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Management and Utilisation of Miombo Biodiversity

Impact of Refugees influx in Kasulu, Tanzania

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Abstract

This study was conducted in Kasulu district in Western Tanzania to assess the impact of refugees influx on the management and utilisation of miombo woodland biodiversity. Specifically, the objectives were to (a) assess the uses of and means of using forest resources by refugees and local Tanzanians, (b) compare the extent of impact resulting from harvesting woodland resources between refugees and local inhabitants and to recommend on how the means of utilisation affect sustainability issues of the forest resources. Questionnaire surveys, participant observation and forest inventories were used as tools for data collection. A total of two hundred and forty people were interviewed from two villages and two refugee camps using a pre-tested questionnaire form for the aim of getting baseline data. From each village and camp a nearby forest, which is currently a harvesting site for various Timber and Non-Timber Forest Products (NTFPs) by local Tanzanians or refugees, was used for the inventory. In addition a forest reserve was inventoried as a control site for the other forest areas surveyed. Commonly used tree species were counted and measured for Diameter at Breast Height (DBH). Other notes were made whenever activities such as charcoaling, chalk making, logging and grazing were observed. It was witnessed during participant observation that a huge area of formally miombo woodland and mostly village forest reserves had been converted to settlements and farmlands for refugees. It was found that refugees' harvesting sites have fewer trees/ha and smaller diameter trees compared to villagers' forests. The reserve, village and camp forests surveyed had 738, 474 & 351stems/ha. The village forests had a higher species diversity than the other forests at 95% CI ($p=0.0008$). Pterocarpus angolensis, which is a valuable timber species, was found almost locally depleted with exception of few juveniles found in the village forests. It was deduced from these findings that miombo woodlands in this area are experiencing rapid deforestation due to faster rate of utilisation, hence highlighting possibilities for degrading its biodiversity. Management of these forests, which locally doesn't have any specific interventional plans and strategies, is facing challenges. The extent of these challenges become complicated since the time for refugees repatriation is not known with certainty. There is a need to assess and redefine present ownership and management patterns and strategies as one of ways to cope with current use pressure and rehabilitate the miombo woodlands in this area. Further studies to compare this influence of massive harvest of miombo resources with places practicing subsistence harvesting of miombo resources are recommended. It is also recommended to carryout population studies for Pterocarus angolensis in Kigoma region to come up with more detailed information about its status for it is highly demanded for furniture despite its threatened status.

Contents

Introduction

Countries in the Sub Saharan region are characterised by having most of its people living in rural areas with peasantry being a major economic activity. A little less than 80% of these peasants have a higher dependency on miombo woodlands for fuelwood, poles, wild fruits, medicine and many other non-timber forest products (Kaoneka and Solberg, 1996). Miombo is a woodland ecosystem found in seven countries south of Africa and has been occupied and utilised by humans for thousands of years. An important notice nowadays is that this occupation and utilisation is currently intensifying mostly due to faster population growth and hence higher demands from miombo (Campbell *et al.*, 1996; Anon, 1998b and Frost & Desanker, 1997). Crises, conflicts, political instabilities, poor governance, famine, drought and rapid population growth have faced most of countries within and those surrounding the miombo eco-region during the past decades until now. Such problems create refugees who intensify use and hence degradation of resources like water, forests and soils. Resource use problems like these are of socio-economic in nature, complex and have long-term consequences, hence need case specific studies on problem areas (Kaoneka and Solberg, 1996) to understand the changes and come up with appropriate management and utilisation interventions.

Until recently the impact of war and other political conflicts on nature have been underemphasized. Not only in Africa has war prevailed and brought consequences on nature but throughout the world. The 1990-1991 Gulf War showed that conflicts have devastating effects on the environment, biodiversity and the quality of life of local people long after the cessation of war (WCMC, 1991; Ramachandran, 1991; Price et al., 1993; Melissa, 1997). Throughout the conflicts the media rarely make it popular to include the damages these conflicts cause on the environment, only the 'direct' impacts on humans such as death and property loss are addressed. In Afghanistan over the past 20 years high unemployment rates and growing resentment coupled by the war on terrorism has caused a lot of people to run as refugee to Pakistan causing general community instability (Rowland et al., 2002, Earth Crush, 2001). This huge influx of migrations has resulted in extensive environmental damage in Pakistan, much of which is probably irreversible (Earth Crush, 2001). The impact of these refugees on renewable natural resources is of particular concern as it can have a drastic long-term effect. At refugees camps trees are cut down to provide support for shelter while branches are collected for firewood and charcoal while foliage is cut to feed livestock. Ground vegetation is cleared to make way for farming; even tree roots are dug up in extreme conditions and used as firewood. The resulting rapid and uncontrolled deforestation has left the refugees area in Pakistan remaining with only about 12% of its original forest cover (Earth Crush, 200). Where natural resources and firewood are scarce, people compete for access to these resources. Influxes

of refugees can threaten natural resource base like soils, forests, wild animals and water sources. Furthermore, refugees are often unaware of local traditions and laws set in place to protect forests and other natural resources, sometimes becoming another source of conflict with local inhabitants in the hosting area (Hania Aslam; WWF,. *Unpubl.*).

The Rwandan conflict and the events that it triggered in the region became a major cause of deforestation in most parts of central Africa (Pearce, 2000). Among others the Africa's first National Park, the Virunga National Park, at the border between the DRC and Rwanda was a victim. International Union for Conservation of Nature (IUCN) reported that in six months, the Rwandan refugees and Hutu soldiers from camps around the town of Goma in the DRC had deforested some 300 square kilometres of Virunga National Park. IUCN estimated that 850,000 refugees were living within or close to the park and took between 410 and 770 tonnes of forest products out of the park daily. Also these conflicts and succeeding guerrilla activities in the surrounding regions resulted in slaughter of mountain gorillas both in Virunga and other places within the region. Similarly, Zairian soldiers were raiding the park for timber to sell to refugees and relief organizations (Biswas *et al.*, 1996; Hart & Hart, 1997; IUCN, 1997; IGCP, 1997 and UNESCO, 1998).

In southern Guinea forests and other natural ecosystems were deforested causing severe impacts on biodiversity and water systems (UNEP, 2000). This resulted from the influx of 600,000 refugees from conflicts in neighbouring countries of Sierra Leone and Liberia. Most of the refugees had cut down forests to grow crops for food and also to get fuelwood(Chris, 2001, UNEP, 2000). Under such circumstances guerrilla armies do as much damage as refugees, since they stay hiding inside forests and exploit forests to generate income for buying arms These armies also rely heavily on bushmeat as a source of food (McNeely and Price unpub; Stewart, 1999; Juichi, unpub.). Guerrilla wars in Cambodia (Catherine, 1997) and west and central Africa have been sustained during the past decade through the cutting and sale of valuable hardwood timbers. Also a wildlife crisis occurred in the Horn of Africa in the 1980s where Somali war bands were frequently behind the rampant poaching of elephants for their ivory. War in Uganda in 1979 and conflicts in Angola and Mozambique also caused mass killings of elephants in these countries. All these facts gained little attention with most concentration only on the massive slaughter of humans (Hart & Hart, 1997; Pearce, 2000).

As stated earlier such crises are creating thousands of refugees who settle to form densely populated patches of areas away from their original homes. To be a refugee is to experience a particularly degrading form of poverty, which denies one from proper national identity, economic resources and even free right to exist and move. These people who are forced to move from their

original homes find themselves squeezed in small areas putting the surrounding environment at higher risks of destruction (Shin-wha Lee, unpub.). In particular such crises in Africa and other developing countries are a result of high rates of population growth, poor governance, insecure tenure, recurrent droughts and armed conflicts (Barbara, 1994). During the political unrest and civil strife in Congo, Burundi and Rwanda millions of people fled away and thousands were killed. During a three-month period from April 6th in 1994 UNHCR reported 500 to 800 thousands people to have been killed in the Rwandan genocide while 2 million people fled as refugees to Tanzania, Burundi and Congo (Black, 1998 & Borton *et al* 1996). With Congo and Burundi also in political problems most of Rwandan refugees together with others from these countries flee to Tanzania raising the number of refugees up to almost a million (UNHCR, 1996). These are almost 3% of Tanzania whole-country population and were squeezed in two small regions, Kigoma and Kagera, near the border with these countries in conflict. Population is continuing to grow and is actually expected to double by the year 2020 despite the HIV/AIDS crisis prevailing in this region (Lynn Brown, *unpubl.,* United Nations Population Division, 1998). Such large numbers of refugees residing in smaller areas established in forests within a limited area has the potential for serious localized degradation of resources with the main worry on the length of time refugees will stay. Refugees as other people in sub-Saharan Africa are peasants and use the surrounding resources for most livelihood needs. Such uses are clearing of miombo forests for agricultural purposes, hunting, fuelwood, wild fruits, vegetables, honey, herbal medicine, fodder, building materials, furniture, handcraft raw materials, etc (Bloesch, unpub.; McGregor 1995; Ainslie *et al*., 1996; Clarke *et al*., 1996; Campbell *et al*., 1997; Cunningham, 1997; Shackleton *et al*., 1999 and Howell & Convery, 1999). These uses are of relatively higher rates as reported earlier by IUCN that up to 770 tones of wood are harvested daily. Also a German foreign aid agency, GTZ; reports that between September 28th and October 2nd 1994 the estimated rate of deforestation at Virunga National Park was 7000 to 10 000 m^3day^{-1} to supply fuelwood to refugees. Jose Kalpers, 2001; also reports that two years after arrival of refugees at Virunga 105 km^2 forestland had been impacted which are equivalent to total deforestation of 63 km^2. This report further indicates that during this time deforestation was at a rate of 10 ha/day.

