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Non-timber Forest Products: Opportunities and Constraints for Poverty Reduction in the Nuba Mountains, South Kordofan, Sudan

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Abstract
This paper examines the potential and constraints for the contribution of non-timber forest products (NTFPs) to poverty reduction in South Kordofan State. The main objectives of this study are to emphasise the variety of NTFP tree and shrub products found in the area, to describe their potential contribution to local inhabitants health and wealth and to indicate major constraints to promoting their domestication and planting for NTFPs. Drawing on a study of four provinces in South Kordofan State, the findings confirm that NTFPs contribute significantly to the diet and income of the rural inhabitants. It is recommended that NTFP producing trees and shrubs should be conserved and improved and given high research priority in order to maintains diversity and sustain productivity and hence food security and income. Their integration in the local farming systems is paramount.

Key words: agroforestry, domestication, livelihood, multipurpose trees, NTFPs, poverty reduction, rural communities

1 Introduction

The livelihood of the majority of rural people in the dry land Africa depends on the forest and woodlands as a prime sources of agricultural land, fuelwood (firewood and charcoal), as well as for non-timber forest products (NTFPs) such as fruits, fibres and medicine (e.g. BARROW et al. 2002, CAMPBELL 1986, FALCONER 1990, FAO 1983, PACKHAM 1993). Africa has abundant wild plants and cultivated native species with great agronomic and commercial potential as food crops, but many of these species, particularly the fruits and nuts, have not been promoted or researched and therefore remain under-utilised (e.g. GEBAUER et al. 2002a). Moreover, many of these species face the danger of loss due to increasing human impact on ecosystems in concurrence with changing climatic conditions. According to several reports (e.g. FAO 1998) Africa has been faced with serious problems of not being able to feed its population or supply it with fuelwood. Frequent crop failure in arid and semi-arid areas often resulted in the poor nutrition of local people (MAXWELL 1991, WATERLOW et al. 1998). For this reason it is imperative to find other sources for getting food for the growing population.

For the past three decades, there has been a growing awareness of the importance of NTFPs especially for food and medicinal uses. This growing awareness is not only for the role they play in the subsistence economy, but also for their potential and real contribution to the economies of many developing countries (FAO 1998). Many studies in various parts of Africa stress the importance of NTFPs specially fruit and medicinal trees for improving the livelihood of the rural people (e.g. ABBOT 1993, BOOTH and WICKENS 1988, FAO 1986, PALGRAVE 1992). Little research has been conducted to determine the relative importance of non-timber fruit trees and shrubs for land users in the drylands of Sudan. Few studies, however, have been conducted looking specially at an inventory of the locally existing plants and products (e.g. GEBAUER et al. 2002b, EL TAHIR 1999, SULIEMAN and ELDOMA 1994) potential and extraction systems (EL-SIDDIG et al. 2003, HAMMAD 1997, FADL and GEBAUER 2004a), studying of different aspects of multi-purpose tree and shrub species with special emphasis on NTFPs for integration in agroforestry systems (EL TAHIR 1999, FADL and GEBAUER 2004b).

Rural poverty in South Kordofan State generally is wide spread with per capita income generally of the order of US$ 350 or less (EARS 1998). This mainly associated with low crop production, inadequate access to market, poor institutions, and inadequate access to land resources. Furthermore, civil war has

aggravated the situation.
The main objectives of this study are to emphasise the variety of NTFPs producing tree and shrub species found in the Nuba Mountains, to describe their potential, contribution to the local inhabitants health and wealth and to indicates major threats and constraints to promoting their domestication and planting.

2 Materials and Methods

2.1 Study Area

South Kordofan States is located in Central Sudan. It composes of five provinces (Kadugli, Rashad, Abu Gubeiha, Talodi and El Dilling). It covers an area of approximately 141,096 km^2 and lies between latitudes 9-13º N and longitudes 27-33º E. It consists of four main regions. These are: the Nuba Mountains, the eastern plains bordering the White Nile, in which three of the provinces under study are located, the southern plains bordering Bahr El Arab, and the western sandy plains to which a large portion of El Dilling province belongs (the northern part). The landscape is metamorphic basement complex surrounded by sedimentary cover of Mesozoic rocks and Cenozoic deposits marked by isolated hills and mountains. The soils of South Kordofan belong to four orders: Vertisols (cracking clays), Alfisols (with textual alluvial horizons), Inceptisols (cambic horizon which shows weak profile development), and Entisols (soils lacking profile development but capable of supporting vegetation). These soils reflect the variations of climate, parent material and history of use (AACM 1993).
The State lies within two agro-climatic zones; namely the Southern Sahel Zone (open woodland savanna), and the Sudan Savanna Zone (shrubs woodland). The climate of the Southern Sahel Zone is classified as hot dry to semi-arid with rainfall varying from 350 mm in the north to 550 mm in the south. The Sudan Zone is sub-humid with rainfall varying from 550 mm to 800 mm. Crop production generally encountered great risk in the Southern Sahel zone, due to the dryness and rainfall fluctuations (EARS 1998). The rainy season starts earlier (April to May) in the Sudan Savanna Zone with longer growing season, while it starts late (June-July) in the Southern Sahel Zone with very short growing season. The mean annual temperature is in the range of 24 to 28°C. The maximum and minimum temperatures are in the range of 32 to 35°C and 17 to 21°C, respectively.
The population of South Kordofan State is 1.6 million according to the 1993 census. Population growth rate is 3.1%, half of the population is under the age 15 years, the population density is 12 persons per km^2. Life expectancy at birth estimated to be 52 years for male (male infant mortality rate 12.7%) and 56 years for female (female infant mortality rate 10.7%). Female households are about 27% in the state. The population in the area is influenced by cyclic migration for labour, transhumant nature of some tribes and migration due to civil war in the regions. It is generally consists of many ethnic groups with different cultural practices, traditions and attitudes. The main ethnic groups include:

- Nuba: This group represents the largest tribe (61%). It consists of sub-groups having different dialects of their own (the Nuba language). They are largely sedentary farmers, but some are semi-nomadic rearing cattle.
- Baggara and other Arabs: Represent 26% of the population. These are of Arabic origin and consist of diverse groups. They are mainly transhumant rearing cattle.
- West Africans: Represent 8%. They are predominantly sedentary farmers, but manage some livestock.
- Nilotic and others: Represents 5%. They are formerly cattle owners used to practice transhumant life, but recently have settled and engaged in sedentary farming and livestock management.

2.2 Methodology

This study covered four provinces in the South Kordofan State namely: Rashad, Abu Gubeiha, and Talodi and El Dilling. The study is a part of formal diagnostic survey for South and West Kordofan Agricultural Development Project (SWKADP). It was carried out in 1998 by a multidisciplinary team from El Obeid Agricultural Research Station (EARS) of which the authors are members. In addition these data were supported by information collected during field surveys conducted by the authors in the following years. The data used were collected from different villages which are located in the four provinces. These are: Rashad, El Moreib, Abassia, Wakara, Abu Karshola, Kalinda, Um Berembita, El Faid, Abu Gubeiha, Abu Geris, El Bitera, El Tartar, Talodi, Kalogi, El Dilling, Debebat and Habila.

Methodologies used include:
1) Direct field observation
This method is confined to the assessment of visual indicators or aspects such as landscape, soil types, vegetation cover, species diversity, types and quantity of NTFPs in local markets. General deterioration in vegetation cover and natural resources in general were also observed.
2) Rapid rural appraisal
The main technique used focused on group discussions with villagers representing different land users, including male and female households.
3) Key informants
This technique focused on key informants including individuals (both male and female) who are directly or indirectly involved in forests and forest products e.g. forestry staff, vendors and governments officials.
4) Household interviews
This is based on structured questionnaires covering different subjects and issues pertaining to the project objectives and activities.

The data collected at household levels covered qualitative and quantitative information. These include socio-economic status, land holding, type of crops, varieties and cultural practices. Regarding the diversity of NTFPs, the household questionnaires included questions covering subjects on tree species, their products, uses, method of extraction, security of supply and income generation. Group discussion questions focused on, land and tree tenure, availability of resource base for NTFPs, experience of local people with tree planting and cultivation, main threats, constraints and opportunities to promotion and domestication of NTFPs.
Regarding the contribution of NTFPs to households health and wealth in each village visited, ten households heads, five males and five females were selected at random. A total of 170 questionnaires were developed and used for the four provinces (10 per site).

3 Results and Discussion

3.1 Diversity of non-timber tree and shrub species

About 150 local tree and shrub species covering a multiplicity of uses other than timber were identified by the respondents in the four provinces. Some exotic and introduced trees were included but the majorities are indigenous to the study areas. Almost about 90% of the species were identified by their vernacular names. The identification of the scientific names of the local species was done by cross-refereeing the respondents knowledge by matching vernacular names with published references (e.g. EL AMIN 1990, VOGT 1995, VON MEYDELL 1990). The identification of some of the tree species and their uses was different with respondents in the household questionnaires and the focus group discussion in the four provinces. For example, same species have different uses were mentioned by the respondents in the four provinces. This precisely mirrors the heterogeneity of the populations which consists from different ethnic groups.
The results show that overall, non-timber producing trees and shrub species identified by the local inhabitants included those used for fuelwood, building materials, food, fodder, medicine, fibre, dye, gum, resins, honey hives and bee forage. Some were categorised and listed according to the most frequently named and preferred for particular uses (Appendix 1). It is important to mention that NTFPs such as fuelwood, building material, fodder, bush meat, gum and resins and other products of biological origins are not reported here. Only those tree species most frequently named and used by all respondents in the four provinces for food, medicine, dye and fibre are reported.

