

Overview of Miombo Woodlands in Tanzania

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Miombo woodlands make up a significant proportional of total forested land in Tanzania, and most of it is in general lands. The main concentrations of this formation are found in the western and the southern part of the country. Miombo woodlands are central to the livelihood systems of millions of rural and urban dwellers in Tanzania for domestic and some agro-industry activities. Utilization of miombo woodlands is unsustainable and inefficient. Deforestation is alarming, marketing and improvement of processing techniques of miombo products is crucial. To develop alternative energy sources and to make them accessible to the poor community is paramount. To invest on addressing constraints emanating when implementing collaborative management is crucial.

1 Introduction

1.1 Background Information

1.1.1 Description, Characteristics and Distribution

Miombo is a vernacular word that has been adopted by ecologists to describe those woodland ecosystems dominated by trees in the genera *Brachystegia*, *Julbernardia* and *Isoberlinia* (*Leguminosae*, sub-family *Caesalpinioideae*). These genera are quite gregarious, are found mostly in the upper canopy, and may represent up to 80% of all trees present (Dykstra 1983). Recently, the World Wide Fund for Nature (WWF) (WWF-SARPO 2001) defined the miombo as an ecoregion complex dominated by the miombo *sensu stricto* and related dry woodlands, namely the *Baikiea* and *Colophospermum* woodlands which are slightly less dense but function similarly in an ecological sense to the Miombo *sensu stricto*. The two genera *Baikiea* and *Colophospermum* are also in the sub-family *Caesalpinioideae*. Among other distinctive features of miombo woodlands are the number of tree species with meso- and microphyllous compound leaves (van der Meulen and Werger 1984); the flush of new leaves before the rains (Tuohy and Choinski 1990); the dominance of tree species with ectomycorrhizae (Högberg 1982, 1992, Högberg and Pearce 1986), and the low biomass of large herbivores.

The woodlands constitute the largest more-or-less contiguous block of deciduous tropical woodlands and dry forests in the world (Campbell et al. 1996), and are home to over 40 million people and the sources of products that serve the basic needs of an additional 15 million urban people

(Campbell et al. 1996). Miombo occurs in seven countries in eastern, central and southern Africa; namely Angola, Malawi, Mozambique, Tanzania, Zaire, Zambia and Zimbabwe Fig. 1, (White 1983).

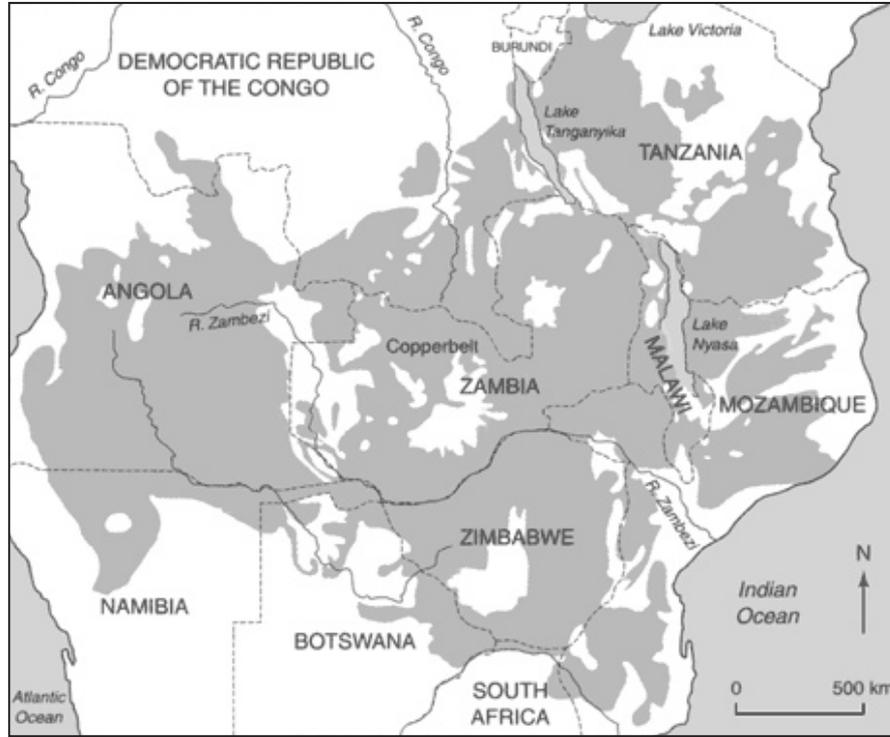


Figure 1. Distribution of miombo woodlands.

