DANIDA

MEMA - Natural Woodlands Management Project Iringa, Tanzania

Non-Wood Forest Product Baseline Survey

April 2000

COWI **in association with**
Danish Forestry Extension
Regulus Consult

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Introduction

1.1 General Introduction

1.1.1 Background to the baseline survey

This report comprises a description of the Non-Wood Forest Products (NWFP) found in the two pilot areas of the Natural Woodland Management Project (NWMP) in Iringa District, Tanzania. The project is one of the two projects jointly referred to as the MEMA Project being the Kiswahili acronym for *Matumizi Endelevu Ya Misitu Ya Asili*, which in English translates into Sustainable Utilisation and Management of Natural Forests. The other MEMA project Udzungwa Mountains Forest Management Project (UMFM) is not covered by this NWFP Baseline Survey.

1.1.2 Terms of Reference for the baseline survey

The present baseline survey was prepared with the aim of creating a reference point for the project and will along with the other baseline surveys i.e. Socio-economic, Wildlife and Vegetation, generate a better understanding of the socio-economic and environmental issues in the two pilot areas. In addition, to the baseline surveys a marketing study, looking particular at wood products will also be carried out to supplement and complement the NWFP Baseline Survey.

The Terms of References (TOR) for the baseline survey was discussed during a briefing meeting with the Joint Project Management Unit and the TOR was translated into an outline for the report format. Agreement was reached on which products were to be considered major NWFPs and consequently be more extensively studied during the baseline survey and compared to other products of lesser importance in the pilot areas.

The major NWFP identified based on the Socio-economic Baseline Survey and during the discussion with project staff include indigenous vegetable/herbs, mushrooms, fruits, medicinal plants, honey, thatch grass and fodder for livestock. Of other NWFP which were believed to be of some local importance the following were indicated Gum Arabic, reeds and grasses used for mat and basket weaving, grass sweepers and decorative plant material.

More specifically the Terms of References called for the following points to be considered:

- Identify the range of NWFP, resource estimate and variation in availability;
- Describe who harvest, consume or market NWFP;
- Analyse and describe the household use and consumption of NWFP;
- NWFP as a source of cash income;
- Describe the tenure, access and management of NWFP;
- Analyse and describe the impact of NWFP use including the impact of commercialisation and urban markets and its impact on forest degradation;
- Analyse potential for commercialisation as input to marketing study.

1.1.3 Definition of key concepts

In contrast to the wood products in the form of timber, fuelwood and charcoal the value of NWFP are not adequately quantified or recorded. Despite the world-wide dependency of rural populations on goods and services from NWFP, most of them have long been grouped as *minor* products of the forest and only lately have they been slowly recognised for their contribution as a subsistence and income generating component of rural livelihood.

FAO (1995) has defined the NWFP as:

> "NWFPs consists of goods of biological origin other than wood, as well as services derived from forests an allied land use."

While the definition covers NWFP of both plant and animal origin and has a more relaxed interpretation of boundaries between strictly forest and other land uses, it does not cover many important cultural and environmental forest functions. These functions are excluded from this study. The NWFPs covered are those of plant origin, which are used, consumed and/or sold by farmers in the project area. A separate baseline survey is planned to cover products of animal origin.

1.1.4 General approach to the baseline survey

The Socio-economic Baseline Survey contains a wealth of information on NWFPs, which were used to identify the major NWFPs, variation in consumption pattern amongst the villages in the project area and overall importance of NWFPs. Study of the Socio-economic Baseline Survey suggested that there were differences between the two pilot area i.e. the Kitapilimwa Forest Reserve and the Nyang'oro Range Forest and a difference between the utilisation pattern north and south of the Nyang'oro Range Forest. The latter assumption is also

plausible through the difference in livelihood systems where the construction of the Mtera Dam to the north had induced an influx of residents primarily occupied by fishing and the difference in soils and climatic conditions prevailing north and south of the Nyang'oro Range.

In order to account for these differences, study villages were selected to include the different access to and use of NWFPs. Sub-village Mwanyingo of village Migole to the north was selected as it was located close to the Nyang'oro Range and therefore assumed that NWFPs would play a greater role due to relative easier accessibility than would be the case for Izazi and Makuka and their sub-villages.

To the south of Nyang'oro Range, Mkulula and Usolanga were selected as the most northern located study villages and Chamdindi as the most southern one. For Kitapilimwa Forest Reserve, Ikengeza as an intermediate village with access to both Kitapilimwa Forest Reserve and Nyang'oro Range Forest was selected to the north and Mfyome as the most southern located village.

The key informants were selected by the Village Council and efforts were made to select people known to possess particular skills and indigenous knowledge on NWFPs. Though the gender balance often was skewed towards a dominance of males a minimum of two females were always present in a group of five to ten people. It was requested that traditional healers were represented in the group of key informants in each village.

After having compiled a list of NWFPs the study team along with the key informants went to the forest to collect samples and identify specimens for which only the vernacular names were noted during the key informant interview.

1.1.5 Limitations of the baseline survey

The under representation of women in the group interviews may have resulted in fewer edible plants identified. However, the gender balance on the study team is believed to make up for this short coming as probing on the females knowledge was constantly made to ensure their involvement in the deliberations.

The traditional healers made it from the start very clear that they would not publicly divulge their knowledge on medic inal plants and their healing properties. The key issue was to protect their profession. Having experienced the limitations in traditional healers volunteering their knowledge the study team decided to meet them separately and this proved to be a much more rewarding approach. It is though, very likely that the traditional healers interviewed, despite the privacy, did not volunteer their most valuable secrets of plants with medicinal value.

Due to time constraint the length of field visits was shorter than desired by the study team. Therefore the list of NWFPs contains entries for which only vernacular names are known and identification thus had to be made by study of

other sources where vernacular names are known for identified plants. This pose a risk of making a wrong identification as vernacular names differ from within very small distances. Even within the same village the study team encountered different vernacular names for the same plant which often may be attributed to the informant's different ethnic languages.

The Socio-economic Baseline Survey indicated that where more ethnic groups were represented in a village the longer were the lists of plants compiled during the survey. The NWFP survey team made a similar observation but was not making any effort to register, which ethnic group each informant belonged to. However, it was obvious that pastoralists like the Wamasai were only represented on one occasion - Usolanga village.

It proved that the field days were demanding on the key informants in terms of the duration of the interview, which generally lasted for five to six hours including field visits. Efforts were therefore made on compiling list of NWFP rather than details of indigenous knowledge on the individual plant identified. It is therefore believed that there could be a wealth of more detailed indigenous knowledge on the individual plant species which are of value to future Joint Forest Management initiatives.

1.1.6 Format of the report

This report is organised into seven chapters and nine annexes. Six chapters (Chapter 2-7) present the findings for the major NWFPs where each of these chapters uses a standard set of headings and format. Each chapter is divided into two major sections. The first describes the household consumption of the NWFP and the second describes its commercial market use. Chapter 7 deals with grazing which could not be organised in the same manner due to the different use of the product. Chapter 8 completes the list of NWFPs, which in the particular study area are of lesser significance either due to their scarcity or absence of any consumption or use.

These seven chapters are linked by an Introduction in Chapter 1 and conclusions presented in Chapter 9. References are provided in places to provide examples to illustrate certain observations as well as to acknowledge the source of information.

The nine annexes contain the details of the NWFP Baseline Survey for the major NWFPs surveyed in each of the six selected study villages. Annex 1,3,5 and 8 provides village level data with details on plant name (botanical and vernacular), availability, habitat, time of harvesting, gender of collector, domestic use, commercial use and price per unit for products which are being sold. Annex 2,4, 6 and 9 contains checklist for all plant species encountered in the six villages within the individual groups of NWFP i.e. edible wild vegetables, edible mushrooms, indigenous fruits and medicinal plants.

1.2 Description of the Study Area

1.2.1 Location

The Natural Woodland Management Project (NWMP) is targeting Joint Forest Management for two natural woodland areas i.e. Kitapilimwa Forest Reserve (FR) - gazetted by the Central Government - and Nyago'oro Range Forest - classified as Public Land. The Kitapilimwa FR is located some 40 km to the north of Iringa town. The total area of the Kitapilimwa FR is some 3,685 ha. The Nyang'oro Range Forest is further to the north stretching in a belt in a north-easterly direction starting some 60 km north of Iringa town and having a total estimated area of approximately 36,000 ha. A total of 14 villages have been identified as key stakeholders who use the products from the woodlands.

The villages identified as key stakeholder for the Kitapilimwa FR are the following five villages Itagutwa, Kinywang'anga, Kitapilimwa, Kiwere and Mfyome. For the Nyang'oro Range Forest the nine key stakeholder villages are Chamdindi, Ikengeza, Izazi, Makuka, Mangawe, Migoli, Mkulula, Nyang'oro and Usolanga. Climate

In the Mtera Basin, north of the Nyang'oro Range, the average annual precipitation is 450 mm at an elevation of approximately 700 m and concentrated in a rainy season between November to April. Most of the rain falls during December and January. The variability in rainfall is high and precipitation is often in the form of heavy showers, causing rapid surface run-off and sudden spates in the seasonal streams and rivers. The climate is characterised by low humidity and high air temperature with a daily variation of about 10-15 degrees C (SWECO. 1985).

To the south of the Nyang'oro Range including the Kitapilimwa FR the annual rainfall is higher and climatic data will resemble the Iringa Airport with an annual rainfall of 739 mm at an elevation of 1420m. The hills in the Kitapilimwa FR and the top of the Nyang'oro Range is at an equivalent elevation.

1.2.2 Soils

Soils are generally red brown lateritic, made of loam, silt, sand and gravel in the miombo woodlands which however are rocky outcrop.

Alluvial black "cotton" soils are found in flat the lowlands. "*Mbugas*" refers to areas where there is accumulation of fine sediment in poorly drained valley bottoms. Fine clay and silt cover the *mbuga* limestone.

1.2.3 Vegetation

The major vegetation communities represented are *Brachystegia* woodland on the ridge tops at Kitapilimwa and higher elevation along the Nyang'oro Range; *Acacia - Commiphora* at the lower elevations merging into the *Acacia* induced woodland at the valley bottom where clearance for agriculture has not been completely effectuated. North of the Nyang'oro Range the vegetation in the

Mtera basin consists of *Acacia - Commiphora* or *Acacia* Bushland (SWECO, 1976, Nahonyo et al, 1998, DANIDA, 2000).

1.2.4 Legal status

The Kitapilimwa FR is a Central Government gazetted reserve, which entails that extraction of forest products and/or other activities are strictly prohibited.

The Nyang'oro Range Forest is classified as public land which entails that local communities around have access to collection of forest products as well as grazing there livestock. People can have permits issued by the relevant authorities to harvest timber and make charcoal as well as permits for fishing and hunting. Permits for other uses or extraction are not required.

1.2.5 Environmental status

Both of the forest areas are considered to be likely future targets for exploitation of fuelwood due to the proximity to the urban market in Iringa and to the demand for tobacco curing in the district. The depletion of wood resources from the current supplies which is drawn from the areas west of the district makes this an imminent threat (DANIDA, 1998).