Food: About 70% of the respondents identified more than 40 species used for food. Among those frequently identified as main food producing species are: *Adansonia digitata*, *Balanites aegyptiaca*, *Borassus aethiopum*, *Cordia abyssinica*, *Cordia africana*, *Detarium senegalense*, *Diospyros mespiliformis*, *Ficus sycamorus*, *Grewia tenax*, *Grewia bicolor*, *Grewia villosa*, *Hyphaene thebaica*, *Moringa oleifera*, *Sclerocarya birrea*, *Strychnos innocua*, *Tamarindus indica*, *Ximenia americana* and *Ziziphus spina-christi*.
The respondents mentioned that the fruits of all the above mentioned species plus others like *Capparis decidua* and *Guiera senegalensis* are consumed during time of food shortages. Species like *A. digitata*, *G. tenax* and *T. indica* are frequently used as beverage during fasting month (Ramadan), while the fruits of *C. africana* are used as sugar substitutes during the same month. The products from these species were unanimously mentioned to have supply vitamins important for nutritional security in the rural areas. These findings are similar to those obtained by ABDELMUTTI (1999) who studied the biochemical and nutritional aspects of famine food in Kordofan and Darfur regions of Sudan. The fruits of some species such as *B. aegyptiaca*, *D. senegalense*, *H. thebaica*, *S. birrea* and *Z. spina-christi* are favoured as delicacies and snacks by children as well as by older people.
In the study area the fruits of *B. aethiopum* have special uses. Quite often local inhabitants buy and eat the fresh fruits which contain yellow juicy fibrous pulp and have nice aroma. In many circumstances, the local inhabitants bury the seeds or some times the fresh fruits in large soil pits, cover it with grasses and soil and leave it to germinate. The germination shoot which appears after 5-6 weeks is dug out and boiled. One fruit produces about 2-3 germination shoots. The boiled shoots are locally known as “Halook” have nice taste and are used as delicious snacks. It is an important starch substituted for low income people.
Selling of *B. aethiopum* fruits as “Halook” is quite common in the area. It has been mentioned by 75% of the respondents that the owners of the palms preferred selling the fruit of this species as “Halook” rather than fresh fruits because it generates higher income. The detrimental impacts of this method of utilisation on sustainability of the species and its uses will be discussed later.

Medicine and dyes: The results of the study revealed that about 90% of the respondents have some medicinal knowledge about one or more of the identified species. It is worth noting that some species had been identified for a variety of medicinal uses. The following species has been mentioned by the 75% of respondents for several medicinal and dye uses. These are: *A. digitata*, *Boswellia papyrifera*, *Cadaba glandulosa*, *Cadaba roduntifolia*, *Celtis integrifolia*, *Commiphora africana*, *Commiphora pedunculata*, *Erythrina abyssinica*, *G. bicolor*, *G. tenax*, *G. villosa*, *Khaya senegalensis*, *Lonchocarpus laxiflorus*, *Maytenus senegalensis*, *Piliostigma thonningii*, *S. birrea*, *Strychnos innocua*, *Sterculia setigera* and *T. indica*.
About 60 tree species were identified by the

respondents in the household interviews and the key informants as having medicinal and dye uses. However, this number compared with those identified in studies carried out in the study area by AWADALLA (1985) and EL GHAZALI et al. (1987), does not give the actual diversity of medicinal tree and shrub species. This however, could be attributed to low representation of women and traditional healers. The eastern Nuba Mountains and specially the three provinces covered by this study (Rashad, Abu Gubeiha and Talodi) have been described previously by AWADALLA (1985) as the richest area in terms of availability and diversity of medicinal plants and of greater folkloric medicinal uses in the Sudan. Further, it has been unequivocally stated by AWADALLA (1985) that this area can be regarded as the medicinal Atlas of Sudan.

Fibres: A great number of species were identified by 50% of the respondents for fibre extractions. The most frequency used includes: *Acacia nubica, Acacia senegal, A. digitata, C. africana, Cordia rothii, G. bicolor, G. tenax, G. senegalensis, G. villosa, H. thebaica, K. senegalensis, M. senegalensis* and *Z. spina-christi*. Most of the fibre extracted from these species is used locally or traded out side the production area as raw or processed products. Fibre extracted from the bark of some species such as *A. digitata, A. nubica, A. senegal, C. africana* and *C. rothii* are used for making robes. These are locally used for building huts, bed making, well lining, and livestock tying. Fibre extracted from the leaves of *H. thebaica* "Saaf" is used for making mats for beds and hut decoration, baskets and small handicrafts. Considerably, large quantities "Saaf" are transported outside the area for interstate trading. These types of products are endlessly mentioned by the respondents as of some major contribution to the households income. These findings conform to those obtained by SULIEMAN and ELDOMA (1994) for Sudan and by HAMMAD (1997) for Abu Karshula Rural Councils in Rashad province.

