for example, about 1 000 million people, both urban and rural depend largely on plant- based medicines. About 800 million inhabitants of South Asia rely on herbal medicines. In India, traditional health care systems, such as Ayurvedic, Unan, Sidda, and Tibetan medicines, run in parallel with the contemporary health care sector, while the Sri Lanka government has a Ministry of Indigenous Medicine, which has set up medicinal plant nurseries. In developing countries, including those in Africa, about 70-80% of people depend on traditional medicine for their health care (Cunningham, 1994; WCMC, 1992). In Tanzania the number is a bit high, for example, in Meatu district about 91% of the population rely on medicinal plants for their primary health care (Kagya, 2002).

The use of medicinal plants in most developing countries as a traditional base for maintenance of good health has been widely observed (UNESCO, 1996). Medicinal plants have been used since pre-historic times. The evidence for man's dependence on plants for

survival has been demonstrated by findings from prehistoric archaeological investigation (Smith, 1986). It is unlikely that the situation has changed today since the use of traditional medicine will most likely continue to increase as the population grows (Medius, 1998). Heavy reliance on plant medicines was attributed to their relative accessibility, low prices, local availability and acceptance by local communities as well as low number of dispensaries and doctors especially in rural areas (Minja, 1992).

2.2.2 Harvesting of medicinal plants

Gathering of medicinal plants is associated with rules and rights. For example, collection is allowed only early in the morning and late afternoon and some plants are supposed to be collected late evening with minimal disturbance or placing some money at the base of the mother trees with reciting some verses to the ancestors (Odera, 1997). In some cases sacrifice must be made before medicines are gathered from particular plants. Medicine efficacy is thought to be highest from plants collected in the wild and plants from deep in the forest are considered to be stronger than those from the fringe (Abdallah, 2001). Various plant parts, including roots, barks, leaves, branches or twigs, stems, flowers of the trees, shrubs, climbers, epiphytes and parasites are gathered (Hamza, 1997). There is no specialized trend on the roles of women and men with regard to collection of medicinal plants. Locally recognized traditional healers, whether men or women, frequently carry out the collection themselves in the forests partly to maintain secrecy of knowledge of relevant species (Kessy, 1998; Otieno, 2000).

Open access to medicinal plants in the wild is perhaps one of the main reasons for the current unsustainable levels of harvesting. Other factors contributing to overharvesting of medicinal plants include, lack of sufficient data on wild plant populations, marketing, and

trading, inadequate regulations and legal protection (including intellectual property rights for local practitioners with local knowledge) and poor access to appropriate technology for sound harvesting and plantation development (FAO, 2000).

2.2.3 Importance of traditional healers and medicinal plants to the health of communities

A traditional healer is a person who is recognized by communities in which he/she lives. He or she is believed to be competent to provide health care by using plant, animal and mineral substances and certain other methods based on the social, cultural and religious background (Kokwaro, 1993). Traditional healers get the knowledge of medicinal plants utilization orally from their elders, which are normally passed on from master to apprentice. As it is reported by Medius (1998), traditional healers are elderly people and younger generation appears unwilling or unable to serve as the receptacles of collective oral tradition. As a result a lot of valuable information can be lost or distorted whenever a medicine man dies without revealing his knowledge to another person (Kokwaro, 1993). There is, therefore, an urgent need to formulate an array of incentive measures to ensure that members of the younger generations will want to learn values, adapt and apply the traditional knowledge, innovations and practices of their elders.

It was estimated that in 1982 about 30 000 to 40 000 traditional healers were working in Tanzania, compared to 600 medical doctors (Cunningham, 1993). It was also reported that Tanzania was estimated to have over 60 000 traditional healers (Weenen, 1990 in Hines and Eckman, 1993). These figures emphasize the importance of medicinal plants for primary health care. The Tanzanian Government has recognized the importance of traditional practitioners by establishing the Traditional Research Unit at Muhimbili

Medical Centre. Akerele (1987) and Anyinam (1987) pointed out that there is a need, through training and evaluation of effective remedies, to involve traditional healers in national health care systems, as they are an important and influential group involved in health care. Sustainable use of the major resource base of traditional healers in medicinal plants is therefore essential.

2.2.4 Factors contributing to communities dependence on medicinal plants

The dependence of communities on medicinal plants is due to the following factors: tribal beliefs in power of herbs or tree parts to bring fortunes or misfortunes, good health and success; inadequate medical facility and qualified personnel in hospitals; recently introduced cost sharing in hospitals, which to most people the cost is unbearable and lead many people to resort to herbalists. Other factors include long distance to health centres and clinics, poor transport facilities and low-level income of household (Minja, 1992; Maximillian, 1998 and Abdallah, 2001).

2.2.5 Trade on medicinal plants

Medicinal plants are used in traditional medicine and traded on the world market. At least 150 medicinal plants were reported to be traded on the world market (Mhame, 2000). International trade in medicinal plants both within South Asian countries and with East Asia, Europe and North America is growing in economic importance. For example more than 90% of the medicinal plants exported from Nepal go to India, earning an estimated US$ 8.6 million annually (FAO, 2000).

In Tanzania the most traded medicinal plants include *Cinchona spp. (C. calisaya, C. ledgeriana, C. officinalis, and C. pubescens).* The bark of *Cinchona spp* is used to extract

alkaloids (e.g. quinine, quinidine), which are necessary for the production of anti-malaria drugs. Other medicinal plants traded on the world market are *Prunus africana* and *Warburgia salutaris*. Some 120 t of bark of *Prunus africana* are extracted every year from the natural montane forests in Tanzania (Mhame, 2000). The value of the bark is estimated to be US$ 2-10 per kg.

Although nationally medicinal products are not basically recognized as an important source of economic gain, individual people and or companies have found this to be one of the areas for economic gain. In 1999 for example, Tanzania exported medicinal products, which earned the government 21.6 billion shillings (Mhame, 2000). To date, with free market economy the country is experiencing economic gains since many people have engaged themselves in the business of medicinal plants and various nations are becoming important countries for the importation of Tanzanian medicinal plants (Mhame, 2000).

2.3 Wild food plants

The term wild food plants is used to describe all plant resources outside agricultural areas that are harvested or collected for the purpose of human consumption in forests, savannah and other bush land areas (Bell, 1995). Wild plant foods are incorporated into the normal livelihood strategies of many rural people be they pastoralists, shifting cultivators, continuous croppers or hunter gatherers (Bell, 1995). Often wild food plants are considered to be a low-status food and its consumption regarded as a source of shame. In normal times only children, youngsters and the poorest families collect and consume regularly wild-food. But for the poorest, collection and consumption of wild-food can make up an important portion of their daily dietary intake (Guinand and Lemessa, 2000).

Wild food plants offer vital insurance against famine during times of seasonal food shortages or emergencies such as droughts, floods and wars. It is common for rural household to depend on wild food plants between harvests, when harvested stocks have been consumed and the next crops are yet to mature. Forests, trees, and fallow farms make significant contribution to food security of rural populations (FAO, 1997; Kajembe, 1994), but foresters and nutritionists have rarely paid sufficient attention to wild food plants. Forests and trees play an important role to the well-being of rural communities. However, it is important to note that forests cannot replace agricultural food production systems (Hoskins, 1990).

"Famine foods" is the term applied to wild foods that are an important component of local survival strategies at times of severe food shortage (FAO, 2000). Such food resources have had a critical role in major famines in the past, such as the Bihar famine in India in 1965-66 and the famine in Bangladesh in 1974-75. A wide range of species is used, including many wild green vegetable leaves, roots and grass seeds. Famine foods are still important in many areas today and in exceptional cases may be the only source of food available.

2.3.1 Types of wild food plants

There are different types of wild plant foods. These plants include wild fruits, wild legumes, wild roots and tubers, wild vegetables, mushrooms, extracts and wild grains.

2.3.1.1 Wild fruits

There are a number of wild fruits consumed worldwide. Fruits are mostly consumed raw and as snacks. Most fruits are valued as food for children and are largely collected by children. It was reported by Hines and Eckman (1993), that where exotic fruits such as

mangoes, papaya and banana are planted, little use is being made for wild fruits. Likewise where a large number of indigenous fruit trees have been retained or planted the variety of exotic fruits is small. A study conducted by Campbell (1986) on the use of wild fruits in Zimbabwe found that there were many fruit species. For instance it was reported by Ramadhani *et al.* (1998), that there are more than 50 indigenous tree species in the miombo woodlands, which bear edible fruits in Tanzania. Similarly Makonda (1997) identified 39 species of wild fruits, which were consumed in Geita district, Mwanza, Tanzania.

2.3.1.2 Wild roots and tubers

Starch reserves in wild stems, roots and tubers usually constitute a major food source in forest areas. Forest yams, which constitute the tubers of lianas, are consumed in Africa, Australia and Asia (FAO, 1995). Wild roots and tubers are important source of food because they are available and consumed throughout the year particularly during periods of food shortage. A survey in two villages of Mtwara region by Missano *et al.* (1994), found that wild roots were being consumed widely by rural people and were being brought by town dwellers as snacks when travelling inland. The cassava-like wild starchy roots known as *Dioscorea spp* (ming'oko) were widely used in two villages of Mtwara region. With the exception of cassava, *Dioscorea spp* (ming'oko) is important because it is available and consumed throughout the year particularly during periods of food shortage. It is believed that without *Dioscorea spp* the hunger incidences could have been more adverse.

2.3.1.3 Wild legumes

Wild legumes contribute to household food security especially during hunger periods usually before the new harvest (FAO, 1995). The seeds of the African locust bean (*Parkia spp*), a perennial tree legume, are consumed in Africa, South -East Asia and tropical South

America. In Malaysia and Indonesia, the whole pods, sometimes preserved by pickling in salt, are eaten raw or cooked as a vegetable known as *petai*. The beans mature in dry season in February and March, providing valuable food in the middle of the hunger season before the new harvest (FAO, 1995).

2.3.1.4 Wild vegetables

Wild leaves contain more riboflavin than eggs, milk, nuts or fish. Herbaceous plants and young leaves are eaten as vegetables and provide essential vitamins. *Gnetum africanum* is a central African forest creeper whose perennial foliage is consumed in large amounts as vegetable (Fleuret, 1979). The leaves are gathered and cut into thin slices. These can be eaten raw and green but are generally added to meat and fish dishes at the end of cooking time. In East Usambara, Mattila *et al.* (1997) found out that many informers preferred wild vegetables to the cultivated ones. Fleuret (1979) and Kajembe *et al.* (2000) reported that wild green leafy vegetable were an essential part of diet, which accounted for 81.2% of all side dishes in West Usambara.

2.3.2 Processing, preservation, storage and consumption of wild plant foods

Processing techniques vary from one society to another; depending on the nutritional content and quality of food eaten. There are various ways of processing wild plant foods such as smoking and sun drying. Drying is very common in some parts of Zimbabwe (Gumbo *et al.*, 1990). The fruits of *Sclerocarya birrea* and *Zizyphus mucronata* are not only consumed in their natural forms but also can be converted into alcohol, which is either consumed locally or sold (Gumbo *et al.*, 1990). Knowledge gained from processing, preservation and storage of wild plant foods will save as inputs while drawing strategies to cope with food shortage.

In Ethiopia, for instance, women and children are the main actors concerning the collection, preparation and consumption of wild food plants. Children forage and climb trees for collection while women do the preparation and the cooking (Guinand and Lemessa, 2000). It was further commented that young boys consume more wild-foods than older ones in normal times (Guinand and Lemessa 2000). At times of food shortage, however, all ages and both sexes consume equally. But young boys do not eat wild plant foods simply to satisfy their need for additional sustenance but also because there exists a traditional obligation and social group pressure at a certain age to collect and eat for example wild fruits together with children of the same age.

2.2.3 Marketing of wild food plants

There is scarce information on marketing of wild food plants in the study area. Some of the gathered products including wild food plants often have low value in rural areas because of generally high supply, competition amongst sellers, and low rural demand especially during the season of abundant production (Brigham *et al.*, 1996). High perishability of most wild plant foods results in low prices as sellers try to realize some return before the products get spoiled (McGregor, 1995). Prices of indigenous fruits are always lower compared to exotic ones such as pears and oranges (Karachi *et al.*, 1991).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Study area

3.1.1 Geographical location and size

The study was conducted in Nndawa, Mihima, Maloo and Kilolambwani villages in Lindi Rural District. Lindi Rural District lies between latitude 9° 30' to 10° 45' South and longitude 38° 45' to 40° 00 East. The district is bordered by Ruangwa district to the west, Kilwa district to the north, Mtwara region to the south and the Indian Ocean to the east (Figure 1). Lindi Rural District has an area of 7, 538 km ^{2} (URT, 1997).

3.1.2 Climate

The area experiences two major seasons, namely dry and wet seasons. The area receives low rainfall, which varies between 800 and 1 000 mm. The rainfall occurs between November and May when the northeast monsoon wind predominates. Average temperatures ranges between 24° to 27° C with little variation between mean monthly temperatures or day and night temperatures (Machumu, 2001; URT, 1997).

3.1.3 Soil and physical features

The soils are generally well drained, red in colour and differ in depth from very deep to shallow. Along river valleys soils are fertile and seasonally flooded. Lindi Rural District has a long coastline, which has a length of approximately 130 km. Along most of it there is a narrow fringing reef about one to two km off shore with a steep slope, which drop to a depth of about 500 m. The coastal area is predominantly marine limestone with exception of few muddy areas (Machumu, 2001).

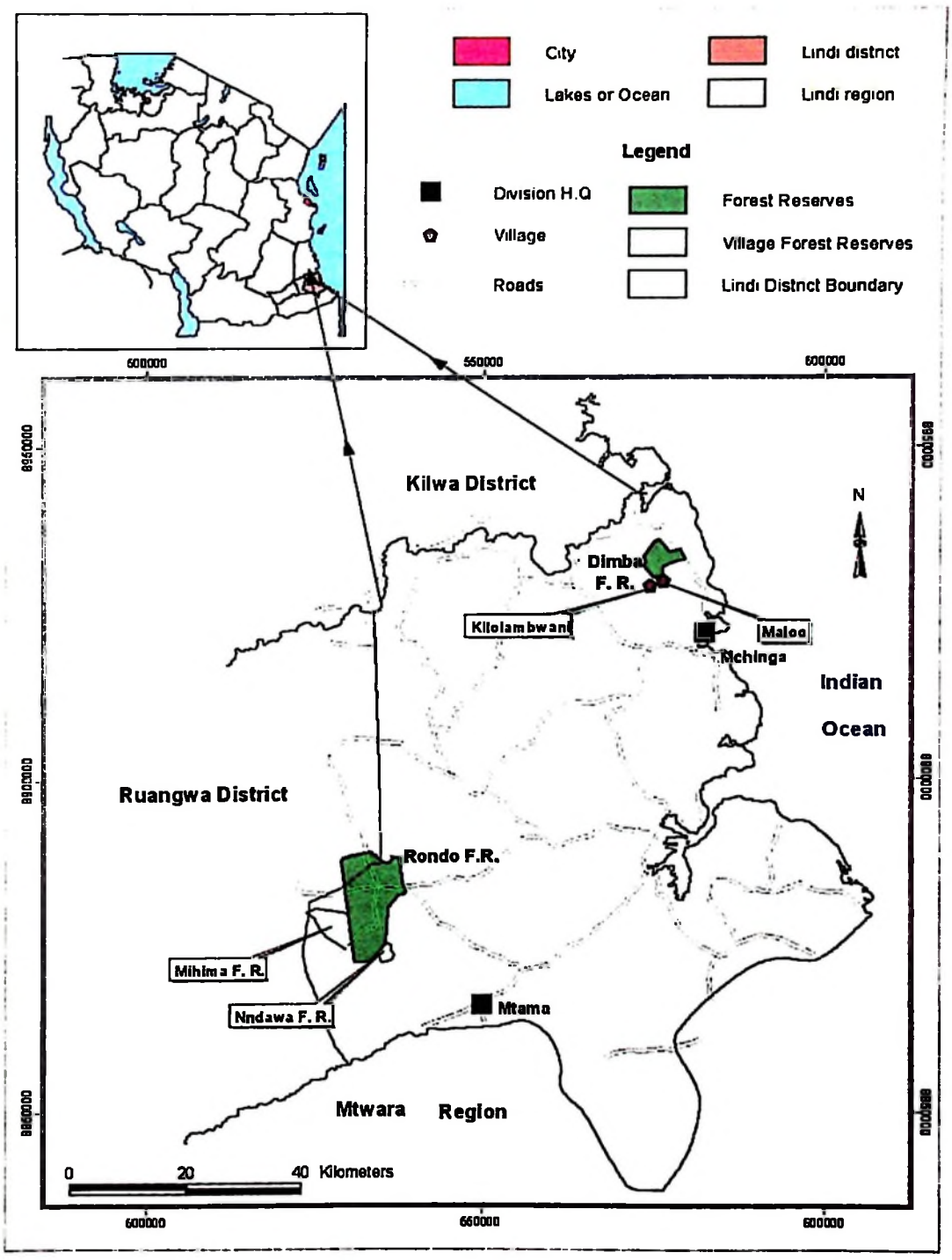

Figure 1: Location of villages and forest reserves surveyed in Lindi Rural District

3.1.4 Vegetation

Three types of forests, namely high forests, mangrove forests, which broadly occur along the coast and miombo woodlands, characterize Lindi Rural District. The high forests are extensively diminishing as a result of shifting cultivation. The district is also dominated by coastal forests, which are rich in biodiversity of both flora and fauna. Some coastal forests include Dimba forest reserve, which is adjacent to mangrove forest reserve of Sudi. Others are Rondo, Chenoa, Ruawa, Matapwa and Mkangala. Apart from coastal forests part of the district is dominated by miombo woodlands (Machumu, 2001).

3.1.5 Population

The human population of Lindi Rural District is 215 764 of which 102 530 are males and 113 234 are females (URT, 2002). The rate of population increase in the district is 1.4%, which is lower than the national average of 2.8% (URT, 2002). This is due to low fertility and high infant mortality rates. The major ethnic groups in the district are Mwera, Makonde, Matumbi and Ngindo. Other minor ethnic groups are Ndonde, Yao and Machinga (URT, 1988).

3.1.6 Socio- economic activities

The main economic activities of villagers in the study area include farming, carpentry and small business. According to URT (1997), small-scale farmers provide 90% of the total district agricultural production. Virtually all the land is hand tilled. As a result only limited areas are being cultivated. The main food crops grown are rice, sorghum, maize, cassava, cowpeas and pigeon peas. Cash crops include cashew nuts, groundnuts and simsim. Most of the land is under communal ownership.

Fishing provides the main source of protein, but not every household has a fisherman. Fishing is also a seasonal activity; maximum abundance of fish coincides with that of the northwest monsoon winds while minimum fish abundance coincides with southeast monsoon. The boats engaged in fishing are traditional canoes with poor fishing gears. Lindi Rural District is the best area along Tanzanian coast for salt production, because of its long dry season and the relatively low rainfall. Only few people, however, are engaged in this business due to high investment costs required for production.