Kitapilimwa Forest Reserve:

The Forest and Vegetation Baseline Survey (Danida, 2000) found that miombo woodland covered the largest part of the forest reserve but that it had been heavily disturbed by cutting for timber, fuelwood and charcoal production. At lower elevation clearing for agriculture was observed within the FR boundaries and there was an absence of larger trees.

Nyang'oro Forest Range:

The Forest and Vegetation Baseline Survey (DANIDA, 2000) preliminary assessment indicates a lesser disturbance than at Kitapilimwa at the higher elevations but everywhere exploited for timber species. At the lower elevations in a zone between the farmed and grazed areas the woodlands were heavily exploited and consisted of significant smaller trees both in diameter and height.

2 Edible Indigenous Vegetables and Mushrooms

Details of findings from the NWFP Baseline Survey are reproduced in Annex 1: Village Level Data on the Use of Wild Edible Vegetables, Annex 2 Checklist of Edible Wild Vegetables, Annex 3: Village Level Data on the Use of Mushrooms and Annex 4: Checklist of Edible Mushrooms.

2.1 Household use of indigenous vegetables and mushrooms

2.1.1 The extent of household use of indigenous vegetables and mushrooms

The present survey together with the Socio-economic Baseline Survey clearly documents the importance of the indigenous vegetables and mushrooms for food security of rural households. They constitute and important variation in the diet, as well as, increases the nutritional value of the diet which often during the end of the dry season and early rainy season would otherwise be restricted to the starchy porridge forming the stable food. In some households indigenous vegetables along with indigenous fruit may be the only source of food during times of food shortage.

Vegetables:

The survey found that all rural households collected and ate indigenous vegetables to a greater or lesser extent. A total of 49 different species was reported in one village (Usolanga), 37 in Mkulula and 27 different species in Chamdindi demonstrating an impressive scale and variety of uses. Frequency of use depends on the species and the time of the year. Leaves from young trees of the Nyampera (*Adansonia digitata*) were consumed on a daily basis at the beginning of the rainy season. To facilitate harvesting some Nyampera trees had wooden spikes hammered into the tree trunk to from a ladder gaining access to the leaves in the crown. Interestingly this is done only for a few selected trees known to produce leaves which are more preferred to others. The very same trees are also considered to produce superior fruits.

Zanthoxylum chalybeum is an important vegetable in that it produces leaves during the wet and dry season, thus women harvest them, dry the leaves indoors

and later pound them. The resulting powder is stored for domestic use during the dry season while some is taken for sale in the village or to Iringa town. In order to maintain taste and colour, the leaves should not be dried directly in the sun. *Manihot glaziovii* is planted around homesteads, but is more commonly eaten during the dry season and less during the rain season. Fast growth rate of *M. glaziovii* during the rainy season is associated with growth of a deadly poisonous leaf, which if eaten can cause death. At the end of the rainy season most *M.glaziovii* plants are pruned to allow growth of new leaves and shoots. Slow growth rate during the dry season gives little chance for the poisonous leaf to develop.

Mushrooms:

The bulk of mushrooms are available in the early rainy season when crops grown in the previous season have been consumed and the vegetable crop not yet available. Mushrooms are a welcome addition and variety to the diet[1]. The NWFP survey found that the most favoured mushroom species were Winyafigulu (*Termitomyces eurrhizus*), Winyamikwee (*Cantharellus isbellinus*) and Wisogoro (*Cantharelus platyphyllus).* The possibility of drying and storing mushrooms makes it possible to consume them during the dry season, which was reported as being widely done both by the Socio-economic Baseline Survey and the present NWFP Baseline Survey.

In the villages north of the Nyago'oro Range mushrooms are considered scarce as they are found in the miombo woodlands in the mountains which are considered too far away to warrant a trip solely with the purpose of collecting mushrooms. This is particular true for Izazi and Makuka village where it was reported that men collect mushrooms in the miombo woodlands when walking back to the village from the Nyang'oro cattle market.

In the villages south of Nyang'oro Range the respondent in the Socio-economic Baseline Survey indicated that three to five different types of mushrooms were regularly collected. The three most commonly mentioned mushrooms were Wilelema (*Amanita zambiana*), Wisogoro (*Cantharellus platyhullus*) and Winyafigulu (*Termitomyces eurrhizus*). However, during the key informant interview carried out during this NWFP survey a total of 11 mushrooms was mentioned as being collected.

For the villages around the Kitapilimwa FR the number of mushrooms indicated in the Socio-economic Baseline Survey was between six to eleven. This may indicate a more extensive use or availability of different types of mushrooms around the Kitapilimwa FR. However, this could not be established during the NWFP survey where the typical variety of mushrooms collected was eleven also for villages south of the Nyang'oro Range.

[1] Analysis on nutritional values of Tanzanian mushrooms has shown that mushrooms with good nutritional values are the ones preferred by taste (Härkönen et al 1995).

2.1.2 Who harvest and use indigenous vegetables and mushrooms?

Vegetables:

Women normally collect wild vegetables. While one would assume that the knowledge of which ones are edible is passed from mother to daughter it was surprising to note how may males, participating as key informants, possessed the same knowledge. This may be attributed to these males being selected for their particular knowledge on NWFP and one should therefore be careful to generalise and attribute this knowledge to men in general. Other accounts indicate that men are generally ignorant of the exact identity of the relish enjoyed. A common observation during the key informant interview is the shift in desires by the younger generation, which is not enjoying the wild vegetables to the same extent as their parents.

Mushrooms:

The NWFP survey found that both gender and all age groups participated in the collection of mushrooms in the villages surveyed. The Socio-economic Baseline Survey were not conclusive and indicated that in some villages both men and women participated in the collection of mushrooms while in others it seemed to be a task performed by women. The probable explanation is that men will collect the mushrooms when they are encountered performing other tasks but normally women and children will venture out on trips with the aim of collecting mushrooms.

2.1.3 Where and when are indigenous vegetables and mushrooms harvested?

Vegetables:

Some of the edible vegetables are typical herbaceous weeds and as such found and concentrated on disturbed sites like fallow land and cultivated lands and around the homesteads. A considerable number of vegetables are also found within the miombo woodlands.

Most of the indigenous vegetables listed in Annex 1 are consumed at the beginning of the rainy season because the plants produce young leaves immediately or just before the rainy season starts. This is the most critical period in terms of availability of green vegetables in the village, the time when people are waiting for the cultivated ones. In most cases, only the very young, tender leaves are preferred because of the taste and easy cooking. As the leaves mature, they become less palatable and difficult to cook.

Some of the vegetables are leaves from trees, which will come into flush irrespectively of the onset of the rainy season. The flush of new leaves 4-8 weeks before the first rains is one of the characteristics of miombo woodlands[2].

Mushrooms:

According to Härkönen *et al*, 1995 the best mushrooms yields in Tanzania occurs in miombo woodlands where most of the miombo trees have myrcorrhizal[3] fungi in their root systems. This is well documented for tree species of the genera *Brachystegia*, *Combretum*, *Julbernadia* and *Uapaca* Högberg 1982. However, a few species are found on fallow land i.e. one species *Wumungulu* (*Macrolepiota dolichaulu*) is found around the kraals; and a few species like *Winyafigulu* (*Termitomyces eurrhizus*) and *Wiluwi* (*Termitomyces letestui*) are found on termite mounds[4].

Nyago'ro Range Forest

The Socio-economic Baseline Survey indicated that there are differences between the villages and availability of mushrooms. For the villages north of the Nyang'oro Range only the sub-village Mwanyengo, of Miogoli Village indicated that two types of mushrooms were available one which was characterised as stringy was found in the mountains and the other more preferred type in the field. None of the other villages north of the Nyang'oro Range indicated that mushrooms were collected regularly and if collected then they were found in the mountains. Men from Izazi will pick mushrooms when they return from the livestock market in Nyang'oro and passing through the mountains.

For all villages south of the Nyang'oro Range the indicated sufficient amount of mushrooms available and in the Socio-economic survey people on average recounted three to five species of mushrooms. The NWFP survey revealed that some ten or eleven species was known to be edible and harvested.

Kuítapilimwa FR:

The total list of edible mushrooms gathered in the NWFP survey are the same as from villages south of Nyang'oro Range forest.

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[2] Leaf emergence is generally well synchronised within a species, although individual plants growing on shallow soils over impermeable bedrock or solid laterite flush later than those growing on deeper soils (Chidumayo and Frost 1996).

[3] Mycorrhizas is a symbiotic relationship between the fungi and the host plant where the fungi penetrates into the roots of the host and receive carbohydrates as nutrients and where the fungi collect water and minerals from the soil which can then be accessed by the plant.

[4] Termitomyces serve as a diet for termites. Termites grow mycelia of fungi in their mounds which can be compared to underground compost heaps. The termites chew plant material and use the cellulose enzyme of the fungi to decompose the plant material.

2.1.4 Tenure, access and management

Farmers have exclusive right to harvest wild vegetables occurring on their own cultivated farmland. Everyone has usage rights for vegetable found in the miombo woodlands, which are regarded as common property and thus governed by common access. However, because of the general abundance of all the listed species there does not seem to be any reasons for conflicts.

No accounts of management, like for example spreading seeds on fallow land, were given. The lack of management also points towards the general abundance of the indigenous vegetables.

2.1.5 Changes in availability (seasonal variability)

Vegetables:

Most wild vegetables are depending on the onset of the rainy season. No scarcity and seasonal fluctuation was reported which may indicate that they are available in sufficient quantities even during periods of drought. As the edible vegetable tender leaves can mostly be used only the early rainy season there is a rapid decrease in usage later in the rainy season and during the dry season. This coincides with the emergence of cultivated vegetables, which in anyway are preferred to the indigenous ones.

Mushrooms:

Availability of mushrooms depends on the timing and the amount the rain received. During years of rainfall shortage, some species of the mushrooms never grow, or are limited in number. It was also reported that, most of the mushroom species grow in very specific micro-habitats. Disturbances to such special habitats have some negative effect to the growth and consequently availability of mushrooms. It would be expected that a general decline in tree cover will also lead to a reduction in amounts of mushrooms for the ones which are associated with specific tree species. Trampling and compacting of the soil by livestock may be a further disturbing factor.

Mushroom collection peaks in January and February in years with good rain.

2.1.6 Supply and demand

Vegetables:

The present study did not attempt to quantify the amount of indigenous vegetables harvested but since the majority of the households appear to make use to the edible vegetables it is clear that the demand is high. One may assume that almost the whole population for some 8-12 weeks entirely depends on fresh indigenous vegetable in the pre- and early period of the rainy season.

Mushrooms:

Generally the supply meets demand judged by the indicated availability where most respondents in the villages had indicated that mushrooms were abundant or sufficient. In villages indicating scarcity i.e. Izazi and Makuka the scarcity is explained by the distance to the miombo woodlands in the mountains. This season was an exception as the late rains had influenced the amount of mushrooms and therefore some villages reported relative scarcity.

2.1.7 Processing

Vegetables:

At least three types of indigenous vegetables i.e. *Mkunungu*, *Msimwa* and *Muhilili* are dried for later use during the dry period. Dried herbs can last for several years if properly dried and stored.

