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# Balancing Wood and Non-Wood Products in Miombo Woodlands

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In most of the sub-Saharan countries including Tanzania, Mozambique, Malawi, Zimbabwe and Zambia, more than 80% of rural people are poor and traditionally rely on existing non-wood goods and services provided by miombo. These woodlands are among the most threatened of the tropical ecosystems. There is a need of investigating the importance of miombo ecosystem, their threats and the governments concerned to ensure sustainable and equitable use of these dwindling resources. This paper gives an overview of the roles played by miombo in the provision of both wood and non-wood products and how the utilization can be balanced for sustainability. It is evident that there has been limited research on miombo productivity and the impact of management on non-timber product supplies. This needs immediate attention in order to address the demand-supply situation. Also sustainable use of trees and shrubs is an integral part of balancing variable products and uses in miombo woodlands. Conservation of miombo while raising the living standard can be enhanced through controlled harvesting, improved domestication and utilization and commercialization of trees and their products.

## 1 Introduction

To-date, much less attention has been paid to the widespread changes occurring in tropical dry forest and woodland ecosystems (Myers 1980, Houghton 1990, Houghton and Skole 1990) on which a majority of rural people in tropical countries depend for their livelihoods (Campbell 1987, Janzen 1988, Packam 1993, Desanker et al. 1997, FBD 1999, FAO 1999). In most of the sub-Saharan countries including Tanzania, Mozambique, Malawi, Zimbabwe and Zambia, FAO (1999) observed that more than 80% of rural people are poor and traditionally rely on existing non-wood goods and services. Moreover, FAO (1996) statistics show that forest fringe dwellers in Mozambique draw 93% of their livelihoods from the forests.

Makonda and Ishengoma (1997), Makonda et al. (1997, 1998a, 1998b) and Kessy (1998) highlighted the need of investigating the importance of forest products to the daily life of local communities in their struggle to make ends meet that sometimes threaten the forests. The economies in the miombo ecoregions are largely dependent on agriculture through poor household farmers (World Bank 1994). The nutrient-poor soils in the miombo woodlands, however, limit agricultural potential in these areas (Moyo et al. 1993). As a result, the share of the population below the national poverty line in this ecoregion has been ranging between 51 and 91% (World Bank 1996).

According to Brown and Lugo (1982) and Solomon et al. (1993), the largest area of these ecosystems is situated in Africa and about half of it is miombo. In Tanzania, woodlands cover 39.6% of the land area (FBD 1999) with potential to deliver many varieties of forest products (Mziray 1999).

Miombo woodlands can be divided into wet and dry types (White 1983), wet miombo being located on eastern Angola, northern Zambia, south western Tanzania and central Malawi with annual rainfall of exceeding 1 000 mm. Canopy height in this type is greater than 15 m. The dry miombo type is found in Zimbabwe, central Tanzania, and the southern areas of Mozambique, Malawi and Zambia, with annual rainfall of less than 1 000 mm. The canopy height in the dry type is less than 15 m (Bridges 1990).

Due to the high rate of deforestation accompanied with low land productivity (Desanker et al. 1995, Frost 1996, Chidumayo 1997) and poor land use in the miombo ecosystem, there is a need of the governments in the concerned countries to ensure sustainable and equitable use of these resources. Janzen (1988) lamented that miombos are among the most threatened of the tropical ecosystems.

This paper gives an overview of the roles played by miombo in the provision of both wood and non-wood products and how the utilization can be balanced for sustainability.

# 2 Products and Uses of Miombo Woodlands

Desanker et al. (1997) estimated 39 million people to be directly deriving their livelihoods from miombo woodlands, in seven countries. These countries are Tanzania, Mozambique, Malawi, Zambia, Angola, Democratic Republic of Congo and Zimbabwe. These authors estimated further that around 15 million urban inhabitants depend on products harvested from these trees, including food, fibre, firewood, charcoal, poles and withies.

## 2.1 Wood Products

Miombo woodlands have been providing large quantities of urban and agro-industrial fuel. In Tanzania for example the industries using much fuel include tobacco curing, salt mining, tea curing, brick burning and fish smoking (FBD 1999). Table 1 shows the trend of increasing fuel wood consumption in Tanzania between 1992 and 1996, which is an indicator of growth in population.

As documented by FBD (1999), fuel wood is becoming scarcer with time, making much of it entering the market economy. Malimbwi et al. (2000) noted that charcoal has attracted farmers to abandon farming in order to trade in this commodity. In central parts of Tanzania, up to 70% of cash income of most of the villagers comes from charcoal production.