According to URT (1997), Lindi Rural District has an average of 3 120 cattle, 7 650 goats and 1 530 sheep. Beekeeping is also practised in the study area. Most of the villages that are engaged in beekeeping activities are those, which are involved in different forestry related projects like Mangrove project and Utunzaji wa Misitu project (UTUMI) (personal communication with project manager (PM) and Village Natural Resources Committee (VNRC) members.

3.2 Types and sources of data

3.2.1 Primary data

Both primary and secondary data were collected. Primary data were obtained through PRA (Participatory Rural Appraisal) and interviews using both structured and semi-structured questionnaires, informal discussions with village elders and direct observations. PRA was geared towards generating information on medicinal and wild food plants; it is commonly referred to as tropical PRA.

3.2.2 Secondary data

Secondary data involved collecting information from different sources including books, journals and official reports, in libraries, NGO's, relevant government offices and other institutions. Secondary data were obtained by consulting relevant documents, both published and unpublished to form an overview and identify gaps in information. Electronic databases such as the CD-ROMs and websites were explored.

3.3 Data collection methods

3.3.1 Socio-economic data

3.3.1.1 Sampling procedure and household questionnaire survey

A multistage sampling was used in sampling of villages. Two divisions out of ten divisions in the district were purposively selected. The two divisions were selected based on the fact that they were pilot divisions which practised Participatory Forest Management (PFM) under the Utunzaji wa Misitu (UTUMI) project. Then from the selected two divisions again two wards from each division were selected. Further, two villages were selected from each of the selected wards. Therefore the study was carried out in four villages namely Nndawa, Mihima, Kilolambwani and Maloo. These four villages were selected according to the distance from the forest, with assumption that, they were close to the forest and that the communities were more knowledgeable about the forest as compared to those of other villages.

At the village level a household was taken as sampling unit. A representative sample of respondents was selected from the villages based on random sampling procedures. This is because it is at the household where all decisions about consumption, production and investment are primarily taken. A village register was used as a sampling frame and

households were randomly picked and the questionnaire was administered to heads of the selected household. Boyd *et al.* (1981) recommended that for a random sample to be a representative it should constitute at least 5% of the total population. In each village 30 households were interviewed which is 6%, 16%, 5% and 11% for Ndawa, Mihima, Maloo and Kilolambwani villages, respectively.

3.3.1.2 Participatory Rural Appraisal (PRA)

According to Duangsa (1996), PRA technique is a flexible strategy, which draws on community expertise and involvement to get action-based, timely cost effective and reliable information and it complements other research techniques. It serves the purpose of dialogue, information generation and analysis. The PRA participants were the Village Natural Resource Committee (VNRC) members from the four villages and other stakeholders dealing with utilization of medicinal and wild food plants. During the PRA exercises, the participants were divided into three groups, i.e. women, men and youth. Women and men were of the age above 35 years and youth were age between 24 and 35 years. The grouping was meant to capture both gender and intergenerational differences. A checklist was used to collect information from key informants. A key informant is an individual who is accessible, willing to talk and has a greater depth of knowledge about the issue in question. Key informants are not only members of the clientele, but also outsiders (Mettrick, 1993).

PRA technique used for data collection based on interactive learning, shared knowledge, flexibility and structural analysis, transect walk, free listing, pair wise and preference ranking and participant observation. The methods quickly generated information on how much medicinal and wild food plants contribute to the well-being of the community in the

study area. Also, the method was based on semi-structured interviews, which involved open and closed ended questions (Martin, 1995).

- **Transect walk**

Tribal and non-tribal people who have strong ties to the forest can identify hundreds of productive species and how they are used as source of food, medicine, fibre, and construction materials (Martin, 1995). Thus ten to fifteen people who have good knowledge of the forest were purposively selected to accompany the researcher during transect walk through the forest in each village. Transect walk involved physical observation and identification of medicinal and wild food plant species together with other useful plants to villagers. Plant specimens were taken, pressed and labelled for scientific identification.

- **Free listing**

A list of medicinal and wild food plants given by respondents was compiled. For each plant listed, the parts used, rules and procedure for management, conservation status as well as their percentage were recorded.

- **Pair wise and preference ranking**

The two techniques were used to rank medicinal and wild food plants mostly preferred in the study area. These techniques were used to study the ranking given to each of the different types of medicinal and wild food plants. Pair wise and preference ranking were also used to rank medicinal and wild food plants used mostly by each member of the community. The respondents were asked to rank them in their order of preference and the results were recorded.

- **Group discussion**

Focus group discussions were conducted in each village. The focus group comprised of 10-18 men and women of different ages. The meeting discussed on the availability, seasonality and identification of different medicinal and wild food plants, their collection, utilization, processing, storage and information on their sources and marketability. The issue of food security in the study area was discussed in detail during group discussion.

- **Informal discussion**

Informal discussions in form of conversation with local people on medicinal and wild food plants were conducted. Such conversation was held at any place, where the researcher found it appropriate. The information was recorded immediately after the conversation.

3.3.2 Questionnaire survey

The information on medicinal and wild food plants were recorded by means of open–ended questionnaire in which the participants were free to give their own answers. This was used to avoid yes or no answers likewise the close-ended questionnaire encouraged maximum discussion while in close-ended a number of alternative answers were provided. These were conducted in the local language (Kiswahili) with each of the respondents selected for this study. According to Newell (1993), open-ended questions allow individuals to respond in any way they wish while the opposite is true for closed questions but they can be pre-coded easily, save time for both the interviewer and respondent. A questionnaire was used as a tool for interviewing heads of households although other members of the household were allowed to participate so as to supplement information (Appendix 1a). Five questionnaire sets were designed for the purpose of data collection from households, herbalists, traditional midwives,

health workers and other key informants in each of the villages visited (Appendix 1 a, b, c, d, and e).

3.3.3 Ecological survey

Ecological data was collected by using forest inventory. The inventory was specifically for medicinal and wild food plants and other non-timber forest products only and it covered three-forest reserve namely Nndawa village forest reserve, Mihima village forest reserve and Dimba forest reserve.

3.3.3.1 Inventory and sampling design

Systematic sampling was adopted; cluster sampling was used to establish transect lines and within transects plots were laid out. The distance from one transect line to another was 500 m and the distance between one plot to another was 200m. Each cluster was a square with its four sides measuring 200m. At each corner of the cluster, a square sample plot measuring 10 x 10m was laid out.

3.3.3.2 Sample plot shape and size

Square sample plots of 10 x 10 m were adopted because they are easy to lay out. The study by Hamza *et al.* (2004 a), used similar sample plots in Mgori forest reserve Singida, Tanzania. The sampling intensity for Nndawa village forest reserve with a total area of 646 ha was 0.05% and for Mihima village forest reserve with a total area of 2 664 ha the sampling intensity was 0.025% and for Dimba forests reserve with a total area of 2 682 ha the sampling intensity was 0.025%. These sampling intensities were adopted due to available time and resources. These sampling intensities were equivalent to 167 sample

plots each of 0.01 ha. Out of the total 167 sample plots, 33 plots were laid in Nndawa village forest reserve while 67 plots were laid each in Mihima and Dimba forest reserves.

In each plot the following parameters were recorded: altitude (m) and position and direction using GPS; other parameters were slope (%), litter cover %, grass cover % and grass height (cm).

Species names (vernacular and botanical) of all encountered plants were recorded in each plot. Local people identified plant species in local names and were translated later into botanical names at the Department of Botany of University of Dar es Salaam.

3.4 Data analysis

3.4.1 Statistical data analyses

Data collected from the vegetation survey was analyzed using Statistical Package for Social Science (SPSS) (1998) and Microsoft Excel 2000 Computer program. The data collected through structured questionnaire was coded to facilitate data entry in the computer. Coding refers to systematic organization of data into categories and in this case numerical codes are assigned to responses (Babbie, 1995). For questions that had single answers, the responses were analyzed without coding. The qualitative data collected through structured and unstructured questionnaires were analyzed using Statistical Package for Social Sciences (SPSS) to obtain descriptive statistics such as percentages of responses, frequencies, means, and standard deviations and the results were used for construction of tables and figures.

3.4.2 PRA data analysis

Data from PRA were analysed in the field with the help of the communities in the study area. The respondents ranked medicinal and wild food plants in their order of preference and the results were recorded immediately.

3.4.3 Structural functional analysis

The components of verbal discussion were analysed in detail with the help of content analysis method. Recorded conversations with respondents were broken into smallest meaningful units of information or themes and tendencies. This helped in ascertaining values and attitudes of respondents. Structural functional analysis seeks to explain social facts, which are related to each other within the social system and by manner in which they are related to physical surrounding (Kajembe, 1994).

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socio-economic characteristics of the study area

4.1.1 Age distribution

The distribution of respondents according to age groups is summarised in Table 1. The results revealed that most of the respondents (32.5%) in the surveyed village households belonged to the age group of 53 years and above followed by 25% in the age group of 31 to 41 years. The results further revealed that 22.5% of the respondents were in the age group of 42 to 52 years and 20% belonged to the age group of 20 to 30 years. All the interviewed traditional midwives were above sixty years old while the age of most traditional healers was above 40 years old and only one traditional healer was 36 years old.

Table 1: Percentage distribution of respondents by age groups

Age group (years)	Frequency	Percentage
20-30	24	20.0
31-41	30	25.0
42-52	27	22.5
53 +	39	32.5
Total	**120**	**100.0**

The results of this study are akin to the results reported by Abdallah, (2001), Augustino (2002), Luoga *et al.* (2000) and Maximillian *et al.* (2001) who commented that age group of above 40 years is considered to be more important with respect to the aspects of biological resources documentation and utilization especially medicinal plants. These observations are similar to those reported by Kokwaro (1993) and Anderson and Staugard (1986).

4.1.2 Gender / sex

During the study about 54% males and 46% females were interviewed. The male respondents were more than females, because most of households were male headed. Maloo and Kilolambwani villages had more female-headed households than male headed households compared to Nndawa and Mihima villages (Table 2).

Table 2: Percentage distribution of respondents by gender and village

Location (Village)	Gender /sex			
	Male		Female	
	Frequency	Percentage	Frequency	Percentage
Nndawa	18	60.0	12	40.0
Mihima	20	66.7	10	33.3
Maloo	13	43.3	17	56.7
Kilolambwani	14	46.7	16	53.3
Total	**65**	**54.2**	**55**	**45.8**

This is different to the typical traditional African societies where the majority of household are male headed like what was observed by Lema (2003) for Morogoro rural district where male-headed households were about 73%.

Comparing the coastal villages (Maloo and Kilolambwani) and upcountry villages (Nndawa and Mihima) there is difference in percentage of female-headed households. In the coastal villages most households (55%) were female headed. This situation is expected due to religious differences where by more Moslems were found in the coastal villages than in upcountry villages. For Moslems divorce is easy and a man can marry and divorce several times while for Christians a man is allowed to marry only once and divorce is not accepted unless one member of couple dies. That is why many of the households in coastal villages were female headed.

4.1.3 Marital status

Table 3 shows a summary of distribution of respondents according to marital status.

Table 3: Percentage distribution of respondents by marital status

Marital status	Frequency	Percentage
Married	77	64.2
Single	15	12.5
Widowed	10	8.3
Divorced	18	15.0
Total	**120**	**100.0**

It can be noted from Table 3 that more than half of the respondents (64%) were married, while 15%, 12.5% and 8.3% were divorced, single and widowed, respectively. Marital status was taken into consideration with the assumption that married individuals were better in identification, documentation and utilization of biological resources to solve some of the problems encountered in their households. The percentage of married respondents is higher than the findings by the Bureau of the statistics (1996), which indicated that more than 50% of Tanzanians are married. High involvement of married people in using medicinal and wild food plants could be attributed to the need to generate income for family care. The marital status of the interviewed traditional midwives was 40%, 40% and 20% for single, widowed and married, respectively, while most traditional healers were married. Also all the interviewed health workers were married.

4.1.4 Education

The results showed that 58.3% of respondents had primary education, 15.8% had adult education, 24.2% had no formal education, 0.8% had secondary education and only 0.8 had college education (Table 4). About 60% of the interviewed traditional midwives had no formal education while 20% had primary education and 20% had adult education.

Table 4: Percentage distribution of the respondents by level of education

Level of education	Frequency	Percentage
Primary education	70	58.3
Adult education	19	15.8
No formal education	29	24.2
Secondary education	1	0.8
College education	1	0.8
Total	**120**	**100.0**

Most traditional healers about 71% had adult education while the remaining 28% had primary education. About 50% of health workers had secondary education and another 50 % had primary education. These results imply that the majority of respondents had attained primary education as their highest education level. According to Maro, (1995) primary education is reported to foster human creativity, and has, hence been reported as having relationship with farmers' readiness to integrate innovations into traditional systems of land use and management. Kamwenda (1999) pointed out that the level of education; sex and marital status of respondents are considered as important factors in relation to natural resource utilization and conservation.

Low level of education of respondents in the surveyed villages was contributed by among other reasons few numbers of schools and lack of self-motivation to go to school due to long distance children have to walk to school, early marriage and belief in witchcraft. Also some elders tend to restrict young people from attending schools by having a notion that education would change their minds and hence loose the people who can inherit their practices and retain the knowledge in future. There were only two primary schools used for all villagers in the four surveyed villages. This indicates that most of the utilization of medicinal plants and wild plant foods is based on the long experience rather than education. Low level of education observed in the surveyed villages contributed to the

inefficient and unsustainable utilization of medicinal and wild food plants. It was reported by WWF and USAID (1993) that education played a big role in consciousness of sustainable utilization of medicinal plants. Furthermore Katani (1999) reported that education created awareness for natural resource management among the community.

4.1.5 Occupation

The type of occupation of an individual greatly affects the utilization of resources. For instance farmers utilize and document biological resources differently compared to those with employment. More than three quarters of interviewed respondents (95%) were farmers while carpenters and businessmen represented 3.3% and 1.7%, respectively (Table 5).

Table 5: Percentage distribution of respondents by occupation

Occupation	Frequency	Percentage
Farmer	114	95.0
Business	2	1.7
Carpenter	4	3.3
Total	**120**	**100.0**

All the interviewed traditional midwives and traditional healers were farmers while all health workers were government employees. Despite the large number of respondents being farmers (95%) still crop production was reported to be very low, the major reason was poor farming tools/ implements and most farmers reported to use hand hoes. Most members of communities in the study sites did not keep cattle, which they could use for farming and the manure to add fertility in their farms. Due to low agricultural produce, most farmers practiced shifting cultivation, which resulted to deforestation (URT, 1997).

4.1.6 Family size

In any household, the number of members in the household has an important implication in household's ability to access enough food, health services and other basic needs as well. Also family size is an important factor in determining the extent to which labour available in economic activities. Table 6 presents a summary of percentage distribution of respondent's family size of the surveyed households.

Table 6: Percentage distribution of respondents' family sizes

Occupation	Frequency	Percentage
1-3	48	40.0
4 -6	59	49.2
7+	13	10.8
Total	**120**	**100.0**

The results reveal that about 49.2% of interviewed households had family sizes ranging from four to six people followed by those having family sizes ranging from one to three (40%). The results further revealed that 10.8% of households had family sizes of above seven people. A large number of members in the household imply more mouths to feed and more people to share the household budget. The implication of these results is that, the household with a large number of family sizes is likely to collect and utilize more medicinal and wild food plants compared to households with small family sizes. Similar observations were reported by Mhinte (2000). The results further revealed that the average family size for all villages was 4.1. The family size reported in this study is slightly high compared to the national household size, which is estimated at an average of 3.9 per household (URT, 2002).

4.1.7 Residence duration of respondents in the study area

Multiple response analysis revealed that residence duration influences knowledge on availability and utilization of medicinal and wild food plants. As shown in Table 7 majority of respondents had stayed in the area for more than 40 years followed by 26.7% of respondents who had stayed for 31 to 40 years.

Table 7: Residence duration in the surveyed villages

Residence duration	Frequency	Percentage
< 10 years	7	5.8
11-20 years	17	14.2
21-30 years	16	13.3
31-40	32	26.7
> 40 years	48	40.0
Total	**120**	**100.0**

The implication could be that increase in residence duration increases knowledge of medicinal and wild food plants and that natives are always knowledgeable about plant species within their surroundings. The results show that majority of the respondents have lived in their respective homestead for a long period. These results are similar to the findings by Mapolu (2002). This indicated that most residents have enough knowledge on the village characteristics especially on utilization and availability of medicinal and wild food plants.

4.1.8 Land ownership

About 98% of respondents reported to own land while 2% had no land for agricultural activities. In Mihima, Maloo and Kilolambwani villages, all respondents owned land while in Nndawa village about 93% owned land. One of the reasons for this might be the small village land size. Majority of respondents owned about 3 ha. Most of the respondents

cultivated small farms. For example, about 70.3% of respondents had farm sizes of up to 3 ha, while 22.0% had farm sizes ranging from 4-7 ha followed by 3.4% having farm sizes of more than 8 ha (Table 8). However, about 4.2% of respondents did not know the sizes of their farms.

Table 8: Sizes of the farms cultivated in the last crop season (ha) in the study area

Location (Village)	Farm sizes (Ha)							
	0-3		4-7		> 8		Not known	
	F	%	F	%	F	%	F	%
Nndawa	19	63.3	5	16.7	2	6.7	4	13.3
Mihima	16	53.3	12	40.0	2	6.7	Nr	0
Maloo	24	85.7	4	14.3	Nr	0	Nr	0
Kilolambwani	24	80.0	5	16.7	Nr	0	1	3.4
Total	**83**	**70.3**	**26**	**22**	**4**	**3.4**	**5**	**4.2**

Note: F = Frequency, Nr = No response

4.1.9 Food production

Different food and cash crops were cultivated in the study area. These crops were cassava, maize, sorghum, cowpeas, millet, paddy, groundnuts; cashew nuts, sweet potatoes, pumpkins, coconuts and simsim (Table 9). Nearly all respondents relied on cassava as their principal staple food. The results show that there was no significant difference for cultivation of crops like cassava, cashew nuts, sweet potatoes, coconut, pumpkins and simsim among the four villages. This is because most of these crops are favoured by the climate of all the four villages. But for other crops like maize, sorghum, cowpeas, millet, paddy and groundnuts there was a significant difference among the four villages. This is because most of these crops perform in different soil types thus they are cultivated in areas, which favour them.