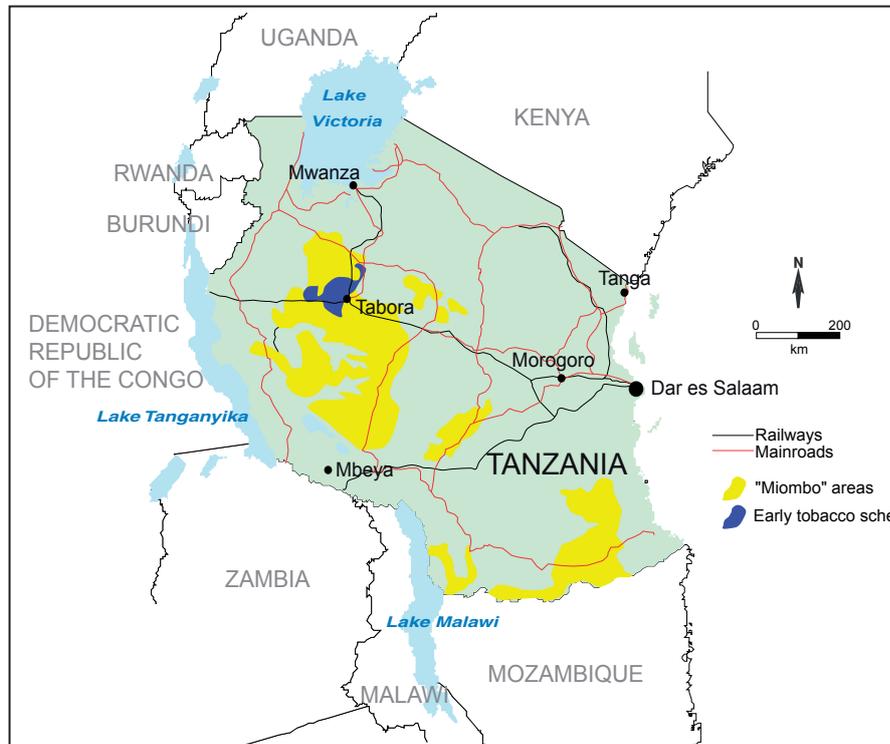


Figure 2. Location of major miombo areas in Tanzania.

They occupy an area of about 2.7 million km², almost equal to the combined land area of Mozambique, Malawi, Zimbabwe, Tanzania and Zambia (Desanker et al. 1997). Miombo woodlands in East and Central Africa can be divided into dry and wet (White 1983). The dry miombo woodlands occur in areas receiving less than 1000 mm rainfall annually. They occur in Zimbabwe, central Tanzania, and the southern areas of Mozambique, Malawi and Zambia. Canopy height is less than 15 m and the vegetation is floristically impoverished. The wet miombo woodlands occur in areas receiving more than 1000 mm rainfall per year and these are found in eastern Angola, northern Zambia, south western Tanzania and central Malawi. Canopy height is usually greater than 15 m reflecting generally deeper and moister soils, which create favorable conditions for growth. The vegetation is floristically rich (Frost 1996). The present day distribution of miombo reflects its history, particularly past climatic changes and past and present human activities (Scott 1984).

Recent coverage data of miombo woodlands is lacking. According to Ahlback (1988) this biomes make up about 90% of all forested land in Tanzania, equivalent to 44.6 million ha, out of which 54% is under general lands (URT 2001). The main concentrations of this formation in the country are found in the western zone (Tabora, Rukwa and Kigoma regions) and the southern zone (Iringa, Lindi, Mtwara and Ruvuma regions) (Fig. 2). The major species are *Brachystegia* and *Jubernardia*. Other species commonly found in this group are *Pterocarpus angolensis (mninga)*, *Albizia* sp. and *Azelia quanzensis*. Vast areas occur in the general lands (non-gazetted), which lack proper management institution, and due to lack of responsible institution these forests are rapidly deforested and degraded through socio-economic activities.

1.1.2 Species Diversity in Mimbo Woodlands

Specific species diversity is increasingly of interest within the miombo. However, there are few detailed studies in this line. Generally, the diversity of canopy tree species is low, although the overall species richness of the flora is high (Frost 1996). Woody plants make up more than 95% of plant biomass in mature woodlands but interspersed within the woodlands are broad, grassy depressions called “dambos” or “mbuga”. These seasonally waterlogged bottomlands can cover up to 40% of the landscape in some areas. “Dambos” are not old river systems, as is often supposed, but are set into the landscape through differential weathering and subsurface removal of material by the lateral flow of groundwater. They are important sites for cultivation and livestock grazing. Another notable characteristic feature of miombo woodlands are their apparent uniformity over large areas. This uniformity is partly due to the remarkably similar physiognomy of the dominant canopy trees, a reflection of their origins in the *Caesalpinioideae*, and partly due to similar environmental conditions. The miombo woodlands typically comprise an upper canopy of umbrella-shaped trees, a scattered layer, often absent, of subcanopy trees, a discontinuous understorey of shrubs and saplings; and a patchy layer of grasses, forbs and suffructices (Frost 1996). Typical dominant tree layer (canopy layer) is 15 m to 18 m in height with density of about 65 stems per hectare, under canopy trees 8 m to 12 m in height with density of 80 stems per hectare, and saplings, shrubs and herbs layer less than 8 m in height with density of 375 to 500 stems per hectare.