In summary, most of the species mentioned above are indigenous with some exotic or introduced. The extraction and utilisation of some of these species in the study area is similar to that described in the literatures for other regions in dryland Africa (e.g. BOOTH and WICKENS 1988, CAMPBELL 1986, FAO 1983, FAO 1986, FAO 1998, PACKHAM 1993, VON MAYDELL 1990).

3.2 Contribution of NTFPs to income

The main sources of income for the household in the study area are shown in Figure 1. The figure shows that NTFPs contribute significantly to household income after agriculture. The percentage of respondents who mentioned that NTFPs are their main source of income was 30%, 25%, 45% and 20% in Rashad, Abu Gubeiha, Talodi and El Dilling provinces, respectively. The figure also shows that NTFPs and agriculture contribute significantly to the income of some households in the different provinces. This is mentioned by 10% in Rashad, 13% in Abu Gubeiha, 20% in Talodi and 11% in El Dilling provinces. The unevenness in the percentage contributions of NTFPs to different households in the four provinces could be explained from the followings indicators: 1) The respondents in the three provinces Rashad, Abu Gubeiha and El Dilling, are less dependent on NTFPs. This could be attributed to the fact that the three provinces include the large scale mechanised farming activities, accessible market places, more urbanised with reasonably good public services and rather secured. Consequently, in these provinces people have great opportunity for farming and could perhaps perform other trading activities. 2) On the opposite, respondents (20%) in Talodi province are more dependent on income from NTFPs. This could be attributed to the remoteness of the province, poor public services, insecurity and probably to the large number and diversity of NTFP tree species. The area also is famous for production of high quality honey and main raw materials for handcrafts mats made from "Saaf" the processed leaves of *H. thebaica*.

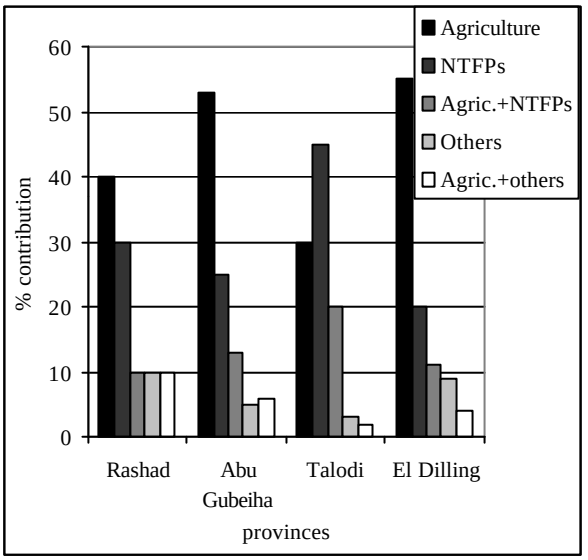

Fig. 1: Main source of income for households in the study area of South Kordofan.

Figure 2 shows the contribution of NTFPs to the income of female and male households. About 70% of the females respondents in the four provinces mentioned the high economic role played by NTFPs. This could be attributed to the facts that collection of NTFPs based on local customs is the sole responsibility of women and children. Moreover, time of collection of NTFPs coincides with crop harvesting time in the mechanised farms, at this time male households migrate for labour. The results showed that NTFPs contribute significantly to female households income than to male. This is in strong agreement with FAO (1997) who stated that women

often dominate NTFPs extraction activities for both households consumption and income generation.

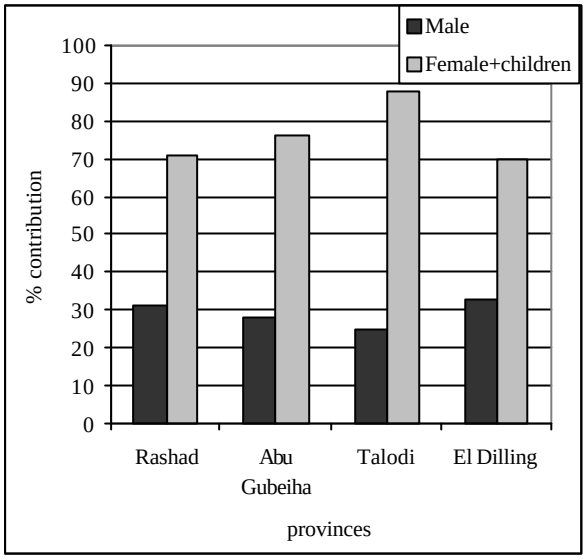

Fig. 2: Contribution of NTFPs to household income in the study area of South Kordofan.