Mushrooms:

Mushrooms are washed then cut into pieces and cooked. Onions and tomato are often added to form a stew, which is eaten with porridge or rice.

A considerable amount of mushrooms are thrown away for lack of appropriate know-how in preserving them. Preservation and storage of certain mushroom species is limited by poor storage methods soon after harvesting. Most of the species gets spoiled just some few hours after collection. Improved processing of mushroom species can serve a large amount of mushrooms which otherwise is thrown away.

Winyafigulu (*Termitomyces eurrhizus*) and Wisogolo (*Cantharellus platyphullus*) were frequently mentioned as suitable species for storing after drying for domestic use as well as sale.

2.2 Existing commercial trading of indigenous vegetable and mushrooms

2.2.1 The extent of existing trade in indigenous vegetable and mushrooms

Vegetables:

A few vegetables were reported to be sold both in fresh and dried form. The vegetables for which a sale is reported are *Lifweni* or *Lufyeni* (*Amaranthus cruentus*), *Muhilili, Msimwa* and *Mkunungu* (*Zanthoxylum chalybeum*).

Mushrooms:

Mushrooms of the *Cantharellus* type were on sale in the market in Iringa during the month of March and early April when this study was undertaken. In the local market sales were reported in Chamdindi, Ikengeza, Nyang'oro and Usolanga.

2.2.2 Who trades in indigenous vegetable and mushrooms?

Vegetables and mushrooms are collected, processed and sold by women from the poorer households. There is little cost involved in it except the labour provided.

2.2.3 Where and when are indigenous vegetable and mushrooms procured for trading?

The vegetables traded are usually in the local market but one vegetable Mkunungu (*Zanthoxylum chalybeum*) is also sold at the market in Iringa during the dry season.

2.2.4 Supply and demand

Most mushrooms are consumed locally but during market days surplus are sold. Mushrooms were generally considered sufficient but the survey did not reveal major sales of surplus.

2.2.5 Processing

As described in section 5.1.7

2.2.6 Marketing

There are women who specialises in bringing mushrooms to the market and some will also be engaged in drying mushrooms for sale in the dry season. These women enjoy trust from the procurer and are therefore able to market a wider selection of mushrooms than would be the case for others trying to enter

the market. Generally, mushrooms of the *Cantharellus* type are widely known and easier to market. An added advantage with *Cantharellus* is that they normally last two to three days in contrast to some others, which will have to be eaten on the same day they are collected.

2.2.7 Pricing and income

Vegetables:

Three different species of vegetables were reported to be sold, namely Lifweni or Lufyeni (*Amaranthus cruentus*), Muhilili and Msimwa. Price quoted was always TSH 50 per bowl when fresh and TSH 100 when dried irrespectively of species. The amount sold and income generated per household involved in the sale could not be established. The price of Mkumungu (*Zanthorylum chalybeum*) is TSH 20 in the market in Iringa.

Mushrooms:

Fresh mushrooms are sold for around TSH 50 per bowl and TSH 100 per bowl when dried in the local market. In urban Iringa the price is reported to be around TSH 100 per bowl of fresh mushrooms. There is no variation in the sales price for the variable mushrooms as they are all sold at the same price. Only the most desired mushrooms like Winyafigulu (*Termitomyces eurrhizus*), Winyamikwee (*Cantharellus isabellinus*) and Wisogoro (*Cantharellus platyphyllus*) are marketable.

2.2.8 Current constraint to trade

Due to the perishable nature of mushroom it is difficult to market them outside the local market and their sales are often limited to the same village or surrounding sub-villages usually located further afield from the miombo woodlands. In addition, the insufficient and variable supply of mushrooms makes it difficult for the individual collector to organise marketing outside the local market where demand is constrained by low cash circulation and reduced demand as most household are able to collect the product for free.

2.2.9 Impact of commercialisation

Mushrooms:

Fungi play and important role in the miombo woodland ecology by decomposing the forest litter and by facilitating water and nutrient uptake through the symbiotic effect of mycorrhiza of the fungi and host tree. This relationships is particular important on the poor lateritic soils characterising miombo woodlands. Destruction of the woodland or the gradually decline in the genera with mycorrhiza will also affect the fungi and making it difficult for new trees to be established in such areas (Häkönen et al 1995). However, harvesting of the mushroom may have little effect on the continued availability. Nevertheless, Härkönen et al 1995 relates to accounts of harvesting practice where one mush-

room are left to be hacked in pieces to ensure that there will be plenty of mushrooms to harvest in the future and this may be taken as a sound advice for sustainable harvesting methods.

3 Edible Indigenous Fruits

Details of the NWFP Baseline Survey on Indigenous Fruits are reproduced in Annex 5: Village Level Data on the Use of Indigenous Fruits and Annex 6: Checklist of Indigenous Fruits.

3.1 Household use of edible indigenous fruits

3.1.1 The extent of household use of edible indigenous fruits

In Tanzania a total of 83 species of indigenous fruit trees have been recorded most of which occur in miombo woodlands (Temu and Msanga 1994). In the villages surveyed, it was found that some 18 to 19 indigenous fruit species were consistently mentioned as being used by the key informants. There are differences within the project area of which fruit trees are common. The findings in the present study are comparable to the vegetation survey undertaken in the Idodi and Pawaga Division, Iringa District by the MBOMIPA Project. In the MBOMIPA Vegetation Survey the various village profile listed between 14 to 33 species but typically some 20 species were listed (Nahonyo et al 1998). There are obvious similarities in terms of common indigenous fruit species encountered in the MBOMIBA Vegetation Survey and the present NWFP survey.

The common species mentioned are Mdawi (*Cordia sinensis*), Mfudu (*Vitex iringensis*), Mkwata (*Cordyla africana*), Mpera (*Adansonia digitata*), Msambalawe (*Vangueria infausta*), Msasati (*Vitex mombassana*), Mtowo (*Azanza garckeana) and* Mtundwa (*Ximenia caffra*).

3.1.2 Who harvest and use edible indigenous fruits?

It is mostly children who consume indigenous fruits and particular the boys when herding the animals. Adults will also eat them when walking through the bush or while collecting other products. In terms of contribution to the daily diet the indigenous fruit does normally not account for much in terms of quantity but are very important in terms of their contribution to the nutritional value of the diet. Many fruits are a major source of iron and some have a high protein and mineral (calcium, magnesium and potassium) content. The fruit collected for home consumption are often used for preparation of juice, which then are mixed with porridge or used for preparation of local brew.

As herding is a daily chore and firewood collection may take place every other day the indigenous fruits may be consumed at least 2-3 times per week per person.

Children sometimes collect fruits for sale to their fellow pupils at school. This allows them to get cash to buy for instance exercise books, pencils, pens which otherwise was to be obtained from their parents.

3.1.3 Where and when are edible indigenous fruits harvested?

When farmers clear miombo woodlands for cultivation they will often spare a number of trees, which all have different values for the farmer. Indigenous fruit trees are amongst the ones being left in the field and therefore they are to be found both in the cultivated land and in the miombo woodlands. The primary reason for leaving trees in the field may be for a combination of uses rather than for the supply of fruit alone. It was observed that the following trees were generally left in the field: *Terminali sericea* (for poles); *Acacia tortilis* (for soil improvement and fodder); *Azanza garckeana, Vitex iringensis, Vitex mombassae, Grewia fallax, Adansonis digitata* and *Strychnos* spp (for fruits).

Nyang'oro Range Forest:

Only few species, *Mdawi* (*Cordia sinensis*) and *Mpera* (*Adansonia digitata*), are mentioned in the villages to the north of Nyang'oro Range. *Mdawi* and *Mkwaju* (*Tamarindus indica)* are not indigenous to the area but both have been introduced for cultivation by CONCERN in Chamdindi village.

To the south of the Nyang'oro Range the diversity is greater and species which are occurring in most villages include again *Mdawi* (*Cordia sinensis*) and *Mpera* (*Adansonia digitata*) but also *Mtowo* (*Azanza garckeana), Mkwata* (*Cordyla africana*), *Mfudu* (*Vitex iringensis*) and *Msambalawe* (*Vangueria infausta*).

Kitapilimwa FR:

The common species encountered in most villages include *Mtowo* (*Azanza garckeana), Msambalawe* (*Vangueria infausta*), *Mtundwa* (*Ximenia caffra*) and *Mpera* (*Adansonia digitata*).

Most species are collected during the period March to July but there are exceptions ensuring an almost continued availability during the year of indigenous fruits. The key off-season species are *Adansonia digitata* (April - December), *Strychnos spinosa* (November -February), *Grewia spp.* (throughout the year) and *Ximenia caffra* (November - February).

3.1.4 Tenure, access and management

Ramadhani *et al* 1998 argues that the tenure system laid down in the Villagization Act of 1975, where farmers are allocated a piece of land for cultivation and

animals are allowed to graze freely at the end of the crop season, are rendering the farmer with no control of the field during that period. The consequence is an encroachment into farmers' fields for harvesting indigenous fruits throughout the year.

It was reported that *Mkwaju*(*Tamarindus indica*), *Mpera* (*Adansonia digitata*), *Mkwata* (*Cordyla africana*) and *Msambalawe* (*Vangueria infausta*) fruits were collected in field without regards to ownership by individuals who then would sell it to an outside buyer.

3.1.5 Changes in availability (seasonal variability)

As is evident by indication of time of harvest in Annex 5 the importance of indigenous fruits can also be seen from their availability, which stretches over most of the year.

In the long term it is very likely that lesser appreciated fruit tree species are cut for fuelwood and charcoal production. Forest degradation caused by these agents along with the clearance for arable land is therefore likely to decrease the availability of indigenous fruit in the long term.

It is likely that drought will have an effect on the fruit production which probably will be related to the severity of the drought. A drought may influence the number of fruit produced, their size and contents of juice (Dzerefos *et al* 1995).

3.1.6 Supply and demand

The indigenous fruit trees mentioned in Annex 5 have generally a wide distribution and are considered abundant or at least sufficient. *Mtowo* (*Azanza garckeana*) was considered scarce in Mkulula as the only village south of the Nyang'oro Range. There was a general scarcity of both the total number and range of indigenous fruit trees in the village north of the Nyang'oro Range.

Children are the primary consumers and any decline in abundance will therefore result in a reduction of the indigenous fruits contribution to the daily diet. As woodland degradation normally extends in concentric circles to the village, indigenous fruits are less frequently encountered, unless the fruit trees are left in the fields. This seems to be the practice

Birds and monkeys also eat edible fruits.

3.1.7 Processing

Most fruit species are consumed fresh when encountered in the woodlands.

Ukwaju (*Tamarindus indica*) which in fact is an exotic - a distinction not made by the villagers - provides a sweet juice used for local brew. During famine it is used as food and sometimes substitute for the stable food. It may also be mixed with porridge. To make juice the fruit is soaked in water and filtered.

Ubuyu (*Adansonia digitata*) fruits are used to make juice and also mixed in porridge.