Miombo woodlands are of outstanding international importance for conservation of plants and birds, many of which are endemic to the region (Chidumayo, unpub.). Growing rural population pressure is increasing the dependency load on many biodiversity resources. Clearing land for shifting cultivation and bushfires have been common disturbances in the miombo ecosystems. But due to current rapid population growth in the rural areas, possibilities to shift and allow enough fallow period, which is on average 30 years at a population density of >20 persons km^{-2} (Mansfield, 1973), are becoming limited. Hence these communities are shifting to practice a more

settled farming system. Miombo woodlands re-grow virtually unchanged if the recruiting vegetation remains undisturbed (Fanshawe, 1971). This is because regeneration consists of stump/root sucker shoots and recruitment from old stunted seedlings already present in the field layer at the time of cutting (Grundy, 1990). Most literature on the ecology and management of miombo woodland addresses issues of fires, shifting cultivation, harvest of food and wood at subsistence levels and the general support miombo provide to rural livelihood (McGregor, 1994; Grundy, 1995; Chidumayo, 1987). However studies on the impact of large-scale clearance of miombo woodlands like that done in the refugees camps are very important to bridge knowledge-gap existing on management and utilisation strategies under such situations. It is important to know how increased anthropogenic uses affect the miombo woodlands and how the woodland will respond to such disturbances (Schwarzt & Caro, 2003). It might be that removal of large part of the woody vegetation results in little regeneration, or change to a different woodland structure, and then heavy exploitation of woodland resources could lead to adverse effects on species composition and possibly on animal species living inside (Campbel et al., 1996). Not only in the miombo regions, but worldwide studies on the impacts of war and conflicts on nature are highly demanded not only for conservation purposes but also to make clear how much it will cost the world economies and nature sustainability by such impacts caused by conflicts. For this case it is not known to what extent land is being converted to obtain settlement land and wood in relation to consequences on the ecosystem. It is not known what will happen in terms of regeneration or succession after refugees repatriate. It should be noted here that when I say refugees population density is high I mean higher than that regarded as expanding in other communities in miombo woodland under normal population growth. Research is required to study these problems to address the impacts on resource management and utilisation as well as contributing to the current knowledge on impacts of wars and conflicts on natural resources.

The impacts of land conversion and deforestation in the refugee camps and the surrounding wood harvesting sites need to be studied because the utilisation intensity may be different. The difference in intensity could be due to high population density per unit area of refugees and the fact that refugees use miombo tree biodiversity differently than local Tanzanians. Regeneration and/or succession are also useful to study in these areas to add knowledge on ecological dynamics of miombo woodlands based on this faster and intensive disturbance. As argued earlier the more settled agriculture is, it might have a different impact on the ecosystem. On the case of refugees who normally clear large areas of forests for settlement and fuelwood (Biswas *et al.,* 1996) regeneration may change the previous type of vegetation or may take years to regenerate through succession to achieve the original vegetation. This problem is intensified by the fact that refugees stay in these areas constantly using miombo resources at very high rates, since they are many, and for a long time.

Refugees in Kigoma have now stayed for 10 years and it is not known when they will be repatriated completely. Even if repatriation takes place local inhabitants may continue using the left camp areas for farming, grazing and other economic activities hence making regeneration more difficult.

The overall aim of this study was to study the impact of refugees influx on management and utilisation of miombo woodlands in Kasulu with specific objectives being:

- To assess the uses of and means of using forest resources by refugees and local Tanzanians
- To compare the extent of impact resulting from harvesting woodland resources between refugees and local inhabitants and to recommend on how the means of utilisation affect sustainability issues of the forest resources.

Methodology

The study area

Data were collected in Kasulu district located in Kigoma region, which is in the western part of Tanzania bordering the shores of the second deepest lake in the world, Lake Tanganyika (Figure 1). Its geographical location is at Longitudes 29.5 and 31.5 East and Latitudes 3.5 and 6.5 South of Equator with an area of 45 066 km^2 equivalent to 4.8% of total country area and of which 45% is covered by forests. The region has characteristically tropical climate with a distinct long wet rainy season beginning from late October until May with short dry spell of 2-3 weeks in January or February. The wet season is followed by a prolonged dry season. The main vegetation types of the area include evergreen riverine forests, deciduous dry forests, thickets, miombo woodlands (mostly wet), and grasslands. The forest serves as habitat for wildlife species and source of various products needed by the local community (MNRT, 1991). Mean annual rainfall ranges from 600 – 1500 mm being heaviest in the highlands. Mean daily temperatures are 25 ^oC in December and January to 28 ^oC in September. This region is one of the two regions in Tanzania hosting almost all the refugees from Congo Kinshasa (the then Zaire), Burundi and Rwanda, the other region being Kagera. Historically refugees started to enter Tanzania since 1950s, but heavy influxes were

recorded in the 1990s after outbreak of crises in the neighbouring countries. Kigoma share borders with two (Congo Kinshasa and Burundi) among the three countries. Kasulu is one of three districts of Kigoma with the smallest area (25% of the total regional area) but highly populated (626 742 people) compared to the other two districts. National Population and Housing Census for the year 2002 in Tanzania stipulates that the high population density in Kigoma region and hence Kasulu district is largely influenced by both registered and unregistered refugees. Kasulu district have three refugees camps namely Nyarugusu, Mtabila and Muyovosi and have hold refugees since early 90s.

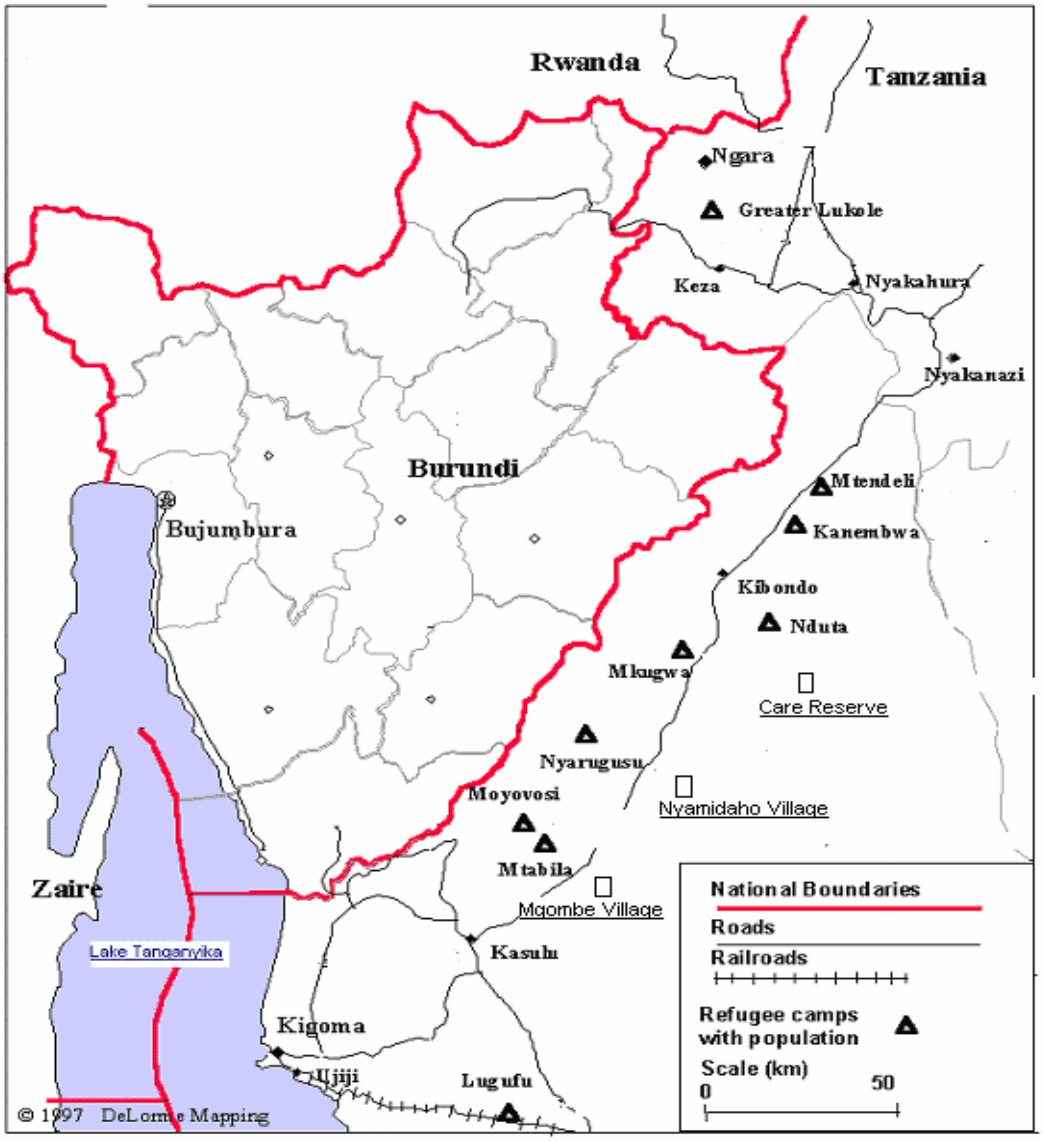

Figure 1: A map showing western Tanzania, the neighbouring countries where the refugees originate and the camp areas in Kigoma and Kagera regions in Tanzania

