Subsistence use of wood products and shifting cultivation within a miombo woodland of eastern Tanzania, with some notes on commercial uses

E.J. Luoga, E.T.F. Witkowski* and K. Balkwill

Department of Animal, Plant and Environmental Sciences, University of the Witwatersrand, Private Bag 3, WITS 2050 Republic of South Africa

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This study categorizes different subsistence and commercial uses of resources and quantifies the amount of wood used for firewood and building poles within an eastern Tanzanian miombo woodland site. Data from questionnaire surveys were collected from 80 households sampled from two villages. Firewood was used solely at the subsistence level by 96% of the population, with a per capita consumption of 1.5 ± 0.17 (SE) m^3 $year^{-1}$, whereas building poles were not only used at subsistence level but were partly commercialised in the informal market. Per capita consumption of wood for building poles was 0.138 ± 0.01 m^3 $year^{-1}$, based on an average house life-span of eight years. Timber and charcoal production were the most commercialised resources. Shifting cultivation, which is undertaken in the majority of the areas cleared for charcoal, is practiced by 68% of the population while permanent cropping is practiced by 32% of the population. Both farming systems predominantly comprise mono-cropping and mixed-cropping of cereals with bean crops. Shifting cultivation changes vegetation structure from woodlands to bushlands because of a short fallow period of only four years after continuous farming for about six years. Current levels of subsistence use of firewood and poles appear to be sustainable, but levels of shifting cultivation are not. However, selection of favoured species for building poles often leads to over-exploitation, especially when these species are inherently scarce.

Keywords: Building poles, firewood, human use, miombo woodlands, sustainable use.

*To whom correspondence should be addressed. (Email: ed@gecko.biol.wits.ac.za).

Introduction

The African savannas have been foci of global attention since the 1970's, but very few studies have been undertaken within an integrated framework which combines economic, social and environmental considerations (Solbrig & Young 1993). Savannas are viewed as non-equilibrium ecosystems within which people form an integral part and the levels of human investment in capital, labour and knowledge are the major determinants of the behaviour of managed savanna systems (Solbrig 1993). Miombo woodlands, a specific type of savanna characterised by deciduous arborescent species (dominated by the genera *Brachystegia* and *Julbernardia)* and grasses, are the most extensive vegetation type in Africa south of the equator. These dry tropical woodlands, covering nearly 3 million km^2 are home to over 40 million people and are the sources of products that serve the basic needs of an additional 15 million urban people (Campbell *et al.* 1996). In miombo woodlands the number of products traded in the formal sector and, therefore, recorded in official statistics, is much smaller than the number traded in the informal sector, although little can be said about the value of such trade (Brigham *et al.* 1996).

The miombo woodlands of Tanzania, occupy nearly 40% of the total area of the country and fall into two tenurial categories: woodlands in protected areas (reserves) managed by the central government, and woodlands in communal areas (public lands) managed by local governments. Apart from using miombo woodlands for farming, local people have twelve types of uses for trees in these woodlands of eastern Tanzania which are charcoal, firewood, poles, timber, medicine, withies, food, ropes (fibre), live fences, carving, rituals and other technological uses (Luoga *et al.* in press). Among these uses, charcoal production had the highest use value accounting for 18.4%, followed by firewood (16.6%) and medicine (15.7%) (Luoga *et al.* in press).

This paper is part of a trans-disciplinary study dealing with the interactions between local communities, the natural resource base, markets and the socio-political environment. Luoga *et al.* (in press) ascertained the local people's knowledge of and reliance on woody resources as a first step towards sustainable resource conservation. In addition, Luoga *et al.* (in prep) assigned monetary values to local charcoal production (the most reliable cash-generating activity in the area) and determined the importance of the charcoal industry to the economies of the local producers through cost-benefit analysis (CBA). This paper fills a gap left by the other two by quantifying wood use for subsistence purposes and determining the types of economic pursuits and land uses in the study area.

Materials and Methods

Study area

The study area comprises the Kitulanghalo Forest Reserve (2638 ha) and surrounding public lands and lies between 6°34'S–6°45'S and 37°53'E–38°04'E. The total population of the three villages (Lubungo, Maseyu and Gwata) is about 4640 people in 1012 households, with an average of about 5 people per household. The area is about 50 km east of Morogoro and 150 km west of Dar-es-Salaam on the Dar-es-Salaam–Morogoro highway, which is the major means of transport for the people and forest products to urban and commercial centres such as Dar-es-Salaam and Morogoro (Figure 1).