In this study the estimation of annual quantity of NTFPs by households was found to be very difficult to estimate particularly for medicinal products. This is mainly attributed to the seasonally of the products and fruiting periods. Moreover, some of the products are consumed at household levels without being quantified. However, the results of the household questionnaires and key informants showed that the average quantities of products for some selected species collected vary between households in the four provinces. It is clear from the study that considerably large quantities of NTFPs could be collected annually in the study area. However, the prices paid to the collectors are on average 50% less than the values of the produce in the urban market. This is a very important researchable area and calls for quick intervention.

Overall, the results showed that NTFPs are of highly significant socio-economic importance to the local inhabitants. However, this of course varies between and within the four provinces. This could perhaps be attributed to the socio-economic status of the main household heads (male or female), primary occupations, number of dependants, external income, availability and security of landholdings. Moreover, seasonal migration and repercussions of the civil war have also great impacts on the type of the economic activities in the area. These results are in conformity with those obtained by (HAMMAD 1997, SULIEMAN and ELDOMA 1994).

3.3 Threats and constraints to NTFPs

The results of the study have revealed a great verity of threats and constraints to the promotion and domestication of NTFP trees and shrubs in the study area. These constraints, however, to some extent appear similar to those reported in other regions in Africa. The most prominent constraints which were repeatedly mentioned by the respondents in the household interviews include the following:

Insecurity of resource base

The most important constraints to development and promotion of NTFPs in the study area are insecurity of resource base particularly tenure of both land and trees. This is mentioned by about 39% of the respondents. Access to land in the study area is regulated by a dual system of tenure. These are customary or traditional system and a modern system. In the traditional system, membership of a particular tribe was sufficient to confer land access. Individuals, who are not members of the tribe, but resident in the area, could obtain access to land by application to the tribe leaders “Sheikh” or “Meik”. In the customary land tenure system, land can not be bought or sold but inherited. Land value is very much dependent on its quality and proximity to a village.

The modern land tenure regime is represented by the land registration system enacted by the condominium government. The system recognised individual ownership rights over urban and irrigated land. It allows pre-existing traditional land rights in other areas to remain intact, leaving the regulation of their exercise largely to local custom (AACM 1993). In the modern system, the land Settlement and Registration Act (LSRA) of 1925 has specified all lands unregistered prior to that year as government land and local inhabitants enjoy the right of use, e.g. occupation, residence, grazing, use of water and passage. Under modern land tenure system the main authorities of the tribe over the land are merely jurisdictional, administrative and organisational (IBRAHIM 1993). However, in 1957 a directive was issued supporting the LSRA of the 1925’s. This directive has further prescribed that tribal lands were at the disposal of the tribal chiefs for the benefit of all tribe members (IBRAHIM 1993). In 1970, the Unregistered Land Act (ULA) was issued. This affected the legal status of usufruct rights prior to the date of issue of that law, and the land became only hold able at the pleasure of the government. In further development the Civil Transaction Act (CTA), which was issued in 1984, has re-instated the legal status of usufruct rights even if not registered as before the ULA of 1970 (IBRAHIM 1993).

In-spite of these development in land tenure policy, there are some conflicts between different land users in the study areas. As stated by IBRAHIM (1993) the more important structural causes of land and resources tenure problems in Western Sudan are fragmentation of control over land resources, lack of co-ordination between different land users and frequent legislative changes. The consequences of this have been reflected on the natural recourses management of forests and woodlands which are the major sources of NTFPs for the local inhabitants.

In the light of the above mentioned land tenure systems, the results of the study revealed that in the study areas three tree tenure systems can be recognised. These tenure regimes regulate access and utilisation to the tree products. 1) In natural woodlands and unreserved forests almost any body has open access to trees and their products; 2) Planted trees in home gardens and fruit gardens are private properties and the owners have the full control over the products and its extraction. The striking examples are those of *B. aethiopum* and *H. thebaica*; 3) Regarding naturally growing trees standing in the cultivated fields or bare lands owned by individuals the situation is less certain. But quite often security of access varies within the study area depending on the economic value of the produce of these trees. In some cases, although the cultivators may be considered the owner of the trees in his land, access to some of its products, like fruits, can still be open. However, some of NTFP producing tree species which was in the past had been open to any body, at present access to them becomes difficult because of their high economic values. This change in tree tenures was mentioned by over 50% of the respondents in the study area, regarding extractions of products from some species. For example, the fruits of *B. aethiopum*, *G. tenax*, *T. indica*, fruits and bark of *A. digitata*, fruits and leaves of *H. thebaica*.

Tree clearance for cultivation and wood

About 30% of the respondents mentioned that tree clearance for cultivation and wood is the main constraints to NTFPs in the study areas. The growing demand for land for cropping was met by horizontal expansion and reduction of rotation and fallow periods. Mechanised farming on clay plains destined whole-sale tree clearance of the natural forests to give way to agricultural crops, while traditional farming on sandy soils removed the trees (e.g. *A. senegal*) out of the traditional fallow systems.