During the Rwandan genocide Kigoma and Kagera regions hosted up to more than a million refugees. But after the genocide most of refugees were form Burundi where up to the year 2000 they hosted approximately 540,000 refugees about 400,000 from Burundi, more than 110,000 from Congo-Kinshasa, nearly 30,000 from Rwanda (USCR, 2001). This number of refugees is nearly half the

number of local Tanzanian population inhabiting these two regions, which are described to be poor in resources, not enough to support the local inhabitants. According to the Tanzania Population and Housing Census (2002), population growth in Kigoma is the highest in Tanzania rating at 4.8% (total country growth rate is 2.9%) despite HIV/AIDS pandemic killing many people in Sub-Saharan Africa. Kigoma being a region dependent on more than 40% of forest resources from other regions (TPC, 2000 & MNRT, 1991) is by no means facing overwhelmed demand for forest products from its woodland forests. Most of the refugees in Kigoma and Kagera regions are settled in a 150-mile (250 km) string of camps and settlements along the main road that connects the two regions (Figure 2).

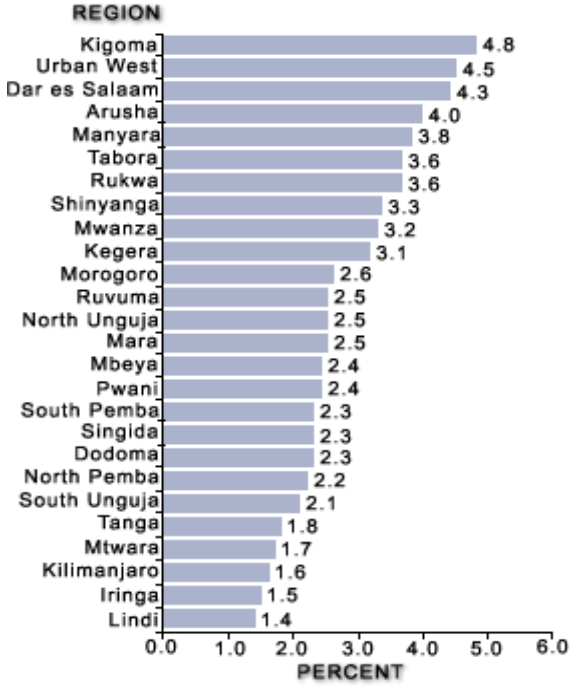

Figure 2: A bar chart showing population growth rate in the 26 different regions of Tanzania, with Kigoma having the highest population growth rate (including refugees). **Source: Tanzania Population and Housing Census, 2002*

Sampling

Two refugees camps and two villages were selected for data collection. This was done in order to compare the differences in degradation resulting from use of woodland resources between places where refugees and local inhabitants, separately, procure these resources. The camps were Mtabila and Nyarugusu while the villages were Mgombe and Nyamidaho. Mgombe is a nearby village to Mtabila camp while Nyamidaho is near Nyarugusu camp. The camps and villages selected were those closely located to minimize influences of

geographical and site condition differences in the comparison. In addition a protected area located in the direction of Nyamidaho village to Kibondo (Fig. 1) that is under management of CARE Tanzania was used as a control site for the inventory data collection. In all sites tree species inventory was done and questionnaires administered in selected villages and camps households. Questionnaires were administered to get basic socio-economic information about the surrounding forest biodiversity. Respondents were selected by stratified random sampling using village registry and random numbers. Sixty respondents from each camp and village were needed for the questionnaire survey. Camp and village leaders assisted in giving a list of 60 men and 60 women from which the 60 respondents were selected using random tables.

Data Collection

Questionnaire survey

A questionnaire was pre-tested to a sample of ten randomly selected individuals from each village and camp to see if the questions were sufficient in giving the information needed. After pre-testing the questionnaire some changes were made in order to eliminate unnecessary questions and incorporate new ones according to pre-testing results. The questions focused to acquire information on land uses and means of using different woodland forest resources. Thereafter the actual survey followed where 60 people were interviewed from each village and camp. Two assistants, one female and one man, were trained by the researcher and recruited in each village and camp for the purpose of assisting the researcher in the questionnaire survey. The assistants and the researcher visited each household administering the questionnaire. It was difficult for the researcher to visit respondents alone since they were hesitating to give true information for reasons that they regarded him as a stranger. Another problem was language, that most of them wanted to use their tribal language. Variables with names or terminology new or very unfamiliar to local people like biodiversity were explained carefully in Kiswahili and local language with the help of these local assistants to ensure proper understanding.

Participant observation

As the name implies, it is distinguished from other methods of data collection by the fact that the observer become part of the situation he/she is studying (Martin, 1995). Participant observation enabled the researcher to gain more understanding on the local institutions and their relationship with management

and use of natural resources. A discussion with district forest officer was done to get information on management aspects on forest resources in Kasulu. Participant observation technique further enabled collection of information on forest resouces use by the local and refugees communities. In this study tailoring, carpentry, handcrafting (curie making), business and other related activities were observed. Business is distinguished here from the other mentioned activities to refer to sale of market-place items (Plate 1) mainly for household daily consumption. Notes on observations like incidences of charcoal making, grazing and encroachment for farming were made whenever seen on or near the plots. At the camps another observation was made to see how trees were cleared to build refugees settlements. The camps were inhabited by two different ethnic groups of refugees, at Mtabila camp there are refugees from Burundi while at Nyarugusu camp there are refugees from Congo who arrived in 1993 and 1997 respectively.

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Inventory

Plate 1: A section of market place where refugees carryout business for a variety of household commodities. Bread is hung while sellers and buyers are standing around as were seen in Nyarugusu cam during Participant Observation session.

At each village and camp a forest, which is used for collection of forest resources was selected. With the help of a local person acquainted with local and traditional knowledge, transects from the camps and village side towards

the interior of the forests were established. Three transects at each forest site were made and within each transect three 20 x 20 metres plots were established at intervals of 300 metres. In the reserve area the same procedure was followed with three transects and three plots in them established from one border of the reserve which is adjacent to a village forest reserve.

Table 1: Location of the different forest sites used in inventory study with coordinates in GPS reading

Forest site	**Location (GPS readings)**
Mgombe forest	36MO202609/UTM 9507669/270º & 5.71 km from village town
Nyamidaho forest	36MO216689/UTM 9530733/055º & 1.97 km from Village town
Nyarugusu forest	36MO213357/UTM9531137/306º & 10.83 km from camp
Mtabila Forest	36MO177992/UTM9494662/183º & 14.12 km from camp
Forest reserve	36MO236246/UTM95305332/123o & 8.90 km from Nyamidaho

At each plot useful trees of not less than 1m high were counted and Diameter at Breast Height (DBH) measured. Useful trees were selected based on CARE surveys, which was done specifically to assess different uses of trees. Results from the questionnaire pre-testing further prioritised the usefulness of these trees. A total of 25 tree species which, had >/= 3 different uses gained a usefulness status in this study and were selected for inventory.

Estimation of refugees settlement area

This was done mainly based on data from CARE offices. Their data was used to calculate number of households and multiplied it with the size of plot per household obtained through questionnaire survey. CARE has figures on total number of refugees and average number of households. Through the questionnaire survey, plot and average household size were calculated. Total number of refugees was divided by average household size, (7 persons/household) to get the number of households. When the result was compared to that of CARE a small difference was observed, but the CARE figure was adopted since it was obtained by a larger scale survey hence more accurate. The number of households was then multiplied with plot sizes to get the settlement area. This area is an estimation of the total area of forest cleared to host refugees in the two camps and lacks area covered by hospitals, churches, schools and roads. The areas of forests which are currently the harvesting sites were also obtained from CARE (Table 3).

Data analysis

Questionnaire data were analysed to get descriptive statistics and measures of central tendency. Inferences on frequencies and means was drawn and used to compare variables between village and camp situations. Where percentages were calculated in some cases they have been reported without totalling to a hundred since there are always other variables not measured. For instance in analysing the different sources of fuelwood, the total percent of dependency on the sources is not 100% since other sources like distant forests figures were not accounted for.