The vegetation of the area has been described by Kielland-Lund (1990). It comprises open miombo woodland dominated by trees of *Julbernadia globiflora* (Benth.) Troupin and *Combretum* spp. The area also has patches of semi-evergreen forest dominated by *Manilkara sulcata* (Engl.) Dubard and *Scodophloeus fischeri* (Taab.) Léon.

The annual rainfall is 900 mm, which is seasonally distributed providing a wet season from November to May and a dry season from June to October. The annual mean temperature is 24.3°C while the annual minimum and maximum temperatures are 18.6°C and 28.8°C respectively. This climate supports a regular rain-fed

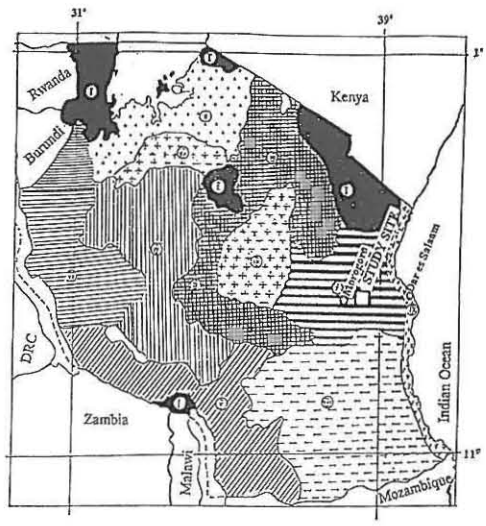

Figure 1 Land use classification in Tanzania showing the area of commercial fuelwood deforestation, other land uses and the study area. (modified from TFAP 1989).

cropping regime, the main crops being maize, sorghum and peas. There are no large wild herbivores in the area, nor are there cattle due to the presence of tsetse flies *(Glossina* spp.), which transmit nagana (sleeping sickness) to domestic animals.

Data collection

Structured questionnaire interviews were administered to 80 households in 8 hamlets of two villages, Gwata and Maseyu in November and December 1997. This sample size represents a sampling intensity of 8%. The selection of households to be interviewed was made systematically in order to obtain a representative sample in terms of wealth, gender and age classes, e.g. the sample comprised 67 male-headed and 13 female-headed households which is nearly proportional to 13% of total households that are female-headed. The respondents were the heads of households and the questionnaire covered broad social and economic perspectives of the households in regard to the use of tree products and land of the surrounding woodlands. Unstructured and group interviews were used to obtain information on utilization from key informants who were traditional healers (n = 4), charcoal burners (n = 8), village headmen (n = 3) and craftsmen (n = 5). Data from interviews were analysed using descriptive and inferential statistics and content analysis.

To determine the amount of wood used in building structures, 18 new unplastered wooden structures of different sizes were selected and all the poles of different categories in each structure were counted. Five poles of each category were measured for length and mid-diameter (Grundy *et al.* 1993).

Results

Subsistence use of resources

Firewood collection and harvesting of poles for construction were the main subsistence products of the trees in the study area. The woodland was also important in subsistence farming where the cultivation of food crops goes along with collection of other food materials of fruits, edible tubers and leaves from the woodlands. *Tamarindus indica* L., a popular fruit tree, bears fruits which are sometimes used locally to make beverages. Edible mushrooms, which are common in other parts of miombo woodlands (Harkonen 1997), do not occur in this area.

Firewood

Ninety-six percent of the respondents used firewood for domestic fuel and 4% used charcoal. Firewood was used for night lighting by 25% of the households, whereas a large proportion (75%) used kerosine lanterns. Each household used about 162 ± 11 (SE) headloads of firewood per year, each weighing 29.2 ± 1.4 (SE) kg, and having a volume of 0.048 ± 0.002 m^3. The annual per capita firewood consumption was thus 1.5 ± 0.17 m^3 $year^{-1}$.

Building poles

Building poles were used both at a subsistence level and as a commercial commodity in the informal market. The surveyed houses had a mean size of 20.2 ± 3 (SE) m^2 floor area (n = 18), ranging from 8 m^2 to 48.2 m^2. On average, a house was built of 309 ± 35 (SE) poles in the ratio of 1:17:25:34 for beams, roofing poles, wall erecting poles, and withies respectively (Figure 2, Table 1). Harvesting of poles for house construction was very selective in terms of diameter (refer to similarity of dimensions within each category in Table 1). The durability of poles, and hence the longevity of houses, ranged from three to fifteen years depending on the natural resistance of the poles to termites and other bio-degraders. With an average household size of five people, four houses per household, and average house life span of eight years, the per capita consumption of construction wood was 0.138 ± 0.01 (SE) m^3 $year^{-1}$. *Spirostachys africana* Sond. is