In Tanzania miombo woodlands species diversity differs from place to place. For example in Kitulanghala Forest Reserve in Morogoro region a total of 532 trees and shrubs distributed in 99 different species were recorded by Nduwamungu (1996). In the same area Luoga (2000) noted a total of 133 arborescent species in 31 families of which 69% had a variety of uses. Abdallah (2001) in Urumwa Forest Reserve Tabota region identified 99 species. In Iringa district, 131 species were identified from the miombo woodlands' forest: *Brachystegia boehmii* Taub. contributed

about 10% to the total number of stems, *Brachystegia spiciformis* Benth. about 7% and *Vitex payson* (Lour.) Merr. about 5%. With respect to the family managed forests, the most dominant species were found to be *Combretum zeyheri* Sond (about 20%), *Vitex paro* (Lour.) Merr. (19%) *Markhamia obtusifolia* (Bak.) Sprague (18%) and *Lannea humilis* (Oliv.) Engl. (8%). With respect to the forest reserves, the main dominant species were *Brachystegia boehmii* Taub. (12%), *Diplorhynchus condylocarpon* (Muell. Arg.) Pichon (8%), *Acacia tortilis* (Forsk.) Hayne (7%).

1.1.3 Potentials of Miombo Woodlands for Livelihood Improvement

Miombo woodlands are central to the livelihood systems of millions of rural and urban dwellers in Tanzania. Goods and services provided by miombo woodlands to livelihoods of local communities are products such as medicines, energy, food, fibers, and construction and craft materials. The services include cultural and spiritual values, climate regulations, erosion and hydrological control. All of the products and services mentioned above cover the basic needs (i.e. food, shelter, health and spiritual well being). Therefore the ranges of products from the miombo woodlands support rural living from medicines and food to building timber and fuel (Abdallah 2001). Luoga (2000) found that in Eastern Tanzania apart from using miombo woodlands for farming, local people have eleven types of uses for the trees including charcoal, firewood, poles, timber, medicine, withies, food, ropes (fibre), live fences, carving and rituals.

Rainfall in the miombo area is variable, resulting in periodic food shortages. On these occasions, the availability of wild foods and fruits, as well as other natural products that can be harvested and sold or exchanged for food, can be crucial for survival (Desanker et al. 1997). 83 indigenous tree species, which bear edible fruits and nuts throughout the year, have been identified in the Tanzania miombo (Temu and Msanga 1994), while more than 50 fruit trees are found in Tabora region miombo (Temu and Chihongo 1998). The rural communities recognize and consume a variety of these edible fruits, which are normally gathered and eaten within the locality, while some are sold in the local markets. Most of these fruits are normally available in the dry season when there is food shortage and make a significant contribution to the diet and income of the rural communities. It is estimated that humans use only 10% of the fruits potential and the rest goes to waste, due to the poor markets and rudimentary processing technologies (Nsubemuki et al. 1997). The collection of wild products is an integrated part of other types of off-farm activities and consumption frequently occur outside the home. This type of consumption results in under-reporting in many studies.

In Tanzania about 97% of all annual wood production is consumed in form of woodfuel, accounting for 91% of Tanzania's total energy consumption (FAO 1981). Woodfuel in Tanzania is used for cooking and in rural and urban agricultural industries. However, quantitative information on consumption of woodfuel for various activities is inconsistent and sometimes is lacking. For example, previous studies revealed inconsistent results in relation to small-scale tobacco curing: e.g. Temu (1979) reported that 20 m³ of miombo woodlands is used to cure 1 ha of tobacco, while Wahid (1984) revealed that 15 m³ is used to cure 500 kg. On average, of recent tobacco farmers use about 1 m³ firewood to cure 57 kg of tobacco (Abdallah and Sauer 2007). However, the actual amount of firewood used varies with the design of the barn. Most farmers use any species type and size they found, but frequently used are *Julbernardia globiflora*, *Brachystegia* spp. and *Combretum* spp.

Firewood in Tanzania is regarded as free good even if it is used to generate cash. For example although flue-cured tobacco had higher gross margin of compared with alternative crops (maize,

sunflower and tomato) in Iringa, but environmental cost-benefit analysis of tobacco production had a negative NPV, suggesting that small-scale flue-cured virginia growing on miombo woodlands would not be economically viable under current practices. Fish smoking and frying, and bricks burning are among socio-economic activity use woodfuel. Information on the amount and extent of woodfuel utilization during fish smoking and frying, and bricks burning is scarce.