Man-Whitney Test was used to tests the statistics of species diversity between village, reserve and camp forests. Duncan Multiple range test was also used to test for the differences in number of stems per plot between areas closer to human settlement and those deeper towards the forests.

Results

Area of forest converted to other uses

Refugees came to Mtabila and Nyarugusu camps in 1993 and 1997 respectively while the villages were established since 1973 during the country villagelisation program. Mtabila camp hosts refugees from Burundi, mostly Hutus, while Nyarugusu camp hosts those from Congo Kinshasa known as Congolese or Congomen. When they arrived, under central government and aid agencies guidance, they established camps in natural forest areas originally under village forest reserves. According to the district forest officer, such forest areas are normally under communal traditional management and there are no district level management interventions for such reserves. The district forest office concentrates mainly in eucalyptus plantation forest and few areas designated as game reserves. Animals found within the district reserve are mainly buffaloes, elephants, antelopes and warthogs. The forest officer revealed that refugees sometimes illegally encroach the game areas for illegal hunting. Due to this disturbance most wild animals have run away and/or been displaced. The natural resource office in the district is now trying to delineate an area far from the refugees where they want to translocate mainly the buffaloes which are the dominant animals in the area. At the camps refugees cut down trees in the forest reserves to get land for building huts, farming and grazing. The land has also been cleared by aid organisations to build schools, hospitals, churches,

offices and roads to serve the refugees. Forest clearing for settlement establishment was done differently between the two camps. At Mtabila camp they clear felled a huge area without leaving trees between their houses while in Nyarugusu camp selected trees were purposely left and all constructions were built in between remnants of these trees (Plate 2 & 3). This difference in land clearance between the camps could easily be observed in aerial photos however they were not available. The camps are divided into Zones, Villages, Clusters and Plots to facilitate administration of the refugees by the authorities, but this has caused a high road and house density in this are. Neither refugees nor villagers are allowed to enter without permission to the villages or camps respectively. However some refugees enter village areas illegally and villagers who works in the camps for various service programs have permission to enter the camps.

Plate 2: Mtabila camp settlement area showing a huge clearfelled area which was formally woodland area

Plate 3: Nyarugusu camp settlement area showing remnants of standing trees within the houses. Children are fetching water for household consumption in a common water pipe outlet point within a cluster.

Table 2: Comparison of different social-economic issues between the two villages and two camps as per the interviews and inventory studies in Kasulu, Tanzania

Item	Villages	Camp
Houses	Low density	Very high density
Mean farmland size	3 ha	0.25 ha
Population size	10 000	120 213
Population density	2/ha	99/ha
Year Settled in	1973	1994 (37.5%)/1997(30.8%)
Main economic activity	Farming (80%)	Farming (75%)
Other economic activities	Business, charcoaling, formal employment	Business, charcoaling, making chalk, employment, honey harvesting and sale, carpentry, tailoring and souvenirring, and running shops, pubs & restaurants
Change in distance to wood sources	3km/30years	15km/10 years for fuelwood and >50km/10 years for furniture wood
Forest food used mostly during	Wet season	Wet season
Use of fuelwood	All households	All households
Number of stumps	146 per hectare	338 per hectare
Sources of wood resources	Homegarden = 5% Forests = 75%	Homegarden = 2.5% Forests = 77.5%

	Wood dealers = 7.5	Wood dealers = 12.5%
Education status	No formal education = 17.5% Primary education = 72.5% Secondary education = 5%	No formal education = 25 Primary education = 33.3 Secondary education = 34.2
Mode of land acquisition	Clearing of forest land = 55% Inheritance = 27.5%	Mostly given by authorities (92%)
Authority over land	Husband and wife (40%) Husband alone (30%)	Mostly husband (75%)
Use of Forest Medicine	60%	55%
Road network	Low density	High density
Presence of trails in forest	Few	Many
Area (for settlements and farming only)	450 hectares	2427 hectares
Main crops grown	Maize, beans and cassava	Maize, beans and cassava

Table 3: Refugees and villagers settlement area together with other household data on population sizes for the study area. The village data used is mean farmland size and approximation of population size since the farmlands are not uniform and no current population data was available unlike the refugees' data.

	Nyarugusu Camp	Mtabila Camp	Mgombe Village	Nyamidaho Village
Mean plot size	0.025 ha	0.125 ha	3 ha	3 ha
Number of households	13800	16654	No data	No data
Total Population	57 458	62 755	≈ 5000	≈ 5000
Settlement area	345 ha	2082 ha	200	250
Population density	167people/ha	30people/ha	2people/ha	2people/ha
Wood-harvesting area	700 ha	600 ha	50 ha	70 ha
Forest area per person	0.012	0.009	0.01	0.014

Plate 4: Handicraft products which are fruit curies on a tray made from Pterocarpus. angolensis log (the tray measures 40cm in wide) made by refugees in Nyarugusu camp and sold in most regions of Tanzania. A waist belt made from Jacaranda. mimosfolia is also seen on the tray.

Interestingly 98% of the refugees interviewed declared to know and appreciate the value of biodiversity, most of them pointing out that it supports their lives and hence worth to be maintained. CARE Tanzania through its Kigoma regional operations is working hard to restore the environment and try to slow down further deforestation. They carryout reforestation and environmental education programmes for refugees and villagers. They conduct forest management and environmental awareness education to villagers and refugees and also education on how to use less fuelwood by using modern stoves to refugees. However one villager interviewed claimed that, as quoted, 'I can't participate in the rehabilitation programmes since refugees have brought these and many other problems. They have depleted our raw materials for making charcoal and now we are suffering bankruptcy after authorities have stopped us from further charcoal making. So let the refugees rehabilitate the environment since they are responsible for its destruction'.

Socio-economic issues

The main economic activity for both villagers and refugees is farming as shown in Table 2. The remaining 20% for locals and 25% for refugees are engaged in a variety of many other activities (Table 2). Inside the refugees camps there are local markets (Plate 1), pubs, dance clubs, carpentry workshops (Plate 7), tailoring mats to mention a few where refugees have small business enterprises and earn money to meet social demands. In fact the tailoring and carpentry products from Hutu refugees in Mtabila camp are very famous for their beauty and quality and are transported to markets in many Tanzanian towns, according to an interview done with refugees who run such activities. Refugees make various handicraft products made from wood such as curies, waist belts and chairs (Plate 4 &5).These people claimed to sell more than 60% of their clothes, curie and furniture products to cities like Dar es Salaam (>000km), Arusha (>800 km) and Mwanza (>200 km) away. Refugees claimed to have exhausted the raw material pool for carpentry and handicrafting activities in the nearby forests and now they go, either by bicycles or on foot, up to 50 km in search for quality wood. Results showed no significant difference in use of forest resources between females and males probably because there were no specific questions on gender preference on certain products or species from the forests during the interviews.

Plate 5: A Congolese refugee making a chair using special plant material which grows on wetlands and along rivers. Such grasses are also depleted in the nearby wetland areas and are now procured in a river approximately 80 km away from this camp.

Use of forest biodiversity

The questionnaire survey indicated forest resources to be commonly used for firelwood, charcoal, fodder, souvenirs, tools, ornamental, food, building, bee forage and medicine by both refugees and native villagers. Charcoal/chalk making, firewood, building, tools, bee-forage and medicine are uses found to be accommodated by almost all the species (Table 4). However, there was a difference in use of forest resources between locals and refugees. The percent of interviewed refugees and villagers who use forest food resources is 68.3% and 100% respectively. The most common forest food harvested from the forest includes mushrooms, fruits and flying ants. Fuelwood was utilized by all refugees and villagers as a means of household energy which was mainly for cooking. The most common type of fuelwood used is firewood (75%) and charcoal (25%). Up to 78 percent of the wood resources are harvested from the forest while the rest comes from the homegardens and wood dealers.

However the wood dealers get the wood from the forest and supply them to those who are not able to collect themselves. Due to high harvesting pressure refugees claimed the distance to where they obtain wood resources to have increased for up to 15 kilometres during the past ten years. Refugees were not allowed to move outside the areas designated as camp without permission from police offices. Such permissions were given only if sound reasons like visiting a sick relative in another camp were given. Therefore, going to procure forest produces in other forests like the villagers' forests were done at refugees' risk and if caught they were subject to penalties. Some villagers claimed the distance to forest areas to have increased for about 3km for the past 30 years.

During the inventory two charcoal kilns were seen in the village forests of which owners were unknown. According to CARE international officials who were working close with the villagers and refugees on afforestation programmes, they said the kilns may belong to refugees as well. There were stricter security actions in the camp forests so it was easier for refugees to be caught inside the camp forests. So refugees do sneak to villagers' forests, where there were no guards, to make kilns. In another event charcoal and chalk kilns, owned by refugees, were found in a village forest reserve far from the refugees camps. Refugees were found doing these activities as owners and operators of the kilns. On the other hand patches of farmland were found in both villagers and refugees forests where shifting cultivation is practiced. Food crops such as maize were grown in such plots to supplement food supply for the household (Plate 6). Such plots are owned by locals without enough farmland to cultivate and some few refugees who were able to do such farming without being caught.