Table 1 Number and dimensions (mean ± SE) of different categories of building poles in houses surrounding Kitulanghalo Forest Reserve, Morogoro, Tanzania

Pole category	Number per house	Length (m)	Diameter (cm)	Volume per pole (m^3)	Volume per house (m^3)*
Wall erecting (n = 90)	98 ± 8.77	2.47 ± 0.049	7.12 ± 0.138	0.01 ± 0.0004	0.99 ± 0.101 (73)
Beam (n = 47)	4 ± 0.5	4.23 ± 0.121	6.82 ± 0.152	0.016 ± 0.0008	0.063 ± 0.008 (5)
Roofing (n = 90)	70 ± 9.83	2.47 ± 0.04	3.79 ± 0.064	0.0028 ± 0.001	0.229 ± 0.035 (17)
Withies (n = 90)	136 ± 25.4	2.92 ± 0.06	1.51 ± 0.035	0.0006 ± 0.003	0.068 ± 0.012 (5)
Total	309 ± 34.7				1.377 ± 0.316

*Figures in brackets indicate percentage contribution by volume of each pole category to the total volume of poles

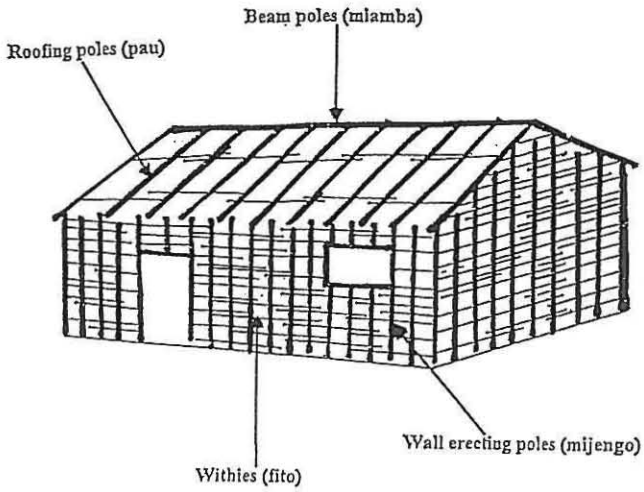

Figure 2 Architectural design of traditional houses showing different categories of poles in villages surrounding Kitulanghalo Forest Reserve, eastern Tanzania.

the species from which durable poles with the greatest commercial potential were produced. The price of one *S. africana* pole of about 12 cm diameter and 3 m long was USD 0.20 at the felling site. Other species for walling and beam poles were sold locally at USD 0.05 per pole while the thin withies were sold for USD 0.02 each.

Shifting cultivation

The farming techniques used were shifting cultivation, which was practised by 68% of the population, and permanent cropping (32%) through mono-cropping or mixed cropping (Figure 3). Except for rice, which was exclusively cultivated as a mono-crop in permanent plots within a few scattered water-logged areas known locally as 'mbuga', other crops were grown in either permanent or 'shifting' plots. Maize and sorghum were the main food crops and were grown by almost the entire population (95% of households grew maize and 93% sorghum) through mono-cropping or mixed with other crops especially peas [*Vigna unguiculata* (L.) and *Vigna radiata* (L.)] which were the major source of protein and grown by 82% of the population. Other crops were sesame (59%) and cassava (30%), while cotton, which had once been a major mono-crop grown for cash, was no longer cultivated because of high input costs and unreliable

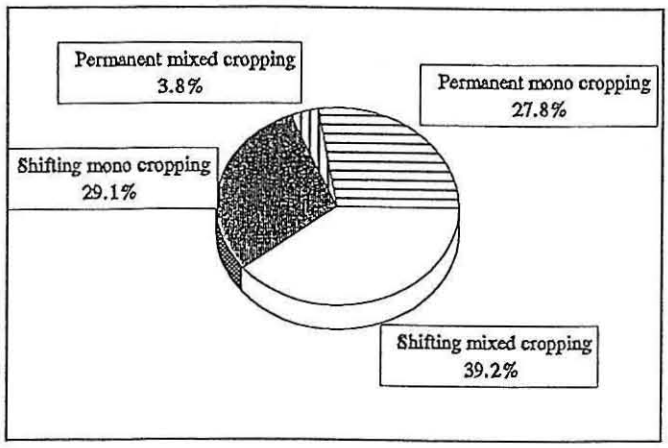

Figure 3 Farming systems of the local people on a per household basis in miombo woodlands surrounding Kitulanghalo Forest Reserve, eastern Tanzania.

markets. Shifting cultivation mostly occurred in the cleared areas after charcoal production, but only on the more fertile soils. With shifting cultivation, after the removal of the big trees for making charcoal, the smaller trees, unused branches, litter and grass were collected into small heaps or spread evenly on the surface and burnt to form ash to fertilise the soil (slash and burn). The land is then cultivated for 6 ± 0.13 (SE) consecutive years and then left fallow for 4 ± 0.27 (SE) years before it is re-cultivated.