Charcoal making is crucial activity in miombo woodlands and is increasingly becoming a lucrative business. Species frequently used (in case of Tabora) are such as *Pterocarpus angolensis*, *Azelia quanzensis*, *Brachystegia* and *Julbernadia*. A traditional kiln in Tabora can take an average volume of 13.96 m³ of billets of various tree species to produce 20 to 30 charcaol bags each weighing 40 to 55 kg depending on species used. The current method of charcoal production by using traditional earth kilns has been preferred by most Tanzanians as they need very little skill and low capital investment. But, traditional conversion of wood to charcoal, wastes as much as 70% of wood caloric value, thus accelerating pressure in destruction of miombo woodlands. Furthermore charcoal production venture is growing high because it is taken as part time job to supplement farmers' income. The incentives from the ready existing markets in cities and towns encourage charcoal production as a full-time income generating work. The main market is urban areas. A bag of charcaol in Morogoro is valued at TAS 12,000 while in Dar es Salaam is at 18,000. Charcoal makers can generate a profit of up to TAS 8000 from one bag of charcoal. The business is forecasted to continue in future, partially due to stagnant in technological development and inability of many consumers to switch over to alternative energy sources.

A further review of energy sector in Tanzania shows that the country has considerable amounts of alternative indigenous energy resources such as hydroelectricity, natural gas, solar energy and coal. But they do not play important role in rural and urban household energy sector because they are poorly developed with relatively high running costs. For instance, hydroelectric power is relatively playing role to the community compared to natural gas, solar and coal, its potential is estimated at 4.7 GW, of which only 10% has actually been developed.

Moreover, the coverage of electricity is only 10% and less than one percent in urban and rural areas respectively. Even in urban areas there is significant number of districts still not connected to national electric grid at all. Regions with lowest electricity coverage are Coast, Lindi, Mtwara, Ruvuma, Singida, Rukwa and Kigoma. Also, its services and related infrastructure are largely weak in both urban and rural areas, but also use of electricity for cooking is reported by only 1% of households in the country (National Bureau of Statistics 2002). Probably because the electric tariffs of 42.97 TAS/Kwh charged by Tanzania Electricity Supply Company (TANESKO – the only national electric supplier in the country) for domestic use is the highest in the SADC region (Mwandosya et al. 1997, Ubwani 2003). But the fact that prices of electric appliances are unaffordable by many households and agro-based industries, compared to the associate costs of firewood utilization, which is regarded as a free commodity could be the contributing factor for dependence on woodfuel. Therefore forests remained to be the main source of fuel for unforeseeable future in Tanzania. The main challenge is to develop these alternative energy sources and make them accessible to society.

Other important values of the miombo woodlands include revenue and employment creation, raw material supply to households and industries as well as producing a variety of non-woody products. There are other indirect contributions from these natural forests among which soil conservation, water catchment, and fodder for livestock as well as wildlife are major components (Kowero and O'Kting'ati 1990).

2 Post-Independence Modes of Development (pre 1975) and Management of Miombo Woodlands

Miombo woodlands management has a long history in Tanzania, and this can be reflected from the policy transitions since independence. For example, after a promising start during the first decade of independence, economic performance in Tanzania started to weaken in the late 1970s, and by the early 1980s. The country plunged into an economic crisis of unprecedented proportions.

Various internal and external factors can be identified behind the abrupt negative turn in Tanzania's economy. Some of contribution factors for this include: since the mid-1970s Tanzania traded in an environment of escalating world prices of oil and manufactured goods, while simultaneously, a global recession dampened the demand for primary commodities. High import prices and low export earnings led to a drastic worsening of Tanzania's terms of trade. The reduction in import capacity hit especially the newly established large-scale industrial units which, financed and planned mainly with foreign assistance.

Furthermore, increase military spending related to the 1978-79 war with Idi Amin's Uganda depleted Tanzania's economic resources and adversely affected its foreign exchange position. In the fiscal year 1979 the share of defense in total expenditure reached a high 23.3%. Finally another exogenous shock came from break-up of the East African Community in 1977, which not only ended trade with its nearest partners, but also caused the country to incur unexpected start-up costs for the new structures of civil aviation, railways and telecommunication systems.