Table 4: Different uses for the surveyed species with their corresponding stem density in the study area in Kasulu, Tanzania.

Species Name	Local Name	Stems per hectare			Uses											Uses per species
		Reserve	Village	Camp	Timber	Building	Firewood	Charcoal	Tools	Food	Carvings	Medicine	Ornamental	Fodder	Bee forage	
Azanza garkeana	Mkole	0	4	0		X	X	X	X	X	X	X	X	X		9
Pterocarpus tinctorius	Mkurungu	50	17	0	X	X	X	X	X		X	X			X	8
Albizia antunesiana	Mpilipili	0	26	0	X	X	X	X	X		X	X			X	8
Pericorpsis angolensis	Mbanga	43	25	17	X	X	X	X	X			X			X	7
Stereospermum kunthianum	Mtelele	0	0	13		X	X	X	X			X	X		X	7
Parinari curaterifolia	Mnazi	49	13	79			X	X	X	X		X	X		X	7
Blighia unijugate	Mturamgina	0	4	0		X	X	X	X			X	X		X	7
Pterocarpus angolensis	Mninga	0	29	0	X	X			X		X	X			X	6
Combretum molle	Mlama	108	50	75		X	X	X	X			X			X	6
Combretum collinium	Mkoyoyo	0	17	81		X	X	X	X			X			X	6
Terminalia sericea	Mhenya	24	4	0		X	X	X	X			X			X	6
Burkea africana	Mgando	22	38	11	X	X	X	X	X						X	6
Lonchocarpus bussei	Mbale	18	29	0		X	X	X	X			X			X	6
Cossonia kirkii	Mhondogori	71	10	6	X	X	X	X	X							5
Strychnos innocua	Mkome	0	13	0			X	X		X		X			X	5
Cadaba farinosa	Mkubagwa	0	29	0	X	X	X	X	X							5
Brachistegia speciformis	Mlembele/Mtuntu	394	665	229	X	X	X	X	X							5
Albizia gumifera	Mlembele Vuma	0	42	0	X	X	X	X	X							5
Hymenocardia acidia	Msagamba	147	611	49		X	X	X				X	X			5

Rhus natalensis	Msagara	24	88	0	X	X	X	X	X							5
Crossopterix febrifuga	Msesankanga	0	0	104			X	X				X	X		X	5
Annona senegalensis	Mtopetope pori	65	42	18	X	X	X	X	X							5
Sterculia quinquelobia	Mweza	0	13	0	X					X		X	X		X	5
Anysophyllea boehemii	Mshindwi	99	63	211			X	X		X					X	4
Jacaranda mimosifolia	Jacaranda	0	2	0				X	X				X		X	4
Total species		13	23	12	12	20	22	23	20	5	4	16	8	1	17	

Forest structure and Composition

Through observation and inventory the plots far from village settlements had closer similarities with the reserve forests than was the case of camp forests. Mushrooms, climbers, old trees, dead wood on the ground and old-decayed stumps were features observed to be almost similar between most remote plots in village forests and the reserve forest.

There was a general trend of declining stem number and size (Table 5) in both village and camp forests moving away from settlements towards interior of the forests. The number of stems per plot was however smaller in the camp than village forests probably because of high harvesting pressure by refugees (Figure 3). Number of stems per hectare for trees >10cm in DBH was higher in the reserves, followed by village forests and was least in the camp forests (Figure 4). Mann-Whitney test showed that village forests are significantly more species-diverse ($p= 0.0008$) than reserve and village forests but there was no significant difference between camp and reserve forests (Table 5). Proportion of number of stumps to standing trees was bigger in camp forests than in the village forests, 27% and 12 % respectively, revealing more damage in the camp forests.

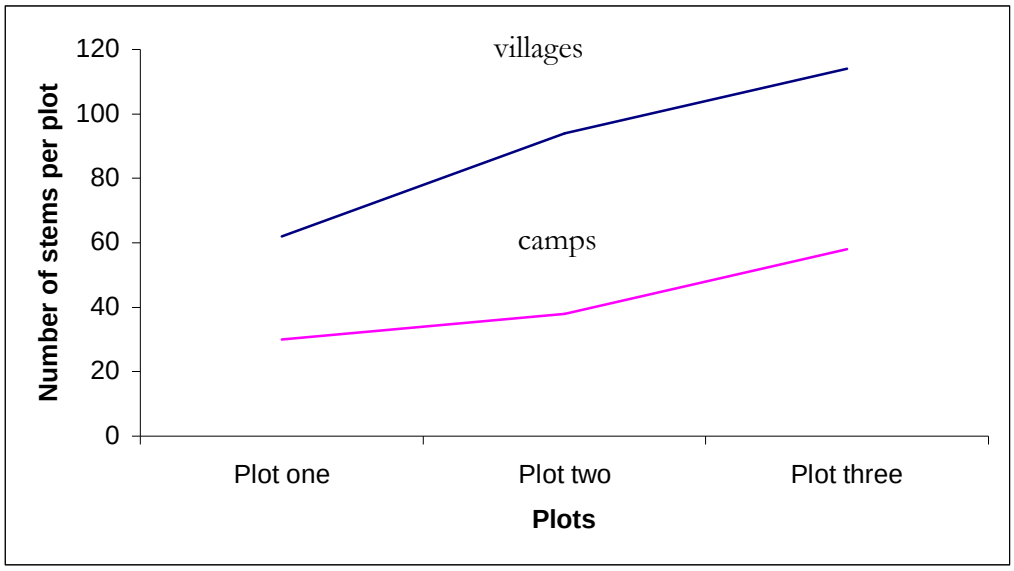

Figure 3: A graph showing increment of stems per plot towards interior of the forest with the camp forests having fewer stems than the village forests in Kasulu, Tanzania

Pterocarpus angolensis which is a useful timber species in the study area and in the whole miombo region (Schwartz, Caro & Banda-Sakala. 2002), was not found in the camp forests. Few juveniles were found in the village forests indicating that the species is becoming locally distinct. No individuals of this species were

found in the reserve forests and this could have been affected by the sample size used in this study but also could be that there were illegal harvesting in the reserve by refugees who have higher demand for the species to use in furniture and carvings.

Despite higher rates of deforestation in the camp forests, some species were found to be more in these forests but absent or fewer in village and reserve forests. There were > 200 & >100 individuals of *Anysophyllea boehemii* and *Crossopterix febrifuga* in the camp forests but < 100 & zero respectively of the species in the village and reserve forests (Table 4). These are species with much lesser uses than the others hence might be the reason for their continuing existence in higher numbers in camp forests (Table 4).

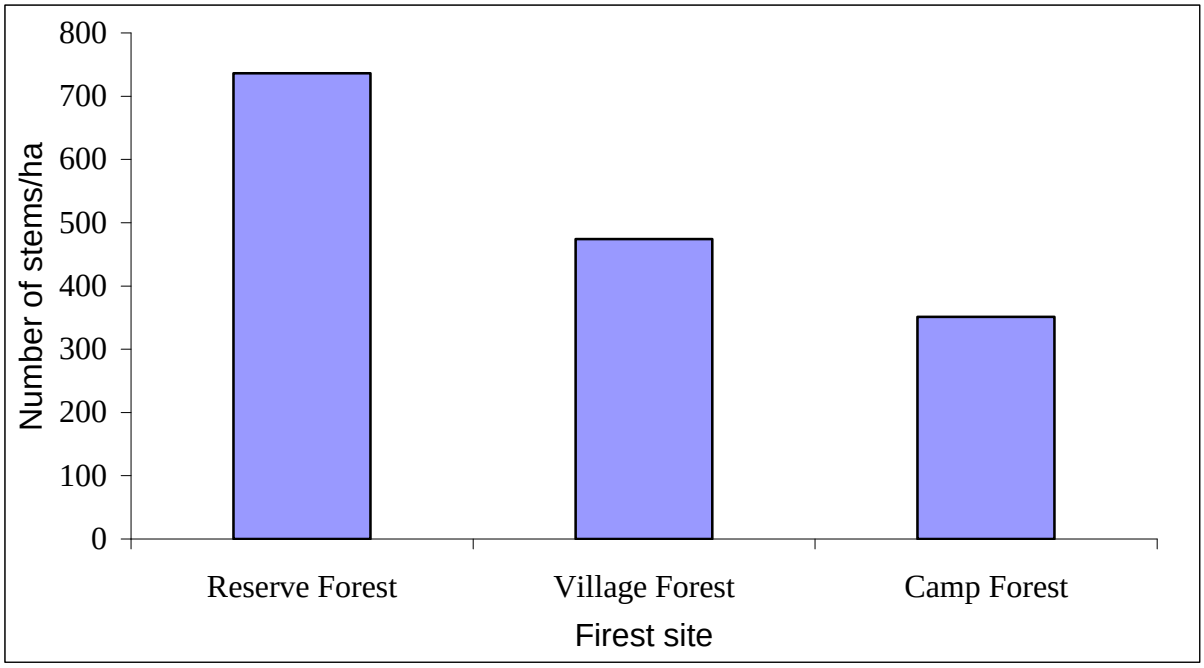

Figure 4: Stem density for trees >10 cm DBH in reserve, village and camp forests in the study area in Kasulu, Tanzania

Species size distribution is shown in Figure 5. There are more juveniles than adults in all forests but the proportion of juveniles is highest in the village forests. Being with the highest proportion of juveniles in the forests indicates presence of opened crown and less disturbances unlike those found in camp forests caused by higher human population density utilising the woodlands at a constant high pressure. Less number of juveniles in the reserve may be

attributed to presence of a more closed upper storey inhibiting recruitment of juveniles.