The average farm size (excluding the fallow lands) was 4.25 ± 0.31 (SE) ha household^{-1}. Cash intensive inputs like chemical fertilisers, chemical pesticides, machinery and improved seed varieties were not used. Less than 3% of the people were able to buy inorganic fertilisers to improve the soil.

Commercialised resources

Timber (for furniture and construction purposes) and charcoal were the commercialised resources in the area. Wood carving, which is reported to be an important economic activity elsewhere in the miombo region (Brigham *et al.* 1996) and South Africa (Shackleton 1996) is not popular in the area because the people have no traditional expertise in wood-working. Beekeeping, another alternative to diversify sources of income, is not practised.

Timber

A plank of sawn timber of *Pterocarpus angolensis* DC. or *Afzelia quanzensis* Welw. measuring 5 cm × 15 cm × 3.6 m was sold at USD 2.70 at the sawing site. The household survey revealed that most of the door and window frames and shutters of older houses were made of these species indicating that formerly these timbers were relatively readily available. Very few local people can now afford to buy the valuable timber as most of it is purchased at the sawing site by carpenters and timber dealers from the Morogoro municipality.

Charcoal

Charcoal was produced chiefly for the markets in the urban areas of Dar-es-Salaam and Morogoro and was the most reliable cash-generating activity (Luoga *et al.* in prep). Money obtained from charcoal sales was used for clothing, youth education, medical services and food (animal protein). Fifty-four percent of the households are involved in charcoal production, but the participants move in and out of the business as conditions warrant. At least seven migrant households, which came from other regions in the country with low economic potentials, were registered annually as villagers in the two study villages and were producing charcoal. Although this proportion is only about 1% of the population, the migrants tend to be more active in charcoal production than the locals. One crew of two migrants was found to use fire as a means to fell trees, especially *Acacia nigrescens* Oliver, a practice which was not used by local producers (Figure 4). This practice has caused some uncontrolled wildfires.

In the study area, charcoal was produced exclusively in earth kilns, each of which was owned by an individual household. Earth kilns can be made either by digging a pit in which the logs are packed, or covering a mound of logs with soil. Carbonation takes place under a limited supply of air after ignition. A sack of charcoal weighing about 35 kg was sold at the rate of USD 2.00 at a kiln site, USD 2.50 at the Dar-es-Salaam–Morogoro highway and at about USD 5.00 to the urban end users (Luoga *et al.* in prep). The urban end users buy their charcoal from retail traders who in turn buy from wholesalers or from producers. The marketing of charcoal, therefore, forms a complex network creating employment for many people (Figure 5).

Figure 4 The use of fire for felling *Acacia nigrescens* Oliver in miombo woodlands surrounding Kitulanghalo Forest Reserve, eastern Tanzania.

Discussion

Subsistence use of wood resources

The per capita consumption of firewood (1.5 m^3 $year^{-1}$) falls within the range of reported annual per capita fuelwood consumption of 1–2 m^3 in rural areas of Tanzania (Nkonoki 1981; FAO 1984) indicating the similarity in levels of use of firewood for subsistence purposes. A few localised areas in the country had higher levels of consumption (≥2 m^3 per capita per year) because of additional rural 'industries' such as tobacco curing, brick burning, tea drying, fish smoking and local brewing, all of which use fuelwood (Mnzava 1981).

The observed per capita pole consumption of 0.138 m^3 $year^{-1}$ is nearly 4× higher than that of 0.038 m^3 $year^{-1}$ which has been cited in Uganda (Cunningham 1993). The highest recorded per capita consumption of construction wood in Africa is 1.5 m^3 $year^{-1}$ used by the Owambo people in northern Namibia, who normally construct strong wood enclosures around homesteads to protect cattle (Cunningham 1993), a practice not undertaken in Uganda or in the study area. The favoured pole species, *S. africana*, is now becoming popular not only in rural areas but also in urban centres where it is also used to make fences and to cover sewage pits. The species, like other members of the family Euphorbiaceae, is termite resistant because of the high levels of toxic substances (Vedcourt & Trump 1969). The commercialisation of *S. africana* poles probably accounts for the observed limited supply in the woodland.

