The Importance of Trees and Forests for the Local Communities in Dry Lands of Sub-Saharan Africa

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Abstract

The relationships between people and their natural support systems, particularly trees and forests, in the drylands of Africa have been broken as a result of overuse. The people depend on the trees and forest resources for subsistence and income generation. Local communities are losing land and tree tenure and have limited access to valuable trees and forests that they used to have under previous customary systems. As a result, they are gradually losing also their traditional resource-based income generating systems. The forest products trade at the local markets is gradually expanding but the resources are declining. The problem may be more associated with management approaches and strategies, yet traditionally managed sustainable yield of trees, forests and grass lands as integrated with agriculture, is being negatively affected. Horizontal expansion is becoming the main approach for increasing crop production to meet increasing demand for food, income generation and export policy requirements. The result is wood removal exceeding sustainable production yield leading to forest and land degradation. Efforts to stop the process of land degradation have resulted in limited achievements but in much knowledge and experience that can facilitate designing suitable approaches to development.

Introduction

The landscape of the dry tropical zone is composed of agriculture and a diversity of forest woodlands characterized by varied species composition, size-classes and densities with grass ground cover. Using the FAO definition of a forest, the major part of the open woodlands has a crown cover within 10 – 20 %. Conversion of these woodlands to below 10 % crown cover or complete clearance is becoming quite common. In spite of their low densities, the dry tropical forests play major roles in soil protection and improvement. The Savanna trees are responsible for more nutrient enrichment and addition of organic carbon, nitrogen, potassium and phosphorus in the sub-crown environment compared with the open land (Belsky 1994, Belsky *et al.,* 1989; Dunham 1991; Kamara and Cheque 1992).

The dependence of people on trees and forests is unlimited. Almost 1.6 billion people in the world rely on forest resources for their livelihood (World Bank 2001) and 1.2 billion people in developing countries use trees on farms to generate food and cash (ILO 2002). The livelihood of the communities living inside and around the forests in the dry lands depends, in various ways, on the products and services provided by a diversity of trees. People use different traditional systems to develop, harvest and utilize the multiple products of trees in the dry lands regions. They use the wood for poles, fuel, simple furniture and utensils; the fruits and leaves are used for food and fodder and the raw material like gums, resins, tannin, and fibre are used in cottage industry and income generation. The people use parts of the trees for medicinal treatments. In addition, the trees provide various services as protection, shade, amenity and cultural uses. When the people used the land for cropping, they in many cases retained the trees in co-existence with crops in an integrated farming system.

Agroforestry Practice

Recent developments in forest management have expanded its scope to accommodate methods and techniques of tree management for multiple uses rather than for timber alone in order to improve their economic and ecological role under dry lands conditions. Agroforestry is one of the recent developments in forest sciences concerned with on-farm tree management for multiple purposes. Agroforestry systems are strongly linked to human agricultural activities in the dry lands of Africa since long time. Farmers in the dry lands region, adopted management practices based on integrated farming systems in which trees exist with crops on the same farm land in various spatial arrangements and time sequence. The system exists in various forms and associated with different tree species composition. Agroforestry parklands which constitute the primary form of agroforestry systems are distributed throughout the semi-arid and sub-humid zones of Africa in varying structure and composition of indigenous species, in pure stands or mixture depending on farmer's preference and zone of occurrence (Lely 1925; White 1941; Clayton 1963; Pullan 1974; Hall *et al.*, 1996; ICRAF 1990).

The agroforestry parklands systems were described as stable plant communities of anthropogenic origin, believed to have replace d the open savannas forests (Bourliere and Hardley 1983). They were constructed by farmers through conservation of selected tree species preferred for their multiple products which are economically significancet in farmer's livelihood (Radwanski and Wickens 1967; Miehe 1986; Poschen 1986; Kamara and Haque 1992).

Much work on agroforestry has been directed towards species distribution characterized by dominance of species and by climatic zones. The species characterized by a wide geographical representation throughout the dry lands zones include *Faidherbia albida, Acacia senegal, Balanites aegyptiaca, Adansonia digitata* and other *Acacias* distributed north of 600 mm/annum

isohyets (Wickens 1969; Wickens 1982; Seif el din 1981; Hall and Walker 1991) while *Vitelaria paradoxa* and *Parkia biglobosa* are distributed south of the 600 mm/annum isohyets (Hall *et al.*, 1996*)*. Many other species were mentioned by White (1941) Pullan (1974).