Mtowo (*Azanza garckeana*) fruits can be boiled and preserved with salt and eaten like gum and sweet.

Mifudu (*Vitex iringensis*) fruits can be dried and stored.

Midawi (*Cordia sinensis*) fruits have a high content of sugar and starch.

Local brew:

A local alcoholic brew called *Lusowa* is made using the fruits of *Tamarindus indica, Adansonia digitata* and *Cordia sinensis*. It should be noted that the preparation of *Lusowa* does not require heating as the *Komoni* brew made out of maize and finger millet and the *Kangala* brew made out of maize husk and can thus be considered as an environmental friendly drink.

3.2 Existing commercial trading of edible indigenous fruits

3.2.1 The extent of existing trade in edible indigenous fruits

Trade is reported for *Mdawi* (*Cordia sinensis*), *Mifudu* (*Vitex sp*), *Mkapo* (*Grewia similis*), *Mkole* (*Grewia bicolor*), *Mkwaju* (*Tamarindus indica*), *Mbuyu* (*Adansonia digitata*) and *Mtowo (Azanza garckeana*). Trade is both locally in the village, in Iringa but also to market in Dar es Salaam. Ukwaju (fruit of *Tamarindus indica*) and Ubuyu (fruit of *Adansonia digitata*) are often reported sold to markets in Dar es Salaam.

3.2.2 Who trades in edible indigenous fruits?

It is mostly women who collect fruits but men also collect valuable fruits like the Ukwaju. Children are sent out by their mothers to collect Ukwaju. The labour input required for collecting indigenous fruit is generally higher than for cultivated exotic fruits or domesticated fruits as they are scattered over the farm and woodland areas. However, several species like *Adansonia digitata, Azanza garckeana, Cordia sinensis, Tamarindus indica* and *Vitex mombassae* can be harvested during the dry season outside the peak demand for labour and therefore the investment in labour is not so critical.

3.2.3 Where and when are edible indigenous fruits procured for trading?

The farmers bring the Ukwaju and Ubuyu to Iringa for sale but sometimes people are coming from Dar es Salaam directly to the village to buy the Ukwaju. The fruits are then sold in sacks.

3.2.4 Supply and demand

The existence of trade does indicate that there is a demand for some of the fruits, which are sold in fresh form at local markets. The possibility of sale in Iringa and the incidences reported of traders from Dar es Salaam who are coming to the villages to buy Ukwaju indicate a high demand from urban markets.

3.2.5 Processing

As described in section 4.1.7

3.2.6 Marketing

The products sold are either fresh fruits or juice for preparation of local brew. Little effort seems to be directed towards marketing. There seems to be market potential for Ubuyu since traders are coming directly to the village to purchase. No organised marketing seemed to be done by the farmers themselves. It has not been possible to establish the prices for the fruit at markets in Iringa and Dar es Salaam but the premium obtained would be of interest in providing an indication of the potential for marketing support.

3.2.7 Pricing and income

Indigenous fruits have low sales prices in rural areas because of the general availability, competition amongst the sellers and low rural demand. A high degree of perishability will also result in low prices particular when combined with difficult market access.

The overall income derived from the sale of fruit could not be estimated. However, for some of the species listed in section 4.2.1 fruits are sold either at a unit price for each fruit or measured by bowl, bucket (20 litres) or sack as the unit. *Mtowo* (*Azanza garckeana*) and *Msasati* (*Vitex mombassae*) were sold at TSH 1 per fruit. *Ubuyu* (*Adansonia digitata*) fruits are sold for TSH 5-10 each. Using bowl as the unit: *Mifudo* (*Vitex* sp.) TSH 20, *Mkapo* (*Grewia similis*) TSH 30, *Msesetya* TSH 30, *Mkole* (*Grewia bicolor*) TSH 20; with bucket as the unit the following prices were reported: *Mtowo* TSH 400, *Ukwaju* (*Tamarindus indica*) TSH 700 and *Mifudi* TSH 500 and finally prices per sack were reported as: *Ubuyu* TSH 1,800; *Mkwaju* TSH 4,000.

Juice of Ukwaju was sold at TSH 50 per litre and the local brew Lusowo was sold at a price of TSH 200 per litre.

3.2.8 Current constraint to trade

Further research is needed to access whether indigenous fruits are available and demanded in sufficient quantities for commercialisation and marketing in urban areas like Iringa and Dar es Salaam or whether there are limitations in terms of inadequate demand. Little information is available on the shelf life of the indi-

vidual indigenous fruit but the shorter shelf life the more difficult it is to market from areas with unreliable transport facilities.

3.2.9 Impact of commercialisation

An increased commercial demand for indigenous fruit would most likely have a positive effect on the resource base as the individual fruit trees would have a higher value. More fruit trees would be retained in the fields and fruit trees in the woodlands would be more likely to be spared when trees otherwise are cut for fuelwood or other uses.

The existence of markets for indigenous fruits could encourage farmers to plant fruits trees on farm boundaries and around homesteads. This is already happening in Chamdindi village for *Mdawi* (*Cordia sinensis*) and *Ukwaju* (*Tamarindus indica*). The former being particular suitable for propagation through cuttings in which case it will only take two years before it bears fruits. For the latter it takes about six years before they bear fruits and propagation is always from seeds.

Indigenous tree research on domestication has provided some preliminary results for twenty-four indigenous fruit trees grown at Makoka in Malawi. The research showed fast growth and precocity within three years in many species including *Azanza garckeana, Flacourtia indica, Tamarindus indica, Vangueria infausta*, *Vitex doniana* and *Strychnos spinosa* (Kadzere et al 1998). Some species of *Grewia* have been successfully cultivated in India for commercial production of fruits (FAO 1988).

4 Honey and Other Bee Products

Details of the NWFP survey on beekeeping and honey production are reproduced in Annex 7: Beekeeping and Honey Production.

4.1 Household use of honey and other bee products

Miombo woodlands are rich on excellent bee forage species including *Brachystegia speciformis, Julbernardia globiflora* and *Julbernardia paniculata* but many other species are suitable as beefodder (Brigham et al 1996; Kihwele et al 1999).

Honey consists essentially of different sugars, predominantly glucose and fructose but also other constituents include protein, amino acid, enzymes, organic substances etc. Therefore the flavour and aroma of honey vary depending on its floral origin. Respondents in the key-informants interview said there was a marked difference in the taste and quality of honey originating from miombo compared to honey from the *Acacia-Commiphora* bushland. According to the villagers honey from the miombo woodlands is distinguished by a darker colour compared to the honey derived from the *Acacia-Commiphora* bushland.

The socio-economic survey indicated that honey was used as food item either as a sweetener for tea or mixed in porridge, medicine and local brew. From other sources (Kihwele et al 1999) various uses are reported.

? Pollen[5] is used as a food item either eaten directly or mixed with honey and brood;

? Propolis[6] is used as medicine;

? Beeswax is used for making candles, carpenters use it for filling up depressions or holes on wood caused by nails and the bee keepers use it as baiting material for attracting honeybees to occupy new hives;

[5] Pollen is the chief source of protein, fats and minerals for the bees.

[6] Propolis is a sticky, gum like mass of resinous material gathered by bees from buds or bark of plants. The material is used by bees for reducing the size of the hive entrance and filling cracks, polishing the interior of the hive and nest defence by providing sticky barriers against ants. (Kihwele, 1991)

? Bee venom is reported used with certain leaves, which are ground or pounded and mixed with the bee venom. The mixture is used to cure ear problems by smearing on the affected ear;

? Brood or bee larvae are consumed directly in raw form or mixed with honey;

? Royal jelly[7]

4.1.1 The extent of household use of honey and other bee products

It is difficult to estimate the amount consumed locally i.e. directly by the collector/beekeeper at the household level and what is sold locally at the village level. Apart from honey there is little use of other bee products at the household level.

However, honey is generally used at household level and by traditional healers and in general as a medicine for treatment of coughing, stomach ulcers and treatment of wounds.

The largest amount of honey is reported used for beer brewing usually in the form of comb honey. Customers buying local brew favour the physical presence of comb in the brew as a proof that honey was used for in the fermentation process.

4.1.2 Who harvest and use of honey and other bee products?

The socio-economic survey indicated that beekeeping and honey collection are exclusively performed by men except for Ikengeza where it is reported that some Wagogo women are also involved in honey collection. It is often elder men who are involved in beekeeping while honey collection directly from trees and underground holes are not that age specific. The Socio-economic Baseline Survey suggest that it is the poorer households who are involved in honey harvesting which is probably the case for the majority of honey collectors while observation made during this study suggest that there are a number of large scale beekeepers who have considerable income from beekeeping. For example, one individual in Kiwere supported by the District Natural Resources Office in Iringa was reported to have 200 hives including both traditional and modern hives.

As indicated in Annex 7 there are fewer beekeepers and more honey collectors who harvest directly from the ground and trees in the villages north of Nyang'oro. This observation is also made in the Socio-economic Baseline Survey. A likely explanation is that the villages are far from the miombo wood-

[7] Royal jelly is secreted by the worker bees and contains among other chemical substances an antibiotic substance which is effective against bacteria and fungi. It is used to feed larvae of the workers and drones and the queen throughout her life time.

lands making security of log hives an issue or/and that the presence of many large Baobab provides the best natural hives from where honey collection can be done successively. The ease of construction a ladder through hammering spikes into the trunk makes the Baobab an ideal host tree for a beehive from the honey collectors' point of view.

In the 6 villages south of Nyang'oro there is a significant number of beekeepers as well as a much larger amount of honey harvested. According to Kihwele, (1994) the productivity of farmland with flowering agricultural crops are higher than the productivity in miombo woodlands.

The stingless bees are reported to produce a special honey which mainly is used for medicinal purposes (Kihwele, 1991).

The main use of honey is for brewing of beer. The Socio-economic Baseline Survey distinctly found this to be the exclusive domain of women from the poorer households.

4.1.3 Where and when are honey and other bee products harvested?

Honey is mostly harvested in the surrounding woodlands but for certain areas agricultural crops are also an important source of nectar. It is reported that in areas where sunflowers are produced bees perform an important pollination service.

As also reflected in the Socio-economic Baseline Survey the problem of theft from beehives placed too far away from the village is limiting the area in which honey can be harvested from either traditional or improved hives.

Honey is harvested during the period May to June. From a productivity and quality point of view it is important that honey is harvested at the right time. An early harvest may result in unripe honey with a high water content which makes it susceptible to fermenting while waiting too late the result can be loss to consumption by bees preparing for swarming.

4.1.4 Tenure, access and management

The open access system of the miombo woodlands means that honey can be harvested from trees and the ground by anyone. The impact of this is that the optimum harvesting period is often not observed as the fear abstaining from harvesting may only leave the harvest to be done by some one else. A further consequence of the open access system is the scant regard or motivation for leaving a viable colony i.e. to repair the hive after harvest and leave an adequate amount of honey for the colony to survive the dry season as one has no security of returning to harvest the same colony again. It remains to be researched how the honey harvesting methods affects the host tree.

In Usolanga it is reported that some villagers carve Baobab to attract bees and these trees then becomes their property. However, that same village, as many others, also states that beehives are not hung too far away in the woodland where they else will be stolen.