Table 9: Crops cultivated in the study area

Crops cultivated	Location (Village)				Average	X^2 -value
	Ndawa n =30	Mihima n=30	Maloo n =30	Kilolambwani n =30		
Cassava	76.7 (23)	93.3 (28)	73.3 (22)	66.7 (20)	77.5 (93)	0.084 Ns
Maize	93.3 (28)	96.7 (29)	13.3 (4)	26.7 (8)	57.5 (69)	0.000 ***
Sorghum	3.3 (1)	46.7 (14)	86.7 (26)	90.0 (27)	56.7 (68)	0.000 ***
Cowpeas	20.0 (6)	33.3 (10)	10.0 (3)	6.7 (2)	17.5 (21)	0.030 *
Millet	46.7 (14)	0 (0)	13.3 (4)	3.3 (1)	15.8 (19)	0.000 ***
Paddy	43.3 (13)	46.7 (14)	0 (0)	6.7 (2)	24.2 (29)	0.000 ***
Groundnuts	3.3 (1)	26.7 (8)	3.3 (1)	10.0 (3)	10.8 (13)	0.010 **
Cashew nuts	10.0 (3)	10.0 (3)	10.0 (3)	3.3 (1)	8.3 (10)	0.727 Ns
Sweet potatoes	3.3 (1)	0 (0)	0 (0)	0 (0)	0.8 (1)	0.388 Ns
Pumpkins	3.3 (1)	3.3 (1)	0 (0)	0 (0)	1.7 (2)	0.565 Ns
Coconut	3.3 (1)	0 (0)	0 (0)	0 (0)	0.8 (1)	0.388 Ns
Simsim	0 (0)	13.3 (4)	23.3 (7)	13.3 (4)	12.5 (15)	0.056 Ns

Note Figures in the brackets presents frequencies of the response

Ns= Non significant, * = Significant at P<0.05, ** Significant at P<0.01, *** Significant at P<0.0001

N B As some of respondents gave more than one option, percentages would not necessarily add to one hundred (i.e. percentages were calculated within option types)

Different agricultural crops storage methods were used in the study area. These include using sisal and polythene bags and *vihenge* and simply hanging the crops under thatched roof. The results further revealed that 66% of the respondents commented that the obtained crop produce satisfied their annual food requirements. The rest, about 34% of all respondents, commented that the obtained crop produce did not satisfy their annual food requirements, thus they had to look for other alternatives so as to fill the deficit. Among the alternatives, which were mentioned, to fill the food deficit, are food buying (95%) and collecting wild plant foods (5%). Further, during the interview most of the respondents (81%) reported to keep small livestock while 19% reported not to keep livestock. The preferred types of livestock were poultry, goats followed by cows. The reasons, which made people in the study area to abandon livestock keeping are presence as presented in Table 10.

Table 10: Reasons for not keeping livestock in the study area

Reasons	Location (Village)				Average	X^2 -value
	Nndawa n =30	Mihima n=30	Maloo n =30	Kilola-mbwani n =30		
No interest	0 (0)	25.0 (1)	0 (0)	50.0 (1)	8.7 (2)	0.064 Ns
Vermin	0 (0)	25.0 (1)	0 (0)	0 (0)	4.3 (1)	0.174 Ns
Theft	0 (0)	25.0 (1)	11.1 (1)	0 (0)	8.7 (2)	0.502 Ns
Diseases	12.5 (1)	25.0 (1)	55.6 (5)	0 (0)	30.4 (7)	0.185 Ns
Wild animals	0 (0)	0 (0)	33.3 (3)	0 (0)	13 (3)	0.147 Ns
Lack of inputs and knowledge	0 (0)	0 (0)	11.1 (1)	0 (0)	4.3 (1)	0.653 Ns
Not yet decided	0 (0)	0 (0)	0 (0)	50.0 (1)	4.3 (1)	0.012 **
No money to buy livestock	62.5 (5)	0 (0)	0 (0)	0 (0)	21.7 (5)	0.007 **
Scarcity of livestock in the study area	25 (2)	0 (0)	0 (0)	0 (0)	8.7 (2)	0.250 Ns

Note: Figures in the brackets presents frequencies of the response
Ns = Non significant, * = Significant at P<0.05, ** Significant at P<0.01, *** Significant at P<0.0001
N B: As some of respondents gave more than one option, percentages would not necessarily add to one hundred (i.e. percentages were calculated within option types)

The reasons, which made people in the study area to abandon livestock keeping are presence of wild animals like lions because most of the surveyed villages are surrounded by Selous game reserve and or forest reserves, which act as habitats for wild animals. Also the presence of tsetse flies discourages livestock keeping. Apart from these reasons, respondents gave various reasons as to why they were not keeping livestock.

Except for lack of money and decision, there is no significant difference among villages in the reasons for not keeping livestock. This can be probably due to the fact that, all the four surveyed villages belong to the same climatic conditions, which do not favour livestock keeping.

4.2 Utilization of medicinal and wild food plants

4.2.1 Utilization of medicinal plants

4.2.1.1 Utilization of medicinal plants for primary health care

Results from this study revealed that about 79% of interviewed people relied on medicinal plants for their primary health care. These results are similar to those reported by Dery *et al.* (1999) and Rulangalanga (1991). The percentage in this study is low compared to 89%, 90% and 91% reported by Lema (2003), Hamza *et al.* (2004 a) and Kagya (2002), respectively. The lower percentage of people relying on medicinal plants in the study area might be caused by the presence of religious institutions in Lindi Rural District, which offer health care services to the communities in the study area.

4.2.1.2 Reasons for using medicinal plants to cure diseases

The main reasons for using medicinal plants to cure diseases were disease resistance compared to conventional medicine (63.3%), lack of money to pay for conventional medicine (6.7%) and readily availability of plants medicine (3.3%). Other reasons include long distance to near by hospitals (2.5%), low household income, reliability of plant medicines (1.7%), cheapness of plants medicine and scarcity of hospitals and dispensaries. The results of this study are similar to those reported by Kessy (1998), Minja (1992), Maximillian (1998), Abdallah (2001) and Nyigili (2003). This is expected because of similarity of health conditions in the country.

4.2.1.3 Source of knowledge in utilization of medicinal plants

Traditional health practices in Tanzania have existed for a long time even before the arrival of foreigners (Mhame, 2000). Lack of employment in the study area and emerging of various deadly diseases tends to favour the utilization of medicinal plants. About 62% of

interviewed people who had knowledge on medicinal plants reported that they obtained the knowledge from traditional healers and the remaining 38% obtained the knowledge from their relatives. These results are similar to those reported by Augustino (2002) in urban districts of Morogoro and Iringa. There is, therefore, an urgent need to formulate an array of incentive measures to ensure that members of the community are willing to learn, adapt and apply traditional knowledge, innovations and practices from their elders.

4.2.1.4 Access to health facilities by communities in the study area

The results show that 29% of respondents get treatment in hospitals when they fall sick, where as 70% reported to get treatment from both hospitals and traditional doctors and only 1% reported to get treatment only from traditional healers (Table 11). Most of people in the study area opted to use plant medicine although majority of them reported to get treatment in hospitals /dispensaries. This is due to the fact that most of health facilities are located far from their homes; also there were only two dispensaries for the four surveyed villages one located in Mihima village and another one at Kilolambwani village.

Table 11: Access to health facilities by communities in the study area

Type of medical service	Frequency	Percentage
Traditional doctors	7	5.8
Hospital	17	14.2
Both traditional doctors and hospitals	16	13.3
Total	**120**	**100.0**

People are required to walk long distance of up to 20 kilometres. Furthermore, there were problems in transport as there was no any kind of public transport in most of the surveyed villages especially the upcountry villages (Mihima and Nndawa) and presence of dangerous wild animals forced people to use plant medicine. This shows the potential use

of the medicinal plants in the society for day-to-day life for healing as supplemented by conventional medicines.

4.2.1.5 Number of patients treated in the village dispensaries

Health workers reported that an average of 4 000 and 217 patients were treated per year in Mihima and Kilolambwani village dispensaries, respectively. The number of treated patients per year in Kilolambwani village dispensary was low compared to that of Mihima village dispensary due to the fact that Mihima village is highly populated and there are so many hamlets. Also there is only one dispensary in Mihima village while in Kilolambwani, plus the village dispensary there are also nearby dispensaries like Mvuleni village dispensary. The health workers further reported that the situation with respect to availability of conventional medicines is good and all villagers have access to them. The diseases, which were reported to affect people in the study area, were diarrhoea, dysentery, malaria and pneumonia. This was of particular important since most of the villages in the study area lack source of clean and safe drinking water, which posed health problems. At least two patients per week were admitted after services provided by traditional healers have failed.

4.2.1.6 Number of health workers against traditional healers

In the two dispensaries (Mihima and Kilolambwani dispensaries) there were only four health workers while at least in each village there were more than seven traditional healers. Therefore the number of herbalists is higher compared to health workers in all surveyed villages. As it was discussed before, the community in the study area decided to use plant medicines due to scarcity of hospitals and health workers among other reasons. Mhame (2000) reported similar results and commented that it is currently estimated that there are

about 75 000 traditional health practitioners in the whole country, exemplifying a ratio of traditional health practitioner/peoples population as 1:400, while that of doctors /patients is 1:20 000.

4.2.1.7 Distance covered in medicinal plants collection

Medicinal plants were harvested from the forest at a varying distance from homestead. At least all the three surveyed forest reserves were more than two km away from the villages. The results suggest that the distance from which medicinal plants are collected depend on the type of plant(s) medicine to be collected from the forest. This is because the type of medicinal plant to be harvested depends on the type of disease. Sometimes the distance depends on beliefs that the plant collected from the wild and deep in the forest is stronger than the one collected from the vicinity. Odera (1997) reported similar observations.

4.2.1.8 Storage of medicinal plants

Some traditional healers reported that most of the medicinal plants were administered fresh after collection from the forest and the remaining medicine was stored in dry form. These results are in agreement with the findings by Dery *et al.* (1999). This might be caused by among other reasons the belief that the concentration of the active constituent in the fresh medicinal plant is higher than in one which is dried and stored. On the other hand this has effect on sustainability and availability of medicinal plants that are found in the study area because collectors have to go in the forest each time they get a patient.

4.2.1.9 Mode of harvesting medicinal plants and diseases treated

Some local beliefs were reported to be associated with harvesting, processing, storing and use of medicinal plants. Among the local beliefs reported in harvesting of medicinal plants were, harvesting while naked, prepare medicine while facing to the direction of wind/ sun or the shadow of the respective medicinal plant.

A study done in Benin by Houngnon (1997) revealed that both men and women gather medicinal plants in the countryside, which are then transported to urban areas. He further pointed out that men gather roots; stalks and barks while women usually gather leaves. Harvesting of medicinal materials can be extremely destructive especially where the barks and roots are required (Gathaara and Kahuki, 1997). It was further described by traditional healers that, the average number of patients treated per year was 15 patients.

Among the common diseases affecting most people in the surveyed villages, include epilepsy, evil spirit and pains during menstruation period, gonorrhoea, syphilis and impotence. These diseases reported to be treated by traditional healers. Makonda (1997) observed that, in a year, a household member in Geita District had an average frequency of only two visits to a modern medical clinic. Thus, most of the time local people visit traditional healers. Various medicinal plants and the respective diseases were treated by traditional healers and traditional midwives (Table 12).

Table 12: List of medicinal plants and the diseases they cure

S/n	Plant species local names	Plant species Botanical names	Parts used	Processing	Application	Condition cured
1.	Wenye	Ui	Leaves	Pounding/Boiling	Drinking	Abdominal colicy
2.	Mgulugai	Ui	Root	Pounding	Smearing	Boils
3.	Nakambwenga	*Maerua angolensis*	Bark	Pounding	Smearing	Broken bones
4.	Mmalala	*Acalypha ornata*	Root	Pounding	Smearing	Broken bones
5.	Mhakec	Ui	Leave	Pounding	Chewing	Cough
6.	Chikombe	*Monantotaxis fornicata*	Leave	Pounding	Drinking	Diarrhoea
7.	Namakango	Ui	Leave	Mix with water	Bathing	Epilepsy
8.	Mchenjele	Ui	Bark	Pounding	Drinking	Epilepsy
9.	Nanyimilila	*Heliotropium supinum*	Bark	Pounding	Bathing	Epilepsy
10.	Mmembe	*Vitex strinkeri*	Bark	Pounding	Drinking	Epilepsy
11.	Mtatu	*Thylachium africanum*	Leaves	Boiling	Bathing	Epilepsy
12.	Mwaka	Ui	Leave	Pounding	Put drops	Ears (ootitis media)
13.	Naveta	Ui	Root	Boiling	Drinking	Hernia
14.	Mbambakofi	Afzelia quanzensis	Root	Pounding	Drinking	Hernia
15.	Nangundu	Ui	Bark	Pounding	Bathing	Miscarriage
16.	Mkalanga	*Blighia unejipota*	Root	Pounding	Drinking	Pains after delivery
17.	Nangundu	*Ocimum suave*	Bark	Pounding	Bathing	Miscarriage
18.	Mngwea	Ui	Root	Pounding	Drinking	Pains after delivery
19.	Mkwelambamba	*Phyllanthus muellerianus*	Root	Burning	Drinking	Pains after delivery
20.	Nangungwe	Ui	Leave	Pounding	Drinking	Pains after delivery
21.	Mtavala	*Monanthotaxcis trichantha*	Root	Pounding	Drinking	Pains after delivery
22.	Mchelemala mkubwa	Ui	Root	Pounding	Drinking	Pains after delivery
23.	Mnondondo	Ui	Root	Pounding	Drinking	Paralysis
24.	Mtengo	Ui	Root	Pounding	Drinking	Pneumonia
25.	Mtapilo	Ui	Root	Pounding	Smearing	Snakebite
26.	Mtiwalala	Ui	Root	Pounding	Smearing	Snakebite
27.	Mnjau mweusi	*Dombeya shupangae*	Root	Pounding	Smearing	Snakebite
28.	Mmambala	*Polysphaeria braunii*	Root	Pounding	Smearing	Snakebite
29.	Mnembelembe	*Cassia abbreviata*	Root	Pounding / Boling	Drinking	Stomach ache
30.	Mpombwe	*Maytenus senegalensis*	Root	Pounding	Drinking	Yellow fever
31.	Mdimupori	Ui	Root	Pounding	Drinking	Venereal diseases

4.2.1.10 Preferred medicinal plant species in the study area

Table 13 presents a summary of preferred medicinal plants from the three forest reserves. It can be observed from the Table that villages surrounding Dimba forest reserve have the highest number of preferred medicinal plants compared to other villages. This is probably due to the fact that Dimba forest reserve is a coastal forest, has large area and higher biodiversity as well compared to other two forest reserves namely Nndawa and Mihima which have small area, low biodiversity and are of miombo woodland category.

Table 13: Preferred medicinal plant species in the study area

S/n	Dimba forest reserve		Mihima forest reserve		Ndawa forest reserve	
	Local names (Makonde language)	Botanical names	Local names (Mwera language)	Botanical names	Local names (Mwera language)	Botanical names
1.	Lidingili	*Bonamia mossambicensis*	Mdibwa	*Chassalia umbraticola*	Chingongolo-mandyanga	*Gardenia ternifolia ssp Jovis-tonantis*
2.	Mlembelembe	*Cssia abbreviate*	Mnipu	*Ipomeas pp.*	Chiguluka	*Polygala virgata*
3.	Mwokozi	Ui	Mnjau	*Xylotheca tettensis or Dombeya shupangae*	Mdibwa	*Chassalia umbraticola*
4.	Mkwaju	*Tamarindus indica*	Mpajupaju	*Maprounea africana*	Chagandile	Ui
5.	Mtalala	*Dichrostachchys cinerea*	Nalupande	*Hollarhena fevrifuga*	Chikwaja	*Dichapetalum macrocarpum*
6.	Mtavala	*Monanthotaxcis trichantha*	Chinamati	*Ertosema spp.*	Nnava	*Asparagus staceus*
7.	Kimembe	*Hensia crinata*	Lutungwi	*Asparagus africanus*	Mchelemalo	Ui
8.	Mnyau	Ui	Chiguluka	*Polygala virgata*	Mnindimila	Ui
9.	Mtandawala	*Markhamia zanzibarica*	Lidingili	*Bonamia mossambicensis*	Nalupande	*Hollarhena fevrifuga*
10.	Mtolo	*Landorphia kirkii*	Mpeu	*Clerodendrum myricoidea*	Mbalale	*Ronospora caffra*
11.	Mpambapori	*Dichapetalum stuhmanii*	Mpitiu	Ui	Mtotwe	*Gonatopus boivinii*
12.	Mchunguchungu	Ui	Nnami	*Acalypha ornate*	Mtatu	*Thylachium africanum*
13.	Mnang'ole	Ui	Mjini	*Tapipyllum burnetii*		
14.	Mbalamwaka	Ui	Mpingo	*Dalbergia melanoxylon*		
15.	Namavele	*Zanthoxlum chalybeum*	Msufi	*Ceiba pentandra*		
16.	Mnindimila	Ui	Ng'wilanyama	*Vismia orientalis*		
17.	Liudiumwene	Ui	Nangungwe	*Salacia madagascariensis*		
18.	Mtatu	*Thylachium africanum*	Mmangu	Ui		
19.	Mlyolyolyo	*Rothia hirsuta*				

4.2.2 Utilization of wild food plants

4.2.2.1 Food insecurity in the study area

Group discussions revealed that there was food insecurity in the study villages. This was caused by crop failure due to climatic changes especially rain shortage and changes in rainfall patterns. It was further noted that there was certain unnecessary utilization of the small harvest, such as use of food during initiation ceremonies, selling of large portion of food at very low prices just after harvesting, use of maize and millet for preparation of local brew and funerals. These findings are in agreement with those reported by Makundi (1996) and Ishengoma (1998). The similarity of the results in this study and those reported by Makundi (1996) and Ishengoma (1998) is expected due to similarity in culture and traditions of people of these areas.

Forests in the surveyed villages provided food security by supplying food products and indirectly by generating cash through selling of wild food products like *Dioscorea* spp (ming'oko). The forest provides varieties of edible plant species, which are consumed directly by households. These include wild fruits, wild roots and tubers, wild legumes, and mushrooms. Majority of the respondents (81.7%) reported to use wild food plants and mushrooms while the rest (18.3%) reported not to use wild food plants. The results are similar to the findings by Kajembe (1994), Kessy (1998) and Missano *et al.* (1994), FAO (1995) and Arnold (1995) who reported that there is high reliance of rural people on forests and trees for food.

Tewari (1994) commented that wild foods provide food security to large low-income populations particularly during periods of drought and work as an insurance against famine and crop failure. These food products had a remarkable seasonal contribution to household

food security especially when agricultural crops and relish are either relatively scarce, unavailable or too expensive. These results are similar to those reported by Lema (2003) who reported that wild root and tubers are consumed during critical periods of hunger in Morogoro rural district. It was also reported by Ruffo *et al.* (2002) that other wild food such as roots and tubers of *Rhychnosia hirta* (angadi) and *Dioscorea spp.* (ming'oko) are important sources of food during periods of food scarcity.

During focus group discussion, it was further observed that farmers in the surveyed villages relied on seasonal crop production. For many smallholder farmers, especially the poor ones, these cycles entail periods of food shortage. It is during these critical periods that the importance of wild food plants is greatest. The peak season for most wild fruits in Lindi rural district is between December and April with few exceptions that mature during dry season. This is also the period for land preparation, seed sowing and then weeding and other farm operations in such a way that there is little time for food preparation. Thus the peak season for wild fruits coincide with food shortage period and peak farm operations such that wild fruits make an important part of diet. Therefore during this period even adults were forced to eat wild fruits. The results are similar to the findings by Kajembe (1994), Kessy (1998), Nyigili (2000), Missano *et al.* (1994), FAO (1995) and Arnold (1995) who reported that there is a high reliance of rural people on forests and trees for food.