The effects of land clearance for mechanised farming in the clay plains of the Nuba Mountains were unanimously considered as the main cause of degradation of vegetation cover. For example, a survey of the plant cover on un-cleared sites in mechanised farms in Nuba Mountains clay plains showed an average of 200 trees and shrubs per 0.42 ha (BABIKER et al. 1985). An area of about 0.21 million ha was estimated to have been cleared in South Kordofan State since the introduction of mechanised farming in 1970. This indicates that about 100 million tree and shrubs have been destroyed. Most affected tree species for NTFPs include: *A. senegal*, *Acacia seyal* var. *seyal*, *B. aegyptiaca* and *Z. spina-christi*.

Moreover, demographic changes created a separate demand for wood for local consumption and for sale outside the area. These have caused more denudation to tree cover. According to ABDELSALAAM (1997) the state of South Kordofan can be classified as the state with prospective deficit situation. According to this classification the state has wood fuel supplies sufficient to meet the local needs and have surplus to supply other regions of the country. Of course this is contingent on the premise that the annual allowable cut should not exceed the annual increments.

Fuelwood production by traditional farmers in the study area is an off-season activity. This activity reaches its peaks during drought years when crop yields are at their minimum. But large scale commercial production is practised by traders from out side the region. This was warranted by the pretext of land clearance for cultivation in the mechanised farms. Moreover, in the past the commercial fuelwood production was concentrated in areas in the states of moderate deficit situation. Now commercial production is concentrated in the states with prospective deficit situation including South Kordofan. This is mainly due to the improvement in road transportation in the new states and denudation of the tree cover in the previous production areas (ABDELSALAAM 1997).

Climatic factors

The diversity and availability of NTFPs in the study area are threatened by changing ecological conditions. 15% of the respondents mentioned changes in climatic conditions as one of the constraints to the development, utilisation, domestication, sustainability and commercialisation of NTFPs. It is worth noting that the Sudan has been hit by successive droughts in the 70's, 80's and 1990's. Consequently, natural resources have undergone serious deterioration and depletion. The study area is not an exception. The outcomes of theses successive droughts had considerable impacts on the productivity of woody vegetation. The impacts of this on forest resources was manifested in wide spread tree clearance for fuel wood production to earn cash income to satisfy basic needs. High rate of forest resource depletion was mostly conspicuous in the northern parts of the study areas (Abassia, Habila, Um Berembita), which lie in the Southern Sahel Zone.

Fire

10% of the respondents mentioned that fire is the main constraints to NTFPs in the study area. The fierce and extensive bush-fire, annually started by lightening, by nomads in search of grazing, by honey gatherers and by cultivators practising shifting cultivation. "Harig" has great influence on the presence or absence of particular tree species and affected the growth form of individual tree.

The traditional "Harig" cultivation is a system of cultivation which has great impact on woodlands. The fire that has been set by cultivators often unattended sweeps to nearby woodlands and causes a lot of damage. Also the fire kills the newly established saplings and reduces soil seed banks by killing trees and grass seeds. Eventually natural regeneration is greatly affected.

On the other hand, honey gathering is quite common practice in the forests and woodlands in the study areas particularly in Talodi province. In this province honey collection is practised in naturally growing trees in

woodlands and mountains vegetation. Traditional practices of honey collection are detrimental to both honey bees and bee-forage tree species. Honey gatherers often set fire around bee hives to scare away bees in order to gather honey. These traditional methods caused a lot of damage to tree species which are key components in honey production. It has been mentioned by some inhabitants in Talodi area that in many occasions fire kills the bees themselves. Another destructive method is that honey gatherers quite often cut down the trees which have been used as bee-hives to gather honey from them.

Grazing

Grazing was mentioned by 9% of the respondents as a threat to NTFPs. Traditionally, the study area host a large number of livestock both owned by sedentary and transhumance inhabitants. Moreover, during the dry season the area is the most favoured grazing sites for nomadic tribes such as the "Shanabla" tribe who are camel raisers. A considerable proportion of livestock feeds come from shrubs and trees. Traditionally, the main utilisation of the plains vegetation away from permanent water sources is by nomad herds which graze during the rain in the drier regions to the North. As the rains ceased they move south wards or south east wards. These traditional grazing routes are disrupted by insecurity in the dry season and the mechanised farming in the wet season. Thus, a large number of livestock has been restricted to graze in a very small area resulting in the deterioration of the vegetation cover and disappearance of trees. Most affected NTFP trees are *A. senegal*, *A. seyal* var. *seyal*, *B. aegyptiaca*, *G. tenax*, *S. birrea* and *Z. spina-christi*.