The volume of wood used for the subsistence purposes of fuel and housing was about 1.64 m^3 per capita per year. The total annual consumption in 1997 was estimated to be 7 610 m^3 $year^{-1}$ of wood (1.64 m^3 per capita per year × 4640 people). With a mean annual increment of 4.35 ± 1.3 (SD) m^3 ha^{-1}, determined from miombo woodlands of the study area (Ek 1994) and an estimated accessible area of 13 350 ha (excluding permanent cultivation and settlements) of communal lands, the sustained yield which could be harvested without reducing the resource base would be 58 072 m^3 $year^{-1}$ of wood (4.35 m^3 ha^{-1} $year^{-1}$ × 13 350 ha). Thus the subsistence but essential to life daily uses have low levels of utilization, with low impacts on the resources and hence are sustainable if considered independently.

Shifting cultivation

The major problems with most tropical soils are low pH and low fertility, particularly with regards to phosphorus and nitrogen (Solbrig 1993), but the post-fire ash deposition through slash and burn raises soil pH and increases fertility for a short period. Human alteration of natural landscapes is not new as people began to transform their surroundings with the adoption of agriculture and the domestication of animals some 10 000 years ago (Solbrig & Young 1993). However, shifting cultivation in miombo woodlands remains sustainable only when the population density is less than 4 people km^{-2} (Chidumayo 1987). With this low population density, the fallow period would be long enough (≥20 years) for woodland fertility to be restored. The population density in the study area is estimated at 22 people km^{-2} (URT 1995) leading to short fallows of only 4 ± 0.27 (SE) years, hence the practice is not sustainable.

The lack of domestic livestock such as cattle and goats (typical of other communal areas without tsetse flies) resulted historically

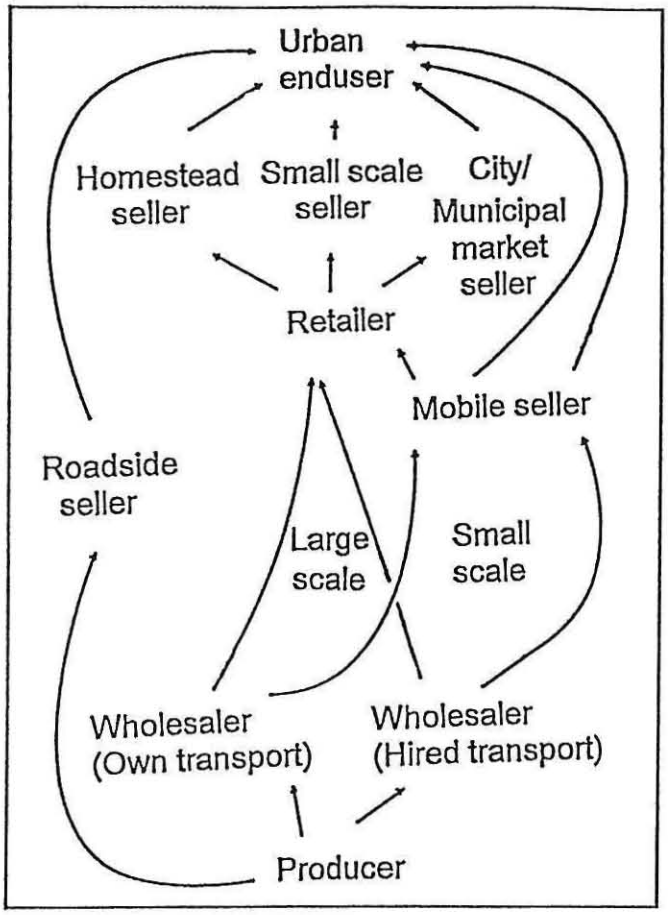

Figure 5 The market chain for charcoal from a producer in miombo woodlands surrounding Kitulanghalo Forest Reserve, eastern Tanzania to an urban end-user, (modified from Brigham *et al.* 1996).

in greater consumption of animal protein from wild game and virtually all wild mammalian herbivores have been depleted in response to increased human density. The main source of protein now is from cultivated or collected plant material. The absence of cattle also results in a lack of draught power for ploughing, leading to a relatively small average farm size of only 4.25 ± 0.31 (SE) ha per household.

Commercialised resources

Following the high price of high quality timber, most people now utilise lesser known timber species for household items. Species now utilised are *Sterculia quinqueloba* Sim, *Xeroderris stuhlmannii* (Taub.) Mendonca & Sousa and *Sclerocarya birrea* ssp. *caffra* Sond. (Luoga *et al.* in press). Wood of the latter is also used in Zimbabwe to make handcrafts, carts, furniture and household items (Grundy *et al.* 1993), unlike in communal lands of South Africa, where the trees are nurtured for several uses including 'marula' fruits.