4.2.2.2 Reasons for utilization of wild food plants

Table 14 presents the reasons for utilization of wild food plants. The main reasons for utilization of wild food plants were: most preferred, scarcity of food (famine), as source of income and their special flavour and taste.

Table 14: Reasons for utilization of wild plant foods

Reasons	Location (village)				Total	X^2-value
	Nndawa N=30	Mihima N=30	Maloo n=30	Kilolambwani n=30	All N=120	
Famine	75.9 (22)	44.8 (13)	11.5 (3)	38.5 (10)	43.6 (48)	0.000 ***
Source of income	0 (0)	16.7 (5)	23.1 (6)	15.4 (4)	13.4 (15)	0.0690 Ns
Habit	20.0 (6)	0 (0)	0 (0)	0 (0)	4.5 (6)	0.001 ***
Flavour	32.3 (7)	0 (0)	0 (0)	0 (0)	6.3 (7)	0.000 ***
Favourite	6.7 (2)	69.0(20)	100 (26)	92.3 (24)	64.9 (72)	0.000 ***
Shortage of vegetables	0 (0)	51.7 (15)	0 (0)	0 (0)	13.5 (15)	0.000 ***

Note: Figures in the brackets presents frequencies of the response

Ns= Non significant, *** Significant at P<0.0001

N.B As some of respondents gave more than one option, percentages would not necessarily add to one hundred (i e percentages were calculated within option types).

Reasons for utilization of wild plant foods differed significantly among the four villages except for income. This is expected because even in famine there are different levels between villages. The significant difference is expected due to the fact that the five reasons are mainly the reasons which, made people to opt for wild plant foods. These reasons were famine, habitat, flavour, taste and shortage of vegetables.

4.2.2.3 Collection of wild food plants by different household members

In most African societies, there is a clear division of labour between men and women in almost all household activities. About 72.5% of respondents reported that collection of wild food plants was carried out by women followed by children (26.7%), by all household members (20%) and finally by men (15%). The results are contrary to those by Ogle and Grivetti (1985), who reported that children collect and consume more species of wild foods especially fruits than adults and most wild food plant species are designated by adults as children's plants and foods. A study done in Ethiopia by Guinand and Lemessa (2000) pointed out that wild food consumption is still very common in rural areas of Ethiopia,

particularly with children. The authors further observed that women largely collect products, which contribute to direct consumption by the family members. According to Green and Thrupp (1998), Katani (1999) and Mapolu (2002) women are mostly involved in collecting non- timber forest products such as nuts, wild fruits, vegetables, mushrooms, roots and root tubers. It was pointed out by Falconer (1990) that gathering and processing of forest products may be favoured by women because of easy access to forest resources, possibility of combining subsistence gathering with income earning activities and flexibility of location of enterprise. FAO (1995) argued that although all family members may be involved in the production system, traditionally women play a major role in collecting, processing and preservation of wild foods.

4.2.2.4 Distance covered in collection of wild food plants

Wild plant foods were collected from the forest at varying distance from homesteads depending on the type of wild plant foods as well as season and availability of particular type of wild plant foods. It was observed that most of the surveyed villages were closer to the forests. The majority of respondents (71%) walk one to five kilometres to collect wild plant foods, while (23%) walk six to ten km and about 6 % walk more than ten km. More than two third of the respondents (82%) reported that the distance one was supposed to walk for collection of wild plant foods was increasing. About 9% of respondents said that the distance was constant, while 6% reported that it was decreasing and 3% reported that it was changing from year to year. Similar observations were reported by Nyigili (2003) in Mbozi district, Tanzania.

4.2.2.5 Preferred wild food plants in the study area

A list of most preferred wild food plants in the study area is presented in Table 15.

Table 15: Preferred wild food plants in the study area

S/N	Dimba forest reserve		Mihima forest reserve		Ndawa forest reserve	
	Local names (Makonde language)	Botanical names	Local names (Mwera language)	Botanical names	Local names (Mwera language)	Botanical names
1.	Mtolo	*Landorphia kirkii*	Angadi	*Rhychnosia hirta*	Ming'oko	*Dioscorea spp.*
2.	Angadi	*Rhychnosia hirta*	Mng'oko	*Dioscorea spp*	Angadi	*Rhychnosia hirta*
	Dinele	Ui	Mpinji	*Ximenia americana*	Ibu	
4.	Malidu	Ui	Mkung'u	*Salacia madagascariensis*	Mbungo	*Landorphia kirkii*
5.	Mabungo	*Landorphia kirkii*	Chikwaja	*Dichapetalum macrocarpum*	Msofu	*Manilkara sulcata*
6.	Msofu	*Manilkara sulcata*	*Manilkara sulcata*	*Monanthotaxis buchananii*	Wambya	Ui
7.	Uyoga	*Mushroom*	Mgulugai	Ui	Vitolo	*Landorphia kirkii*
8.	Mtili	*Landorphia kirkii*	Mmula	*Parinari curatellifolia*	Mtili	*Landorphia kirkii*
9.	Mbubudu	*Grewia forbesii*	Mnjishi	*Strychnos spinosa*	Mkung'u	*Salacia madagascariensis*
10.	Mkwaju	*Tamarindus indica*	Mbungo	*Landorphia kirkii*	Mnjishi	*Strychnos spinosa*
11.	Lichindu	Ui	Mtili	*Landorphia kirkii*	Mtondoli	*Enlorephytum magilismontanum*
12.	Mtindingololo	Ui	Mtolo	*Landorphia kirkii*	Mmula	*Parinari curatellifolia*
13.	Mgongo	Ui	Mpunju	*Antidesima venosum*	Mabulugai	Ui
14.	Mtondodi	Ui	Mtongatonga	Ui	Mbinji	*Ximenia americana*
15.	Mfuru	*Vitex strinkeri*	Mtope	*Annona senegalensis*	Utumbogwanku ku	Ui
16.	Mkalawanje	Ui	Utungulu	*Aflomomum orientale*	Uyoga	*Mushroom*
17.	Lilende	Ui	Mtundumai	*Tetracera litorlis*		
18.	Nakauludi	Ui	Chingongolomandyanga	*Gardenia ternifolia ssp Jovis-tonantis*		
19.	Mbuyu	*Adansodia digitata*	Limbonga	Ui		
20.	Kikomampini	Ui	Mmavi	Ui		
21.	Uwanga	Ui	Uyoga	*Mushroom*		
22.	Dihani	Ui	Mwembe	*Mangifera indica*		
23.	Mpama	Ui				
24.	Mng'oko	*Dioscorea spp.*				

The numbers of preferred wild food plants differ between forest reserves. As it can be observed from the above Table, Dimba forest reserve has highest number of preferred wild food plants as compared to Ndawa and Mihima village forest reserves. The low number of preffered wild food plants might be caused by among other reasons the difference in the forests areas, type of the forest and biodiversity. This is due to the fact that Dimba is a coastal forest reserve while the other two forest reserves are of miombo woodland type. Also, Dimba forest reserve has a large area compared to the other two forest reserves.

4.2.2.6 Domestication of wild food plants in the study area

Table 16 presents the results for domestication of wild food plants in the study area. The results revealed that, 91% of respondents reported that they have never attempted to domesticate wild food plants while 9% reported that there are few attempts of domesticating wild food plants.

Table 16: Reasons for not domesticating wild food plants in the study area

Reasons	Percentage
Lack of experience	52.0
Lack of knowledge	12.1
Not possible	10.3
Lack of planting materials	8.4
Readily availability of wild food plants	6.5
Adaptation of wild food plants only to forest condition	5.6
Difficulties in domesticating wild food plants	5.6
Not used to domesticating wild food plants	2.8
Lack of markets	0.9

Low percentage of people in the study area domesticated wild food plants because either there are plenty of wild food plants in the study area or the population is low as compared to available wild plant foods. Among the reasons for not domesticating wild food plants in the study area included, lack of experience 52%, no knowledge 12.1%, not possible 10.3% and lack of planting materials 8.4%. Other reasons for not domesticating wild food plants in the study area were as presented in the above Table.

Walters and Hamilton (1993) reported that at global level, about 75 000 plant species are edible, out of which 12 000 have been used for food but only 2 000 have been domesticated so far. Malaisse and Parent (1985) listed 241 species of wild edible plants of southern central Africa of which 184 were sampled and their nutritional values established. There is a great need for some of these indigenous wild food plants to be domesticated, starting with those, which have high nutritive value and are easy to propagate.

4.2.2.7 Trade on wild plant foods in the study area

About 65.5% of respondents collected wild plant foods for domestic consumption and the remaining percent 34.5 collected them for sale. Figure 2 shows trade of *Dioscorea* spp (*ming'oko)* in the local market in Lindi town. One bundle was sold at a price of Tshs. 100/=. The results revealed that most respondents (71.7%) used the revenue from sales of wild plant foods for health care services. The same observations on trade of wild plant foods were reported by Mhoro and Mtotomwema (1994) who found that mbao-mng'oko (wild edible yam) was sold at Mbuyuni village in the Coast region, Tanzania. Similar observation on trade of wild plant foods reported by (Guinand and Lemessa, 2000) that in Ethiopia, less prominent fruits and seeds from wild food plants were mainly traded on local markets.

Figure 2: Trade of *Dioscorea spp* (*Ming'oko)* in the local market in Lindi town.

For respondents who sold wild food plants, 23.3% reported to do so annually, 8.3% occasionally, 50% weekly and 4.5% monthly. The results further revealed that most of their customers (49%) were from within the villages. Other customers of wild plant foods (24%) were coming from outside the study villages.

Many reasons were given as to why many members of the community did not sell wild plant foods. Among the reasons mentioned were that they do not collect wild plant foods (26.9%), they are not interested in collecting wild plant foods (21.5%), and wild food

plants are used for domestic consumption only (20.3%). Other reasons were as given in Table 17.

Table 17: Reasons for not selling wild food plants in the study area

Reasons	Percentage
Most of people do not collect wild plant foods	26.9
Not interested in collecting wild plant foods	21.5
Wild food plants are used for domestic consumption only	20.3
Wild food plants have no markets	7.6
Have no customers	6.4
It is a hard task to collect wild plant foods	6.3
Transportation problem	5.1
Lack of experience	1.3

4.2.2.8 Trend of availability of wild plant foods in the study area

About 73% of the respondents reported that availability of wild plant foods was decreasing. The results of this study conform to the findings by Mapolu (2002) and Nyigili (2003) who also reported a decrease in availability of non-wood forest products, which included medicinal and wild food plants. The decreasing availability of the products might have a significant impact on household food security of most households especially those, which rely on forest products for food and income. The decreasing availability of wild plant foods might be caused by poor management and conservation strategies of natural resources in the study area.

4.2.2.9 Preservation of wild plant foods in the study area

The results indicated that about 38% of the respondents preserve wild plant foods while majority of them (62%) do not preserve them. Commonly preserved wild plant foods were *Angadi* and mushrooms. Among the methods used for preservation in the study area were

boiling, sun drying and smoking. Similar preservation methods were reported by Nyigili (2003). It was also noted that 98% of wild plant foods preservation was mainly done by women; 6.7% by men; 0.85% by children and 3.3% by all members of the household. The results indicate that women are the main group responsible for preservation of wild plant foods compared to their male counterparts. Similar results on preservation of wild food plants were commented by Guinand and Lemessa (2000), in Ethiopia. Also, the results are similar to those reported by Nyigili (2003) who observed that in Mbozi district 93.3% of those responsible for preservation were women.

4.3 Results from field survey

4.3.1 Medicinal plants

4.3.1.1 Medicinal plants found during field survey

A total of 125 medicinal plants were encountered in the surveyed forest reserves. About 114 medicinal plant species were scientifically identified. These were from 45 plant families (Appendix 3b). The family that was found to have the largest number of medicinal plant species was Rubiaceae composing 13.2% of all medicinal plant species followed by Fabaceae and Eurphorbiaceae, which composed 10.9% and 9.3% of the total species, respectively. Eleven medicinal plant species could not be identified and have therefore been presented by their local names as indicated in Appendix 2. Most vernacular names recorded in Nndawa and Mihima village forest reserves originated from Mwera tribe. In Dimba forest reserve, most of vernacular names originate from Makonde tribe.

The number of medicinal plants recorded in the study is lower than those reported by Abdallah (2001) in Zaraninge Forest Reserve, Augustino (2002) in Morogoro Urban District and Iringa Urban District, Ruffo *et al.* (1989) in East Usambara Forest Reserve,

Maximillian *et al.* (2001) in Ruvu Forest Reserve and Medius (1998) in Bwindi Impenetrable Forest, Uganda who recorded 159, 246 and 177, 185, and 295 medicinal plants, respectively. However, the number of medicinal plants recorded in the study is higher than those reported by Hamza *et al.* (2004 a). The variation in numbers of recorded medicinal plants from one study area to another might be caused by low knowledge of collectors i.e. they could be knowledgeable in few medicinal plants they use more frequently in their areas. The forests might have more medicinal plants than the number mentioned.

4.3.1.2 Growth forms of medicinal plants

Figure 3 summarizes growth forms of the different medicinal plants recorded during this study. The results revealed that most of the medicinal plants were trees (47%), followed by shrubs (26%), climbers (23%), herbs and tubers (2% each). These results are similar to those reported by Abdallah (2001) for Zaraninge forest reserve and its surrounding forests. The author found that 50.7% of medicinal plants were trees, followed by shrubs (27.1%). However, these results are contrary to those reported by Medius (1998) in which the herbs were more frequently used for medicines in Bwindi Impenetrable Forest Reserve, Uganda.

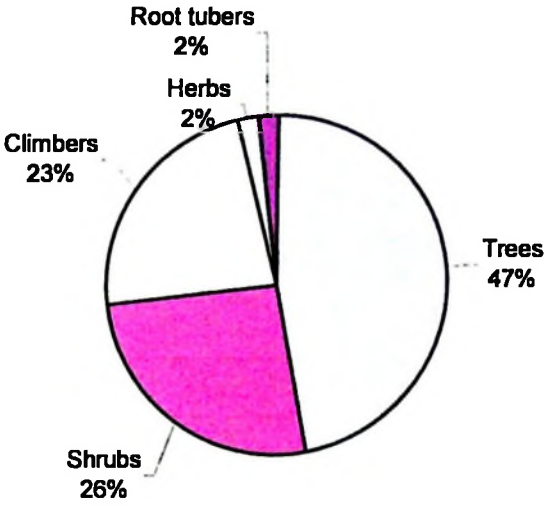

Figure 3: Growth forms of medicinal plants in the study area

4.3.1.3 Plant parts used for medicine

Different plant parts were being harvested for medicines. The results indicated that roots were the most preferred parts followed by leaves and barks. Other plant parts used were stems, fruits and tubers. In some cases a whole plant may be harvested.

Since the most harvested plant parts in this study were found to be roots, this could endanger the sustainability of medicinal plants in the forests if no regulations and restrictions were formulated and enforced. This is because it is the roots, which absorb nutrients from the soil and anchor the plants. The proportion of plant parts used for medicine is indicated in Figure 4.

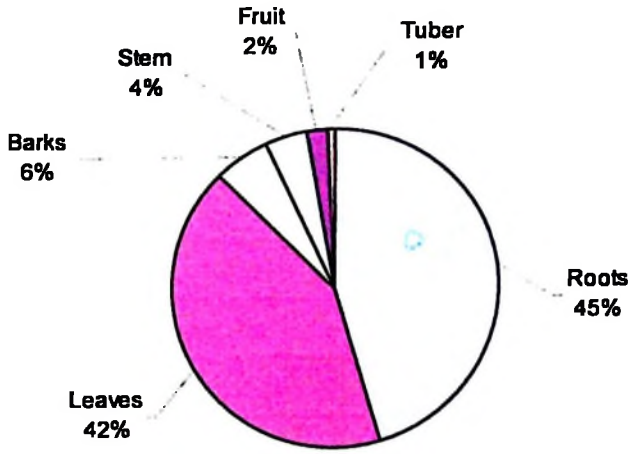

Figure 4: Proportion of plant parts used for medicine in the study area

Extraction of medicinal plants can be extremely destructive to live plants especially where bark and roots are required (Hamza, 1997; Urio *et al.*, 1996; and Gathaara and Kahuki, 1997). Makonda *et al.* (2000) observed drying patches of tree species following overexploitation of their roots and barks in Geita and Kilosa districts. For sustainability, only a very small portion of the root mass should be harvested. This emphasizes the need for more extension education to medicinal plants users, on proper ways of sustainably harvesting the roots and other parts of the plants. Also domestication programme may be necessary for plant species whose continual extensive use may endanger their survival.

4.3.1.4 Modes of application of plant medicine

The most frequently used mode of application of plant medicine was drinking followed by chewing, smearing the medicine on the affected area, washing of the whole body or certain part of the body and application of the medicine in form of droplets (Figure 5). The least frequently mentioned modes were tying the medicine on the affected body part, inhaling

smoke or fumes after either burning or boiling of a certain medicinal plant part. Appendix 2 presents a list of medicinal plants with respect to the diseases they treat, parts used, preparation and storage.

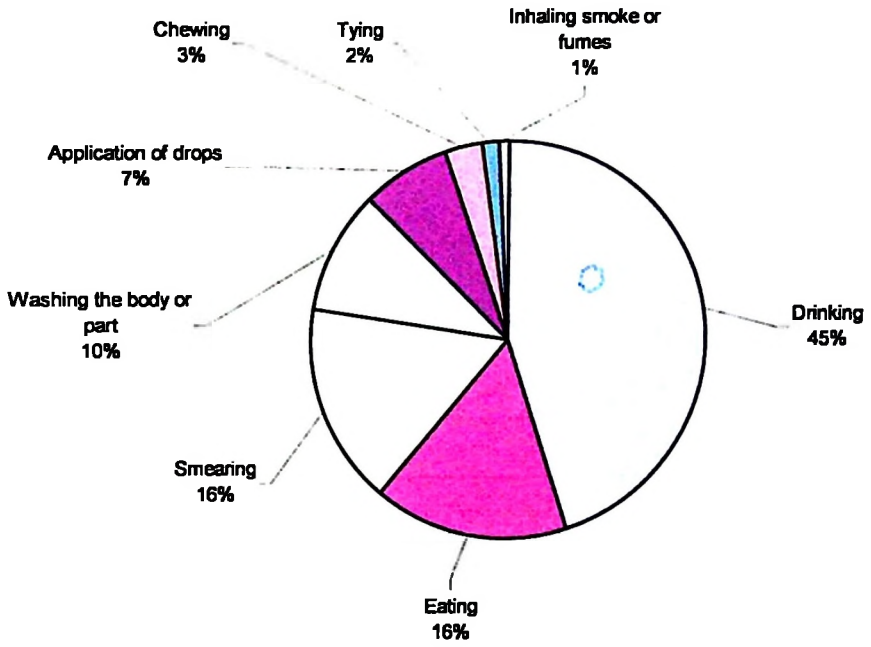

Figure 5: Modes of application of plant medicines

Also the number of diseases or complications reported in this study is lower than those presented by Augustino (2002) who reported 72 and 57 diseases in Morogoro and Iringa urban districts, respectively.