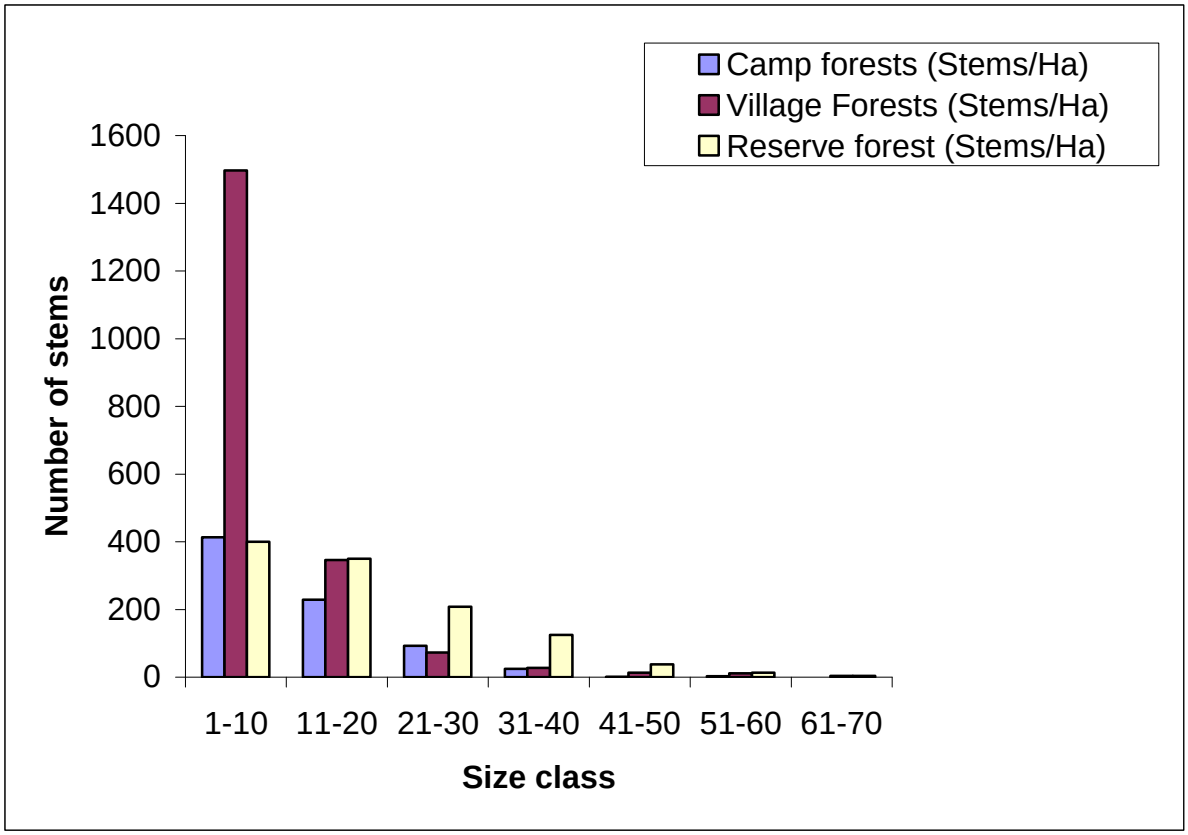

Figure 5: Size class distribution for useful tree species inventoried in two camps and villages in Kasulu, Tanzania

Plate 6: A patch of farmland inside villagers' forest in Mgombe village where maize is planted of which it was not possible to know whether a villager or refugee owned the farm

Table 5: Mean DBH in centimeters and number of stems per hectare between plots placed at intervals of 300 meters in transects in the study sites at $\propto = 0.05$

Duncan Grouping	Mean DBH	Number of stems/plot	Plot Number
A	10.25	26	3
B	8.89	21	2
C	8.11	14	1

**Similar letters in Duncan grouping means no significant difference*

Plate 7: A carpentry workshop where refugees makes various furniture products in Nyarugusu camp in Kasulu, Tanzania

Discussion

Area of forest converted to other uses

Through measurement and direct observation of the current forest status a set of inferences have been made. The forest areas around camps were more degraded than in the villages. This is probably an effect of the higher population pressure on forests and tough living conditions in the camps compared to the villages. In general refugees demand more fuelwood than the locals since they are many and living in tough situations. Refugees are foreced to find ways to survive and heve become innovative making more different varieties of products from the forest than local Tanzanians.

Clearing of land is among historic disturbances in miombo ecoregion others being deforestation, poaching, pollution and eutrophication (Timberlake,

1998). Succession has shown to take place after disturbance and people have been interacting with the ecosystem for thousands of years. But this was probably possible due to low levels of disturbances done by the low number of people inhabiting this region. Permanent and intensified utilisation of miombo species might lead to severe impacts (Timberlake, 1998). Normal rotation or fallow duration is between 20 to 40 years when occupation is at low densities of <20 persons km^{-2} (Mansfield 1995). Local Tanzanians in the study area have used the same land for 30 years. Refugees have stayed in the camps for even less than 10 years but the degree of deforestation calls for need to shift them to other areas, something which is unlikely to happen. Rotation time enough to allow them to return to previously harvesting sites at a sustainable period may not be easy to meet. Rotation time for subsistence fuelwood consumption in miombo woodlands is normally 8 to 15 years, (Chidumayo, 1997). The clearance done by refugees is typical of intensive conversion of land, due to high population density (Scholes, 1996), in the miombo and may lead to severe biodiversity impacts. Invasive species may come to inhabit the area because when succession takes place other species may colonise an area (Munyanziza, 1996), with or without replacing the previous ones. If the refugees continue to stay in the camp for longer time increased degradation due to overuse may happen.

The high road and house density in the camps has caused a profound impact to the surface and underground ecosystem. Soils have been compacted, ground cover depleted and erosion accelerated. Compacted soil influence soil microorganism and impairs water and air circulation (Grabowsky, 2003 and Avent, 1993). This may make it difficult for regeneration of plant species and also is largely dependent on the length of time refugees will stay. Soil microorganisms are important in the nutrient cycle and if affected by this it means soil fertility may also take time to restore after repatriation. This is another severe problem in the woodlands since miombo soils are normally less fertile (Chidumayo, 1993; 1997; Stromgaard, 1984 and Frost, 1996). Soil fertility can also be reduced due to surface erosion since the top soil is removed and useful organic matter washed away. Important minerals for plant nutrition can also decline due to leaching and evaporation.

However, with appropriate planning, financial institutional and human resources, the impact can be reduced. If authorities responsible for taking care of the refugees were well prepared then clearfelling and use of energy could be regulated. This can be illustrated by the example of the differences in the settlement areas of Mtabila and Nyarugusu camps where a reasonable amount of standing trees have been left in the latter. The refugees came to Nyarugusu camp almost four years after those in Mtabila camp and hence authorities had seen the impacts and prepared themselves to use more appropriate plans for settling refugees in Nyarugusu.

On the local people's side the level of disturbance can be absorbed by the miombo ecosystem. This is reasoned by the fact that people living in relatively low population densities like those of local Tanzanians of approximately 2 people/ha have interacted with these woodlands for the past thirty years and might have created some sort of equilibrium (Frost, 1996) enhancing a high diversity of species (Table 4). The added high demand by refugees might impair the equlibrium which was there and in the near future people's demand may not be met by the woodland system, hence unsustainable.

As many as 80% of interviewed refugees declared life to be better if they return home than staying at the camp. However those who wish to repatriate cannot go yet due to continuing political unrest in their home countries. It is therefore difficult to know the time when the increased uses over woodland resources in this region will slow down as a result of repatriation.