Several authors have acknowledged the role played by miombo woodlands as chief source of hardwood timbers throughout eastern, central and southern Africa (Humbert 1959, Bryce 1967, White 1983, Phillipson 1994, Ishengoma et al. 1997, 1998, Richter and Dallwitz 2000, Mackenzie 2005).

Table 1. Per capita fuelwood consumption in Tanzania by various sectors ($MTcap^{-1}year^{-1}$).

| Year | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|
| Household | 0.766 | 0.785 | 0.777 | 0.771 | 0.834 |
| Industries | 0.093 | 0.101 | 0.110 | 0.120 | 0.130 |
| Others | 0.046 | 0.048 | 0.051 | 0.059 | 0.063 |
| TOTAL | 0.935 | 0.934 | 0.938 | 0.950 | 1.027 |

Source: FAO (1999) in FBD (1999)

## 2.2 Non-Wood Forest Products

### 2.2.1 Products

There is increasing recognition of the value of non-timber forest products from miombo including food (fruits, vegetables, fungi, roots, tubers, game meat and insects), medicine, essential oils, bees wax and honey, gum, tannins, latex, dyes, fibres, fodder and conservation functions.

Many authors have documented the role of wild foods in improving nutrition and increasing food security particularly in poor rural areas and during famine periods (FAO 1992a, 1992b, 2001, MNRT 1998, FBD 1999). In pronounced severe food shortage in Tanzania for example, wild vegetables either supplement or substitute staple foods, common in parts of Iringa, Dodoma, Singida and Morogoro (FBD 1999, Mvungi 2001). The common vegetables during the period include *Zanthoxylum chalybeum, Adansonia digitata, Bidens pilosa* and *Sesamum* spp.

Fruits are used as food, beverages, and sources of essential oils for cooking. The main fruits include *Adansonia digitata*, *Allanblackia* spp., *Parinari* spp., *Azanza garckeana*, *Uapaca kirkiana*, *Vitex* spp., *Strychnos cocculoides* and *Tamarindus indica*.

Flying termites (Kumbikumbi in Kiswahili), green grasshoppers (Senene in Kiswahili), mushrooms and bush meat are important protein sources in miombo woodlands where animal husbandry is not possible (Karmann 1998, FBD 1999). These are traded in local markets either fresh or after being fried, dried or salted.

The miombo ecosystems have high potential of producing mushrooms; over 34 edible species have been identified in Tanzania (Härkonen et al. 1995), 53 in the Democratic Republic of Congo (Lawton 1995) and 60 in Malawi (FAO 2000).

Tanzania produces about 138 000 tonnes of honey and 9 200 tones of bees' wax per year an industry which takes place in miombo woodlands (FBD 1999). Most of the honey and bees wax produced is consumed locally and only small amounts are exported to Germany, Japan, United Kingdom and the United Arab Emirates. Dewees (1996) in FBD (1999) highlighted that beekeeping and honey hunting in the miombo woodlands of Tanzania could be an especially lucrative business.

The non-wood forest products from miombo are therefore important as they form alternative sources of livelihood, contribute to poverty alleviation through generation of income, and provide food and improved nutrition, medicine and a range of products and foreign exchange earnings.

Research done in six communities in Tanzania by CIFOR (1999) found that farmers were deriving up to 58% of their cash income from the sale of honey, charcoal, fuel wood, wild fruits and vegetables. O'ktingati and Monela (1990) concluded that the value of non-timber forest products contribution to the existing low value of woodlands in Tanzania can have quite a substantial addition to the national economy.

### 2.2.2 Services

A number of services are derived from miombo including agriculture and grazing, water catchment, climate amelioration and carbon sequestration.

In Handeni Tanga for example, observed that people consider miombo woodland first of all as a resource for agriculture and cattle grazing (Karmann 1998). Such services have also been well documented by Desanker et al. (1997) for the miombo ecosystems of central Africa.

It is important to note that the headwaters of several major southern and central African river systems lie in the miombo region. Examples of these rivers and countries in which they occur are: River Zambezi (Zimbabwe and Zambia), River Kafue and Lualaba (Zambia), River Okavango (Angola and Namibia), River Ruaha, Rufiji and Ruvuma (Tanzania), River Save (Zimbabwe and Mozambique) and River Congo (Democratic Republic of Congo).

The miombo ecosystems regulate climate, operating through both the hydrological and carbon cycles (Brown and Lugo 1982, Solomon et al. 1993). The vegetation partitions radiant energy into different components thereby regulating the climate system. Vegetation is also a major source of carbon dioxide and methane which are themselves radiatively reflective particulates.