4.3.1.5 Human diseases/ complications cured or treated using plant medicines

A total of 52 human diseases/complications were treated using different plant medicine (Appendix 2). The cured diseases ranged from simple diseases /complications such as stomach ache, aphrodisiac, venereal diseases, bewitchment, otitis media, and convulsion, epilepsy and body rashes to chronic diseases such as tumours, anaemia, hernia, stroke and

blood pressures. The number of diseases or complications reported in this study are higher than those reported by Abdallah (2001) and Hamza *et al.* (2004 a) but lower than those reported by Ruffo (1989) and Maximillian (1998) who reported 63 and 70 diseases in East Usambara and Ruvu Forest Reserves, respectively. In this study, it was found that medicinal plants were being used by the majority of respondents throughout the areas to treat hernia, bewitchment and other problems like aphrodisiac. Although medicinal plants reported to be used by the large segment of the population in the study area, diseases like malaria was rarely mentioned to be cured or treated by these medicinal plants.

4.2.1.6 Preparation of plant medicine

After harvesting, medicinal plants are processed for instant use or stored for future use. The results revealed that most common methods of preparation were through grinding to obtain powder or pounding and squeezing to obtain liquid extracts. Results of this study are contrary to the findings by Maxmillian (1998), Hamza (1997), Hamza *et al.* (2004 a) and Abdallah (2001), who reported boiling to be the most common method for extraction of plant medicines. The authors further reported that boiling was the best extraction method. This is because active ingredients can be extracted and also it is one way of sterilization of the toxins associated with plant medicines. Other methods used were boiling, soaking in water to obtain extracts, burning dried parts to obtain charcoal or ash, scratching and squeezing the medicinal plant part before application (Figure 6).

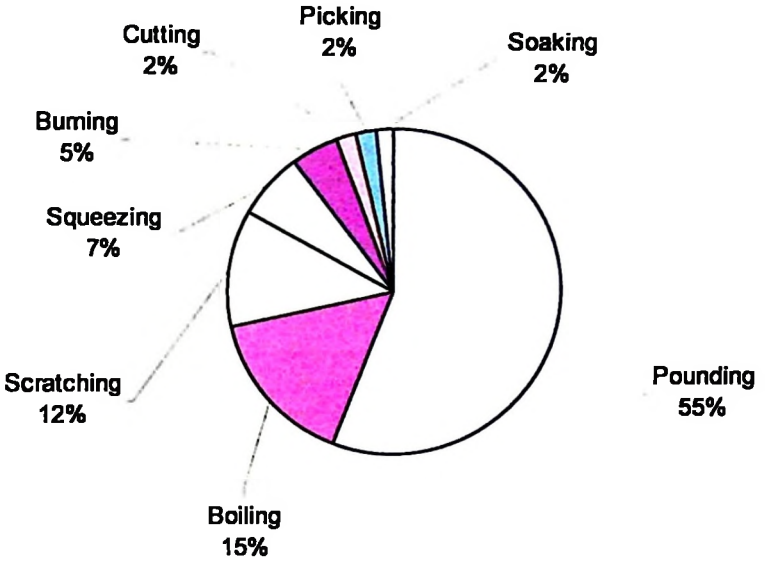

Figure 6: Methods of preparation of plant medicines in the study area

4.5.1.7 Medicinal plants used against bad omen, attracting bees, repel mosquito and winning court cases

Apart from treating human diseases or complications, about twelve medicinal plant species were used against bad omen, to attract bees in hives, to attract customers in business, to protect farms, as mosquito repellent, to prevent misfortune, to enhance success in fishing and hunting, tradition and norms, and winning court case (Table 18). There is low similarity between these results and those reported by Hamza *et al.* (2004 a) who reported that about 6 medicinal plants species were used against bad omen in villages surrounding Mgori forest reserve in Singida region, Tanzania.

Table 18: Medicinal plants used against bad omen, attracting bees, repelling mosquito and winning court cases

S/n	Scientific name	Vernacular name	Tribe	Growth form	Used for	Parts used	Processing	Application
1.	*Ampelocissus africana*	Mtamba [c]	Makonde	Climber	Tradition and norms	Stem	Cut fresh stem	Drinking the exudated sap from the fresh cut stem
2.	*Chassalia umbraticola*	Mdibwa [a]	Mwera	Shrub	Winning court case	Roots	Pound mix with other medicinal plants	Smear on the face before going to the judgment
3.	*Flueggea virosa*	Mpalapala [a, b]	Mwera	Tree	Attraction of bees in bee hives	Roots	Cut into pieces	Smear on the face before going to the judgment
4.	*Gardenia ternifolia ssp.jovis-tonantif*	Chingongoloma ndyanga [a, b]	Mwera	Tree	Winning court case	Roots	Burn mix with other tree medicines then pound	Smear on the face
5.	*Hoslundia opposita*	Mng'umbe /Liumbe [b]	Mwera	Shrub	Mosquito repellent	Leaves	Burn	Close all the doors and windows after burning the leaves
6.	*Ipomea spp.*	Mnipu [a, b]	Mwera	Climber	Attracting customers in business	Leaves	Pick fresh leaves	Put nearby your business
7.	*Jusminum fluminese*	Chikanga [a]	Mwera	Climber	Prevent misfortune	Roots	Cut roots into pieces	Tie with thread and wear
8.	*Psychotria eminiana*	Mtelalela [b]	Mwera	Tree	Success in fishing and hunting	Roots	Pound	Smear to the tool which is used for hunting or fishing
9.	*Strychnos pungens*	Mngulungulu [b]	Mwera	Tree	Tradition and norms	Roots	Cut root into pieces	Put at a playing ground
10.	*Ximenia americana*	Mpinji [b]	Mwera	Mwera	Tradition and norms	Leaves or roots	Boil	Drinking
11.	*Zanthoxylum chalybeum*	Nannakolo [b]	Mwera	Tree	Farm protection	Roots	Cut into pieces	Put in all angles of your farm
12.	Ui	Naminyai [a]	Mwera	Shrub	Tradition and norms	Leaves	Pick fresh leaves	Put the leaves at the initiation venue

Ui = Unidentified species

(a = available in Nndawa village forest reserve; b = available in Mihima village forest reserve and c = available in Dimba forest reserve)

4.3.2 Wild food plants

4.2.2.1 Wild food plants found during field survey

A total of 32 wild food plants were encountered in the surveyed forest reserves. About 26 wild food plants were scientifically identified. Six plants could not been identified, therefore, were presented in their local names (Table 19). The number of wild food plants reported in this study is low compared to that reported by Campbell (1986) and Ruffo (2002) who reported 73 and 326 species of wild food plants in Zimbabwe and Tanzania, respectively. Also Becker (1986) reported 800 edible plant species in the arid and semi-arid Sahelian belt. The lower number of wild food plants observed in this study might be caused by plant endemism, seasonality, environmental differences and low indigenous knowledge on the uses of wild food plants in the study area.

Not all wild food plants, which were listed during the PRA exercise, were found during forest inventory. The results depict that not all wild food plants can be found in the forest reserve. This is because during PRA all wild food plants were listed regardless of whether they can be found in the forest reserves or even in open areas as well as around homesteads. Another reason is that most wild food plants mature seasonally therefore it was not possible to find all the plants during forest inventory.

Table 19: Wild food plants found in the study area, their growth forms, parts used, harvesting, processing and season of harvesting

S/N	Scientific name	Vernacular name	Language	Growth form	Parts used	Application processing and comments	Seasonality
1.	*Aflomomum ssp.*	Utunguiu [b]	Mwera	Herb	Tuber	Boil the tubers then eat	Dry season
2.	*Annona senegalensis*	Mtopetope [b]	Mwera / Makonde	Tree	Fruits	Peeling and eating	Rain season
3.	*Antidesima venosum*	Mpunju [b]	Mwera	Shrub	Fruits	Peeling and eating	Rain season
4.	*Combretum pentagon*	Mnjweshwe [b]	Mwera	Shrub	Fruits	Peeling and eating	Rain season
5.	*Cyphostemma buchananii*	Litembo [c]	Makonde	Climber	Fruits	Peeling and eating	Rain season
6.	*Dichapetalum macrocarpum*	Chikwaja [a, b]		Shrub	Fruits	Peeling and eating	Rain season
7.	*Dichapetalum macrocarpum*	Mtochi [a]	Mwera	Tree	Fruits	Peeling and eating	Rain season
8.	*Dioscorea ssp.*	Mng'oko [a, b, c]	Mwera / Makonde	Climber	Roots	Wash, boil then eat or pound together with fried maize then eat	Throughout the year
9.	*Enlorephytum magilismontanum*	Mtondoli [b]	Mwera	Tree	Fruits	Peeling and eating	Rain season
10.	*Grewia forbesii*	Mmbubudu [c]	Makonde	Climber	Fruits	Peeling and eating	Rain season
11.	*Haplocoelium foliolusum*	Mkalawanje [c]	Makonde	Tree	Fruits	Frying peel then eat	Rain and dry season
12.	*Heinsia zanzibarica*	Mtondodi [c]	Makonde	Tree	Fruits	Peeling and eating	Rain season
13.	*Landolphia kirkii*	Mmungo/ Mbungo [a, b]	Mwera / Makonde	Climber	Fruits	Peeling and eating	Rain season
14.	*Landolphia kirkii*	Mtili [c]	Mwera	Climber	Fruits	Peeling and eating	Rain season
15.	*Landolphia kirkii*	Mtolombutuka [a]	Mwera / Makonde	Climber	Fruits	Peeling and eating	Rain season
16.	*Margaritalia discoidea*	Mnyani (Dihani) [c]	Makonde	Climber	Fruits	Boil then peel to eat	Rain season
17.	*Manilkara sulcata*	Mng'ou (Msofu) [a, c]	Mwera / Makonde	Climber	Fruits	Peeling and eating	Rain season
18.	*Parinari curatellifolia*	Mmula [a, b]	Mwera	Tree	Fruits	Peeling and eating	Rain season
19.	*Pavetta iutambensis*	Ndaula [c]	Makonde	Shrub	Fruits	Peeling and eating	Rain season
20.	*Rhychnosia hirta*	Angadi [a, b]	Mwera /Makonde	Climber	Roots	Boil, cut into slices, soak in water for 24 hours to remove bitterness, and then dry and grind to obtain flour for porridge or stiff porridge	Dry season
21.	*Salacia madagascariensis*	Mkolong'oa [a, b]	Mwera / Makonde	Tree	Fruits	Peeling and eating	Dry and rain season
22.	*Salacia madagascariensis*	Mkung'u [a, b]	Mwera / Makonde	Climber	Fruits	Peeling and eating	Rain season
23.	*Sphaerocoryne gracilis*	Mpindingololo [c]	Mwera / Makonde	Shrub	Fruits	Peeling and eating	Rain season
24.	*Strychnos spinosa*	Mnjishi [a, b]	Mwera	Tree	Fruits	Peeling and eating	Rain season
25.	*Synaptolepis kirkii*	Upupu [a •]	Mwera	Climber	Pods (legume)	Boil and pour the water three times to remove poison then eat the seeds with rice or stiff porridge like other legumes such as beans	Dry season
26.	Ui	Mgulugai [a]	Mwera	Tree	Fruits	Peeling and eating	Rain season
27.	*Strychnos madagascariensis*	Mtongatonga [a]	Mwera / Makonde	Tree	Fruits	Peeling and eating	Rain season
28.	Ui	Utumbogwankuku	Mwera	Shrub	Fruits	Peeling and eating	Rain season
29.	Ui	Mpama [a]	Makonde	Climber	Roots	Boil the tubers then eat	Dry season
30.	Ui	Mchiu [a]	Mwera / Makonde	Climber	Roots	Boil the tubers then eat	Dry season
31.	Ui	Matupa [a]	Mwera	Climber	Roots	Boil the tubers then eat	Dry season
32.	*Vitex strinkeri*	Mfuru [c]	Mwera / Makonde	Tree	Fruits	Peeling and eating	Rain season

(a=available in Ndawa forest reserve, b= available in Mihima forest reserve and c=available in Dimba forest reserve)

The identified 26 wild food plants species belong to 17 plant families. The family, which composed many species was Annonaceae followed by Apocynaceae, Dichapetalaceae, Verbenaceae, Celastraceae and Rubiaceae. The families, which had least number of species, are as indicated in Table 20. These results show that most of wild food plants in the study area belong to Annonaceae and Apocynaceae families.

Table 20: Families of wild food plant species in the study area

Family name	Number of species	Percentage
Annonaceae	4	14.0
Apocynaceae	3	10.0
Celastraceae	2	7.0
Dichapetalaceae	2	7.0
Rubiaceae	2	7.0
Verbenaceae	2	7.0
Fabaceae sub family Papilionaceae	1	3.0
Tiliaceae	1	3.0
Sapindaceae	1	3.0
Chrysobalanaceae	1	3.0
Dioscoreaceae	1	3.0
Loganiceae	1	3.0
Combretaceae	1	3.0
Eurphorbiaceae	1	3.0
Sapotaceae	1	3.0
Thymecaeceae	1	3.0
Zingiberaceae	1	3.0

Most of the wild food plants in the surveyed forest reserves were climbers and trees. About 44% of wild food plants were climbers, followed by 34% trees, 19% shrubs and 3% herbs. The results further show that several wild food plants parts were used for food that is 78% as fruits, 19% as roots and root tubers and 3% as legumes. From the 32 wild food plants found in the study area, 25 were fruit plants. The number of fruit plants obtained in this study is lower than those reported by Makonda (1997), Mapolu (2002) and Nyigili (2003)

who identified 39, 47 and 33 wild fruit plant species in Geita, Tabora and Mbozi districts, respectively. Also the results of this study differ much from those reported by Ramadhani *et al.* (1998), and Ogle and Grivetti (1985) who reported 179, and 110 edible wild fruit plant species, respectively. The low number of plants observed in this study might be caused by plant endemism, seasonality, environmental differences of the areas and indigenous knowledge on the uses of wild fruit plants in the study area.

The peak season for most wild fruits in the study area is during rain season with few exceptions that mature during dry season. Fruits, which mature during dry season, are important as they serve during food shortage periods. Wild fruits are eaten between meals and as snacks. During the forest inventory some fruits were found rotting on the ground indicating that there are plenty of fruits especially during peak seasons.

Among the wild food plants reported in Table 19, six species were roots and tubers. The species include *Dioscorea spp, Rhychnosia spp* and *Afromomum spp.* These results are different from those reported by Nyigili (2003), who recorded four species of roots and tubers in Mbozi district, Mbeya, Tanzania. The difference might be caused by the seasonal availability of most root and tuber species. Most people in the study area preferred *Dioscorea spp.* The reason for using it was easy availability of the tuber during critical period of food shortage. Findings of this study are similar to those reported by Mapolu (2002), Kabuye (1996), Zinyama, *et al.* (1990), and Missano *et al.* (1994). *Dioscorea* spp (ming'oko) was available throughout the year. However, the roots were not palatable during rain season as they absorb a lot of water. The findings that ming'oko is consumed throughout the year conform to those reported by Missano *et al.* (1994). In Kenya,

however, Kabuye (1986) reported that wild roots and tubers were consumed only as a snack while herding.

Only one species of wild legume was used as food in the study area. The species is called Upupu (*Synaptolepis kirkii*) and is used only during food shortages. The preparation of this food is very tedious, as it needs time to prepare. It was reported that care must be taken during the preparation of this food because it is poison. The legumes are boiled three times and during each time of boiling the water is poured and the legumes are washed and re-boiled again and again until the legumes becomes free of poison and ready for eating. The legumes are eaten with rice or *ugali* and sometimes they may be taken alone as the main meal like other legumes such as beans. Similar results on the utilization of wild legumes were reported by FAO (1995).

The study by Guinand and Lemessa (2000) reported that fruits from wild plants are usually consumed raw as they are picked. Leaves and other tender parts of wild plants are prepared like cabbage and other vegetables, i.e. chopped into small pieces and boiled in water. Roots are either eaten raw or cooked. Some wild tubers are first dried and then crushed. Root parts are usually more complicated and need a longer preparation time and process, especially those which are toxic and need special treatment. Kernels, seeds and nuts are also mostly cooked for a fairly long time before consumption. The consumers revealed that, whenever possible, they need to use more salt to mask the distasteful feature of the foodstuff prepared (Guinand and Lemessa, 2000).

4.2.2.2 Common methods of harvesting wild food plants in the study area

It was observed that common methods used to harvest wild food plants in the study area included picking and digging /uprooting. Some of these methods such as uprooting are detrimental. It is worth noting that over harvesting of species such as *Landolphia kirkii* was observed. The results conform to results reported by FAO (1997), that Tropical countries are currently experiencing the highest rates of forest clearance and degradation.

4.4 Contribution of medicinal and wild food plants to the well-being of rural communities

4.4.1 Direct contribution

The amount of wild plant foods and other non-timber forest products (NTFPs) consumed on daily basis was taken as indicator of their contribution to household food security. Table 21 shows the percentage contribution of wild plant foods and medicinal plants as compared to agricultural crops, livestock products, and other non-timber forest products, including honey consumed in a household per year.

Table 21: Direct contribution to household food security

Name of product	Average quantity (kg) consumed per household per year	Percentage contribution
Agricultural crops	1 098	93.8
Livestock products	18	1.5
Wild fruits	25	2.1
Wild roots and tubers	12	1.0
Wild legumes	6	0.5
Plants medicine	4	0.4
Other NTFPs including honey	8	0.7
Total	**1 171**	**100.0**

4.4.1.1 Agricultural crops and livestock products

The average amount of agricultural crops consumed in household per year was 1 098 kg, which contributed about 93.8% to household food security. The average amount of livestock products consumed in a household per year was 18 kg, contributing about 1.5% to household food security.

In general, agricultural crops and livestock products contributed about 95.3% to household food security annually. This high percentage contribution of agricultural crops and livestock products to food security is expected because agriculture is the main economic activity of most people of this country. The percentage contribution of agricultural crops and livestock products of this study is higher than that reported by Hamza (2004 b), who reported the percentage contribution of this sector to be 86.1% in villages around Mgori forest reserve in Singida, Tanzania.

4.4.1.2 Wild plant food products

As reported in section 4.2.2.1 wild plant food products in this study included wild fruits, wild roots, wild tubers and wild legumes. The average amount of wild fruits consumed per household per year was 25 kg, which contributed about 2.1% to household food security. The average amount of wild roots and tubers consumed per household per year was 12 kg, which contributed about 1% to household food security while the average amount of wild legumes consumed per household per year was 6 kg, contributing only about 0.5% to household food security. The percentage of wild fruits consumed in this study (2.1%) is lower than that recorded by Hamza (2004 b), who reported that the contribution of wild fruits to household food security was about 6.3% of amount of wild fruits consumed in villages around Mgori forest reserve in Singida, Tanzania.