Agroforestry system based on *Acacia senegal* (gum Arabic) and other Acacias producing gums and resins, has been in practice since long time in shifting cultivation system based on cropping for 4-5 years and fallows for 20 years period of gum production. Fallows are managed in distinct blocks of five years age gradation such that when the cultivation block is converted to a gum garden, a twenty years old block, no longer producing gum, is cut for cultivation.

Agroforestry systems based on tree planting have recently been developed in areas throughout the dry lands region based on intensive human and project interventions. Fast growing exotic and indigenous species are more preferred for pole production or fuelwood at short rotation (Esiddig *el. al*., 1998). On-farm tree planting is becoming more appealing because the establishment of parklands, through tree selection and conservation, is becoming difficult as a result of ecological and legislative problems in the dry lands area. Land allocation systems were formerly controlled by traditional customary rights and tribal leadership in almost all the dry land regions, granting households small land holdings for cultivation and management of selected trees. This customary system has been changed in most of the dry lands countries. As an example, the Land Settlement Act issued in the Sudan in 1970 declared that all unregistered land, which used to be common lands, is government land. Since the mid 1970s land allocation has been controlled by the government, granting agricultural land to individuals in large units of 500 – 1000 hectares for mono-cropping, rain fed mechanized farming systems.

The conversion of forest lands into extensive agricultural lands and ultimately into waste lands, resulted in great loss of access by local communities to forest resources in most of dry land in Sub-Saharan Africa (Brockensha and Riley 1986; Vermuelen 2001). Nomads in the Sudan lost the corridors through which they annually moved between grazing areas as a result of mechanized rain fed agricultural expansion in the dryland savannas.

Most of the tree species associated with agroforestry are described in linkages with settlement areas and ethnic groups like the Fur in western Sudan, (Miehe 1986) the Mossi, the Fulani and Hausa farmers and other ethnic groups in West Africa. The agroforestry systems practised by the Fur tribes is indicative of farmers' management traditions and experience in tree selection based on defined objectives. The species selection and the density and size-class structures are controlled by farmer's judgement and decision-making. The Fur know that soil fertility is maintained through animal droppings while they are feeding on *Faidherbia albida* fallen leaves and fruits. Some farmers add animal manure and spread it before cultivation of the land.

The Fur traditional agricultural systems are practised at three sites at various distances from their settlement areas. The types of crops cultivated, the objectives and intensity of management, the times of cultivation during the season and the management responsibilities within the family are strongly related to the site selected. Tree species known to be of greater use and benefit, like *Faidherbia albida* and *Cordia abyssinica* are more abundant on permanently cultivated fields closer to the settlements, while species identified to be of more limited benefit like *Ziziphus spina-christi* and *Balanites aegyptiaca,* or which have their product collected at intervals, as in the case of gum trees, are maintained on fallow fields found at greater distances from the settlement areas (Miehe 1986). In addition to the most preferred species, the Fur also know a diversity of other tree species that provide a variety of products and uses.

Many crops are cultivated on the small and medium-sized agricultural land holdings on the two sites, often associated with agroforestry systems. Some of the cereals and horticultural crops are cultivated on a small scale or on small piece of land at the homestead as a third site which are given the local name "Gibraka" where cultivation takes place early during the rainy season. The objective is to obtain early food support to the family before the main products, cultivated on the other two sites, are available. Women are the responsible managers of the Gibraka because of their presence at home. The Gibraka sites are known to be highly productive as a result of intensive management and heavy manuring with animal droppings and household waste. Recently the Gibraka system has been promoted as a village agroforestry practice where natural trees are conserved and other indigenous and exotic trees are planted (Elsiddig *et.al.,* 1998). *Eucalyptus camaldulensis* and *Eucalyptus tereticornis* are planted at home in many villages in Jebel Marra area and the selection of poles for sale to merchants is becoming everyday practice in these villages.

The traditional agricultural practices in the Fur region are similar to the traditions of agricultural practices of the ethnic groups in West Africa. Cultivation in concentric circles starting at the homestead cultivation (the central circle), then permanent agroforestry cultivation around the village (the middle circle) and the fallow system (the outer circle) at further distances from the village are mentioned in the literature (Morgan 1969; Pullan 1974; Miehe 1986; Prudencio 1993). The species composition and tree values differ between the three cultivation zones.