## 3 Balancing Variable Products and Uses in Miombo Woodlands

The diversity of the wood and non-wood products from miombo have been extensively recorded, however, very little quantitative information is known on the extent of their use, including actual and potential supplies which is key to sustainable utilization.

Using tree and shrub resources sustainably is an integral part of balancing variable products and uses in miombo woodlands. Conservation of miombo while raising the living standard can be enhanced through controlled harvesting, improved domestication and utilization and commercialization of trees and their products.

About 60% of the woodlands in Tanzania, however, do not have any legal status, as noted by Mnzava (1991). It is in these woodlands where a lot of uncontrolled wood harvesting and charcoal production takes place. According to UN (1994) as cited by FBD (1999), fuelwood is the second major cause of deforestation throughout the developing world.

In this way, FAO (2001) estimated Tanzania to be losing 92 000 ha/year (0.2%) of its forest land through deforestation. In Malawi, particularly Zomba area, Desanker et al. (1997) observed that the miombo woodlands had been very degraded by tobacco companies for fuel.

In these countries, charcoal is being produced from traditional earth kilns which are so wasteful as billets are not properly seasoned before carbonization starts and attention of operators to the kiln during carbonization is very inconsistent. The recovery rate is only 30% by weight compared to

60% when using metal kilns (Emrich 1985).

The demand for fuel wood and charcoal continue to rise while growth of trees and shrubs (inputs) occur at a slower rate. In Tanzania, in 1988 there was a deficit of about 21 million $m^3$/year (the human population was about 23 million), to-date when the population stands at about 37 million, the deficit is even wider than ever as it is directly proportional to population increase and aggravated by deforestation. Similar observations were made elsewhere by Campbell et al. (1996).

Such changes in land cover are likely to have caused a variety of impacts on the river regimes and water quality as observed by Mumeka (1986) for River Lualaba and McFarlane and Whitlow (1990) elsewhere. For the past five years, Tanzania has been experiencing problems in hydroelectricity generation due to shortages of water in the dams.

Marketing of miombo products can be considered as an incentive for the conservation of the woodlands (Dewees and Scherr 1996). Fruit trees that have potential to provide food security and to alleviate poverty and malnutrition have been overlooked by science, and their potential left untapped.

Though for example, Tanzania is the richest in *Sclerocarya birrea* trees in Southern Africa, they are not significantly used (FBD 1999) but harvested for timber and veneer. This is a commercially very important tree in South Africa, for distillery of famous liquor known as “Amarula”. In their study concerning domestication of wild species in Zimbabwe, Gumbo et al. (1990) revealed *Sclerocarya birrea* was the most preferred followed by *Azanza garckeana* and *Parinari curatellifolia*.

In Malawi and Zambia, Packam (1993) noted that farmers were already being encouraged to use miombo fruits in their range of products, such as the *Uapaca kirkiana* fruit processing for commercial sale. Establishment of woodlots or plantations using miombo species to carter for wood and non-wood forest products has the potentials of relieving miombo from pressures.

In comparison with honey hunting in which the revenue from bee-keeping is higher, with a small capital outlay required, Karmann (1998) was optimistic that the higher profits of beekeeping might encourage people to use resources in an environmentally friendly manner.

When considering destructive harvesting, however, expanding the markets would become even more risky. Several authors have calculated the damages of miombo woodlands due to bark harvesting and Karmann (1998) concluded that its use can only be justifiable in the utilization of the whole tree. For subsistence economies, Karmann (1998) recommended a strengthened use of NWFP with establishment of collaborative processing and marketing to favour the marketing possibilities of all product samples.

## References

Bridges, E. M. 1990. World Geomorphology. Cambridge University Press, UK.

Bryce, J. M. 1967. The Commercial Timbers of Tanzania Forestry Division. Ministry of Agriculture and Co-operatives. Utilization Section, Moshi, Tanzania. 139 p.

Brown, S. & Lugo, A. E. 1982. The Storage and Production of Organic Matter in Tropical Forests and Their Role in the Global Carbon Cycle. Biotropica 14: 161–197

Campbell, B. M. 1987. The Use of Wild Fruits in Zimbabwe. Food and Nutrition 12:3 8–44.

Campbell, B., Frost, B. G. H. & Byron, N. 1996. Miombo woodlands and their use: Overview and key issues. In: Cmpbell, B. (ed.). The Miombo in Transition: Woodlands and Welfare in Africa. CIFOR, Bogor, Indonesia. p. 1–10.