Inadequate forestry extension

This constraint was mentioned by 5% of the respondents. It worth noting that like in many other countries in Africa, forestry extension activities in Sudan are still in its formative years. Extension outreach across the country in general and the study area in particular is rudimentary. The Forest National Corporation (FNC) is unduly recognised the role of extension in achieving community involvement in forestry activities. However, training assistance to farmers at field level was inadequate due to lack of trained staff and inadequate funds. In addition, currently extensionists seem less encouraged and with low morale to their jobs due to inadequate training and low remuneration.

Forest pests and diseases

The impacts of forest pests and diseases on diversity of NTFPs were mentioned by 1% of the respondents. A pests of economic importance is the tree locusts, *Anacridium melanorhodon*. Non-timber tree species most affected include: *A. senegal*, *B. aegyptiaca* and *Z. spina-christi*. An insect identified as a bag worm, *Auchmophila kordofensis* which forms a white cocoon, locally known as "Um Sigara" was reported to have some significant damage to some tree species such as *A. nubica*, *Acacia tortilis* and *G. tenax*. Bark borers were reported in some tree species such as *D. mespiliformis* and *S. birrea*. Seed borers were widespread on the pods of many tree species in particular the *Acacia spp*., *A. digitata*, *Khaya senegalensis*, *T. indica* and *Prosopis spp*..

Civil war

The effects of civil war on availability and sustainability of NTFPs were mentioned by 1% of the respondents. This factor seem of less significance as threat but in many occasions some of the respondents mentioned it as protective measure against tree clearance.

In addition to the constraints mentioned by households the following constraints were mentioned by the key informants:

Poor management of natural resources

The status of natural resource management in general and natural forests and woodlands particular in the study area typically resembles that of most African countries. It lacks management plans and means to implement such plans. WORMALD (1984) concluded that management of the public and communal woodland in the arid and semi-arid zones in dryland Africa is negligible. Even in the forest reserves management is not intensive and does not involve much more than early burning and patrolling to control grazing and agricultural encroachment. In the study area this traditional management systems have been discouraged by government who continued to maintain authorities over vast forest areas with adequate control measures. Moreover, the liquidation of the Native Administrations in 1970 and its substitutions with weak institutions had contributed significantly to overexploitation of forest resources.
According to ALDEN and MBAYA, (2001) the poor management of natural forests and wood lands which constitute the resources base of NTFPs could be attributed to the fact that policymakers are unaware of 1) the extent of the uses or the values of NTFPs in these natural forests, 2) the economic importance and the contribution of fruit trees and medicinal plant to the informal sector and national economy and 3) the magnitudes of dependence of the rural poor on the resource for food security and income. So that to realise the potentials of these natural forest and woodlands and to secure their sustainability land use planning and natural forest management plans must be made (e.g. ALDEN and MBAYA 2001). It is also essential that inventories, valuation, consumption and marketing studies be undertaken.

Extraction methods

In the study area the methods of extraction of most NTFPs are like those in most African regions. Extraction was carried out without adequate knowledge about the resource base, silvicultural requirements and the seasonal variation in their productivity will result in resource depletion and

severe environmental damage. The current extraction methods of some fruits and other items from fruit trees in the study area are detrimental to the sustainability of the resource base, pose threat to the existence of the species. Moreover, in some cases it may reduce the quality of the produce.

For example, species like *A. digitata* do not have any natural regeneration and the tree bark is continuously peeled for making robes. This practice has led to the death of large number of trees in natural stands in El Moreib and Abassia areas in Rashad province. Natural regeneration of *B. aethiopum* has been greatly reduced in some parts of study area as a consequence of tree cutting for building construction and selling of the germinated embryos "Halook" as food snacks. The stripping of *H. thebaica* leaves for making mats is one such practice that have led to the stunted growth of this tree species in areas in its natural habitat (e.g. Kalogi, Talodi and Abu Karshola).

3.4 Opportunities and potentials

Based on the results of this study and data from previous studies (e.g. ABDELMUTTI 1999, AWADALLA 1985, HAMMAD 1997, EL TAHIR 1999, SULIEMAN and ELDOMA 1994) it can be safely stated that there are great potential for the promotion and development of NTFPs in the study area. This in turn will contribute significantly to alleviate poverty, secure foods and at the same time conserve and maintain the biodiversity which is very rich and still virtually virgin for the prosperity of the local inhabitants and for the Sudan at large.