Honey is collected in trees and underground.

The hive types encountered are predominantly the traditional log and bark hives which are cylindrical in shapes. They are relative easy to make and cost nothing as the material can be obtained locally. This makes them the preferred hive type and explains the difficulty encountered in introducing the relatively expensive Tanzania Top-Bar Hive which is being promoted by the Forest and Beekeeping Division as a more productive alternative and also as an alternative to illegal logging/destruction of trees. With regard to traditional beehives, the following species were reported to be used for making beehives: *Mhemi* (*Erythrina abyssinica*), *Mkongolo* (*Commiphora* sp.), *Mkuyu* (*Ficus* sp.), *Mlangali* (*Euphorbia candelabrum*), *Mninga* (*Pterocarpus angolensis*), *Mheve* (*Albizia tanganyikensis*), *Mkwee* (*Brachystegia spiciformis*), *Mbwegele* (*Sclerocarya caffra*) and *Mpululu* (*Terminalia sericea*).

Choice of species is influenced by their durability, resistance to termites and other wood borer as well as their easiness to work. *Euphorbia spp*. need to be scorched to remove poisonous saps before splitting and use as beehive. However, there is doubt to the usefulness of this species as others had the belief that bees using this as a hive will be aggressive due to the vapour which will continue to emanate from the wood.

It was revealed in Nyang'oro that beekeepers may not necessary be the ones who make the log hives but that some in the village have specialised in making log hives. Prices charged are normally about TSH 2-3,000 but even up to TSH 4,500 for a large size which will allow a production of some 20 litres of honey.

Hives hung from trees are safe from fires and pests like ants, honey badgers, termites and other wild animals. Another advantage is that tree hives are cooler during the day than those placed on the ground. In Usolanga it was reported that hives are never put in a *Mkunungu* (*Zanthoxylum chalybeum*) as bees do not come near this species. This interesting statement was denied in *Mkulula* and therefore deserves further investigation. Popular trees to hang hives are *Myombo* (*Brachystegia boehmii*) and *Mbuyu* (*Adansonia digitata*).

In principle, people around Kitapilimwa FR needs a permit to collect honey. The NWFP survey did not attempt to evaluate how many where in possession of a permit. For public land i.e. Nyang'oro Range Forest permit for beekeeping and honey collection is not required.

It is important to leave sufficient amount of honey for the colony to survive the dry season and beekeepers observe this by leaving three to five honey combs in the hive. Honey collectors are believed to take scant consideration of this and will normally maximise their harvest by taking all of the honey.

4.1.5 Changes in availability (seasonal variability)

Most deep-rooted trees and shrubs in miombo woodlands flower before the onset of the rainy season during September to October. However, *Julbernardia* species flowers in the latter half of the wet season from February to April, while *Julbernardia globiflora* flowers from November to April. Some shrub species will flower in the mid and the late part of the rainy season. Most shallow-rooted woody suffructices, perennial forbs, sedges and bulbous plants flower during the rains (Chidumayo and Frost 1996).

Distinction is made between two honey flow seasons. A major honey flow season from January to March and a minor honey flow season from October to December. Honey harvesting during the minor honey flow season will negatively influence the brood rearing and therefore productivity in the major honey flow season (Kihwele et al 1999).

There are different accounts of the honey season. In Mangawe the season is indicated as March to April while Nyang'oro indicates a later season in the month of June but no accounts were given of harvest during the minor honey flow season from October to December.

4.1.6 Supply and demand

The amount of honey and other bee products produced per colony, termed colony productivity, is a function of size of the colony (i.e. number of worker bees); availability of bee fodder resources near or around the colony (i.e. has a working radius of approximately 5 km); size and volume of the hive; colony management; presence of bee pests such as the honey badger; and the types of honey bees (Kihwele *et al*, 1999).

Depending on the above:

- Production from log hives is in the order of 15 - 50 kg;
- 1 to 3 kg beeswax corresponding to the above honey productivity of 15 - 50 kg
- Honey from natural nests of stingless honey bees are in the order of 2 - 2½ kg per season.
- Propolis production is depending on hive size in the order of 200 - 400 g

The five villages around Kitapilimwa FR have all in the Socio-economic Baseline Survey indicated that there was sufficient honey available. This observation is also corroborated by Annex 4 where the same villages have relative large amount of honey harvested.

The open access system have often led to negligent honey collectors who destroy both the colony and the host tree in the process of collecting honey. Honey collectors are also often blamed for many bush fires with devastating

effects as they carelessly are using fire and smoke as a tool to subdue the bees and thereby gaining access to collect the honey without being stung by the bees. Some are harvesting honey at night where bees are less active and thus using fire to improve visibility.

4.1.7 Processing

The NWFP survey did not encounter anyone extracting the beeswax or using other bee products than honey.

4.2 Existing commercial trading of honey and other bee products

4.2.1 The extent of existing trade in honey and other bee products

The FBD, 1998 has estimated that the actual production of honey and bee wax is less than 4% of the existing potential.

There is limited sale of bee wax in the surveyed villages. Sale is reported in the following villages: Ikengeza, Kiwere, Mkulula and Usolanga with a total amount of some 124 kg. The reported honey production for the same four villages is some 5,200 kg which potentially should produce some 365 kg bee wax. The above figures suggest that only one third of the potential amount of bee wax is salvaged in villages where a market already exist. The villages where sale of bee wax is reported are villages, which are also characterised by a large total production of honey. The socio-economic survey indicated that only one man was selling wax in Chamdindi, which is the village with the second largest honey production and located closer to Iringa.

4.2.2 Who trades in honey and other bee products?

The HIMA Programme in Mufindi is reported to have reached agreement with Temi Wildlife Research Centre in Arusha to buy honey at TShs 1,000 per litre for honey and TShs 1,000 per kg for beeswax.

4.2.3 Where and when are honey and other bee products procured for trading?

It is reported by Kihwele, (1991) that some Tanzanians use propolis in flutes and other musical instruments and that it is also used for filling holes in household appliances.

In Kitapilimwa it was reported that honey was sold to buyers coming from the two neighbouring villages Kiwere and Mfyome.

4.2.4 Supply and demand

Kihwele *et al*, 1999 provide an interesting observation that prices variation locally are influenced by the demand of Maasai's or Mang'ati's who may buy comb honey at a higher price because the two tribes uses honey for paying dowry, circumscision ceremonies and honey-beer preparation. This has not been authenticated by this study, though there are clearly differences in prices of honey. It seemed that any amount of honey could be sold locally.

4.2.5 Processing

Comb honey can be used directly for beer brewing and processing is therefore not required. As beer brewing is the major source of honey use locally it explains the small quantities of wax harvested. In fact, there is a preference for comb honey as the wax collect at the top of the brew and thereby seals the brew off during the fermentation process.

Comb honey is used for preparation of Kangala. The brew is made by maize husks, which have been soaked in water for 2-3 weeks. Thereafter it is boiled and water is added. The liquid is then decanted after having settled. The comb honey is crushed and added to the brew to aid the fermentation process. Depending on the temperature during the fermentation the brew is ready for drinking after 2 to three days.

Kihwele et al (1999) provide useful low cost and low technology options for straining honey, rendering beeswax and storage of honey.

4.2.6 Marketing

The general impression is that people are unaware of the possibility of marketing beeswax. The project may explore further potential in making contact with Temi Wildlife Research Centre in Arusha which apparently already are buying honey and beeswax in the region.

4.2.7 Pricing and income

Nyang'oro Range Forest:

There are pronounced differences in prices for honey in different areas. For the three villages Izazi, Makuka and Migoli located north of the Nyang'oro range prices are between TSH 4,000-5,000 per 20 litres of honey. South of the Nyang'oro range honey commands higher prices but again a lower price in the most northern situated villages for example Usolanga where honey is sold at TSH 12,000 per 20 litres. Elsewhere south of Nyang'oro prices seems to be uniform around TSH 15,000 per 20 litres.

Kitapilimwa FR:

Prices indicated in the Socio-economic Baseline Survey seems to vary considerable and it is suspected that this may be due to the purity of the honey i.e.

from raw comb honey to the refined clear honey where wax and other impurities has been skimmed off. The price range is from TSH 8,000 to TSH 15,000.

Local brew

One litre comb honey is generally used per twenty litre brew. Brew made of maize and/or finger millet is normally sold at TSH 100 per litre. If honey has been added to the brew the price is TSH 200 per litre. Alternatively sugar is used and the quantity required is five kg sugar per twenty litre brew. At a price of TSH 500 per kg sugar in the village the cost of sugar is some TSH 2,500 per twenty litres. At the prevailing prices of sugar and comb honey the latter is the cheapest and also most favoured as the brew becomes sweeter.

4.2.8 Current constraint to trade

The crude refinement of some honey producers is a constraint to trade which both relates to honey and beeswax.

There is a lack of technical expertise on how to process beeswax for marketing as well as refining the honey by appropriate straining methods.

The quantities offered for sale prevent economy of scale and particular transport is a problem.

Lack of an organised market for honey and bees products is another constraint for the small producers.

4.2.9 Impact of commercialisation

Honey is a product, which already is in high demand for local brew meaning the effect of commercialisation should already be visible. There is a concern that lack of ownership and security of beehives in the miombo woodlands at distances from the village have created a situation of ruthless exploitation of the resource. The one who comes first stand to reap the benefit of the harvest and since there is no assurance that they will in future harvest from the same beehive destructive harvesting practices are employed to facilitate easy access. Destructive harvesting by felling the host tree to get access to the beehive when the hive is out of immediate reach instead of preparing a ladder to gain access. The lack of security may also lead to a scramble for the honey leading to an earlier harvesting period and thus a lower productivity.

However, these are weaknesses in the present situation of open access and a Joint Forest Management Agreement could be an important tool to regulate and secure ownership right of natural beehives in the miombo woodlands. Boundary demarcation within the woodlands would be an important step towards securing ownership rights between villages and would facilitate an agreement on harvesting by honey collectors within the village.

Having secured tenure and ownership of the resource a higher degree of commercialisation should provide an incentive for better management and result in less destructive harvesting practices. Annex 4 suggest that better market access reflected by higher prices and larger amounts harvested have already resulted in more beekeepers and fewer people who are only involved in honey collection directly from trees and underground hives.

Figures obtained from beekeepers indicate that productivity is far from optimal. According to Kihwele *et al* (1999) reported maximum production from Idodi and Pawaga Divisions in Iringa District is in the order of 100 kg (66 litres) honey; 7 kg beeswax and 1kg propolis for stinging honeybees. Stingless honeybees have a lesser maximum productivity of about 12 kg (10 litres).

Domestication of bees will have a positive effect on pollination of agricultural produce and provide an alternative income generating activity.

Access to marketing of beeswax should increase the economic return to the beekeeper provided that the beeswax produced is of sufficient quality.

4.2.10 Baseline Data on Honey and other Bee Products

The question is to what extent existing honey harvesting is reaching maximum productivity. Annex 7 provides figures on present productivity. A decrease in production, which is not a result of variability due to climatic factors, may indicate a decrease in bee forage, which will be the effect of vegetation loss or degradation. However, the baseline survey has indicated the variability in prices for honey ranging from TSH 5,000 to TSH 20,000 per 20 litres reflecting the existence of local or more regional market for honey.