Chidumayo, E. N. 1997. Miombo Ecology and Management. An introduction. IT Publications in association with the Stockholm Environment Institute. London.

CIFOR 1999. Managing Miombo Woodlands to Benefit African Communities. CIFOR Annual Report 18 p.

Desanker, P. V., Frost, P. G. H., Frost, C. O., Justice, C. O. & Scholes, R. J. (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, Sweden. 109 p.

Dewees, P. & Scherr, S. 1996. Policies and markets for non-timber tree products.

Emrich, W. 1985. Handbook of Charcoal Making. D. Reidel Publishing Company, Dordrecht (For Commission of European Communities).

FAO. 1992a. More than Wood. Special Options on Multiple Use of Forests. Forestry Topics Report No. 4. FAO, Rome, Italy.

FAO. 1992b. Forests, Trees and Food. FAO, Rome, Italy.

FAO. 1996. Food Grains, Marketing and Improvement in Tanzania. Report of Technical Cooperation among Developing Country (TCDC). Experts on grain marketing during their visit to Dar-es-Salaam, Dodoma and Morogoro, Tanzania. 20th September to 6th October 1996. 21 p.

FAO. 1999. Non-Wood Forest Products in Mozambique. A Country Brief on Non-Wood Forest Products. Rome, Italy.

FAO. 2000. World Forest Resources Assessment, FAO, Rome, Italy.

FAO. 2001. Non-Wood Forest Products in Africa: A Regional and National Overview. FAO, Rome, Italy.

Forestry and Beekeeping Division (FBD). 1999. The Status of Non-Timber Forest Products in Tanzania. EC-FAO Partnership Programme 1998–2000.

Frost. P. 1996. The ecology of Miombo woodlands. In: Campbell, B. (ed.). The Miombo in Transition: Woodlands and Welfare in Africa. CFIOR, Bogor, Indonesia. p. 11–57.

Gumbo, D., Mukamuri, B., Muzondo, M. & Scoones, I. 1990. Indigenous and Exotic Fruit Trees: Why do People Want to Grow Them? In: Prinsley, R. T. (ed.). Agroforestry for Sustainable Production, Economic Implications. Commonwealth Science Council, London.

Härkonen, M., Saarimäki, T. & Mwasumbi L. 1995. Edible Mushrooms of Tanzania. Karstenia supplement. Vol. 35. 199 p.

Houghton, R. A. 1990. The Global Effects of Tropical Deforestation. Environmental Science and Technology 24: 414–422.

Houghton, R. A. & Skole, D. L. 1990. Carbon. In: Turner II, B. L., Clark, W. C., Kates, R.W., Richards, J.F., Mathews, J.T. & Meyer, W.B. (eds.). The Earth as Transformed by Human Action: Global and Regional Changes in the Biosphere over the Past 300 Years. Cambridge University Press, Cambridge, p. 393–408.

Humbert, H. 1959. Origines Présumées et Affinités de la Flore de Madagascar, Mém. Inst. Sci. Madag., sér. B, Biol. Vég., 9: 149–187.

Ishengoma, R. C., Gillah, P. R. & Chihongo, A. W. 1997. Properties of lesser utilized *Trichilia emetica* (rocka) and *Pterocarpus stolzii* timber species of Tanzania. Annals of Forestry 5(1): 10–15.

Ishengoma, R. C., Gillah, P. R. & Andalwisye, M. O. 1998. Some physical and strength properties of lesser known *Milletia oblata* species stolzii from Tanzania. Faculty of Forestry Record 67: 54–59.

Janzen, D. H. 1988. Tropical Dry Forests: The Most Endangered Major Tropical Ecosystem. In: Wilson, E. O. & Peter, F. M. (eds.). Biodiversity. National Academy Press, Washington, DC. p. 130–137.

Karmann, M. 1998. Investigations about sustainable Miombo woodland utilization – Examples of four villages in Handeni district, Tanzania. IV, 302 S.III., University of Freiburg, Dissertation.

Kessy, J. F. 1998. Conservation and utilization of natural resources in the East Usambara Forest Reserves. Conventional views and local perceptive. Tropical Resource Management Papers No. 18, Wageningen Agricultural University, The Netherlands. 168 p.

Lawton R. M. 1998. Cleared African forest: An Ecological Nourishment nutrition approach. Commonwealth Forestry Review 77 (4): 291.

Mackenzie, C. 2005. Mozambique: Forestry in Zambezia Province, Chinese takeaway! World's Rainforest Movement No. 96. July 2005.