Socio economic issues

Due to the high number of refugees, their small sized land and perhaps their rich traditional knowledge on use of forest resources, they were more innovative in diversifying types of uses of miombo woodlands than local Tanzanians. This may be the reason why most of the other economic activities shown in the result section were done by refugees rather than by villagers. Farming was shown in the results to be the main economic activity for both groups. But since refugees get relief food from UNHCR, their main objective as farmers is not food but rather to get money, and in trying to fulfil this they work as casual labourers in the local Tanzanians' farms. This is illegal but a number of them can manage to sneak using the footpaths observed in the forests and hence difficult to be traced by security authorities. Refugees living conditions were not what many people expects as to be the poorest life than other African communities, but actually they sometimes are richer than surrounding communities in host areas. Refugees in Kasulu are living relativelly a competent and richer life standard than local inhabitants to an extent that some women and/or girls found it better to get married to refugees, some of them are already married to refugees, than with their local men due to welfare reasons (Njahani & Nyamoko, pers. Comm.). The better welfare of refugees is atributed mainly to their innovativenes and that they are a mixture of people from cities, towns and villages from their native countries and with higher levels of education (Table 2). Due to problems of road infrastructure and poor local market it becomes difficult to transport perishable agricultural products to distant markets still in fresh state. Therefore, farming remains a less

profitable economic activity for local Tanzanians. This makes their reliance on miombo biodiversity in supplementing to their livelihood even more important therefore need to be sustained.

Handcrafting and carpentry are activities which use species with the most desirable quality. Species commonly used for these activities in the area, like *Pterocarpus angolensis* (Mninga) and *Jacaranda mimosifolia,* are seen to have declined in population locally as shown in this and other studies by Schwarzt, Caro & Banda-Sakala, (2002) and Schwarzt & Caro, (2003).

Plate 8: A charcoal kiln inside a village forest reserve in Kasulu, Tanzania. Lime stones are put into the kiln through the top side and are roasted using fuelwood injected below the kiln. Afterwards the stones are cooled and ground to make chalk powder ready for use in house paints or making writing chalks.

This is a threat to the species and also to people's livelihood. It is a thresat to people due to their economic importance as valuable furniture species and in

conservation since *P. angolensis* is threatened (Schwartz and Caro, 2002). There is therefore a need to carry out more inventories of this species to assess its sustainability as measured against current harvesting pressure.

Charcoal and chalk making (See Plate 8) as done mostly by refugees for income generation is also a big threat to the forests. Chalk making is done in kilns where considerable amount of fuelwood mostly of high calorific value is used to roast limestone which is then cooled to get chalk in powder form. Chalk and charcoal kilns are found deep inside forest reserves far from the camps. Those which were found are owned by refugees, a situation which is illegal but difficult to control probably due to lack of enough and an efficient guardying system. These activities consume a huge amount of wood (Plate 8 & 9) of good quality in terms of calorific energy content, so mainly high density wood species are selected. Such species are normally slow growing and therefore difficult to recolonise if depleted from these forests. Charcoal making has been shown to escalate impacts on miombo woodlands since demand by nearby towns and cities has increased due to population growth (Luoga *et al.,* 2000b). If done at low subsistance levels the impacts are small (Luoga *et al.,* 2000a). Although it is not clear at which scale this subsistance level is stipulated but the high number of refugees and the length of time they stay poses a substantial demand to these woodlands. New advanced methods of energy consumption being introduced to the camps, like the use of less fuel wood demanding stoves, seem to reduce the impact at insignificant levels (Pers. comm) due the the big numbers of refugees. And if valuable species like *Pterocarpus angolensis* are misused for charcoal making then this will be economically unjustifiable at the same time increasing the impact on the species population.

The market places, groceries, restaurants, butcheries and other business activities run by refugees make life for them a little bit easier. These activities diversifies the use of the forest resources. Butcheries for example encourages livestock keeping hence may increase livestock densities locally. High density grazing have been shown to have impacts by several studies including those by Lawton, 1982; Celender, 1983; Chabwela and Mumba 1992 and Lowore *et al*., 1995. Not only does overgrazing eliminate the herbaceous components of the vegetation, high numbers of cattle generally displace game, as there is less suitable habitat available (Karen Goldberg, WWF; *in press*). The livestock observed during this study was at low densities, with few and scattered herds of livestock seen grazing or pegged on trees in the refugees campsites and forests. But possibilities of intensification may be there since refugees will still need income and wood resources are becoming more scarce in the vicinity. Butcheries also encourage '*nyama choma*' (barbecued meat) places which consumes not only extra fuelwood but also may provide market for livestock animals and even bushmeat. Refugees may easily encroach the remaining few wild animal areas to supply bushmeat to camps. This of course is not a problem typical for refugees but since they have a

restricted income source they may find themselves doing illegal hunting than the villagers.

Plate 9: Piles of fuelwood used in ready for use in Charcoal and Chalk kilns inside forests in Kasulu, Tanzania

Forest status

The most striking results of this study were the high difference in numbers of utilized species (see Table 4). The village forests appeared to be twice as numerous in high value species as in both the camp and the reserve. This could be caused through careful management by the Tanzanian villagers where valuable species are promoted or left intact deliberately. These results are in contrast to the norm that woodlands used by man always become degraded. However, this study focused on high value species only, and if a total woody species inventory would have been done, results may fall out differently.

Where there is no selective cutting but large scale clearance, woodlands regeneration is difficult and such places result in reduced number of trees per hectare (Schwartz and Caro, 2003). Similar cases where refugees have cleared forests henceforth reducing the number of stems per hectare or reducing the forested area have been reported in places like those of Goma and the surrounding areas of Virunga national Park in Congo-Kinshasa (Henquin &

Blondel; 1997). However, where there is selective or small scale clearance of woodlands with mild disturbances of fires, browsing by ungulates and grazing of livestock, there are possibilities of stimulating tree recruitment with results of a forest with many juveniles. In the study site this is revealed by the fact that number of trees with DBH >15 per hectare are less closer to settlement areas, with the refugees forests experiencing lesser intensity closer to settlements than the village forests. The last plots in the village transects have stand characteristics almost similar to that of reserve forest while those closer to settlements have >1400 juveniles per hectare of those useful species. Schwartz and Caro, (2003) found similar results on a study carried out in western miombo regions of Tanzania that juveniles' abundance decrease away from road areas due to medium anthropogenic disturbances close to roadways.

High species diversity and presence of *P. angolensis* (although juveniles) in village forests than in the reserve forest needs further studies to understand the phenomenon behind this. Schwartz and Caro (2003) found that there were no recruitments of *P. angolensis* inside a Park area, approximately 300 km away from Kasulu, compared to outside forests and hypothesized that the species is browed by large herbivores present in the Park. Since the reserve forest used in this study is not a Park but protected area with no such herbivores we still do not understand the reason for this.

Conclusion

This study has revealed an increasing pressure on the utilisation of woodland resources at a relatively short time. This is clearly evidenced by this and other studies like those carried out in Virunga (Henquin and Blondel, 1997). Refugees derive more varieties of products from the forests and they are population is higher that that of local Tanzanians, hence a reason for the increased pressure on forests. There are signs that *P. angolensis* is becoming locally depleted due to higher demands on it for furniture. This calls for further detailed studies to assess its status in this region. It is obvious that both refugees and local people have interacted with the miombo forests for many years since they are in the same ecoregion, hence have similar knowledge about the ecosystem. Sustainable management of miombo forests rather than total protection may be useful in increasing species diversity. However, this conclusion that controlled use results into a diverse forest needs to be proved by further intensive studies since this study had a rather small sample size.

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References

Ainslie, A., Kepe, T., Cinderby, S. and T. Petse, 1996. Rural livelihoods and local level management of natural resources in the Peddie District. LAPC working paper No. 42. LAPC, Johannesburg.

Anon, 1998. IGBP Miombo Network Website at: http://miombo.gecp.virginia.edu/

Avent, T., 1993. Soils and soil preparation. The American Journal of Hosta Society. Vol 24, Number 2. subsistence

Barbara P. T., 1994. Structural change, power politics, and community organizations in Africa: Challenging the patterns, puzzles and paradoxes. World Development, Volume 22, Issue 10, October 1994, Pages 1479-1490

Biswas A.K. and H. C. Tortajada-Quiroz, 1996. Environmental Impacts of Rwandan Refugees on Zaire, Ambio, Vol. 25, No. 6 403-408.

Campbell, B., Bulter, J. R. A., Mapaure, I., Vermeunlen,.S.J. and Mashove, P., 1996. Elephant damage and safari hunting in Pterocarpus angolensis woodland in northwestern Matebeleland, Zimbabwe. African Journal of Ecology. Vol. 34, 380-388.

Campbell, B., Frost, P. and N. Byron, 1996. Miombo woodlands and their use: Overview and key issues. In: Campbell, B. (ed.) 1996. The miombo in Transition: Woodlands and welfare in Africa. Centre for International Forestry Research, Bogor. (Pp 1-10).

Campbell, B.M., Luckert, M. and I. Scoones, 1997. Local-level evaluation of savanna resources. A case study from Zimbabwe. Economic Botany 51: 59-77

Catherine Knight, 1997. War, Politics and the Environment. Conservation Law Foundation, Oxfam America. Visited online on 10th June 2003 at: http://www.clf.org/pubs/war.htm

Celender , N. 1983. Miombo woodlands in Africa: Distribution, ecology and patterns of land use. Sveriges Lantbruksuniversitet, U-landsavdelningen, arbetsrapport 16: 1-54

Chabwela, H.N. and W. Mumba. 1998. Integrating Water Conservation and Population Strategies on the Kafue Flats. A. de Sherbinin and V. Dompka, editors. Water and Population Dynamics: Case Studies and Policy Implications. Zambia. American Association for the Advancement of Science (AAAS).