4.4.1.3 Plant medicine

The average amount of plant medicines consumed per household per year was 4 kg, which contributed about 0.4% to household primary health care. Direct utilization of medicinal plants by household members helps them to improve their primary health care and thus save some money, which is then used to buy food or other household requirements resulting into improvement of their well-being.

4.3.1.4 Other NTFPs including honey

The average amount of other NTFPs, including honey, consumed per household per year was 8 kg, which contributed about 0.4% of total food consumed per household per year. In the study area honey was used as jam or as a side dish in order to increase nutritional value of the meal. The contribution of honey reported in this study is a bit higher than 0.2%, which was reported by Hamza (2004 b) in villages around Mgori forest reserve in Singida, Tanzania.

4.4.2 Indirect contribution

The amount of wild food plants and plant medicines collected in a year and annual revenues earned are presented in Table 22. Part or all the income accrued from sales of NTFPs including honey, wild plant foods, plant medicines together with agricultural crops and livestock products was used to buy food and other basic needs thus contributing indirectly to household food security.

Table 22: Indirect contribution to household income

Name of product	Quantity sold (kg) per household	Price	Income	Percentage contribution
Agricultural crops	1 000	200	200 000	80.0
Livestock products	25	800	20 000	8.0
Wild fruits	31	150	4 650	2.0
Wild roots and tubers	7	100	700	0.3
Wild legumes	2	300	600	0.2
Plant medicine	15	450	6 750	3.0
Other NTFPs including honey	33	500	16 500	6.5
Total			**249 000**	**100.0**

4.4.2.1 Agricultural crops and livestock products

About 95% of respondents were involved in selling agricultural crops and livestock products. Such sales contributed 80% and 8% to household income per year, respectively. These results are higher than those of Hamza (2004 b), who reported the contribution of agricultural and livestock products to be 53. 2% in villages around Mgori forest reserve in Singida, Tanzania. The difference in percentage contribution of agricultural crops and livestock products to household income between the two study areas is expected due to differences in the climatic conditions of the two areas.

4.4.2.2 Wild plant food products

About 31 kg of fruits were sold earning a household about Tshs. 4 650 per year. This contributed about 2% of the total household income per year. The low contribution was because rural communities prefer to collect wild fruits themselves rather than buying them (Hines and Eckman, 1993). The contribution of wild fruits to household income reported in this study is, however, higher than 0.7% reported by Hamza, (2004 b) in villages around Mgori forest reserve in Singida, Tanzania. Wild roots and tubers also contributed about 0.3% of household income per year while wild legumes contributed about 0.2%.

4.4.2.3 Plant medicines

The average income from plant medicines per household per year was Tshs. 6 750 that contributed about 3% to household income. The income earned from sales of plants medicine reported in this study is lower than Tshs 600 000 reported by Abdallah (2001) in villages around Zaraninge forest reserve in Bagamoyo, Tanzania and Tshs 170 000 reported by Hamza (2004 a) in villages around Mgori forest reserve Singida, Tanzania. These differences might be caused by differences in income levels of households among the three communities, which in turn influenced their abilities to pay for services offered by herbalists and traditional midwives.

4.4.2.4 Other NTFPs including honey

The income generated by other NTFPs, including honey, per household per year was Tshs 16 500 that contributed about 6% to household income. This figure is lower than 19.5% reported by Hamza (2004 b), as annual household income contributed by honey in villages around Mgori forest reserve in Singida, Tanzania.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

It was concluded that medicinal and wild food plants played a big role to the well-being of rural communities in Lindi Rural District. They contributed about 4% and 5.5% to household food security and income respectively, 79.7% of people relied on medicinal plants and 81.7% people used wild plant foods. Although majority of the people in the study area used medicinal and wild food plants, the percentage contribution of these plants seemed to be small due to their low monetary value in the study area. It was further concluded that overharvesting of medicinal and wild food plants especially the roots could endanger the sustainability of these plants in the forests if no regulations and restrictions are formulated and enforced.

5.2 Recommendations

From the preceding conclusion, the following recommendations were made:

- To ensure sustainable supply of medicinal and wild plant foods the remaining forests should be managed in a sustainable manner and the plants be domesticated.

- Efforts should be made to add value to medicinal and wild plant foods by developing and disseminating simple appropriate technologies for processing of these products. This will provide employment to the communities.

- Wild plant foods should be integrated in the national food security programme thus be considered in developing strategies to fight rural food insecurity especially for food insecure areas of the country.

- Plant medicine should be integrated with modern health care system.

- Regulations and restrictions be formulated and enforced to minimize overharvesting of medicinal and wild food plants to enable sustainability of these plants in the forests.

- It is further recommended that more research be carried out on processing, marketing and domestication medicinal and wild food plants.

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APPENDICES

Appendix 1 (a): Household Questionnaire

Division..... Ward..... Village.....
Respondent code number..... Date.....

SECTION A: BACK GROUND INFORMATION

1. Name of household head.....
2. Age
3. Gender (i) Male (ii) Female
4. Marital status

   (i) Single (ii) Married (iii) Widowed (iv) Divorced
5. Education level

   (i) Primary (ii) No formal education (iii) Adult education (iv) Secondary
6. Occupation .....
7. Household composition

Age	Male	Female	Total
Under 18 years			
18-55 years			
Over 55 years			

8. For how long have you been living in this village? .....
9. Do you own land for agricultural activities? .....

   (i) Yes (ii) No

9.1 If yes, what was the size of the farm cultivated in the last crop season? ....ha

9.2 List the types of crops cultivated

Type of crop grown	Total harvested	Amount consumed	Amount stored	Amount sold	Price per unit

9.3 Does the obtained crop produce satisfy your annual food requirements?
Yes /No

9.4 If no how do you do to fill the deficit? .....
9.5 How are you storing your agriculture produce? .....
9.6 Do you face any storage problems? List if any.....

9.7 Do you own livestock?
Yes / No
9.8 If yes, list the types of livestock kept

Type of livestock	Total	Amount sold	Amount consumed	Price per unit
Animal products				

9.9 If no, give reasons.
.....

10. What type(s) of NTFPs do you collect?

Type(s) of NTFPs	Local name	Growth form	Part(s) used	Harvesting season	Habitat

SECTION B: INFORMATION ON MEDICINAL PLANTS

1. Where do you get treatment when you are sick?
   (i) Hospital (ii) Traditional healers (iii) Both hospitals and traditional healers
2. Do you use plant medicine?
   (i) Yes (ii) No
3. For how long have you been involved in the use of plant medicine?

4. (a) Why have you decided to use plant medicine? Give reasons
   (b) Mention plants that are used for medicines(s)

Name of plant	Tribe	Harvesting method	Part used	Diseases cured	Preparation method	Storage	Dosage	Other uses

5. Where did you get knowledge of using medicinal plants?
   .....
6. What do you prefer between plant medicines and conventional medicine?
   .....
7. How many hospitals/dispensaries do you have in this village? .....
8. How many herbalists do you have in this village? .....
9. How many traditional midwives do you have in this village? .....
10. How do you compare services obtained from traditional healers to that provided in hospitals/ dispensary? .....

SECTION C: INFORMATION ON WILD FOOD PLANTS

1. Do you use wild plant foods?
   (i) Yes (ii) No
1.1 (a) If yes how do you rate your frequency of collecting wild plant foods?
   (i) Daily (ii) Weekly (iii) Monthly (iv) Occasionally
1.2 (b) If no, give reasons. .....
2. Could life be possible without wild food plants? Why do you think so?
   (i) Yes (ii). No

3. What type(s) of wild plant foods do you collect?

S/N	Scientific name	Vernacular name	Tribe	Growth form	Estimated quantity per ha	Parts used	Application, Processing and comments	Seasonality

4. Who is responsible for the collection of wild plant foods?
   (i). Women (ii) Men (iii) Children (iv) All household members
5. How far is the forest from which wild plant foods are collected? .....Km
6. How can you judge the distance?
   (i) Increasing (ii) Decreasing (iii) Constant with time (iv) Changing
7. For how long do you think the forest will continue providing wild plant foods?
8. Is there any attempt of domesticating some of the wild food plants?
   (i) Yes (ii). No
8.1 If yes, for which species and why?
8.2 If no, give reasons.....
9. Do you sell wild plant foods?
   (i). Yes (ii) No
9.1 If yes where do your customers come from? .....
9.2 If no, give reasons.....
10. How frequent do you sell wild plant foods?
   (i) Daily (ii) Weekly (iii) Monthly (iv) Annually
10.1. Out of this money how much is used for health services?

11. Why have you decided to use wild plant foods?
    Give reasons .....
12. Who mostly uses wild plant foods within the household?
    (i) Men (ii) Women (ii i) Children (IV) All household members
13. Do you preserve wild plant foods? (i) Yes (ii) No
14.1 If yes, which preservation methods do you use? .....
14.2 If no, why? Give reasons.....
14. Who is responsible for the preservation of wild foods?
    (i) Women (ii) Men (iii) Children
15. What is the current availability of wild plant foods as compared to the past ten years?
    (i) Increasing (ii) Decreasing (iii) Same (iv) Fluctuates
17. What do you consider to be the best way of improving the availability of wild plant foods?
18. Do you have any institutions for regulating resource use in this village?
    (i) Yes (ii). No
18a If yes, what are these institutions? .....
19. What do you think must be done to ensure sustainable utilization of wild plant foods?

Appendix 1 (b): Checklist for Participatory Rural Appraisal (PRA)

1. Do the community use medicinal plants/ wild food plants (yes/no

2. Mention plant species used for food and/ or medicine.
   Wild food plants .....
   Medicinal plants.....
3. What methods are used in harvesting the above plant species (specify every plant and its method)?
4. Mention the parts used and their respective tree species by names.
5. What is the trend/ status in case of availability of wild food plants / medicinal plants as compared with the previous situation?
6. What constraints do the community face in collecting/harvesting medicinal plants / wild food plants?
7. What is the use status of plant medicine as compared to conventional medicines?
8. What type of common diseases is normally treated by traditional healers and not by conventional medicine or both treat the diseases?
9. Are there any local believes in the whole exercise of collecting and or harvesting medicinal and wild food plants?
10. Are there any mechanisms in place to ensure the continuous supply of medicinal and wild food plants? Why?
11. Who are the major dealers in collecting/ harvesting medicinal and wild food plants? Why?
12. What is the trend of using medicinal and wild food plants in previous years and the present situation?
13. Is there any public awareness in conservation strategies for medicinal and wild food plants to ensure sustainable utilization?
14. What type of plants, which have undergone extinction as a result of lack of conservation awareness or over exploited due to its potentialities?
15. List such plants which were previously available and are no longer available in the vicinity.
16. Give your suggestions what should be done so as to ensure availability and sustainable utilization of medicinal and wild food plants?
17. What government should do to help in management of medicinal and wild food plants? Give your opinions?

Appendex 1 (c): Questionnaire for Herbalist

1. Division..... Ward..... Village.....Date.....

SECTION A: BACK GROUND INFORMATION

•Name .....• Age
• Gender (i) Male (ii) Female

•Marital status
(i) Single (ii) Married (iii) Widowed (iv) Divorced

• Education level
(i) Primary (ii) No formal education (iii) Adult education (iv) Secondary (v) College
• Occupation.....

2. Which plants do you use for medicine? For which diseases? .....
3. How do you harvest medicinal plants from the forest? .....
4. What part(s) do you use for each species mentioned above? .....
5. How do you prepare the medicinal plants before giving to the patient? .....
6. How do you store the remainder of the medicinal plant after giving the patient?
.....
7. Where did you get knowledge of using medicinal plants? .....
8. How far is the forest from which medicinal plants are collected? ..... Km
9. Is there any indigenous knowledge associated with harvesting, processing, storing and using medicinal plants? .....
10. Could life be possible without medicinal plants? (Yes/ no)
10.1 Why do you think so? .....
11. What is the current trend of medicinal plants in the forest as compared to previous years?.....
12. How many patients do you attend per year?.....
13. Is there any taboo on use of medicinal plants in this village? .....
14. What do you think are the roles of medicinal plants? .....
15. What are the common diseases affecting most people in this village?.....
16. How do you treat the diseases mentioned above?.....
17. Where do your customers come from? .....
18. Do you sell medicine accrued from medicinal plants to other people outside the village-?
18.1 Mention them with respect to the amount of money obtained.....
19. How much money do you obtain from sales of medicine and treating people?.....
20. How are you apportioning the money to buy food and other requirements?.....

Appendix 1 (d): Questionnaire for traditional midwives

1. Division..... Ward..... Village.....Date.....

2. **SECTION A: BACK GROUND INFORMATION**

- •Name .....• Age
- •Gender (i) Male (ii) Female
- •Marital status
  (i) Single (ii) Married (iii) Widowed (iv) Divorced
- • Education level
  (i) Primary (ii) No formal education (iii) Adult education
  (iv) Secondary (v) College
- • Occupation.....

3. Which plants do you use for treating mothers and children?

3.1 Which diseases are common for mothers and children?

.....

4. How do you harvest medicinal plants from the forest? .....

5. Which part(s) do you use for species mentioned above? .....

6. How do you prepare the plant medicine before giving the patient? .....

7. How do you store the remainder of medicinal plants after giving the patient?.....

8. Where did you get the knowledge of using medicinal plants? .....

9. What complications do pregnant women face? .....

10. How do you treat them? .....

11. What types of treatment are given to pregnant women after delivery and infants?

.....

12. How many pregnant women have you attended? .....

Appendix 1 (c): Questionnaire for health workers

1. Division..... Ward..... Village.....Date.....

2. **SECTION A: BACK GROUND INFORMATION**

- Name .....• Age .....
- Gender (i) Male (ii) Female

- Marital status
  (i) Single (ii) Married (iii) Widowed (iv) Divorced
- Education level
  (i) Primary (ii) No formal education (iii) Adult education (iv) Secondary (v) College
- Occupation.....

3. Since when have you been residing in this village? .....
4. How is the situation with respect to availability of conventional medicines?
.....
5. Do you have accessibility to them? Yes/ No.....

6. How many patients are you treating per year? (Average) .....
7. Are there any taboos on use of conventional medicines around this area? .....
8. How do you compare between the use of modern medicines and plant medicines in this area?.....
9. Could life be possible without conventional medicines? Yes /No
9.1 Why do you think so?.....
10. What are the disease affecting most people in this village? .....
11. How do you treat each of the diseases mentioned above? .....
12. How many patients are attended in the village dispensary every week? .....

Appendix 1(a): Medicinal plants for treating human diseases and other complications, parts used, processing methods and modes of application in the study area

(a= available in Nndawa village forest reserve, b= available in Mihima village forest reserve and c= available in Dimba forest reserve).
Ui = unidentified species

S/N	Scientific name	Vernacular name	Tribe	Growth from	Diseases/ Complications treated	Parts used	Processing, and mode of application
1.	*Cassytha filiformis*	Avila [a, b]	Mwera	Climber	Tumour	Roots	Pound then eat/chew
2.	Ui	Chibabangala [c]	Makonde	Tuber	Stomach-ache Hernia	Root Tuber	Boil then drink Scratch add water stir then drink
3.	*Ehretia amoena*	Chibumba [a, b]	Mwera	Shrub	Otitis media Hernia	Leaves Roots/ Leaves	Pound leaves filter with a piece of cloth put some drops in ear Scratch, the roots put into water then stir to drink or pound leaves then drink or boil the roots then drink
4.	*Tectracera litoralis*	Chibutuka [b]	Mwera	Climber	Abnormal heartbeat	Roots	Mix with salt pound then eat /chew
5.	*Hibiscus micranthus*	Chidedea [b]	Mwera	Herb	Paronichia Aphrodisiac	Roots Leaves	Pound roots and smear to the affected finger Mix leaves with medicine from plant medicines pound then add to the food of the one you love
6.	*Polygala virgata*	Chiguluka [a, b]	Mwera	Tree	Convulsion Stomach-ache Hernia Head ache	Leaves Roots Roots Leaves	Squeeze fresh leaves put in water ready for taking bath Pound roots add water then drink Scratch roots add water stir then drink Boil leaves then drink
7.	*Monanthotaxis fornicata*	Chikombe [b]	Mwera	Climber	Diarrhoea Stomach ache	Leaves	Pound the eaves then drink or boil the leaves then drink
8.	*Dichapetalum macrocarpum*	Chikwaja [a, b]	Mwera	Shrub	Snake bite Convulsion Measles	Leaves Roots Leaves	Pound leaves, filter then drink Pound roots then eat/chew Pound leaves mix with other trees medicines add water then use the resultant liquid for bath
9.	*Dichapetalum mossambicense*	Chikwaja cheusi [b]	Mwera	Climber	Hernia Gonorrhoea	Roots Leaves	Scratch roots add water stir then drink Pound leaves filter then drink

10.	*Strophanthus kombe*	Chilema[c]	Mwera	Climber	Back ache	Roots	Scratch, burn roots and smear around the back bone
11.	*Uvaria acuminata*	Chilombi[c]	Mwera	Shrub	Cough	Leaves	Burn mix with popcorn, pound then eat Boil then drink
12.	*Eriosema spp*	Chinamati [b]	Mwera	Climber	Heart diseases Aphrodisiac	Rots Leaves	Pound roots then eat Pound leaves put water filter and give it to the one you love to drink without him or herself knowing
13.	*Gardenia terniforlia ssp. Jovis-tonantis*	Chingongolom andyanga [b]	Mwera	Tree	Aphrodisiac Bewitched	Roots Leaves	Pound the roots add water give your lover to drink without himself knowing Pound the leaves add water then drink
14.	*Dalechampia scandens*	Kidedea ya msituni [b]	Mwera	Climber	Paronychia Aphrodisiac	Roots Roots	Pound roots and smear to the affected finger Mix medicine from other trees then pound and add to the food of the one you love
15.	*Hensia crinita*	Kimembe [c]	Makonde	Shrub	Otitis media Bilharzias (Schistosomoasis)	Leaves Roots	Pound and put in a clean piece of cloth, press then put few drops in the ear Tie roots in bundle then boil to drink
16.	Ui	Kinamanemela [c]	Makonde	Shrub	Venereal diseases	Leaves or Roots	Boil then drink or pound then eat/chew
17.	*Asparagus falcatus*	Kinavinavi [c]	Makonde	Climber	Ears	Leaves	Pound and put in a clean piece of cloth, press then put few drops in the ear
18.	*Gardenia subacaulis*	Kioti [c]	Makonde	Tree	Cancer	Fruits	Pound fruits and put in the wound/affected area
19.	*Bonamia mossambicensis*	Lidingili [a, b, c]	Makonde / Mwera	Climber	Hernia Eyes Hernia	Roots Leaves Roots /leaves	Boil roots then drink Pound, soak in water, filter and wash the face Boil leaves or roots then drink or Scratch the roots add water stir then drink
20.	*Phyllanthus muellerianus*	Lipeto [b]	Mwera	Climber	Convulsion Delirium	Roots/Leaves	Pound roots then drink or pound leaves put in water in a special container then take bath
21.	*Vernonia amygdalina*	Liuluya [b]	Mwera	Shrub	Stomach ache Hernia Abortion	Leaves Roots Roots	Boil leaves then drink Pound roots add water then drink Pound roots, press then drink
22.	*Acacia brevispica*	Love [a, b]	Mwera	Climber	Measles	Leaves	Pound leaves then drink