Trees functions and uses

Trees in the dry lands, whether in the savanna forests or the agroforestry fields, play an important role in satisfaction of peoples' needs (Maydell 1986) and in contribution to the household economy through the variety of products obtained from many tree species used. Table 1, adapted from Maydell (1986) shows that, of the 112 tree species, nearly 80% provide multiple uses.

In his study in Turkana district in Kenya, Barrow (1996) recorded 512 trees of which 43 % had recorded uses, of which 37 %, 32 %, 32 %, 23 % and 20 % were used for fodder by goats, sheep, camels, donkeys and cattle respectively in addition to human use for food (8 %) and medicine (13 %). Elsiddig *et.al*., (1998) recorded 46 tree species on the western slopes of Jebel Marra; 74.3 % of which were recorded to be used for different purposes including 50 % used for wood (including fuel), 19.5 % for food and 10.4 % used for fodder and other uses like gums and tannin.

Table 1. Total number of species and their uses in the dry lands of the Sudano-Sahelian zone, (adapted from Maydell 1986)

Item	Number	Percent	main used		lesser used	
			number	%	number	%
All species	112	100				
Uses	9					
Number of species used	89	79.4				
Used for timber	89	79.4	13	11.6	76	88.4
Used for energy	84	75.0	18	16.0	66	4.4
Used for food	83	74.1	16	14.3	67	85.7
Used for fodder	88	78.5	16	14.3	72	85.7
Used for medicine	86	76.7	33	30.0	53	70.0
Used for raw material	86	76.7	7	6.2	79	93.8
Used for protection	56	50.0	8	7.1	46	92.9
Used for amenity	61	54.5	19	17.0	42	83.0
Cultural uses	29	25.9	12	10.7	17	89.3

In terms of commercial importance and livelihood support, trees and forests occupy a central position in the household and village economy as well as at national levels. At the household level, forest products are sold at the local markets and to small merchants. Table 2 is a summary of the monetary values of tree products developed from a questionnaire and market surveys at some villages in western Sudan. The monetary values were based on the forest product consumption survey conducted by FAO (1994) in Sudan in addition to surveys and inventories in Jebel Marra (Elsiddig *et.al*. (1998).

Table 2. Percentage distribution of income generation by source as averaged for some villages in west Sudan

source	% of total
Agriculture	18.0
Forestry	
Direct sales (NWFPs, wood, ect)	17.5
Monetized income of consumed products (NWFPs, poles, energy, grazing, wild food ect,)	46.7
Manufacturing (baskets, hats, ropes, carpentry etc	1.5
Casual labor	
Forest labor	10.0
Other labor	2.0
Others	4.3
Total	100.0

Results of a questionnaire in the Fur region of west Sudan, (Elsiddig *et.al*., 1998) indicated that 16 indigenous species were used for biomass energy; 17 species for furniture and 18 species for building poles. The Fur use 19 species as a source of non-wood forest products and nine of then provide food. The surveys also indicated that there are some families in west Darfur whose income is completely dependent on non-wood forest products (NWFPs), in particular tall grasses and short poles used for huts and house enclosure construction.

The contribution of tree products, from agroforestry and natural woodlands, in household income generation and life support has been mentioned in a large number of studies and reports. The figures mentioned as percent of total income of households included 25 – 50 % of total income as reported by Lagemann (1977), 33 % of total income earned by individuals in a village in Gambia (Madge 1995), 10 – 20 % of the weekly expenses (Schreckenberg 1999), and 58 % of farmers total cash income in six Tanzania villages (Monela *et.al.,* 2000). Other authors report the diversity of tree products available in the markets throughout the drylands areas. Examples include records of 42 NWFPs from 16 tree species in the markets of Benin, (Schreckenberg 1999) and a total of 30 products from 17 tree species in the markets in Burkina Faso (Lamien *et. al*. 1996).

Trees and forests in dry Sub-Saharan Africa constitute the source of income, life support and means of survival for the poor people and women (Dei 1992, Nabangao and Gombya-Sembajjwe 2001; Mogaka *et. al.*, 2001) particularly in

periods of hardship, disasters and famine (Biellik and Henderson 1981; Cambpell 1986; Rahmato 1988; De Waal 1989; Falconer 1990; Rochelau 1991; Dei 1992). However, losing access to these products and markets can have negative impacts on rural households and can even threaten their survival (Kaimowitz 2003).