Most of the factors contributed to the economic crisis of the late 1970s and 1980s, can be connected to the wrong choice of development policies and strategies, and misappropriation of domestic and external resources. The economy suffered from policies and administrative decisions such as:

1. Neglect of the agriculture sector, forcing it to struggle with a shortage of available funds for investment, low producer prices, little expenditure on supportive infrastructure and extension services, poor marketing arrangements for agricultural products and a poor distribution network for agricultural inputs.
2. The "villagization" programme, which forced rural people to move to communal centre, causing disruption in rural areas and, at least in the short term, involving losses of agricultural output.
3. An emphasis on large-scale industry, which was both capital- and import-intensive and suffered from technological and managerial dependencies, which aggravated problems of foreign exchange shortages.
4. Expansion of the public sector beyond the country's technical, financial and managerial capacities, resulting in a proliferation of unproductive bureaucracies and excessive administration costs across the whole system.
5. Excessive government intervention in the economy, including quantitative restrictions on all categories of imports, the fixing of interest and foreign exchange rates at artificial levels and government monopolization of various key sectors of the economy.
6. Drastic changes in policies, e.g. towards institutional arrangements in the key areas of agricultural marketing and input distribution, which paid little attention to efficiency, caused serious disruptions and prevented long-term development of the institutions involved.

When the first signs of the economic crisis emerged in the late 1970s, there was a lag before policies reacted adequately. The Government spending increased by 47.5% between 1978 and 1980

relative to a 27.6% increase in revenue. The ratio of the overall budget deficit to GNP rose by 53.4% over the same period. Similarly, government borrowing increased dramatically and averaged 65% of total domestic credit in 1981–84. In total, ineffective counter-cyclical management characterized the onset of the economic crisis in Tanzania and deepened various imbalances in the national economy. By the early 1980s Tanzania was deep in economic crisis, which is reflected in the development of macro-economic indicators for that period. This trajectory had various implications in forests management including miombo.

Economic crisis in this period reflected very well to small-scale farmer's hardships. This necessitates changes in income sources, which reflected changes in priorities and activities in the rural areas, hence changes in the rural structure. They reflect a growing dependency on non-farm activities for livelihood. How this translated into dependence on forest resources such as miombo as sources of income in this period remained unclear.

In that period there was a rapid increase in production of staples which was accompanied with increase in their real producer prices while there was decline in both production and real producer prices of major export crops. Information on the extent to which increased production drew land from forested areas such as miombo woodlands is scarce and much localized in Tanzania. For example, in Iringa region, Abdallah (2006) revealed that annual miombo woodlands deforestation rate for the period 1959–1978 was 335.7 ha/year, while for 1978–1999 the deforestation rate was 56.9 ha/year. The higher deforestation rate in 1959–1978 period could be attributed to the increased agriculture/tobacco area (173.6 ha/year), structured by firewood utilization and shifting cultivation.

On the other hand Tanzania adopted the policy of villagization in 1967 as part of a national strategy for development. It was assumed to be the best means by which the welfare and standard of living of the majority of people in rural areas could be improved. Since the majority of the population lived in isolated homesteads, large-scale resettlement was recommended as the first step in the direction of modernization. This policy entailed, among other things, the resettlement of all households outside areas of dense settlements into villages. By 1975, it was estimated that over 75% of the national population was resident in such villages. Judging from the effects of the implementation of the villagization policy, it seems that major environmental implications of large-scale resettlements were not fully considered before the plan was carried out. The extent of deforestation resulting from implementing this policy during this period remains unclear. Also, some farmers who would have moved to new villages in the preceding period would still open new farms, probably by encroaching more forests and woodlands. Consequently, the poor location of new settlements on land of inferior quality led to a sharp decline in agricultural production in the years followed villagization. Moreover, villagization necessitated the intensification of land use, a practice unfamiliar to most of the people and unsuitable for fragile environments. The result has been the spread of serious cases of soil erosion and the rapid destruction of the natural vegetation.

However, given the difficult economic climate prevailing in this period, the provision of social services declined dramatically. Accordingly the growth rates in government expenditure on education nationally and on per capital basis were respectively 0.3% and -2.8% in 1980–86. The corresponding statistics for health were -0.7 and -3.7 for the same period. These were also the same rate for the period 1972–79, indicating that perhaps the relative weight for various sectors in government priorities remained unchanged and were therefore not taking into account evolving socio-economic demands. Given the big and increasing deficit in successive government budgets

and pressure on balance of payments, it is also likely that in real terms social services received less attention by the Government. This also indirectly increased rural households' reliance on non-farm activities. It is likely that such non-farm income sources included forests and miombo woodland resources.

It is during this period that localized fuelwood scarcity as well as incidences of land degradation due to grazing started to draw national attention. In order to arrest and/or contain such situations the government initiated some specific environmental conservation oriented projects like soil conservation, with acronym HADO and HASHI, initiated in 1973 to contain extensive soil erosion in the central part of the country. In addition, government's village forestry programmes which had been ongoing since 1967/68 gained momentum in the late 1970s. Some forest plantations were established to complement and possibly to substitute for wood supply from the miombo woodlands. However, village forestry programme proceeded very slowly. By 1989 only about 8,000 ha of forest plantations had been established by the government. Therefore the effort to arrest wood demands through afforestation continued to receive decline emphasis. In fact real government expenditure on afforestation declined by slightly more than 50% between 1975 and 1985. This constrained government efforts in complementing and/or substituting for wood supplies from the miombo woodlands using plantation wood.