					Heart disease	Roots	Burn mix with other plant medicines pound then eat/ chew
23.	*Acacia brevispica*	Luseya [c]	Makonde	Climber	Ears or eyes	Leaves	Pound fresh leaves put in a clean cloth then squeeze and put few drops in ears or eyes
24.	*Gonatopus boivinii*	Lutondwe/Ndondwe [b]	Mwera	Root tuber	Syphilis Ears	Tuber Leaves	Boil the tuber drink twice a day for 3 days Squeeze leaves and put some drops in ears
25.	*Asparagus africanus*	Lutungwi [b]	Mwera	Shrub	Hernia Head ache Impotence	Leaves Roots Roots	Boil leaves then drink Pound roots then eat/chew Pound roots add water then drink
26.	Ui	Makutumbawala [c]	Makonde	Herb	Pneumonia	Bulb	Boil and tie up the part affected parts e.g. ribs
27.	*Ronospora caffra*	Mbalale [a]	Mwera	Tree	Hernia	Roots	Scratch the roots add water stir then drink
28.	*Acacia brevispica*	Mbalang'awe [b]	Mwera	Tree	Problems during birth Convulsion	Leaves/Roots Leaves	Pound leaves or roots then eat /chew Mix leaves with other trees medicines, pound add water wash the body
29.	*Steganotaenia araliaceae*	Mbalika [b]	Mwera	Shrub	Evil spirit Skin diseases Stomach ache	Leaves/Roots Leaves Barks	Boil leaves pound then drink or pound roots add water filter then drink Boil leaves pound then drink or pound roots add water filter then drink Pound dried barks add in porridge or tea then drink
30.	*Phytolaca dodecadra*	Mbonopori [c]	Makonde	Shrub	Wound	Sap	Cut /chop the stem to obtain sap and slowly put droplets in the wound
31.	*Sclerocarya birrea ssp.caffra*	Mbwabwalaka [c]	Makonde	Tree	Stomach ache	Leaves / Roots	Pound leave then filter and drink or boil roots then drink
32.	*Dalbergia nitudula*	Mchejea [b]	Mwera	Tree	Hernia Bewitched	Leaves Roots	Pound the leaves add water then drink Pound roots add water then drink
33.	Ui	Mchenjele [a]	Mwera	Tree	Convulsion Tumour	Barks Barks	Pound to obtain powder then eat/ chew Pound to obtain powder then eat/ chew
34.	*Hugonia castaneifolia*	Mchuluchulu [c]	Makonde	Tree	Pains during menstruation period	Roots	Boil roots then drink or grind then eat /chew
35.	*Strychnos schefferi*	Mchulwe [c]	Makonde	Tree	Stomach-ache Waist ache (Lumbago)	Leaves/Roots Leaves/Roots	Boil leaves or roots then drink Pound leaves then dink or burn the roots and apply around the waist
36.	*Chassalia umbraticola*	Mdibwa [a, b]	Mwera	Shrub	Aphrodisiac	Roots	Mix medicine from other trees then pound

					Aphrodisiac Heart diseases	Roots Roots	and add to the food of the one you love Mix medicine with other plant medicines then pound and add to the food of the one you love Burn the roots mix with popcorn pound then eat /chew
37.	Ui	Mfukizi [c]	Makonde	Shrub	Evil spirit Convulsion	Leaves	Burn leaves in a container then inhale the resultant smokes or fumes
38.	*Tapiphyllum burnetii*	Mjini [b]	Mwera	Tree	Evil spirit	Roots	Boil leaves pound then drink or pound roots add water filter then drink
39.	*Blighia unijepota*	Mkalanga [b]	Mwera	Tree	Fungus	Roots	Burn, pound and apply on the affected area
40.	*Commiphora pteleifolia*	Mkololamanga [a]	Mwera	Tree	Bewitched Pain during menstruation period	Roots Roots	Pound, add water then drink or boil then drink Pound, add water then drink or boil then drink
41.	*Boscia angustifolia*	Mkotoshau [a]	Mwera	Shrub	Dysentery Diarrhoea	Leaves Barks	Boil leaves then drink Boil barks then drink
42.	*Lannea fulva*	Mkungunyanjila [b]	Mwera	Climber	Hernia	Roots	Pound roots add water then drink or scratch roots add water stir then drink
43.	*Phyllanthus muellerianus*	Mkwelambamba [b]	Mwera	Climber	Convulsion Snake bite Bewitched	Leaves Roots Leaves	Squeeze leaves put in water for the Patient to take bath Pound roots then smear on the injured area Squeeze leaves put in water for the patient to take bath
44.	*Jaminum meyerijohannis*	Mkwinyanyati[b]	Mwera	Shrub	Wound	Roots Leaves	Pound dried roots apply the obtained powder on the wound Pound fresh leaves and apply on the wound
45.	*Rothia hirsuta*	Mlyolyolyo [c]	Makonde	Climber	Ears	Leaves	Pound fresh leaves put in a clean piece of cloth then squeeze and put few drops in ears
46.	*Acalypha ornata*	Mmalala [b, c]	Makonde / Mwera	Tree	Bewitched Anaemia	Leaves Roots	Pound roots add water then drink Boil root then drink
47.	*Erythoxylum fischeri*	Mmalanjai [b]	Mwera	Tree	Paronychia Bewitched	Roots Roots/ leaves	Pound roots and apply on the affected finger Pound leaves add water then drink or boil leaves then drink
48.	*Erythoxylum fischeri*	Mmalanjai mdogo [a]	Mwera	Tree	Ears	Leaves	Pound leaves and put in a clean cloth and press then put few drops in the ears

49.	*Bysocarpus orientale*	Mmalanjai mkubwa [a]	Mwera	Tree	Eyes	Fruits	Squeeze and put a drop of fruit juice in eyes
50.	*Polysphaeria braunii*	Mmambala [b]	Mwera	Shrub	Paralysis	Leaves Roots	Boil leaves and wash the affected area Pound the roots and apply on the affected area
51.	*Vitex strinkeri*	Mmembe [a, b]	Mwera	Tree	Delirium Convulsion Eyes	Roots Leaves Leaves	Pound roots then eat /chew Squeeze leaves into water and wash the body Squeeze fresh leaves put in water then wash the face
52.	*Keetia venosa*	Mmuluti [b]	Mwera	Tree	Delirium Bewitched	Leaves Roots	Squeeze leaves and put in water ready for taking bath Pound the burned roots then eat / chew
53.	*Cassia abbreaviata*	Mnembelembe [b]	Mwera	Tree	Bewitched Hernia	Leaves Roots	Pound leaves filter then drink Scratch roots add water stir then drink
54.	*Erythrococca bongensis*	Mnemela [a]	Mwera	Tree	Aphrodisiac Miscarriage	Roots Roots	Mix medicine with other plant medicines pound then add to the food of the one you love Scratch mix with other plants medicine put in water then take bath
55.	*Pseudolachnostylis maprouneifolia*	Mng'olo [b]	Mwera	Tree	Boils Dysentery	Roots Barks	Pound roots apply on boils Pound dried barks add in porridge or tea then drink
56.	*Rhus natalensis*	Mng'ombo /Mtatu [a, b]	Mwera	Tree	Eyes (Corneal scar) Pains during menstruation period Bewitched	Leaves Leaves Leaves	Pound put in snail shell then put few drops of liquid in eyes Pick three leaves then chew Pick three leaves with a mouth then chew
57.	*Catunaregam spinosa*	Mng'ondoka [a, b]	Mwera	Tree	Hernia Ears Eyes Worms infection	Roots Leaves Fruits Roots	Scratch the roots add water stir then drink Pound leaves filter and put few drops in ears Squeeze and put a drop fruit juice in eyes Chew fresh roots
58.	*Hoslundia opposita*	Mng'umbe/Liumbe [b]	Mwera	Shrub	Convulsion	Leaves	Squeeze leaves in water then take bath with
59.	*Vismia orientalis*	Mng'wilanyama [b]	Mwera	Tree	Scabies	Barks	Pound barks and smear on the affected areas
60.	*Ochna mossambicensis*	Mng'wili [b]	Mwera	Tree	Convulsion	Leaves /	Pound roots or leaves then eat / chew

						Roots	
61.	*Solanum incanum*	Mnini [b]	Mwera	Climber	Fungus Hearts	Leaves Roots	Squeeze leaves and apply on the affected area Burn roots, pound then eat / chew
62.	*Ipomea spp.*	Mnipu [a, b]	Mwera	Climber	Impotence Aphrodisiac Hernia	Leaves Leaves Roots	Pound put in snail shell then drink Mix medicine with other plant medicines and add to the food of the one you love Pound or scratch add water then drink
63.	*Xylotheca tettensis*	Mnjau mweupe [a, b]	Mwera	Tree	Bewitched Eyes Evil	Roots / leaves Leaves Leaves	Pound leaves add water then drink or pound roots and smear on the body Pound and put in the clean piece of cloth and press then put few drops in the ear Pound fresh leaves add water then drink
64.	*Dombeya shupangae*	Mnjau mweusi [a, b]	Mwera	Tree	Convulsion Evil spirit	Roots /leaves Leaves	Pound leaves or roots add water then drink Pound fresh leaves add water then drink
65.	*Dodonea viscosa*	Mnjumbu [a, b]	Mwera	Shrub	Dysentery Malaria Evil spirit Evil spirit	Leaves Roots Roots / leaves Roots /leaves	Pound dried roots to obtain powder then drink with porridge or tea or any drink Boil roots then drink Squeeze leaves and apply the whole body/or pound roots then eat / chew Pound, soak in water, smear on the body
66.	*Pentas parvifolia*	Mnjweshwe [a, b]	Mwera	Tree	Convulsion Delirium Bewitched Hernia Gonorrhoea	Leaves Leaves Roots /leaves Roots Leaves	Pound leaves add water then drink Pound leaves add water then drink Pound leaves or roots add water then drink Scratch roots add water then drink Pound leaves or roots then eat
67.	*Ochna holstii*	Mnungamoo [b]	Mwera	Tree	Sleeping-sickness Convulsion	Roots / leaves Roots / Leaves	Boil leaves or roots then drink Pound leaves or roots then eat / chew
68.	*Salacia madagascariensis*	Mnyanganumbili [c]	Mwera	Climber	Aphrodisiac	Roots	Pound and put in the food of the one you intend to love you
69.	*Maprounea africana*	Mpajupaju [a, b]	Mwera	Tree	Stomach ache Paronychia Bewitched	Roots Roots Roots /Leaves	Scratch put in water, porridge, tea or any drink ready for drinking Pound roots and apply on the affected area Pound roots add water then drink Boil leaves then drink
70.	*Flueggea virosa*	Mpalapala, [a, b]	Mwera	Tree	Delirium	Roots	Pound roots and eat / chew

					Measles	Leaves	Boil leaves and wash the body with
71.	*Bysocarpus orientale*	Mpambajini [b]	Mwera	Shrub	Evil spirit Malaria	Leaves Leaves	Pound leaves then apply all over the body Soak leaves in water then wash the body with
72.	*Dichapetalum stuhmanii*	Mpambamwitu [b]	Mwera	Shrub	Evil spirit	Roots / Leaves	Pound leaves or roots and apply all over the body
73.	*Dichapetalum stuhlmanii*	Mpambapori [c]	Makonde	Shrub	Venereal diseases Fungus	Leaves Leaves	Pound drink Squeeze leaves and smear on the affected area
74.	*Flueggea birosa*	Mpemba [b]	Mwera	Shrub	Evil spirit Skin diseases	Leaves Roots	Boil leaves then drink Pound roots add water filter then drink
75.	*Clerodendrum myricoidea*	Mpeu [b]	Mwera	Shrub	Pneumonia Fungus	Roots Roots	Pound the roots and apply on the affected area Pound the roots and apply on the affected area
76.	*Chassalia umbraticola*	Mpilipilipori [c]	Makonde	Shrub	Bewitched Uterus cysts (Fibroid)	Leaves Roots	Pound leaves filter then drink Boil the roots then drink
77.	*Sphaerocoryne gracilis*	Mpindingololo [c]	Makonde	Tree	Bilharzia (Schistosomoasis)	Roots	Boil then drink
78.	*Erythrina abyssinica*	Mpinga/ Liudiumwene [c]	Makonde	Tree	Dysentery Rectal prolapse Tumour	Leaves Leaves Roots	Pound leaves boil and apply the medicine around the anus Pound leaves boil and apply the medicine around the anus Scratch root, burn and apply on the affected area
79.	*Sorindeia madagascariensis*	Mpingamahoka [b]	Mwera	Tree	Convulsion Abnormal heart beats	Leaves Roots	Squeeze leaves in water and wash the body Pound roots then eat /chew
80.	*Erythrina abyssinica*	Mpingapinga [b]	Mwera	Tree	Flu Hernia Bewitched	Leaves Roots Roots	Squeeze leaves put in water for the patient to take bath Boil roots then drink or Scratch roots add water then drink Pound and apply all over the body
81.	*Dalbergia melonoxylon*	Mpingo [a]	Mwera	Tree	Kids protection	Stem	Cut or chop pieces of stem tie with a thread wear
82.	*Ximenia americana*	Mpinji [b]	Mwera	Tree	Gonorrhoea Diarrhoea Eyes	Barks Roots Leaves	Scratch, add water, drink Scratch, add water, drink Pound leaves and squeeze few drops in

							eyes
83.	*Triumfetta rhomboidea*	Mpokolo [b]	Mwera	Climber	Malnourished child Pains during delivery	Leaves Roots	Squeeze leaves in water then take bath Pound the roots and apply all over the body
84.	*Maytenus senegalensis*	Mpombe [b]	Mwera	Tree	Delirium Ears	Roots Roots	Scratch roots and put in water then wash the patient Pound roots then press to put some drops into the ear
85	*Antidesima venosum*	Mpunju [a]	Mwera	Shrub	Convulsion	Roots	Pound leaves put in water then drink and take bath
86.	*Clerodendrum spp.*	Mpupulu [b]	Mwera	Tree	Boils Hernia Bewitched	Leaves Roots Roots	Boil leaves pound and smear on affected area Boil roots then drink Scratch rots then smear on the body
87.	*Paropsia grewioides mast.var.orientalis*	Mpwapwalaga [b]	Mwera	Climber	Boils Bewitched	Roots / barks Roots /leaves	Pound roots or barks and apply on the affected area Pound roots or leaves then drink
88.	*Dichrostachys cinerea*	Mtalala/Ndalala [b, c]	Mwera/ Makonde	Climber	Paronychia Bewitched Gormorhoea Pneumonia	Leaves Roots /Leaves Roots /leaves Fruits	Pound leaves and apply on the affected finger Boil roots or leaves and drink Boil roots or leaves and drink Burn fruits and apply on the affected area
89.	*Anpelocissus africana*	Mtamba [a, b, c]	Mwera / Makonde	Climber	Measles Tumour Boils Boils	Stem Barks Barks Roots or Stem	Cut or chop the stem to obtain water then drink that water Scratch the bark then smear on the affected area Scratch the bark then smear on the affected area Scratch mix with little amount of water smear on affected area
90.	*Markhamia zanzibarica*	Mtandawala [c]	Makonde	Tree	Dysentery Wound	Leaves Leaves	Pick with mouth then chew Pound the leaves smear on the injured part
91.	*Thylachium africanum*	Mtatu [c]	Makonde	Tree	Ears Pain during menstruation periods	Leaves Roots	Pound fresh leaves put in a clean piece of cloth then squeeze and put few drops in ears Pick three leaves with a mouth and chew
92.	Ui	Mtatu mkubwa	Mwera	Tree	Pain during	Leaves	Pick thee leaves then chew

		[a]			menstruation periods		
93.	*Flacourtia indica*	Mtava [b]	Mwera	Tree	Heart attack Wound	Roots Roots	Mix with salt pound then eat Scratch, and apply on the affected area
94.	*Monathotaxcis trichantha*	Mtavala [c]	Makonde	Climber	Asthma Aphrodisiac Headache	Leaves /Roots Roots Roots	Mix roots or leaves with chicken meat boil then drink Mix with other trees pound then give it to your lover to eat Burn roots and message the fore parts of the head
95.	*Phychotria eminiana*	Mtelalela [b]	Mwera	Tree	Hernia Delirium Bewitched	Barks Leaves Leaves	Soak barks in water then drink Pound leaves add water then wash the body with the resultant water Pound leaves add water drink
96.	Ui	Mtindingololo/ Mnyang'anyalu kundu [c]	Makonde	Tree	Bilharzia (Schistosomoasis)	Roots	Boil then drink
97.	*Pteleopsis myrtifolia*	Mtokoma [b]	Mwera	Herb	Aphrodisiac	Roots /Leaves	Burn roots or leaves and add to the food of your lover without himself knowing
98.	*Landolphia kirkii*	Mtolo [c]	Makonde	Climber	Dysentery	Leaves	Pound leaves add water then drink
99.	*Diplorhynchus condylocarpon*	Mtomoni [a, b]	Mwera	Tree	Cough Cough Stomach ache	Stem / (sap) Stem / (sap) Roots	Cut / chop the tree to exudates sap then eat the exudates Cut the three to exudates sap then drink the sap three times per day Scratch the roots add water, stir then drink
100.	*Dichapetalum macrocarpum*	Mtoshi [b]	Mwera	Climber	Crying kid or baby	Leaves Roots	Boil leaves and wash its body or Pound roots add water and wash the body
101.	*Tetracera litorlis*	Mtundumai [a, b]	Mwera	Tree	Evil spirit Ears Kids protection Venereal disease	Roots Leaves Leaves Roots	Pound roots then eat /chew Pound leaves and put some few drops in ears Pound fresh leaves add water then drink Pound roots then eat /chew
102.	Ui	Mtutumanomajini [b]	Mwera	Shrub	Malaria Convulsion Ears	Leaves Roots Leaves	Boil leaves squeeze in water wash the body Pound the roots and smear on the body Pound leaves and put some few drops in

							ears
103.	*Thylachium paranoxum*	Mwipukacham bu [c]	Makonde	Tree	Stomach-ache Pains during menstruation periods Malnourished child	Leaves Barks Roots	Boil and drink Boil and drink Boil and drink
104.	*Hensia crinata*	Nakalyekete [a]	Mwera	Shrub	Hernia	Leaves / Roots	Pound leaves or roots then eat /chew
105.	*Maerua angolensis*	Nakambwenga [a, b]	Mwera	Tree	Broken bones Convulsion Snake bite	Barks Leaves Roots	Mix with other plants medicine, tie up the broken part Squeeze leaves put in water for the patient to take bath Pound roots and apply on the injured part
106.	*Mildibraedia carpinifolia*	Nalihungula [c]	Makonde	Tree	Ears and eyes Head ache	Leaves Leaves	Pound fresh leaves put in a clean piece of cloth then squeeze and put few drops in ears or eyes Boil fresh leaves then drink
107.	*Milletia usaramensis*	Naliundu [c]	Makonde	Tree	Heart diseases	Leaves	Pound fresh leaves boil then drink
108.	*Hollarhena fevrifuga*	Nalupande [a, b]	Makonde	Tree	Hernia Hernia	Roots Roots	Scratch, put in water the drink Scratch stir with water, then drink
109.	*Steganotaenia araliaceae*	Nalwai [b]	Mwera	Tree	Scabies	Leaves /Barks	Pound, leaves or barks then boil and smear on the affected areas
110	*Hellinus integriforlius*	Nalyoto [b]	Mwera	Climber	Stomach ache Hernia	Leaves Roots	Pound leaves add water then drink Scratch roots add water then drink
111.	Ui	Namakango [b]	Mwera	Shrub	Malnourished child Evil spirit	Leaves / Roots Leaves / Roots	Pound leaves or roots add water and wash the baby with Pound leaves or roots add water and wash the baby with
112.	*Pavetta schumanniana*	Namakolo [b]	Mwera	Tree	Impotence	Roots	Scratch roots add water then drink or chew the roots
113.	*Zanthozlum chalybeum*	Namavele [a, c]	Mwera / Makonde	Tree	Front fontanelle Diarrhoea Wounds	Stem (thorn) Roots Barks	Pound and massage the fore parts of the head Boil the roots then drink Pound the barks put it in the water or tea then drink
114.	*Tapiphyllum burnetii*	Nambilii [b]	Mwera	Tree	Bewitched	Roots /	Pound roots or leaves add water then drink