Makonda, F. B. S., Hamza, K. F. S. & Ishengoma R. C. 1997. Non-Wood Forest Products: Saviours of Rural poor Communities in Tanzania. Proc. IUFRO all Div. 5 International Conference, 6th–12th July 1997. Pullman, Washington, USA.

Makonda, F. B. S. & Ishengoma, R. C. 1997. Indigenous Knowledge and Utilisation Potentials of Selected Gum, Resin and Oil Plant Species of Tanzania. Regional Conference for Africa on the Conservation, Management and Utilisation of Plant Gums, Resin and Essential Oils, 6–10 October 1997, Nairobi Kenya.

Makonda, F. B. S., Hamza, K. F. S. & Ishengoma, R. C. 1998a. Gums, Resins and Oils: The Forgotten Non-Wood Forest Products of Tanzania. Proc. International Symposium. FORESEA-Miyazaki-SEAGAIA 5$^{th}$ to 8$^{th}$ October 1998, Miyazaki Japan.

Makonda, F. B. S., Ishengoma, R. C. & Hamza, K. F. S. 1998b. The Role of Non-Wood Forest Products to the Livelihood of Rural Communities of Geita District, Mwanza, Tanzania. Faculty of Forestry Record, Morogoro.

Malimbwi, R. E., Misana, S., Monela, G. C., Jambiya, G. & Zahabu, E. 2000. Impact of Charcoal Extraction to the Forest Resources of Tanzania. The case of Kitulangalo area, Tanzania.

McFarlane, M. J. & Whitlow, R. 1990. Key Factors Affecting the Initiation and Progress of Gullying in Dambos in parts of Zimbabwe and Malawi. Land Degradation and Rehabilitation 2: 215–235.

Ministry of Natural Resources and Tourism 1998. National Forest Policy. Government Printer, Dar Es Salaam.

Mnzava, E. M. 1991. Entering the 21$^{st}$ Century: The Wood Energy Burnout in Africa. Paper presented for SADC. Workshop on Community Forestry and Wood Energy Programme. Harare 6$^{th}$–13$^{th}$ October 1991.

Moyo, S., O'Keefe, P. & Sill, M. 1993. The Southern African Environment. The ETC Foundation Earthscan Publication Limited. London.

Mumeka, A. 1986. Effect of Deforestation and Subsistence Agriculture on Runoff of the Kafue Headwaters, Zambia. Hydrological Sciences Journal 31: 543–554.

Mvungi, E. 2001. Iringa residents are living on wild vegetables. In: Mtanzania (A Tanzanian) Newspaper p. 1.

Myers, N. 1980. Conversion of Tropical Moist Forests. National Academy Press, Washington, DC.

Mziray, W. R. 1999. Current Status of the Tanzania Tropical Botanical Training Programme. In: Newsletter of the crossborder Biodiversity Project: Save Biodiversity 1(2): 26–27.

O'ktingati, A. & Monela, G. C. 1990. Multiple use in Tabora Miombo woodlands management. Journal of Tanzania Association of Foresters 8:45–51.

Packam, J. 1993. The Value of Indigenous Fruit-Bearing Trees in Miombo. RDFN Paper 15c Summer 1993 15 Agroforestry, ODI Social Forestry Network Paper 8c.

Phillipson, P. B. 1994. Madagascar. In: Davis, S. D., Heywood, V. H. & Hamilton, A. C. (eds.). Centres of plant diversity. A guide and strategy for their conservation. Vol. 1., Europe, Africa, South West Asia and the Middle East, IUCN Publ. Unit, Cambridge, p. 271–281.

Richter, H. G. & Dallwitz, M. J. 2000. Commercial timbers: descriptions, illustrations, identification, and information retrieval. Version: 4th May 2000.

Solomon, A. M., Prentice, I. C., Leemans, R. & Cramer, W. P. 1993. The Interaction of Climate and Land Use in Future Terrestrial Carbon Storage and Release. Water, Air, and Soil Pollution 70: 595–614.

White, F. 1983. The Vegetation of Africa. A descriptive memoir to accompany the UNESCO/AETFAT/UNSO. Vegetation Map of Africa (3 Plates), Northwestern Africa, Northeastern Africa, and Southern Africa, 1:5,000,000. UNESCO. Paris.

World Bank 1994. Tanzania Agriculture Sector Memorandum, 3 volumes, Agriculture and Environment Operations Division, Eastern Africa Dept.

World Bank 1996. Tanzania: The Challenge of Reforms – Growth, Incomes and Welfare, 3 volumes, Country Operations Division, Eastern Africa Dept.