Overall it would appear that the demand for land has still been driven by demands in agricultural production, villagization programme, habitation due to increased population and perhaps less so from rural infrastructure to support major social services like those of education and health. The extent to which rural communities depend forests such as miombo woodlands as sources of income in this period is unknown, as well as the pattern and degree of their probably deforestation.

3 Institutional Arrangements in Miombo Woodlands

Formal forest management and conservation in Tanzania dates back to the German period, following the realization of unsustainable and destructive forest utilization through uncontrolled harvesting and encroachment for agriculture. A move was followed by the gazettment of the first forest reserve in 1906. The British administration (1920–1961) pursued the forest protection policy initiated under the German rule by protecting more catchment forests as well as other forests bringing the total reserved areas to 13,369 km² (Ahlback 1986). After independence, efforts were made to re-survey and demarcate old reserves while few new ones were created and some degazetted. By 1996, Tanzania had about 540 forest reserves ranging from 3 ha to 870,000 ha in size and covering a total of 13 million ha of gazetted forest reserves.

MNRT (1998) estimated the total area covered by forests and woodlands to be about 33.5 million ha, making up about 38% of total land area in the country. Almost two-thirds of the forest and woodland areas are found on general lands. Besides the forest resources on general lands, which are under open access regimes and the central government forest reserves, other forms of forestland tenure in Tanzania include local government and village forest reserves and private forests. These tenure systems are in line with the current land policy which divides lands into three tenure categories namely (i) General lands (lands removed from the domain of deemed rights of occupancy), (ii) Reserved lands (lands reserved principally for various conservation purposes) and (iii) Village lands (the rest of rural lands). However, despite the legal status of customary land rights, rural lands and particularly pastoral lands, primarily held through deemed rights of occupancy,

have been highly susceptible to allocation by the state often against the will and interests of local communities. Today almost 30% of Tanzania's territory is in the protected areas. Before gazettement as protected areas, these lands and resources were customarily held and utilized by rural people. However, protected areas have become "landscapes of consumption" and not "landscapes of production".

Hence, despite protection efforts by the colonial governments and later the independent state government, forest depletion and degradation has been proceeding at an alarming rate in the country. Data on deforestation rate in Tanzania differs from different source e.g. 91,200 hectares of forests and woodlands are lost each year (FAO 2000). The National Forest Policy (1998) refers to a deforestation rate of between 130,000 ha to 500,000 ha per year. The situation is alarming and therefore there is need to investigate and adopt effective remedial strategies through sound forest management practices and good forest governance.

In Tanzania, the apparent main reasons behind forest depletion and degradation have been reported to include clearing for agriculture, overgrazing, commercial and domestic fuelwood production, mining, forest fires for various reasons (e.g. tsetse eradication, shifting cultivation and hunting) and harvesting industrial wood (Misana 1988a). Shifting cultivation may account for more than 50% of deforestation on Tanzania mainland. Charcoal making becomes the second contributing factor. Illegal harvesting and mining activities are also reported (Iddi 2002) to contribute to deforestation in Tanzania. However, several scholars (e.g. Vanclay 1993, Misana et al. 1996) have argued that not all causes behind forest depletion are real, others are simply apparent or symptoms, and hence, in order to tackle the problem of forest depletion and degradation a clear and deep understanding of the causes of deforestation is essential. For these scholars, the current deforestation problem is a complex socio-economic problem generated by the interaction of economic, social, political, historical and natural factors. Thus, the real causes of forest depletion and degradation, include among others poverty, overpopulation, inadequate agrarian policies, corruption and greed, ignorance and carelessness, undervaluation of natural forests, and open access into public forestlands (general lands). Adequate solution to forest depletion and degradation can only be achieved by addressing these real causes of deforestation.

Forest depletion and degradation has several impacts that affect people's livelihoods and their environment. Some of these impacts include erosion and loss of soil productivity; acute shortages of timber, fuelwood and other forest products and services; drying of water sources and shortage of water for various purposes; floods, sedimentation of rivers, reservoirs and irrigation systems; global warming, and species extinction due to habitat fragmentation and over-exploitation. In Tanzania, due to deforestation, many parts of the country have been experiencing serious soil erosion problem particularly in the central region where miombo woodlands dominate (Misana 1988b, Misana et al. 1996). Deforestation has also affected the potential of water catchment areas in terms of the quantity and quality of water they supply. Increased sedimentation of rivers and dams, river sands and frequent flash floods are reported in several parts of the country (e.g. recent floods in Mwanza, Shinyanga and Tabora where 60% of total forest is miombo woodlands). The resulting lack of water and poor quality of water have been, in many cases, associated with incidences of many water-borne diseases such as typhoid, diarrhoea and cholera. Addressing effectively the problem of forest depletion and degradation will mitigate/reduce or eliminate those hazards and improve rural livelihoods. This can be achieved through good miombo woodland governance and sound management practices.