Charcoal production is the main activity in the area because of the ready market in nearby urban centres. Charcoal is the preferred household fuel in urban areas for the following reasons (Dennis *et al.* 1980; Ishengoma 1982; Shechambo 1986; Monela *et al.* 1993):

- its calorific value is about 7420 kcal kg^{-1} compared to firewood with a calorific value of 3500 kcal kg^{-1};
- it is lighter than wood and hence easier to transport;
- it burns steadily and without smoke and, therefore, can be used indoors with minimum inconvenience;
- charcoal stoves are cheap and affordable;
- it does not deteriorate with time;
- it occupies less space and, therefore, is easier to store, ideal for urban living quarters where space is normally scarce; and
- it is more reliable than electricity, which is subject to frequent power cuts.

A trend of local people moving temporarily out of the charcoal business, which occurs mostly during the rainy season when people devote their labour to farming activities, has been reported in other places in the miombo region (Brigham *et al.* 1996). The use of fires as a felling tool by 'outsiders' who were involved in charcoal production in the area can mean that they have more effective ways of felling trees, or that they may have a different attitude to sustainability, possibly because they feel no ownership of the resources and are likely to move elsewhere when the resources are depleted.

Steel and brick charcoal kilns, which have high efficiency (Booth 1981), are not used in miombo woodlands because charcoal producers have no access to investment capital to buy them nor the technological expertise to manage them. In Europe, on the other hand, steel kilns are used because of the high returns on the charcoal market, ready availability of cheap steel, good transport facilities and greater access to investment and operating capital (Booth 1981).

Potential impacts of present levels of resource use

Ninety percent of the above ground biomass of woody plants is suitable for charcoal production by the earth kiln method in miombo woodlands (Chidumayo 1991). Monela *et al.* (1993) estimated that the total area cleared annually for charcoal production for Dar-es-Salaam city alone is 4354 ha $year^{-1}$. Apart from Dar-es-Salaam, mainland Tanzania has another 19 urban regional (provincial) centres and more than a hundred district hubs all of which depend on charcoal as their main source of household energy. Miombo woodlands, which are the main source of fuelwood, are estimated to cover nearly 34 million ha. However, most of the woodlands have been degraded by a variety of land uses (Figure 1), resulting in dwindling fuelwood supplies (Kaale 1995). Degraded woodlands surround all large population centres with charcoal having to be transported from increasingly distant sites (Chidumayo 1991; Monela *et al.* 1993). The bio-energy programme of the Tanzanian Forestry Action Plan (TFAP 1989) attempted to rationalize the demand for charcoal by encouraging urban people to use improved metal-ceramic charcoal cooking stoves which use less fuel, but most people still use conventional metal stoves which are readily available (Monela *et al.* 1993).

The ecological effects of the slash and burn farming system is the change of land cover from woodlands to bushlands because of the short fallow period of only 4 years. This shows the strong link between environmental degradation and marginalisation of a human population, the first being the manifestation of the second. Incurring costs in reducing land degradation must be the aim of any rational land use policy as nobody consciously tries to degrade land, but it is an inevitable consequence of use (Solbrig & Young 1993). Thus the problem of deforestation and land degradation is a complex one, requiring concerted transdisciplinary studies.

Diversification of uses and the rural economy

Although current levels of subsistence use of wood have been shown to be sustainable, selection of favoured species for building poles often leads to over-exploitation of scarce species. For example, *S. africana* has been depleted in Owamboland, northern Namibia (Cunningham 1993). In order to protect highly favoured species in the study area there is a need to diversify to other species. Alternatively, the commercial exploitation of these species has to be limited, an action which needs policy intervention.

Tanzania has four potential alternative energy sources which can be utilised in urban areas: coal, kerosine, hydro-electric power and gas (industrial, natural and bio-gas) (Mnzava 1981). As a long-term strategy the country's energy policy should explore the possibility of diversifying to these alternative sources of energy as the continual use of charcoal as the main urban domestic fuel will result in the progressive disappearance of the miombo woodlands.