						Leaves	
115.	*Rhynchosia hirta*	Namonanga [b]	Mwera	Climber	Impotence	Roots	Pound roots add water then drink or chew the roots
116.	*Ocimum suave*	Nangundu [b]	Mwera	Shrub	Eyes	Leaves	Pound leaves filter with a piece of cloth put few drops in eyes or boil the leaves then wash the face with the resultant liquid
117.	*Salacia madagascariensis*	Nangungwe [a, b]	Mwera	Shrub	Stomach ache Hernia Uterus cysts (Fibroid)	Leaves Roots Leaves	Pound press then drink Scratch add water, stir then drink Pound leaves, filter then drink
118.	*Heliotropium supinum*	Nanyimilila [b]	Mwera	Climber	Miscarriage Convulsion Delirium	Roots Leaves Leaves	Pound roots and apply on the face of patient Pound leaves add water then wash the body of the patient with Pound leaves add water then wash the body of the patient
119.	*Maerua angolensis*	Nanyimilila mdogo [a]	Mwera	Shrub	Eyes	Stem	Pound, burn then face the patient's face direct to the resultant smoke
120.	*Steganotaenia araliaceae*	Nanyimilila mkubwa [a]	Mwera	Shrub	Eyes	Stem	Pound, burn then facing to the direction of the resultant smoke
121.	*Pavetta lutambensis*	Ndaula [c]	Makonde	Tree	Uterus cysts (Fibroid)	Leaves or Roots	Pound leaves filter then drink or boil the roots then drink
122.	Ui	Ng'alanje [b]	Mwera	Shrub	Heart diseases Delirium	Roots Leaves Roots	Burn roots or leaves mix with popcorn then eat/ chew Pound leaves add water then drink Burn the roots then eat
123.	Ui	Ng'ungulu [b]	Mwera	Tree	Hernia	Roots Leaves	Pound roots add water then drink Pound leaves add water then drink
124.	*Acalypha ornate*	Nnami [a, b]	Mwera	Shrub	Hernia Diarrhoea Bewitched	Roots Leaves Roots /Leaves	Pound the roots mix with medicine from other trees add water then drink Pound fresh leaves add water then drink Burn roots then pound to eat / Pound leaves add water then drink
125.	*Asparagus staceus*	Nnava [a]	Mwera	Climber	Pains during menstruation periods	Roots	Scratch the roots then eat the resultant powder

Appendix 3 (a): Master species list of medicinal plants in the study area

SPECIES NAMES	FAMILY NAME	LOCAL NAMES
Acacia *brevispica* Harms	FABACEA SUB.FAIMILY MIMOSACEAE	Mbalang'awe
Acacia brevispica Harms	FABACEAE SUB. FAMILY MIMOSACEAE	Love
Acacia brevispica Harms	FABACEAE SUB.FAMILY MIMOSACEAE	Luseya
Acalypha ornata A. Rich.	EUPHORBIACEAE	Nnami
Ampelocissus africana (Lour.) Merr.	VITACEAE	Mtamba
Antidesima venosum	EUPHORBIACEAE	Mpunju
Asparagus africanus Lam.	LILIACEAE	Lutungwi
Asparagus falcatus Lam.	LILIACEAE	Kinavinavi
Asparagus setaceous (Kunth.) Jessop.	ASPARAGACEAE	Nnava
Blighia unijepota	SAPINDACEAE	Mkalanga
Bonamia mossambicensis (Klotsch) hall.	CONVOLVULACEAE	Lidingili
Boscia angustifolia A. Rich.	CAPPARIDACEAE	Mkotoshau /Nkondashau
Bysocarpus orientale Schum. Thonn.	CONNARACEAE	Mmalanjai mkubwa
Bysocarpus orientale	CONNARACEAE	Mpambajini
Cassia abbreviata Oliv.	FABACEAE SUB. FAMILY CAESALPINIACEAE	Mnembelembe
Cassytha filiformis L.	LAURACEAA	Avila
Catunaregam spinosa (Thunb.) Tirveng	RUBIACEAE	Mng'ondoka
Hensia zanzibarica/ Chassalia umbraticola Vatke	RUBIACEAE	Mdibwa
Chassalia umbraticola Vatke	RUBIACEAE	Mpilipilipori
Clerodendrum myricoidea	VERBENACEAE	Mpeu
Clerodendrum sp.	VERBENACEAE	Mpupulu
Commiphora africana (A. Rich.) Engl.	BURCERACEAE	Mkolola/Mlaha
Commiphora pteleifolia Engl.	BURCERACEAE	Mkololamanga
Dalbergia melonoxylon	FABACEAE SUB. FAMILY PAPILIONACEAE	Mpingo
Dodonea viscose L.	SAPINDACEAE	Mnjumbu
Dalbergia nitudula Bak	FABACEAE SUB. FAMILY PAPILIONACEAE	Mchejea
Dalechampia scandens L.	EUPHORBIACEAE	Kidedea ya msituni
Dichapetalum macrocarpum Engl.	DICHAPETALACEAE	Chikwaja /Chikwaja cheusi
Dichapetalum macrocarpum	DICHAPETALACEAE	Mtoshi

Engl.		
Dichapetalum stuhlmanii	DICHAPETALACEAE	Mpambapori/ Mpambamwitu
Dichrostachys cinerea (L.) Wight &Arn	FABACEAE SUB. FAMILY MIMOSACEAE	Mtalala/Ndalala
Diplorhynchus condylocarpon (Muell.Arg.) Pinchon	APOCYNACEAE	Mtomoni
Dombeya shupangae	STERCULIACEAE	Mnjau mweusi
Ehretia amoena	BORAGINACEA	Chibumba
Eriosema spp	FABACEAE SUB.FAMILY PAPILIONACEAE	Chinamati
Erythoxylum fischeri	ERYTHROXILACEAE	Mmalanjai
Erythoxylum fischeri /Indigofera ormocarpoides Bak.	ERYTHROXILACEAE	Mmalanjai mdogo
Erythrina abyssinica DC	FABACEAE SUB. FAMILY PAPILIONACEAE	Mpingapinga
Erythrina abyssinica	FABACEAE SUB.FAMILY PAPILIONACEAE	Mpinga/Liudiumwene
Erythrococca bongensis Pax	EUPHORBIACEA	Mnemela
Flacourtia indica (Burm. F.) Merr	FLACOURTIACEAE	Mtava
Flueggea virosa (Willd.) Voigot	EUPHORBIACEA	Mpalapala
Flueggea virosa (Willd.) Voigot	EUPHORBIACEAE	Mpemba
Gardenia subacaulis Stapf &Hutch.	RUBIACEAE	Kioti
Gardenia ternifolia ssp.jovis-tonantis Schumach. Thonn	RUBIACEAE	Chingongolomandyanga
Gonatopus boivinii Hook .f.	ARACEAE	Lutondwe/Ndondwe
Heliotropium supinum L.	BORAGINACEA	Nanyimilila
Hellinus integrifolius (Lam.) Kuntze	RHAMNACEAE	Nalyoto
Hensia crinata (Afzel.) G.Tylm.	RUBIACEAE	Nakalyekete
*Hensia crinita (*Afzel.) G. Tylor	RUBIACEAE	Kimembe
Hibiscus micranthus L.f.	MALVACEAE	Chidedea
Hollarhena febrifuga Klotzch.	APOCYNACEAE	Nalupande
Hoslundia opposita	LABIATAE	Nng'umbe/Liumbe
Hugonia castaneifolia Engl.	LINACEAE	Mchuluchulu
Ipomea sp.	CONVOLVULACEAE	Mnipu
Jaminum meyeri-johannis Engl.	OLEACEAE	Mkwinyanyati
Jusminum fluminense Vell	OLEACEAE	Chikanga
Keetia venosa /Cathium	RUBIACEAE	Mmuluti

venosom		
Lannea fulva (Engl.)	ANACARDIACEAE	Mkungunyanjila
Lantana sp./Dombeya shupange	VERBENACEAE	Mnjau mweusi
Steganotaenia araliacea Hochst.	ARALIACEAE	Nakambwenga
Maerua angolensis DC.	CAPPARIDACEAE	Nanyimilila mdogo
Maprounea africana	EUPHORBIACEA / PAPILIONACEAE	Mpajupaju
Markhamia zanzibarica K.Schum	BIGNONIACEAE	Mtandawala
Maytenus senegalensis (Lam.) Exell.	CELASTRACEAE	Mpombe
Mildibraedia carpinifolia (Pax.) Hutch.	EUPHORBIACEAE	Nalihungula
Milletia usaramensis Taub.	FABACEAE SUB.FAMILY PAPILIONACEAE	Naliundu
Monanthotaxis fornicata	ANNONACEAE	Chikombe
Monanthotaxis fornicata (Bail.) hall. */Acalypha ornata*	ANNONACEAE	Mmalala
Monathotaxis trichantha (Diels.) Verdc.	ANNONACEAE	Mtavala
Ochna holstii Engl.	OCHNACEAE	Mnungamoo
Ochna mossambicensis Klotzch	OCHNACEAE	Mng'wili
Ocimum suave Willd.	LABIATAE	Nangundu
Paropsia grewioides Mast.var.orientalis sleumaer	PASSIFLORACEAE	Mpwapwalaga
Pavetta lutambensis Bremek.	RUBIACEAE	Ndaula
Pavetta parvifolia K. Schum. */Pentas parvifolia*	RUBIACEAE	Mnjweshwe
Pavetta schumanniana K. Schum	RUBIACEAE	Namakolo
Phyllanthus muellerianus (Kuntze) Exell.	EUPHORBIACEAE	Lipeto
Phyllanthus muellerianus (Kuntze) Exell	EUPHORBIACEAE	Mkwelambamba
Phytolacca dodecaudra L.H.	PHYTOLACEAE	Mbonopori
Polygala virgata Thunb.	POLYGALACEAE	Chiguluka
Polysphaeria braunii K.Krause	RUBIACEAE	Mmambala
Pseudolachnostylis maprouneifolia Pax	EUPHORBIACEAE	Mng'olo
Psychotria eminiana	RUBIACEAE	Mtelalela
Pteleopsis myrtifolia (M.A. Lawson) Engl. &Diels	COMBRETACEAE	Mtokoma
Rhus natalensis Krauss/*Thylachium africanum*	ANACARDIACEAE /CAPPARIDACEAE	Mng'ombo /Mtatu

Lour		
Rhynchosia hirta Meikle &Verdc.	FABACEAE SUB.FAMILY PAPILIONACEAE	Namonanga
Rothia hirsuta Bak.	FABACEAE SUB. FAMILY PAPILIONACEAE	Mlyolyolyo
Salacia madaascariensis (Lam.) DC.	CELASTRACEAE	Mnyanganumbili
Salacia madagascariensis (Lam.) DC	CELASTRACEAE	Nangungwe
Sclerocarya birrea (A. Rich.) &Hochst. *Ssp.caffra*	ANACARDIACEAE	Mbwabwalaka
Solanum incanum	SOLANACEAE	Mnini
Sorindeia madagascariensis DC.	ANACARDIACEAE	Mpingamahoka
Sphaerocoryne gracilis (Engl. &Diels) Verdc.	ANNONACEAE	Mpindingololo
Steganotaenia araliaceae	UMBELLIFERAE	Mbalika
Steganotaenia araliaceae	UMBELLIFERAE	Nalwai
Steganotaenia araliaceae	UMBELLIFERAE	Nanyimilila mkubwa
Strophanthus kombe Oliv.	APOCYNACEAE	Chilema
Strychnos pungens Soler	LOGANIACEAE	Mngulungulu
Strychnos scheffleri Gilg & Busse	LOGANIACEAE	Mchulwe
Tapiphyllum burnetii Tennant	LORANTHACEAE	Nambili
Tapiphyllum burnetii Tennant	RUBIACEAE	Mjini
Tetracera litoralis Gilg.	DILLENIACEAE	Chibutuka
Tetracera boviniana Baill.	DILLENIACEAE	Mtundumai
Thylachium paranoxum	CAPPARIDACEAE	Mwipukachambu
Tonospora caffra	MENISPERMACEAE	Mbalale
Triumfetta rhomboidea	TILIACEAE	Mpokolo
Uvaria acuminata acum	ANNONACEAE	Chilombi
Vernonia amygdalina	COMPOSITAE	Liuluya
Vismia orientalis	GUTTIFERAE	Mng'wilanyama
Vitex mombassae/Vitex strinkeri	VERBENACEAE	Mmembe
Ximenia americana	OLACACEAE	Mpinji
Xylotheca tettensis	FLACOURTIACEAE	Mnjau mweupe
Zanthoxylum lindense (Eng.) *Kokwaro/Zanthoxylum chalybeum* Engl.	RUTACEAE	Namavele
Ui		Chibabangala
Ui		Kinamanamela
Ui		Makutumbawala
Ui		Mchenjele
Ui		Mfukizi
Ui		Mtatu mkubwa

Ui		Mtutumanomajini
Ui		Namakango
Ui		Ng'alanje
Ui		Ng'ungulu
Ui		Mtindingololo/ Mnyang'anyalukundu

Ui = Unidentified species

Appendix 3 (b): A list of medicinal plant families in the surveyed three forest reserves

Serial number	Plant family name	Frequency	Percentage
1.	Rubiaceae	17	13.2
2.	Fabaceae	14	10.9
3.	Euphorbiacea	12	9.3
4.	Annonaceae	5	3.9
5.	Capparidaceae	5	3.9
6.	Dichapetalaceae	5	3.9
7.	Anacardiaceae	4	3.1
8.	Apocynaceae	4	3.1
9.	Verbenaceae	4	3.1
10	Celastraceae	3	2.3
11.	Flacoutiaceae	3	2.3
12.	Umbelliferae	3	2.3
13.	Boraginacea	2	1.5
14.	Burceraceae	2	1.5
15.	Convulvulaceae	2	1.5
16.	Dilleniaceae	2	1.5
17.	Erythroxilaceae	2	1.5
18.	Labiatae	2	1.5
19.	Liliaceae	2	1.5
20.	Loganiacea	2	1.5
21.	Ochnaceae	2	1.5
22.	Oleaceae	2	1.5
23.	Sapindaceae	2	1.5
24.	Araceae	1	0.8
25.	Asparagaceae	1	0.8
26.	Bignoniaceae	1	0.8
27.	Combretaceae	1	0.8
28.	Compositae	1	0.8
29.	Lauraceae	1	0.8
30.	Linaceae	1	0.8
31.	Lorantaceae	1	0.8
32.	Malvaceae	1	0.8
33.	Menispermaceae	1	0.8
34.	Olacaceae	1	0.8
35.	Passifloraceae	1	0.8
36.	Phytolaceae	1	0.8
37.	Polygalaceae	1	0.8
38.	Rhamnaceae	1	0.8
39.	Rutaceae	1	0.8
40.	Solanaceae	1	0.8
41.	Sterculiaceae	1	0.8
42.	Tiliaceae	1	0.8

Appendix 4: Master species list of wild food plants in the study area

Scientific name	Family name	Vernacular /Local name
Afromomum alpinum (Gagnep.) K. Schum	-	Mpama
Afromomum orientale Lock/	ZINGIBERACEAE	Utungulu
Annona senegalensis Pers	ANNONACEAE	Mtopetope
Antidesima venosum	-	Mpunju
Cyphostemma buchananii (Planc.) Willd.R.B.Drumm.	VERBENACEAE	Litembo
Dichapetalum macrocarpum Engl.	DICHAPETALACEAE	Mtochi
Dichapetalum macrocarpum Engl.	DICHAPETALECEAE	Chikwaja
Dictyophleba lucida (K.Schum.) Pierre	APOCYNACEAE	Mtolo /Mtolombutuka
Dioscorea hirtiflora Benth.	DIOSCOREACEAE	Mng'oko
Englerophytum magilismontum (Sond.) T.D. Penn.	SAPOTACEAE	Mtondoli
Grewia forbesii Harv.	TILIACEAE	Mbubudu
Haplocoelium foliolosum (Hiern) Bullock	SAPINDACEAE	Mkalawanje
Heinsia zanzibarica (Bojer) Verdc.	RUBIACEAE	Mtondodi
Landolphia kirki Dyer	APOCYNACEAE	Mmungo /Mbungo
Landolphia kirkii Dyer	APOCYNACEAE	Mtili
Margaritalia discoidea (Baill.) Webster	EURPHOBIACEAE	Mnyani/ Dihani
Monanthotaxis buchananii (Engl.) Verdc.or Uvaria spp.	ANNONACEAE	Mng'ou /Msofu
Parinari curatellifolia Benth	CHRYSOBALANACEAE	Mmula
Pavetta lutambensis	-	Ndaula
Pavetta refractifolia K. Schum	RUBIACEAE	Mnjweshwe
Rhychnosia hirta Meikle & Verdc	PAPILIONACEAE	Angadi
Salacia madagascariensis (Lam.) DC.	CELASTRACEAE	Mkolong'oa
Salacia madagascariensis (Lam.) DC.	CELASTRACEAE	Mkung'u
Sphaerocoryne gracilis (Eng. Diels) Verdc.	ANNONACEAE	Mpindingololo
Strychnos spinosa Lam	LOGANIACEAE	Mnjishi/ Mnjichi
Synaptolepis kirkii Oliv.	THYMELACAECEAE	Upupu
Ui	-	Mgulugai
Ui	-	Mtongatonga
Ui	-	Utumbogwankuku
Ui	-	Mchiu
Ui	-	Matupa
Vitex strinkeri	VERBENACEAE	Mmembe/ Mfuru