The ongoing degradation of miombo woodlands poses a threat to the level of production of honey and other bee products. Particular, the indiscriminate felling of trees where charcoal is being produced, where brick making is undertaken, in areas with tobacco production and in areas where fish are smoked. These activities are leading to destruction of nectar producing species. As the woodland degradation is more pronounced closer to the village where beehives enjoys some protection against theft it may have serious implication for the amount of honey harvested.

5 Medicinal Plant

Details of the NWFP Baseline Survey on Medicinal Plants are reproduced in Annex 8: Village Level Data on the Use of Medicinal Plants and Annex 9: Checklist of Medicinal Plants.

5.1 Household use of Medicinal Plants

5.1.1 The extent of household use of medicinal plants

The advent of the so-called western or modern medicine has been slow to make inroads to the rural areas. A limited stock of modern medicine like pain killers, cough syrup and tablets, tetracycline, penicillin and chloroquine may now be available in shops in villages which have all weather road access to urban areas like Iringa.

The Socio-economic Baseline Survey revealed that traditional medicine is widely used in all the villages surveyed but it also recounted the difficulty it had with getting information from the traditional healers they encountered during the survey. The reason for this was the traditional healers reluctance to reveal their knowledge in presence of others. This is not surprising as they quite naturally were only protected their professional knowledge for which they depended financially on in providing health and healing services to community members. The information on use of medicinal plants in the Socio-economic Baseline Survey are therefore presenting findings with regards to the common known medicinal plants and their uses. In order to obtain more details on the range of medicinal plants the NWFP Survey Team was successful in establishing a dialogue with the individual healer through separate interviews where other villagers were not present.

On an average respondents were mentioning some six to eight different medicinal plants for common ailments like abdominal pain for menstruating women, diarrhoea, stomach worms, chest pains, pneumonia, skin rashes and headaches but also treatments against more special illness like convulsion in children, mental nervousness and restlessness. By interviewing traditional healers an impressive list containing some 55 plant species was compiled. In a vegetation survey undertaken by the MBOMIPA project between thirty to forty species with medicinal values were listed of which the majority were tree species Nahonyo et al 1998. If more resources had been allocated in the present survey it

would have yielded a considerable larger number of medicinal plants. A more thorough study on medicinal plants would have to allow for enough time to build up trust with the traditional healers who by nature are secretive about their business and sceptical to the intention of an outsider. The official excuse for not being able to assist with information was the common belief that a medicine looses its potency if its identity is revealed. This can also be viewed as a polite way of protecting their profession.

Several studies in South Africa have demonstrated that despite the access to western medicine in many urban areas 80 to 85% of the population continued to use traditional indigenous medicine irrespective of religion, age, education and economic status (FAO 1998). A study in peri-urban Bushbuckridge estimated that 58% of the clinic patients used indigenous medicine. This is considered a conservative estimate as people generally were reluctant to admit to the use of traditional medicine (Mander 1997). Analysis on the reason for relying on traditional indigenous medicine revealed that it was not motivated by cost of western medicine alone but also the notion that there were ailments that the modern clinics could not cure. Respondent indicated that the selection of healing systems depended on the type of illness and problems that they were experiencing (FAO 1998). It therefore seems realistic to assume that traditional medicine also in Tanzania will remain important for both the rural and urban consumer and that the source of traditional medicine will to a large extent come from the vegetation of the miombo woodlands.

5.1.2 Who harvest and use medicinal plants?

Some of the common known medicinal plants are harvested by the individual households. For the lesser known species harvesting is undertaken by the traditional healer. The trend with specialised collectors gathering medicinal plants for resale to the traditional healers either directly on demand or through established market which is common in South Africa are a rare phenomenon or absent in Tanzania. The present survey was not able to find any indication of sale by collectors or trading amongst traditional healers themselves.

Sale of medicinal plants are observed at the market in Iringa where four to five Masai women daily can be seen displaying the medicine in the form of roots and barks in its original form for easy verification.

5.1.3 Where and when are medicinal plants harvested?

Medicinal plants are harvested throughout the diverse habitats in the area but predominantly in the miombo woodland. The healers revealed an intimate knowledge of the habitat for each particular species. Habitat mentioned included miombo woodland, termite mounds, valleys with sandy soils and lowland areas. Almost all plant parts are used for medicinal purposes but the most common are roots and leaves. Bark, seed/fruit and latex are also used as medicine.

There may often be certain rituals associated with harvesting of medicinal plants for example the plant may not be approached in such a way that the person shade is falling upon the plant.

A traditional healer may keep a stock of medicine for ready use but healers generally said that they would harvest on demand. Certain medicine needs to be fresh and will loose its potency when dried and therefore necessitate harvesting on demand. Most medicine can be dried and stored but the healers claimed that they would harvest on demand. This statement may have its natural explanation in the claim that they would not charge for the medicine but only receive an incentive to go to the bush to harvest medicine. During the winter month it would be expected that there is a higher demand for chest-related medicine.

5.1.4 Tenure, access and management

Most medicinal plants are found on communal land with open access. In Izazi village people related that people from outside came to collect medicinal plants and that men from Ihanyi visit Makatapola sub-village where they collect plants not found in their own village. The same story of people from outside the area coming to collect medicinal plants was related in Nyang'oro of people from Izazi, Makuka and Mangawe.

One may fear that such collection expedition may be exhausting the local plant supply as people from outside may not appreciate the option of sustainable plant supply to the same extend as people enjoying rights of ownership. The same may to a lesser extent be argued about healers from the village seeing that plant spared by them are subsequently harvested by other people from outside.

5.1.5 Changes in availability (seasonal variability)

There are plants, which can only be harvested during certain times of the year where above ground plant material makes it possible to locate and identify them. For instance, fewer bulbs are harvested during the dry season due to the aerial plant parts dying back or being destroyed by fire. During the rainy season the development of leaves and flowers makes the identification easier. The seasonal availability of medicinal plants necessitates that the healer builds up a certain stock, which can last through the year.

5.1.6 Supply and demand

The list of medicinal plants in Annex 9 indicates an abundance of medicinal plants and without the existence of major market for medicinal plants in Iringa or Tanzania it does not seem to be any immediate prospect of short supply. However, it is suspected that the NWFP Baseline Survey may not, due to time constraint, have fully revealed the extent of availability of medicinal plants. There was little time to build up a level of confidence with the healers and because other villagers were present during plant verification in the field it is suspected that the healers may not have revealed all their plant knowledge.

Harvesting of medicine can be highly destructive and where the bulb and often also roots are extracted the whole plant may be extracted from the ground. Where bark is taken from smaller trees there is a risk of death of the plant. For scarce species there is a risk of ring-barking by the negligent harvester who may only care for maximising the harvest. However, with the absence of established market and collectors harvesting for resale this risk may not be acute in the project area. There is also a belief in some places that bark should only be removed from a strip on the west and the east side of the trunk of the tree as this is the place where the most potent medicine are found. This is in effect is a sustainable harvesting practice preventing ring-barking (Clarke et al 1996).

The indication of abundance of the species listed in Annex 5 does not give rise to concern of local extinction of the species dealt with in the Annex. However, any plant species moving into the category of scarce should be carefully monitored and measures taken to ensure sustainable harvesting, possibility of enrichment planting or possibility of cultivation.

5.1.7 Processing

Medicinal plants are generally subjected to limited processing apart from grinding, chopping and mixing. Raw plant material is frequently sold directly to the consumers who then may grind it themselves following instructions provided by the healer. Plant products are taken as medicines in the following forms:

- Infusions (chopped bark, leaves, seeds/fruit, stems, bulbs, rhizomes and roots steeped in water);
- Concentrates (infusions where the water is boiled off concentrating the liquid);
- Inhalants (plant parts or powdered parts burnt to produce smoke or boiled to produce steam) which is breathed in,
- Powder (ground plant parts, usually tree bark, roots or leaves - usually burnt or raw) which can be licked, used as a snuff, bathed with, rubbed on the skin, or implanted under the skin;
- Poultices (fresh leaves of fleshy plants) applied to wounds, sores or other skin ailments and,
- Protective charms (live or dried plants) used for planting or scattered around the homestead (FAO 1998) or carried by individuals.

5.2 Existing Commercial Trading of Medicinal Plants

5.2.1 The extent of existing trade in medicinal plants

Though some Masai women are plying their trade of medicinal plant in the market in Iringa there is no indication of an organised major market of medic i-

nal plants. The origin of medicinal plants at Iringa market is obscure and may not even come from the vicinity of Iringa.

5.2.2 Who trades in medicinal plants?

Masai seem to be recognised as traditional healers and about four to five have informal stands at the market where medicinal plant parts are sold.

5.2.3 Where and when are medicinal plants procured for trading?

The existence of major markets could not be verified.

5.2.4 Supply and demand

It is believed that there in South Africa is an increase in the use of traditional indigenous medicine which it is speculated may be attributed to the high degree of urbanisation, competition and stressful modern environment. Indigenous healing and healers are used extensively to treat stress-related illnesses (Mander, 1997).

Poverty also fuels the demand for indigenous medicine as households are forced to make use of affordable medicine. Poor infrastructure makes modern medicine unavailable to a large segment of the rural population, which therefore has to rely on local available alternatives. There are certain psycho-social sicknesses which according to beliefs can only be cured by treatment with traditional medicine. Where a person grown up in a "western" influenced environment in case of certain psychological problems would consult a psychotherapist, the spiritual wellbeing in the African culture can also be attained through administering of traditional medicine along with the observance of certain rituals.

In the wake of the AIDS epidemic the cost of western medicine offer little relief and many are then resorting to traditional medicine.

International demand for local plant products is also likely to increase with the growing popularity of alternative medicines and natural products. The mobility of people increases with a better infrastructure and with that an exchange of knowledge of traditional medicine with healers from outside the region leading to an increasing demand.

5.2.5 Processing

One individual was seen at the market in Iringa from where he sold already grounded powder contained in small bottles. This practice obscures the origin of the plant material. As most products are sold in raw form there is limited processing and value-adding to the products. The most sophisticated product is in the form of a mixture of ground plant parts. Most of the value is therefore added when medicine is prescribed by the traditional healer.

5.2.6 Marketing

Masai display the plant product in its natural form, being it bulb or bark, for the customer to verify its genuine nature.

Against the background of the regional, as well as, international interest in traditional medicine and natural products it is likely that indigenous medicine from the miombo woodlands could be successfully marketed. However, the miombo woodlands extends over a considerable area and the identification of a marketable medicinal plant product would probably not be unique for the project area and competition should therefore be expected from elsewhere.

5.2.7 Pricing and income

The traditional healer will charge the client with a fee for collection of medicine while other healers charge depend on the severity of the disease, availability of the plant and economic status of the client. A price of TSH 500 was given as a standard fee. If a person is cured the healer can often expect a large sum of money or payment in kind.