Tree planting campaigns in Tanzania is done national wide. First day of January each year is set aside specifically for planting trees. There are also private initiatives and incentives for tree planting by small farmers such as free distribution of seedlings. However, these settings do not frequently take into account the opportunity costs of the land, land tenure problems, availability and accessibility of markets, and so on.

Therefore, although tree planting can be seen as a suitable rejoinder to fuelwood shortages, regrettably, too often the decision to pay out meager revenue, time and land for planting trees has been roughly an imprudent retort to most of the small-scale farmers, taken without contemplation of other alternatives and the consequences of existing market and policy failures (Ahlbäck 1995, Bakengesa 1997).

The current forest management move is to designate the main responsibility of forest management to local stakeholders i.e. the villagers and village governments. A forest component, with a programmatic approach, was approved in December 2002 for a five-year period. The programme, called Participatory Forest Management (PFM) is contributing to a comprehensive reform of Tanzania's forest administration and management, which places new emphasis on participatory management systems of natural and other forests. In Tanzania, PFM has become the most important approach within the forestry sector following its inclusion in the National Forest Policy in 1998 and the Forest Act of 2002 and Land Act of 1999.

The move towards PFM has been derived from two factors: firstly, recognition that neither central government nor local governments have the human and material capacity to manage the nation's forest resources in a sustainable way without the support of poor communities living close to the forest. Secondly, there has been a political will to decentralize government functions to the lowest levels of government. The PFM attempts to secure and improve the livelihoods of local people dependent on forest resources. Hobley (1996) observed that livelihood enhancement is by involving all key stakeholders in the process of forest management, understanding their needs and situations, allowing them to influence decisions and receive benefits and increasing transparency and consequently curb the current high deforestation rate.

4 Collaborative Forest Management: a Paradigm Take-Over of Management of Miombo Woodlands in Tanzania

Early attempt to solve environmental problems without local people involvement have achieved very little success. Today the role community in the management of natural resources has become a key component in development programs (Kajembe and Mgoo 1999). Since 1998 the Government has changed forest policy from central government oriented to participatory management where communities around were given mandate to manage the forests on behalf or under joint management. Various Community Based Forest Management models (CBFM) been established with success such as Duru-haitemba (CBFM), Urumwa (CBFM) in Tabora, Mgori Joint Forest Management (JFM) in Singida. However, under JFM and CBFM the legal ownership of land remains with the Government. Village committees are co-managers of the forest and are entitled to shares in forest products. Forest protection committees control access to the forests and manage them. These local community institutions are said to proving more effective than State Forest Departments in managing the forest. Regenerating forests now provide more medicinal, fibre, fodder, and dry fuelwood and food products for rural people, whose livelihoods are thereby improved. For example, Abdallah and Sauer (2007) compared species diversity of three forest management regimes: forests under general land, community based management in Iringa region. The

study revealed that most of the species were observed in forests with lowest Shannon-Weaver Index (1.5) (see also Table 1) and with uneven relative abundances (general land forests and family forests). However, the forests under family and general lands revealed the lowest volume and basal area (11.1 m³/ha and 2.5 m²/ha respectively) compared to forests under community based management (20.0 m³/ha and 4.3 m²/ha respectively).

Further economic efficiency of small-scale farmers were correlated with species diversity of places where forest management regimes where they collect firewood for tobacco curing. The correlation coefficients indicate that a higher economic efficiency of small-scale tobacco production is associated with higher species diversity in the surrounding forest area. Since species diversity is not a direct input for tobacco production, however, it could be suggested that a more efficient use of firewood (energy saving) for tobacco curing as well as a more efficient use of land would lower the rate of biodiversity loss. In other words, reducing shift cultivation/forest clearing for new tobacco plots could reduce the rate of change of miombo woodlands to other land use.