Wood carving, beekeeping and fruit processing are other feasible activities which could be introduced in the area to diversify the economy and hence reduce pressure on the woodland. The local market for carvings could be reliable because of the presence of the Dar-es-Salaam–Morogoro highway, which most tourists visiting the eastern and southern national parks use. However, the study area has little potential for tourism as it has no wild game or attractive physical features. Miombo woodlands are renowned for having a high potential for beekeeping as the trees flower at different times of the year. Ecologically beekeeping is advantageous to the woodlands as bees are efficient pollinating agents. *Tamarindus indica* and *Adansonia digitata* fruits from Tanzania are sometimes exported to the Middle East for making beverages (Chihongo 1995) but this does not happen in the study area. Thus, there is a clear need to sensitize people to the potential for venturing into other non-traditional activities.

Conclusion

Current levels of subsistence use of firewood and poles appear to be sustainable, but levels of shifting cultivation are not. However, selection of favoured species for building poles often leads to over-exploitation, especially when these species are inherently scarce. Unless farming practices are improved or people are exposed to other income generating activities, people will persist with shifting cultivation and commercial exploitation of woodland resources at the expense of the environment and their future

security. Rural people may be responsible for damaging the environment, but it is their marginalisation and the urban demand which triggers the whole process.

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Appendix 1

Structured household questionnaire for collection of socio-economic and resource utilisation data from villages surrounding the Kitulanghalo Forest Reserve, eastern Tanzania.

VILLAGE .....
DATE : .....
ENUMERATOR .....
HOUSEHOLD IDENTIFICATION'S NUMBER: .....

A. GENERAL INFORMATION :

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

1.1 Gender
1. Male ☐
2. Female ☐

1.2 Age .....years.

1.3 Education
1. No formal education ☐
2. Adult education ☐ years .....
3. Primary education ☐ years .....
4. Secondary education ☐ years .....

1.4 What is the age composition of your household members?

Male (Age)	Female (Age)
1 2 . . n	1 2 . . n

B. FARMING SYSTEM :

2 What crops do you grow on your farm and specify whether grown for food, cash or both.

Crops	Food	Cash	Both
1 2 . . n			

2.1 Do you apply any fertiliser to your crops?
1. Yes ☐
2. No ☐

2.1.1 If yes, what type of fertiliser?
1. Inorganic ☐
2. Organic ☐

2.1.2 How much do you apply per hectare? .....

2.1.3 How often? .....

2.2 What main system do you use to grow your crops and what is the area?
1. Permanent plots; monocropping ☐ Hectares .....
2. Permanent plots; mixed cropping ☐ .....
3. Shifting cultivation, monocropping ☐ .....
4. Shifting cultivation, mixed cropping ☐ .....
5. Agroforestry ☐ .....

2.3 In what manner do you prepare the field before ploughing?
1. By clearing all the vegetation ☐
2. By retaining a few trees ☐

2.4 If you practice shifting cultivation, how many years do you continuously cultivate the field before abandoning it? .....years.

2.4.1 For how long do you leave the land fallow?.....years.

C. ETHNOBOTANY / UTILIZATION

3 Where do you get your forest based products? Are there any fees charged by the government for the collection?

Product	Where collected		Fees charged
	Public land	Forest reserve	
1 2 . . n			

Fuelwood

4. What type of fuel do you use in your household?
1. Firewood ☐
2. Charcoal ☐
3. Kerosine ☐

4.1 If firewood and /or charcoal, which tree species do you prefer to collect or burn respectively? Give reason for preference.

Type of fuel	Tree species	Reason for preference
Firewood	1 2 . . n	
Charcoal	1 2 . . n	

4.2 Which tree species are never cut down for fuel, and why?

Tree species	Reason for not cutting
1 2 . . n	

4.3 How many head-loads of firewood, tins of charcoal or litres of kerosine do your family consume in one week?

1. Firewood ..... (Headloads)
2. Charcoal ..... (Tins)
3. Kerosine ..... (Litres)

4.4 Have you ever bought firewood, charcoal or kerosine for home consumption?

1. Yes ☐
2. No ☐

4.4.1 If Yes, what are the 1997 fuel prices at the village

Fuel type	Unit price (Tanzanian Shs)
Firewood Charcoal Kerosine	

4.5 How many hours does a member of the family spend in firewood collected

.....

4.6 What is the approximate distance to the firewood collection sites .....

4.7 What type of wood do you collect?

1. Dry ☐
2. Live ☐

4.7.1 If live wood, which part of the tree is cut?

1. Branches ☐
2. Whole tree ☐

4.8 Is your household involved in charcoal production?

1. Yes ☐
2. No ☐

Medicines /Remedies

5. Which tree/shrub species and which parts of the trees do you use for medicines/remedies?

Tree	Disease	Part of the plant collected				
		stem	bark	roots	leaves	fruits
1 2 . . n						

5.1 Which category of medicine (between "modern" and "indigenous") is more effective for common diseases?

1. Modern ☐
2. Indigenous ☐
3. Both ☐

5.2 Comment on the availability of modern and indigenous medicines in the vicinity

.....