5.2.8 Current constraint to trade

There seems to be local self-sufficiency of medicinal plants and therefore major markets on medicinal plants have not emerged.

5.2.9 Impact of commercialisation

The commercialisation of medicinal plants in South Africa and elsewhere in Africa has resulted in local extinction of certain species. The interest of pharmaceutical companies in natural plant medicine and the increasing scarcity have led to an interest in cultivation of valuable medicinal plants. However, there is little indication that a commercialisation at that scale is imminent in Tanzania where a major market for medicinal plants does not exist.

The factors which have led to the high degree of commercialisation in South Africa is the fragmented distribution of medicinal plant species due to the natural climatic and topographic conditions, a concentration of consumers in urban areas and already locally extinct plant populations (Mander, 1997). Urbanisation in Tanzania could eventually lead to a market for medicinal plants.

6 Thatch Grass

6.1 Household use of Thatch Grass

6.1.1 The extent of household use of thatch grass

There are several species of thatch grass, which are used in the study area. Species reported to be used in three divisions of Iringa Region (Ndangalasi, 1998) are:

a) Hyperrhanea filipendula

b) Hyperrhanea rufa

c) Heterogon contortus

d) Andropogon spp.

e) *Aristida lecophaea* (Mkulula)

With few exceptions of houses with corrugated iron sheets, mainly official buildings and a few wealthy individuals, thatch grass is used as roofing material for most rural houses. Apart from being the only affordable roofing alternative thatch grass has some advantage to corrugated iron sheet. Houses with thatch grass as roofing material are cooler in the summer and warmer in the winter and it is not so noisy during rains. The advantage of corrugated iron sheets is the longer life span, which is an issue in areas where better quality grass is not available. However, thatch grass is free and poorer households do not need to buy it but can collect it.

6.1.2 Who harvest and use thatch grass?

The Socio-Economic Baseline Survey clearly indicate that collection of thatch grass is undertaken by women but it is men who do the thatching of the roof. The exception is Makuka Village where the Baseline Socio-economic Survey indicates that it is the men who are responsible for collection of grass. At two sub-villages of Izazi, Mabatini and Mnadani the majority of houses used reeds for roofing material with a layer of sand on top, which was applied to prolong the life span of the roof. Reeds are found along the Mtera Dam and the presence

of crocodiles and hippos along with the need for a boat may explain why men have this responsibility.

6.1.3 Where and when are thatch grass harvested?

Each of the thatch grasses mentioned in section 6.1.1 have their own ecological niche and are therefore not widely available. For example, *Aristida leucophaea* is the only thatch grass available in Mkulula village while Mapelele, Lusige and Likuvi (*Hyperrhania schimperi*) was available in the neighbouring village of Usolanga. In Makuka a bush scrub know as *Ngelula* is used as an alternative.

Hyperhanea spp. and *Heteropogon contortus* are found as the most dominant grasses in the open patches along the hill slopes. *Heteropogon contortus* are also found in some patches in the regenerating forests. *Andropogon* spp. is the most dominant species in the *Mbuga*.

The optimal harvesting period is when the grass is dry and has shed its seeds. However, the availability of thatch grass during the dry season is scarce when most of the area is affected by fires.

6.1.4 Tenure, access and management

Thatch grass on communal land is governed by open access and is free for every one to collect. Harvesting of the grass when the grass is dry and has shed its seeds ensures that the reproductive potential are intact but as grasses also reproduce by vegetative formation earlier harvesting is not necessary a threat to the continued supply. Traditional regulations of harvesting of thatch grass were not encountered but elsewhere in Africa there are examples of harvesting only being allowed when the chief declares the thatch ready to harvest and that is once the seeds have fallen to the ground to ensure good harvest in subsequent years. The harvesting may even be regulated by by-laws where offenders violating the harvest regulations are being fined.

Where the resource is limited people are reported to have cut the grass when green and then sun dry it on the site. However, early harvesting of thatch grass has the draw back that the grass is weaker and therefore will not last as long as normally. Green grass not properly dried may turn mouldy and deteriorate before it is used.

Generally one would expect a tendency to cut the grass earlier out of fear of not harvesting at all due to reduced amount of grass and the increasing incidence of bush fires. Grazing also affect the amount of thatch grass harvested and where there is a considerable grazing pressure thatch grass is scarce.

6.1.5 Changes in availability (seasonal variability)

The availability of thatch grass is highly dependent on the rainfall and during drought period the amount of thatch grass is reduced. In 1999 the thatch grass was very scarce due to lack of rain and compounded by insect attack - *Mbilasi.*

6.1.6 Supply and demand

The respondents in the Baseline Socio-economic Survey indicated that thatch grass was scarce in the three villages north of Nyang'oro i.e. Izazi, Makuka and Migoli. South of Nyang'oro and around Kitapilimwa FR the amount of thatch grass is considered sufficient except for the last year were it was scarce in some areas due to the lack of rain.

Demand for thatch grass is regulated by the durability of the thatch grass, number of houses to maintain building activity and choice of building material. The first phases of deterioration of the roof can be mended by maintenance and patching with a few bundles of new thatch. The durability of the individual species is variable. *Andropogon* sp. is reported to be the best thatching grass lasting up to ten years while other grasses only last three years (Ndangalasi, 1998).

6.1.7 Processing

If thatch grass is being cut while it is still green it is being spread out to sun dry before it is bundled. If it is cut while it is dry it is bunched immediately into manageable bundles. Each bundle is tied up with a string of grass to keep it together and a number of bundles may be tied together into a larger headload. The bundles are then stacked to dry for a few weeks. There is no treatment prior to using it for roofing.

6.2 Existing Commercial Trading of Thatch Grass

6.2.1 The extent of existing trade in thatch grass

No sale of thatch grass was reported in the three villages north of Nyang'oro even though there was short supply of thatch grass as reported by the socio-economic survey team. In most of the other villages south of Nyang'oro and around Kitapilimwa FR thatch grass was sold for around TSH 200. The price indicated for a bundle of thatch grass in Chamdindi, Ikengeza was TSH 300. There are no indications that the higher price of thatch grass is affected by its scarcity.

All sale of thatch grass is undertaken locally. There is no demand from Urban Iringa where all houses are built using corrugated iron sheets or more rarely tiles.

6.2.2 Who trades in thatch grass?

It is solely the women from the poor households who engage in sale of thatch grass. It is an activity where all female age groups in the household participate i.e. youth, middle and old.

6.2.3 Where and when are thatch grass procured for trading?

The thatch grass for sale is harvested in the same places as grass for domestic use.

6.2.4 Supply and demand

The Socio-economic Baseline Survey indicated that there was no scarcity of thatch grass in the villages south of Nyang'oro and around Kitapilimwa FR. However, this Baseline Survey found that there locally are scarcity in some of the sub-villages which explains some of the sale but also that richer household opt to buy instead of undertaking the time consuming exercise of collecting themselves.

6.2.5 Processing

Treatment of thatch grass of the lesser lasting species with anti-termite chemicals may increase the longevity from three years to six years but the chemicals are too expensive and therefore not used (Ndangalasi, 1998).

6.2.6 Marketing

As there is only local markets marketing is by word of mouth of whom is interested in buying.

6.2.7 Pricing and income

It could not be established how much was actually traded and thus what contribution it may make to a household engaged in sale. A standard house would need 10-15 bundles of thatch grass at Migoli being considered adequate for smaller and more temporary as a dwelling at the fishing camp. With the current prices given at TSH 3-500 per bundle this would imply a cost and potential income of between TSH 3,000 and 7,5000 depending on size of house and price of grass. In Chamdindi a standard house with a bedroom and living room will require 25-30 bundles and with prices in the order of TSH 300 per bundle this would imply a cost of between TSH 7,500 and TSH 9,000.

6.2.8 Current constraint to trade

The absence of an urban market in Iringa and the cost of transport provide constraint to trading local surplus, if any.

7 Grazing

7.1 Grazing quality and potential of the miombo woodlands

The amount and distribution of rainfall is a major factor influencing the herbage production, which therefore tend to fluctuate with annual rainfall, especially in dry miombo woodlands. There is a linear relationship between herbage production and annual rainfall. This relationship is modified by soil type and the ratio of trees to grasses. Bush clearance increases grass yields but also leads to changes in herbaceous species composition and in some instances to replacement of palatable grasses with unpalatable. In dry miombo, tree clearance could also reduce the amount of forage available during drought years since trees tend to be more droughts tolerant than herbaceous plants (Chidumayo *et al* 1996b).

There are seasonal changes in the quality of fodder where the crude protein contents of grasses decreases from about 10% during the growing season to 3% during the dry season. Browse from miombo species maintains a crude protein of some 10% throughout the year. Some species suitable for browse contains elements like condensed tannins, which tend to reduce the availability of nitrogen to ruminants. Since most miombo species, which are suitable for browsing are deciduous there is a shortfall of fodder during the dry season although litter is consumed. This is the time of year where agricultural residue provides an important alternative fodder supply.

The annual leaf flush and new coppice shoots are important sources of browse. Particular since the leaf flush for many miombo species occur 4-8 weeks before the onset of the rainy season and thus growth of the herbaceous layer. Livestock browse woody coppice readily and with heavy grazing pressure through the presence of large livestock herds the heavy browsing are also detrimental to the regeneration of the browse species. Dominant plant species such as *Brachystegia speciformis* and *Julbernaridia spp.* and other common browse species do not tolerate frequent defoliation. Heavy grazing pressure therefore influences the species composition of the miombo woodlands.

The herbivore wildlife populations will offset periodic shortage of high-quality forage by moving seasonally between different landscape unit and by selecting areas, which have recently been burnt and therefore produces a brief high-

quality fodder. This strategy requires large foraging areas, which in turn means low population densities.

Despite these apparent natural limitations to the grazing quality of the miombo woodlands they are nevertheless extensively used for grazing both by pastoralists who in some regards have adopted the same grazing strategies for their livestock as the herbivorous wildlife population. In addition resident agriculturist make wide use of the miombo woodlands for grazing particular during the growing season of the agricultural crops.

The following miombo species are considered very palatable: *Acacis tortilis, Afzelia quanzensis, Bauhiniathoningii, Brachystegia spiciformis, Burkea africana, Combretum apiculatum, Cussonia arborea, Dichrostachys cinerea,Ficus sycomorus, Julbernardia globiflora, Julbernardia paniculata, Kigelia africana, Piliostigma thonningi, Pericopsis angolensis, Pseudolachnostylis maprouneifolia, Steganotaenia araliaceae, Strychnos spinosa, Swartzia madagascariensis* and *Zanha africana (*Chidumayo, 1997 and Clarke et al, 1996).

7.2 Availability of grazing

Pasture for grazing is generally considered scarce but had it not been for the issue of migrating pastoralists farmers in the Socio-economic Baseline Survey considered available land for grazing sufficient. The authors believe there may be some elements of blaming pastoralists for insufficient grazing areas and a too optimistic outlook on the question of land availability for grazing had it not been for the pastoralists.

None of the farmers in the entire project area considered grazing to be sufficient indicating a relatively scarce resource, which is further aggravated by the presence of migrating pastoralists. For the pastoralists,who do generally not have access to letting their cattle graze on crop residue, the miombo woodlands are refuges during the dry season.