Gum Arabic, gum myrrh and gum frankincense are gaining national and regional emphasis in the dry lands of Africa in addition to their importance at the local level. Gum Arabic has a wide application in the food, pharmaceutical, textile and other industrial uses. The main uses of myrrh and frankincense are in the pharmaceutical industries and fragrances. Virtually all the gum of commerce comes from Africa with Sudan accounting for up to 80 % of the world production. The remaining 20 % is produced by another 12 African countries stretching in the Sahel from Senegal in West Africa to Somalia in the Horn of Africa. Frankincense is a product of *Boswellia papyrifera* distributed in Sudan, Ethiopia and Somalia and *Boswellia neglecta* distributed in east Africa. Myrrh is produced by the *Commiphora* species including *C. myrhha,* in Somalia, Ethiopia and Kenya.

The production of gums and resins from the acacias is also of commercial value, constituting an important source of financial revenue for rural people. The financial returns from acacia wood are very low as a result of the low density and low productivity of the trees (Elsiddig 1986). Their economic value is very much increased as a result of the sustainable production of gum over 15 years starting from five years of age. In addition, many of the acacias prove useful as shelterbelts and windbreaks against desert encroachment and have an important role in soil stabilization in addition to other benefits (Serif El Din 1981).

The well known species *Vitellaria paradoxa* distributed between the 600 mm/annum and 1500 mm/annum isohyets (Breman and Kessler, 1995; Hall *et. al.*, 1996) is known for its economic importance both at the household and the national and international levels for valuable butter and oil products. The products, used in food, chocolate and the cosmetic industries in Africa, Europe and Japan, are an important source of export earnings for Sahelian countries, as well as being sold in local markets.

Acacia senegal and the other acacias which are producers of gums and resins as well as *Vitellaria paradoxa* as a source of butter and oils may be more attractive for national, regional and international support because of their high potential for income generation for farmers throughout the region and contributing to development at the national and international levels. There are many other indigenous tree species that deserve national and regional support for their ecological and economic potentials to the communities in the dry land region. *Balanites aegyptiaca* distributed north of the 600 mm/annum isohyet is characterised by producing high quality oil which could be useful in some industries. The hormone diosgenin is used as a component in the manufacture of contraceptive pills. *Parkia biglobosa* is an associate of *Vitellaria paradoxa* and

many other indigenous species are known to be distributed through a wide ecological range and have valuable products which support communities and the region. Development of regional networking (like NGARA) to accommodate these important species may facilitate research and knowledge distribution, enhancing ecological and economic development that can contribute to land development and poverty reduction in their respective regions.

Management of Forest Reserves

The creation and management of natural forest reserves and Protected Areas under government control in the dry land region has reduced access of local communities to these forests (Ghimire 1994; Colchester 1997; Archibald and Naughton-Treves 2002; Elsiddig 2003). Economic incentives awarded for legal uses of the forest land or products inside the reserves is a valid factor in determining the pressure on the forests. Policy changes and effective law enforcement involving local communities, coupled with maximization of the legally obtainable commercial values of the of the forest's products may result in reducing the illegal activities inside the forest reserves. A management approach, developed in eastern Sudan based on collaboration between the government, as land owner, and the farmers living in villages around Elrawashda natural forest reserve (40000 hectares), provides an example of how legal rights of forest users can be ensured. The collaboration is based on a legal contract that defines the obligations of each of the two partners. The system grants each farmer land for cultivation each year such that 75 % of the land is used for crops and 25 % for forest stand establishment. The forest authorities provide the tree seeds and supervise the guarding and patrolling exercised by the farmers and forest guards as a joint activity. Farmers also accept to pay 10 – 20 % of the grain products to the forest authorities, who issue licences to the local people and local bakeries, at low royalties, for gathering dead wood and fallen trees under the control of the forest guards.

The system provided a successful experience that resulted in rehabilitation of the bare land on an annual area of approximately 400 hectares with age gradation of 1 – 6 years old units with tree stocking densities from 96 % for a one year old stand to 76 % for a six years old stand. The experience of this collaborative system indicates that revenues gained by the communities from agriculture and from wood and non-wood forest products sales contribute both to forest management and to people's livelihoods. The major part of the returns is channelled to the local area in the form of household income that helps in meeting the daily needs and contingencies. This approach will result in co-operation between the local communities and the forest authorities for law enforcement and will contribute to the sustainable management of the forests. The number of people willing to co-operate is annually increasing from 50 farmers in 1994 to 700 farmers in 2000. It started to be accepted also by the communities around other forest reserves.