.....

5.3 How do you acquire the indigenous medicines?

1. Own collection ☐
2. From traditional practitioner ☐

5.3.1 If you do your own collection, where do you collect them from?

1. Public land ☐
2. Forest reserve ☐
3. Both ☐

5.3.2 If buying from the practitioner, how much money on average does your family spend monthly on medicines/remedies?

.....

5.3.3 How does this amount (5.3.2) compare with monthly costs of modern medicines?

.....

Construction and Domestic Materials.

6. Where do you get materials for construction of your houses?

1. Public land ☐
2. Forest reserve ☐
3. Both ☐

6.1 Which tree species do you use mostly in house construction?

Type of material	Species	Price/unit
Beams Walling poles Roofing poles Frames Withies Ropes Thatch		

6.2 How often do you re-build your houses.....years

7. Which tree species do you use to make domestic items and other artifacts?

Item	Tree species
Chairs / tables	
Beds	
Mortar	
Pestle	
Baskets, mats & brooms	
Glue	
Paints	
Bows	
Arrows	
Tooth and other types of brush	
Drums	
Gun handles	
Beer fermentation catalysts	
Hair combs	
Others (Specify)	

Food

8. Which tree species and which parts of the trees do you use as food?

Tree species	Part of the tree		
	Roots	Fruits	Leaves
1			
2			
.			
.			
n			

9 Do you have bee hives in the woodland?

1. Yes ☐
2. No ☐

9.1 If yes, how many? .....

9.2 Which tree species provide materials (wood and bark) for making hives?

Tree species		Materials		Size of tree
		Wood	Bark	
1				
2				
.				
.				
n				

9.3. From which tree species do you hang your bee hives and why?

Tree species	Reason
1 2 . . n	

D. MANAGEMENT

10. List all government rules that you know regarding the protection of trees in forest reserves and public land.

Forest Reserve	Public Land
1 2 . . n	1 2 . . n

10.1 Besides government foresters, which other institutions in the village have been active in protecting the forests?

.....

.....

11 Are there any outsiders cutting trees in the Kitulanghalo forest Reserve?

1 Yes ☐

2 No ☐

12 Are there any outsiders cutting trees in the Public lands?

1 Yes ☐

2 No ☐

13 How are local people involved in the protection of forests?

.....

14 Suppose the surrounding woodlands are given to your village, which institution do you think can best safeguard them.....?

15 Which land use would you prefer for the public lands around your village

1. Farming ☐
2. Natural woodlands ☐
3. Livestock ☐

16. What are the causes of fires in the woodlands?

.....

16.1 Have there been any seminars or meetings in the village to educate people on the effects of uncontrolled fires?

1. Yes ☐
2. No ☐

16.2 What are the effects of the fires?

.....

17. List the reasons why forests/ woodlands are important to the environment?

1.....

2.....

3.....
4.....

18 Is there any place in the forest/woodland which is used for ritual purposes?
1. Yes ☐
2. No ☐

18.1 If yes, what are the rules and regulations pertaining to this forest?
1.....
2.....
3.....
4.....

18.2 What happens to a person if he/she breaks the rules?
.....

19 Are any species of trees used for ritual purposes?
1. Yes ☐
2. No ☐

19.1 If yes, which are these tree species?
.....

19.2 What are the rules and regulations pertaining to these tree species?
1.....
2,.....
3.....
4.....

19.3 What happens to a person if he/she breaks the rules?
.....

20. Do you have your own planted trees?
1. Yes ☐
2. No ☐

20.1 If yes, what did you plant them for?
1. Timber ☐
2. Building poles ☐
3. Firewood ☐
4. Fruits ☐
5. Shade ☐
6. Others ☐ Specify:

20.2 What tree species have you planted and how have you arranged them?

Tree species	Spatial arrangement			
	Woodlot	Scattered	Line	Mixed with crops
1 2 . . n				

21 Which tree species have you retained (nurtured) in your field and what is the reason for tree retention

Tree species	Number	Reason
1 2 . . n		

22 What most limits tree planting in this area?

1. Land shortage ☐
2. Labour unavailability ☐
3. Insecurity of land/tree tenure ☐
4. Unavailability of planting stock ☐
5. Fires ☐
6. Lack of capital ☐
7. Lack of reliable markets ☐
8. Others ☐ Specify:

.....

.....

23 Give your general comments on what could be done to improve the management of natural forests in this area.

.....

THANK YOU VERY MUCH