Resident farmers consider grazing unattainable in some woodland area due to risk of theft. At Izazi village it was reported that grazing in the mountain was less attractive due to the saltiness of the only available spring. Visible signs of overgrazing were seen both in terms of vegetation cover and soil erosion particularly north of the Nyang'oro Range.

As indicated in section 9.1 the availability of grazing is dependent of the amount of rainfall. Around Makuka the amount of grass was last year generally affected by less rainfall and the attack of insects *"mbilasi"* destroyed the pasture to the extent that pastoralists did not bring their livestock in for grazing at all.

7.3 Grazing by pastoralists livestock

The Socio-economic Baseline Survey revealed conflicts with regards to grazing but also mutual beneficial arrangements of leasing grazing rights to the pastoralists, as well as, the leasing of bullock and cows by the resident farmers. The migrating pastoralists include the Wamasia, Wasukuma and Wamang'ati who may enter the area with large herds of livestock.

Conflicts arise when the pastoralists' livestock graze on crop residue without prior agreement with the resident farmers or even on crops not harvested. Other conflicts are related to incidences of thefts of cattle belonging to the resident farmers. At Izazi resident farmers complained over the pastoralists not respecting the special pastures created for grazing of young animals and fenced off with thorny shrubs.

7.4 Grazing by resident farmers livestock

In contrast to the pastoralists, resident farmers have both the opportunity of grazing cattle in the miombo woodlands throughout the year and on crop residue during the dry season. However, fear of physical confrontation and theft of cattle by migrating pastoralists have somehow restricted the resident farmers' movements of livestock. For example, the resident farmers of Ikwega have stopped grazing their cattle in the valley to the north of the sub-village, since they fear the Wamasai staying there.

There are also examples of conflict regarded grazing between resident farmers in the neighbouring villages. This seems to be more pronounced in the area north of Nyang'oro range where Izazi and Migole in particular were mentioned and have resulted in a demarcation of village boundary exercise initiated by the village divisional secretary and village councils.

There are also examples of mutual beneficial arrangements on grazing rights on farm residue in exchange for lease of bullocks or cows during their lactation period. Resident use bullocks for ploughing and have the responsibility of fattening the bullock until it is ready for slaughtering. In other cases the resident farmer will be responsible for training the bullock and may be committed to plough the pastoralists' fields.

7.5 Tenure, access and management

Some of the conflicts between the migrant pastoralists and resident farmers are embodied in differences of opinion on tenure to grazing in the miombo woodlands. The Socio-economic Baseline Survey relates to the fact that some of the pastoralists now have established camps to which they return year after year on the very land which the resident farmers were cultivating before the villagisation forced them to leave. The pastoralists having established camps are now somehow claiming exclusive user rights to the area. In Kiwere village it is re-

ported that some areas of the woodlands and agricultural lands are excluded from grazing through a by-law protecting these areas. The areas are found along the stream and other water bodies, which constitutes the drinking water supply for the village. However, it is also reported that the Wamasai do often not respect this by-law.

While fire is a management tools to ensure new growth of palatable grasses farmers also complained over the rampant bush fires which were set intentionally by hunters or accidentally by honey collectors, which destroyed the grazing areas.

7.6 Who herds and tend the livestock?

Both men and women are involved in the grazing of livestock. Women tend the younger animals while the men or boys herds the grown up. For the pastoralist Wamasais women also tend the older livestock.

In Kiwere a by-law exists which prohibits boys to graze animals during school hours. To what extend this by-law is enforced could not be verified.

7.7 Lease of pasture, bullocks and cows

Examples of leasing of pasture are taken from Mangawe village where a resident farmer can give access to a pastoralists' cattle if he is willing to pay TSH 2,000 per acre. Elsewhere prices of THS 500 and TSH 1,500 per acre are reported. Also in the same villages it seems customary to enter into agreements where a resident farmers takes in milking cows for grazing on crop residue in exchange for the milk and manure, or agreements where bullocks will be grazed by the resident farmer in exchange for using it for ploughing. Since bullocks need training to plough such an arrangement has a duration of two to four years. In Nyang'oro it is reported that the farmer in addition to grazing the bullock also have to pay some part of the produce if the bullock is already trained.

It is noted that all agreements relating to lease of grazing relates to crop residue on farmland. The miombo woodlands remain under open access for all community members and any form of village ownership seems not to be respected by the pastoralists migrating from elsewhere.

8 Other Non-Wood Forest Products

8.1 Reeds for Mat Weaving and Basket Making

The Socio-economic Baseline Survey recounted this to be a very important income generating activity for the villages in the Udzungwa Mountains Woodland Management Project were *milulu* is collected to make sleeping mats and baskets for carrying crops. *Milulu* is a *Cyperus* sp found in wetland areas in the valley bottoms in the high lands. Basket making is an income generating activity for both men and women and baskets are sold a TSH 200 to 250. Mats fetches a higher price and depending of how tightly it is woven are sold for up to TSH 2,500. The tightly woven mats are used for drying maize flower and the looser woven as sleeping mats. Mats are also important in the event of funerals and each household will keep mats reserved for such occasion. *Milulu* is scarce outside the Forest Reserve and therefore most is gathered inside.

The NWFP survey team did investigate the importance of basket making in the pilot areas for the Natural Woodland Management Project where the Socio-economic Baseline Survey had reported this as an activity in Itagutwa village but did not provide any details. The NWFP survey team could not find any evidence of the occurrence of *milulu* in the project area but villagers informed that they bought reeds at the markets where it was brought from Ilambo village, Mazombe Division where it is plentiful. In Chamdindi some people who originate from Njombe and thus were brought up with the tradition and skills of basket weaving take some *Milulu* back with them when they return from visits to their former home areas in Njombe where *Milulu* is abundant.

8.2 Gum Arabic

The NWFP team was informed in Mkulula that people collect gum from within the vicinity of Luhomelo, a sub-village of Mkulula. This sub-village is found closer to the Great Ruaha river, a six hours walk from the village centre. The local name for the tree is *Mhadadi*, from the description given about the tree, it is likely that it is in the genus *Commiphora* (Family *Burseraceae*). A similar explanation was given when walking with key informants in Migoli village, though here they also use the name *Mbani*. Due to time constraint, the NWFP team could not go to Luhomelo to see the tree. It is therefore not correct to call it Gum Arabic as this is used for the gum of *Acacia senegalensis*. The gum is

reported used as incense mostly bought by people from the coast. A 20 litre container was sold for TSH 4-600 at market in Iringa.

8.3 Household Utensils

During this survey several other uses were identified. The following were trees reported to be used for making wooden mortars: *Mvembadanda*(*Pterocarpus tinctorius*), *Mkola* (*Afzelia quanzensis*),*Mkwata* (*Cordyla africana*), *Mwondo* (*Entandrophragma bussei*),*Mpogolo*(*Faidherbia albida*), *Mbwegele* (*Sclerocarya caffra*)and *Mfumbi* (*Kigelia africana*).

Wooden pestles for pounding cereals were reported to be made from the following species: *Mpululu* (*Terminalia sericea*), *Mhavava* (*Baphia cordifolia*), *Mlama (Combretum molle), Mgandu (Berchemia discolor), Mkambale (Acacia mellifera), Mvulagavega (Acacia nilotica), Mtowo (Azanza garckeana), Mkwee* (*Brachystegia spiciformis)*and *Mgulukanziva (Lonchocarpus bussei).*

Other utensils on daily use in the households such as wooden spoons and spoons for making porridge were reported to be made from the following trees: *Mtowo* (*A.garckeana), Mkombalwiko* (*Schrebera trichoclada*), Mdunguya (*Balanites aegyptica*), *Mhavava* (*Baphia cordifolia*), *Mguvani* (*Markhamia obtusifolia*) and *Mkapo* (Grewia fallax).

9 Conclusions

9.1 Use of NWFP

The key informants participating in this survey where individuals recognised by the village leadership to have exceptional knowledge on the uses of indigenous plants and therefore the listed species which are edible include lesser known species. The species indicated in the Socio-economic Baseline Survey probably lists the more popular and commonly known species.

The farmers with exceptional knowledge on NWFPs are often belonging to the older generation and indication is that their knowledge is not passed over to their children. It was also indicated that young people do not appreciate forest food to the same extent as the older generation. It therefore seems very probable to assume that much of this knowledge will be lost if not recorded.

A number of indigenous fruit trees are amongst the trees normally left in the field when clearing for arable land and thus illustrating the value farmers assign to them.

The notion of poor household in particular depend on the NWFP for their livelihood and women relying more on NWFP for household use and income has been confirmed. Substantial income from the sale of NWFP could not be verified but there are sale of indigenous herbs, mushrooms, fruits, thatch grass and honey. Women from poor households are also normally the ones who are involved in the preparation and sale of local brew.

9.2 Indigenous Edible Fruits, Vegetable and Mushrooms

The NWFP Baseline Survey has clearly demonstrated that most of the rural households depend on edible indigenous vegetables during lean periods towards the end of the dry season and early rainy season and that they are particular important during periods of hunger. The edible vegetables do not only ensure an all year food supply but also add variety to the diet.

Indigenous fruits are mainly consumed by children and provide essential vitamins and minerals of particular importance to the growth of children who oth-

erwise are subjected to a carbohydrate rich nutritionally poor diet consisting mainly of porridge.

9.3 Honey Production and Beekeeping

The current unregulated access to honey harvesting is unfavourable to the sustainability and productivity of the honey production. Boundary demarcation within the Forest Range of Nyag'oro and Kitapilimwa Forest Reserve would be an important step towards securing village ownership of honey resources within village boundaries. Joint Forest Management agreement could be an instrument to regulate honey harvesting and ensure a sustainable production..

Honey is almost exclusively marketed for use in local brew and prices obtained varies. Since the major use of honey is as comb honey there is little extraction of beeswax or other bee products. Production levels are generally low and there is an untapped potential for an increased productivity for the individual beehive and in the project area as a whole.

9.4 Medicinal Plants

There is a vast knowledge of plants with medicinal values, which the present survey could only provide a glimpse of. A more comprehensive study would require a more extensive survey where trust is sought established with the key informant, who mostly are to be found amongst the traditional healers. People encountered with detailed knowledge of medicinal plants were reluctant to discuss and reveal their knowledge during group discussions and some indicated that this was a knowledge they could not share freely.

Traditional healers play an important role in the health care system, as they remain the only accessible and affordable means of treatment for a number of ailments and diseases.

The present survey has not established any major market for medicinal plants in the area and the survey did not identify plants, which were considered scarce and thus under imminent threat of extinction. Nevertheless, any knowledge of scarcity of individual plants should be recorded and efforts made to develop and extend the principle of sustainable harvesting methods.

9.5 Grazing

The migrating pastoralists are one of the biggest challenges to Joint Forest Management Agreements and the issue of boundary demarcation within the miombo woodlands. There is evidence of overgrazing and soils erosion in parts of the project area and grazing may have long term effects on regeneration of miombo woodlands.

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