An example of successful community based wildlife management reported by Lewis *et.al..,* (1989) is based on recruitment and training of local residents to provide the major share of the required workforce in the management of wildlife. Legal and sustained use of wildlife was increased by encouraging local residents to engage in small non-disruptive cottage industries that depends on either consumptive or non-consumptive use of wildlife. Results included an increased understanding and appreciation of wildlife resources, their economic values and the need to prevent non-residents from entering their area to hunt illegally (Lewis 1989).

Surveys

Causes of land degradation in dry lands are recognized, classified and understood. However, the degradation processes are still creating problems, enhanced by legislation, agricultural policies and human practices in dry lands countries. As an example, the agricultural policy in Sudan opens new lands in the Savanna region for rain-fed mechanized farming, allocating large holdings to individuals for mono-cropping grain cultivation. No longer than four years, these large area schemes are abandoned and add to the waste land as a result of declining productivity. Table 3 shows land area classified by categories of land use north of latitude 10^0 N indicating that the waste land area approximates 16 million hectares.

Table 3. Land area under different land use categories in Sudan in 2000, (areas in million ha)

Land use category	forest land	grass land	nature reserves	agricultural	waste land	desert
Area (million ha)	50.3	20.0	11.8	18.0	15.9	67.0
% of (183 million ha)	27.2	10.9	6.4	9.6	8.7	37.2

Comparing the results of a 1996 inventory with that of 1982 shows that land degradation in the form of waste land is continuously increasing. The continuous decline of the tree stocking densities is also an indication of forest degradation. The major part (42.7 million hectares) of the forest land north of latitude 10^0 N has been changed to scattered trees and shrubs with crown cover ≤ 10 % while the forest land with crown cover 10 – 20 % and ≥ 20 % are 3.1 million and 4.5 million hectares respectively (Table 3). The annual loss of forest land in Africa approximates to 5.3 million hectares (0.8 %) while the rate of deforestation and depletion of tropical natural forest is estimated to be almost 29 times the rate of reforestation, (Lanly 1982, WRI 1985)

In fact, there is a huge wealth of experience and knowledge on land rehabilitation mechanisms whether based on previous traditional systems or recently processed through project development. What is lacking is the promotion of these experiences on a large scale to rehabilitate degraded lands or to halt any

further degradation. At present many of the applications of these experiences are at the individual level of farmers or groups within communities, and in pilot projects based on extension, seedling distribution and farmers and individual people's involvement on their small land holdings. Large scale application for sustainable management based on projects and with government support is only a priority if the project improves government revenue. Rehabilitation of the Gum Arabic belt in Sudan is an example of a large scale project supported by the government and executed by UNSO during 1981 – 1994 at the national level. The activities included training of farmers on improved techniques of planting and maintenance of *Acacia senega*l gum gardens, establishment of decentralized nurseries, and improvement of gum production, cleaning and grading. The regional project titled "Acacia Operation" is another large scale project with a regional perspective, considering gums and resin-producing trees in integrated farming, supported by international assistance and under implementation of the FAO. The beneficiary countries include Sudan, Chad, Niger, Senegal and Burkina Faso and all other countries associated with NGARA.

Recommendations

Policies, legislation and development programmes should ensure community and local institutional involvement in the management of the land, trees and forests and provide clearly-stated and secured rights of access and use to these resources and their multiple products.

Arrest of further degradation of the forests and lands and the rehabilitation of the degraded ones should be built on integrated land use systems of management in which agroforestry, in all of its forms, constitute the basic approach.

The natural forest reserves and protected lands are in a state of continuous degradation and decline of stocking densities as a result of controlled formal management, prevention of local people's entry and low inputs of investment in their protection. Policy changes and effective law enforcement accommodating local communities involvement coupled with maximization of the legally obtainable commercial values of the forests may result in reducing the illegal activities inside the forest reserves and enhance forest rehabilitation and sustainable management.

National, regional and international initiatives are needed for the development of regional projects for rural development based on common interests and objectives in trees and forests that support the economy and ecology of the region

Forest-based community and rural development programmes should focus on multiple uses of the resources to improve the role of the resources in the livelihood of the communities. Consideration should be given to the technologies of harvesting, processing and marketing of forest products at the local

communities' levels in order to improve the economic returns at the local and national levels.

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