Chidumayo, E, N., 1987. A survey of wood stocks for charcoal production in the miombo woodlands of Zambia. Forest Ecology and Management. Vol. 20, 105-115.

Chidumayo, E.N. 1993. Responses of miombo to harvesting: ecology and management. Stockholm Environment Institute, Stockholm.

Chidumayo, E.N. 1997. Miombo Ecology and Management: a Handbook. Intermediate Technology Publications, London.

Chris B. S., 2001. Sierra Leone's Biodiversity and the Civil War. Washington, D.C.: Biodiversity Support Program

Clark, J., W. Cavendish, & C. Coote, 1996. "Rural households and miombo woodlands: use, value and management." In: Campbell, B. (ed.) The Miombo in Transition: Woodlands and Welfare in Africa, pp. 101-136. CIFOR, Bogor.

Cunningham, A. B., 1997. Review of ethnobotanical literature from eastern and southern Africa. Bulletin of the African Ethnobotany Network. 1 23-88.

Desanker, P. V., P. G. H. Frost, C.O. Frost, C.O. Justice, and R. J. Scholes, (eds.). 1997. The Miombo Network: Framework for a Terrestrial Transect Study of Land-Use and Land-Cover Change in the Miombo Ecosystems of Central Africa. - IGBP Report 41. The International Geosphere-Biosphere Programme (IGBP), Stockholm. 109 p. –

Earth Crash., 2001. Pupolation: Environmental impacts of war and the military. Available online and visited on 8th June 2003 at: http://eces.org/ec/population/military.shtml

Frost, P and P. Desanker, 1998. The Miombo Network: Causes and Consequences of Land-Use and Land-Cover Changes in the Miombo of South Central Africa. Available online at: http:/miombo.gecp.virginia.edu/Main/LUCCNEWS.html

Frost, P. 1996. "The ecology of miombo woodlands." In: Campbell, B. (ed.) The Miombo in Transition: Woodlands and Welfare in Africa, pp. 11-58. CIFOR, Bogor

Grabowsky, J., 2003. Compaction in tree establishment and root zone protection. Available on line on 8th August 2003 at: http://www.treecareindustry.org/content/pubs/July_2003_TCI_-_Compaction.htm

Grundy, I. M., 1990. The potential for management of the indigenous woodland in communal farming areas of Zimbabwe with reference to the regeneration of Brachistegia speciformis and Julbernardia globiflora. Unpublished M Sc. Thesis. University of Zimbabwe, Harare.

Grundy, I, I. M., 1995. Wood biomass estimation in dry miombo woodland in Zimbabwe. Forest Ecology and Management. Vol. 72, 109-117

Hart, T and Hart, J., 1997. Conservation and civil strife: two perspectives from Central Africa. Conservation Biology. 11(2): 308-309.

Henquin & Blondel., 1997. "Etude par télédétection sur l'évolution récente de la couverture boisée du Parc National des Virunga, deuxième partie (période 1995-96).» UE,, ADG, UNHCR, ICCN (Union Européenne, Aide au Développement Gembloux, Office of the United Nations High Commissioner for Refugees, Institut Congolais pour la Conservation de la Nature). Goma. Quoted online on 20th September 2003 at: http://www.bsponline.org/bsp/publications/africa/144/response.htm

IGCP, 1997. Park suffers in civil war. Mountain Gorilla Update. January, issue 3.

IUCN, 1997. State of conservation of Natural World Heritage properties. A report prepared for the Bureau of the World Heritage Committee. 21st session, Paris, 23-28th June.

José Kalpers. 2001. Volcanoes under Siege: Impact of a Decade of Armed Conflict in the Virungas. Washington, D.C.: Biodiversity Support Program

Kaoneka A. R. S and B. Solberg, 1997. Analysis of deforestation and economically sustainable farming systems under pressure of population growth and income constraints at the village level in Tanzania. Agriculture, Ecosystems and Environment 62(1997) 59-70. Elsevier Science.

Lawton, R. M., 1982. Natural resources of miombo woodland and recent changes in agricultural and land-use practices. Forest Ecology and Management 4: 287-297.

Luoga E., E. T. F. Witkowski, and K. Balkwill, 2000a. Differential Utilization And Ethnobotany Of Trees In Kitulanghalo Forest Reserve And Surrounding Communal Lands, Eastern Tanzania. Economic Botany 54(3):328-343.

Luoga, E.J., et al., 2000b. Economics of charcoal production in miombo woodlands of eastern Tanzania: some hidden costs associated with commercialisation of the resources Ecological Economics Vol. 35, No. 2: 243-257.

Martin, G.J. (1995). Ethnobotany. Pilot Project for Landuse Management Programme in Kiteto District, Leisoti Village Natural Forestry Inventory Report. Pp. 13-14.

McGregor, J., 1994. Woodland pattern and structure in a peasant farming area of Zimbabwe: ecological determinats and present and past use. Forest Ecology and Management. Vol. 63, 97-133.

McGregor, J., 1995. Gathered produce in Zimbabwe's communal areas: Changing resource availability and use. Ecology of Food and Nutrition 33: 163-193

Melissa K, 1997. Environmental and Economic Repercussions of the Persian Gulf War on Kuwait. Kuwait Case Studies. Case Number 9.

MNRT, 1991. Ministry of Natural Resources and Tourism. Taarifa ya Maendeleo ya sekta ya misitu ya mwaka 1990/91 ya mkoa wa Rukwa. Urban paper presented to the annual meeting held in Dodoma from 11-14 Nov., 1991. Forest Division, Dar Es Salaam.

Munyanziza E., 1996. Domestication and comercialization of non-timber forest products in agroforestry systems. Non-wood Forest Products Number 9. Food and Agriculture Organisation of the United Nations. Also available on line visited on July 2003 at: http://www.fao.org/docrep/w3735e/w3735e26.htm

Pearce, F., 2000. From Vietnam To Rwanda: Wars' Chain Reaction. The New Scientist, also available online at http://www.unesco.org/courier/2000_05/uk/planet.htm visitation on 04 June 2003

Price, A.R.G and J.H. Robinson., 1993. "On the Impacts of the 1991 Gulf War." Marine Pollution Bulletin. 1993 ed. New York: Pergamon Press, Vol 27, 1993, pp. 305-314.

Ramachandran, K.S., 1991. Gulf War and Environmental Problems, New Delhi, Ashish, 1991. 318 p.

Rowland, M., Rab, M. A., Freeman, T., N. Durrani and N. Rehman., 2002. Afghan refugees and temporal and spatial distribution of malaria in Pakisatan. Social Science and Medicine.

Saket, M., 1999. Tendencies of forest fires in Mozambique. Maputo, DNFFB.

Scholes, B., 1996. Miombo woodlands and global change. In Campbell, B., (Ed); The miombo in Transition: Woodlands and Welfare in Africa. Page 13. CIFOR, Bogor.

Schwartz, M. W., T. M. Caro and T. Banda-Sakala, 2002. Assessing the sustainability of harvest of Pterocarpus angolensis in Rukwa Region, Tanzania. Journal of Forest Ecology and Management. Vol. 170, 259-269.

Schwartz, M.W., and T. M. Caro, 2003. Effect of selective logging on tree and understory regeneration in miombo woodland in western Tanzania. African Journal of Ecology. Vol. 41, 75-82

Shackleton, C. M., Netshiluvhi, T. R., Shackleton, S. E., Geach, B. G. S., Balance, A. and D. F. K. Fairbanks 1999a. Direct use-values of miombo woodland resources from three rural villages. Unpublished report No. ENV-P-I 98210, CSIR, Pretoria.

Stewart, K., 1999. Gorilla Conservation News. Issue Number 13, May 1999.

Stromgaard, P. 1984. "The immediate effect of burning and ash-fertilization." Plant and Soil 80: 307-320.

TPC, 2000. Tanzania Planning Commission. Kigoma regional socio-economic profile. Dar Es Salaam, Tanzania.

Timberlake, J. 1998. Biodiversity of the Zambezi Basin Wetlands. Phase 1: Review and Preliminary Assessment of Available Information. Volume 1: Main Report. Consultancy report for IUCN- Regional Office for Southern Africa, Harare, Zimbabwe.

UNEP, 2000. Environmental impacts of refugees in Guinea. United Nations Environment Program (UNEP) Assessment Report 15th March 2000, Nairobi.

UNESCO, 1998. Convention Concerning The Protection Of The World Cultural And Natural Heritage. World Heritage Committee, 22nd Session, Kyoto Japan, 30th November to 5th December 1998.

United Nations Population Division, 1998. World Population Prospects: The 1998 Revision.

USCR, 2001. United States Committee for Refugees

WCMC, 1991. Gulf war impact on marine environment and species. World Conservation and Monitoring Centre(WCMC). Gulf War Environmental Information Service: February 1991, Cambridge.