These contentions can be supported by the following indicators:

- The rural population represents the largest group and they use these products for livelihood and social and cultural purposes. During critical periods of droughts and famine some of NTFPs are the only available foodstuffs to rural inhabitants.
- Urban consumers started to grow faster for NTFPs. The use of NTFPs as food stuff is becoming more familiar to urban households (e.g. fruits of *A. digitata*, *G. tenax* and *T. indica*). Furthermore, traders and vendors of these products are increasing as urban markets grow.
- Some decades ago, the commercialisation of NTFPs in Sudan has been limited to Gum Arabic of which Sudan commands 80% of the world trade. At present, there are increasing demands locally and abroad for NTFPs especially for medicinal purposes, such as fruits of *A. digitata*, *A. nilotica*, *G. tenax*, *T. indica*, *Z. spina-christi* and other tree species. The study area particularly Rashad, Abu Gubeiha and Talodi provinces are characterised by its highest tree density of gum and resins producing tree species such as *A. senegal*, *A. seyal var. seyal* and *B. papyrifera*. Rashad province can be considered as the main production area in Sudan for frankincense from *B. papyrifera*. Its estimated (Abass Ali 2004, per. comm.) that the average annual production of this NTFP approximate 8000 ton with local market price ranged from SD 72,000- 112,500 per ton.
- Also in the study area small scale industry for the extraction of oils from *B. aegyptiaca* in Abu Gubeiha town is flourishing.
- More important in the last two decades there are changes in forest policies in the Sudan. The classical forest management approach which concentrate on the production role (mainly timber species) and gives low priority to NTFPs has been replaced by participatory forest management approach. The current forest policy recognised the social role of forests and realised the need to involve communities and other stakeholders in forest management. Consequently, the Forest National Corporation (FNC) is much concerned with integrating and planting non-timber forest producing tree and shrub species.

Sudan had ratified the Rio Conventions and concerted efforts had been exerted to fulfil their objectives to the betterment's of its population and rest of the world. However, these efforts are hampered by lack of funds, inadequate training, and inadequate resource materials. Donor supports can make great help to FNC in this respect. This can be achieved under the recently signed Nuba Mountain Peace Agreement.

4 Conclusions and Recommendations

It appears from the results that the study area is naturally endowed with great variety of non-timber forest producing tree and shrubs species. These can be found in reserved forests, natural woodlands, and communal lands or intentionally retained on private farms and holdings and homesteads. A variety of products are being extracted without consideration to the sustainability of the resource base. However, existing traditional regulations, by lows laws and customs have succeeded to some extent to protect some of these species for specific purposes and uses. Under these conditions NTFPs producing trees and shrubs are passively maintained. Both propagation and management are generally left to nature. It would be safe to say that management and utilisation of NTFP species in the study area is opportunistic on woodlands and natural forest, while small scale selective conservation on fields and by planting in home gardens is occasionally practised.

Moreover, the pressure on forested lands for agriculture and other uses has adversely affected this practice. This state of affairs calls for quick actions to safe guard the biological diversity and sustainability of produce. This could be through formulation of policy and legislations and identification of appropriate techniques to promote and develop NTFP practices.

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Appendix 1: Selected NTFP producing trees and shrubs identified by local inhabitants in the study area for food, medicine, dyes and fibre.

Botanical name	Local lame (Arabic)	Parts utilised	Uses
Acacia nilotica	Sunut	fruits, bark	medicine, tannins
Adansonia digitata	Tabaldi	fruits, leaves, bark, seeds	food, drinks, medicine, snacks, robes
Balanites aegyptiaca	Higlig	fruits, leaves, bark	food, vegetable oil, soap, forage
Borassus aethiopum	Daleib	fruits, leaves, seeds	food, drink, medicine
Celtis integrifolia	Mohagria	fruits	food, medicine, dye
Commiphora pedunculata	Luban	resins	perfume
Cordia africana	Gambil	fruit, leaves, bark	food, tannins
Cordia abyssinica	Andrab	fruit, leaves, bark	food, tannins
Detarium microcarpum	Abuleila	fruits	food, snacks, medicine
Diospyros mespiliformis	Jughan	fruit	food, chewing gum
Erythrina abyssinica	Hubelaros	fruits	perfume
Ficus sycamorus	Gummeiz	fruits	food, snacks
Gardenia lutea	Abugawi	fruits, bark	food, soap substitute
Grewia tenax	Gudiem	fruits, leaves, bark	drinks, medicine, snacks
Hyphaene thebaica	Dom	fruits, leaves	food, handcrafts, robes
Khaya senegalensis	Mahogany	bark	medicine
Lonchocarpus laxiflorus	Khaskhasazrag	bark	dye, medicine
Moringa oleifera	Rawag	fruits, leaves	food, water purification
Piliostigma thonningii	Kharoub	fruits, bark, leaves	medicine, fibre
Prosopis africana	Abusuruj	seeds	local coffee
Sclerocarya birrea	Homeid	fruit, seed, bark	food, drink, tannins
Strychnos innocua	Karmadoda	fruits	food, medicine,
Tamarindus indica	Aradeib	fruits, leaves	food, drinks, medicine
Terminalia brownii	Sobagh	bark	tannins
Ximenia americana	Mideka	fruits, bark	food, medicine
Ziziphus spina-christi	Nabag	fruits, leaves	food, snacks, medicine