The coefficients further indicate that CBFM has a positive impact on the species diversity of the respective forest resources. Hence community based institutional arrangements significantly would contribute to the conservation of the forests in Tanzania. This indicates the need for replication of such arrangements to other types of forest management such as those in general lands and families. This supports the view of PFM and decentralization of forest management in the country i.e. continue to transfer the control over the woodland resources to the community level because local communities are successful in curbing free-riding behaviour and in sustainably managing the resource (Deweese 1994, Ruttan 1998, Ostrom 1999, Trawick 2001, Milinski and Semmann 2002). Since forests with lower diversity indices occur in the general lands (non gazetted), which lack proper management, and harvesting is done without close supervision due to absence of or weak property rights, households producing tobacco at the expense of these forests could lead to inefficient scores. This is because forests under general lands rarely motivate conservation efforts. According to Ostrom (1999) general lands forests do not have property right, appropriators gain property rights only to what they harvest. However, the appropriators usually make no effort to conserve the resource. Frequently, the appropriators act independently and do not communicate or coordinate their activities in any way, hence these predict over-harvesting.

However, both CBFM and JFM in Tanzania are still in experimental stage. Although efforts for scaling-up JFM and CBFM in Tanzania are underway, but private sectors, donors and government efforts to provide benefits on an equivalent scale from non-forest sources and an essential supplement to agriculture are naïve. Therefore chances for poverty reduction and forest conservation reconciliation are rare.

Table 1. Forests and institutional arrangements.

Village	Forest name	Management regime	Area (ha)	Use	H'
Kiwere	Kidundakyave Village Forest Reserve	CBFM	1 985	Two zones: 1) zone of utilization (firewood for tobacco and home use, charcoal, timber, etc.) 2) protection zone.	3.4
Itagutwa	Total of 63 family based forests	Family management	699	406 ha used for cultivation (10% of this is used for tobacco production, the remaining is used for maize, sunflower, pigeon peas, beans etc.) 288 ha are reserved.	1.7
Kitapilimwa	Total of 17 family forests	General forest	436	121 ha are used for cultivation (25% of this is used for tobacco production, the remaining is used for maize, sunflower, pigeon peas, beans etc.) 776 ha are reserved.	1.5
Mfyome	Mfyome Village Forest Reserve	CBFM	2456	Two zones: 1) zone of utilization (firewood for tobacco and home use, charcoal, timber, etc.) 2. Reserved zone.	2.4
Mgera	A total of 30 family forests	Family management	1781	81 ha are used for cultivation (10% of this is used for tobacco production, the remaining is for maize, sunflower, pigeon peas, beans etc.) 1 700 ha are not under utilization.	1.5

n.a. = no forest inventory as the forests are not under utilization, H' = Species Diversity Index
 Source: Abdallah and Sauer (2007)

5 Participatory Forest Management Constraint

While many villages are participating in PFM across the country, relatively few have formalized their forest management in line with the Forest Act of 2002. This requires that villagers have an approved management plan or signed Joint Management Agreement for their forest land. The introduction of PFM is currently hampered by the cost and time taken to transfer management right to non-government stakeholders and currently only 1% of the total forest reserve area is under this form of management. For example, it is estimated that a single PFM may even take up to 4 years to realize, and cost between US\$50,000 – 100,000 to implement, depending on the size and the location of the forest. Clearly more work is needed to improve the economic efficiency of the PFM process and to streamline the actual implementation process.

FBD (2006) revealed that revenues reported from areas under JFM, particularly in catchment forests, remain particularly low. One important source of revenue from village forest management is fines levied by the village council on those found undertaking unauthorized activities in the forest. However, as law enforcement efforts by local communities increase and as illegal activities drop, revenue from fines decreases. This sometimes acts as a disincentive to local forest management as fines often represents one of the only sources of revenue to local communities from catchment forests.

The accelerated retrenchment during the 1990s, often to comply with structural adjustment policies, occurred together with the realization that centrist management strategies need reformulation. Erosion of the legitimacy of local institutions is one of the PFM constraints. Local institutions have no real authority to decide on the management of forest resources. Another challenge is with regard to the stratified communities. Interests of some actors are represented only inadequately. Lack of political will at the centre to give powers to communities and grassroots organizations is also a challenge to CBFM initiatives. It is also important that benefits must be significant if the community is to go to the trouble of establishing and enforcing the rules about resource use. This begs the question on whether community based forest management programmes/projects have sufficient value to stimulate community participation. This remains a puzzle! Rural communities are undergoing rapid social, economic, and political change, as the development and modernization process spreads and deepens. Even if effective and viable user groups exist or can be put in place today, will they survive and persist in the face of modernization pressures? Much more need to be known about the institutional context in which users now find themselves and the type of support that will increase the probability of sustainable management of our forest resources (Kajembe et al. 2000).

In some PFM projects often the interests of women are forgotten. In addition to this, conversion of general lands into JFM or CBFM restricts access to land and other natural resources by women (Rani Undated). Realities that could work against CBFM or JFM include, among others, difficulty in recognizing the most appropriate community members for programme participation, e.g. men or women (Little 1994). Women are often excluded from community organizations or committees that manage natural resources, even when the projects are intended to benefit them (IFAD Undated).

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