

Developments in Forestry Education in the Sudan

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1. Introduction

1.1 General

Sudan, the largest country in Africa, is characterized by diverse climatic conditions. The northern half of the country is arid, with rainfall between zero to 300 mm/annum. Just south of this zone is the savanna region, which is divided into low rainfall (300 –800 mm/annum) and high rainfall (800 – 1500 mm/annum) zones, constituting about 40% of the land area of the country. This region forms the primary natural forest area in the Sudan. However, the natural forestlands are continuously being cleared for various purposes of which mechanized and traditional farming constitute the main factors that have resulted in extensive land clearance.

Until the late 1960s , the forests were estimated to cover about 40% of the country, and to contain approximately 2.4 billion cubic meters of standing wood, which then continued to decline. At present, the forests cover only about 12% of Sudan's area, with approximately 0.8 billion cubic meters of standing wood.

Management of the natural forests is currently neglected and limited largely to the creation of forest reserves. The area of these forest reserves has reached about 12.0 million hectares, approximately 4.8% of the area of the Sudan. Since their reservation, the management of these natural forest reserves, as stated in the legislation and policies, has been based on prevention of the local communities from access except under limited permission. However, the 1989 Forest Act and recent developments in policy, put emphasis on community and private forest development as a means for peoples' involvement in forest development. At present, the management of the forest reserves has started to consider community involvement in an integrated forestry and agriculture cropping system albeit within limited areas, which is providing promising land use experience for future development inside forest reserves. The integration of trees with crops in any form indicates the important role played by forests and trees in dry tropical land use systems.

An agroforestry system maintains the existence of crops, trees and animals in a time sequence or in co-existence at the same time on the same piece of land. A number of well known tree species, associated with the system, are able to provide famine food for people and fodder for animals during dry periods. Approximately 1.2 billion people (20% of the world's population) depend directly on agroforestry products and services in rural and urban areas of developing countries, as mentioned by Leakey and Sanchez (1997). In addition, trees are able to provide shelter and protection for the land, crops and animals. Additionally, agricultural residues provide an important source of

animal feed during dry periods. This interaction provides linkages between farmers, crops, animals and trees on lands.

Agroforestry practices have been known in Sudan for a very long time and practised in various forms. Farmers used to practise traditional bush-fallow systems in sequential phases of crops and trees when the land was not a constraint. Today, a number of farmers are willing to undertake the establishment and management of parklands, shelterbelts and scattered woodlots on their small farms in simultaneous co-existence with their agricultural crops on the same piece of land.

1.2. Bush-fallow system

Sudan's age-old traditional farming system was the bush-fallow, in which sequential agricultural cropping and forest regeneration was adopted. At the end of the forest rotation (the bush period), the land was again cleared for agricultural cropping. The land was fertile; crop production was high and might continue for 5-7 years before the land had to be abandoned for another rotation forest cover. A number of factors could have contributed to the success of this bush-fallow system. First, cultivable land was not a constraint and the need for food was limited to local and national demand. Second, the bush-fallow system was given the time to complete its soil restoration function before the land was again cleared for agriculture.

Figure 1 shows the gum arabic bush-fallow production system on sandy soils with rainfall 280 – 450 mm/annum where the gum tree rotation was 20 years followed by a five-year cropping period.

Figure 1. Gum arabic bush-fallow age gradation

0-5 Years

cropping

16 to 20 1 to 5

Years years

period of gum of

production young hashab

11 to 15 5 to 10

years years

gum production gum production

The gum bush-fallow system is an indigenous practice in which every farmer used to divide his land holding into five cropping blocks under a system managed on a 25 year rotation. The system is able to continue as long as the same area of the land holding is maintained under the ownership of the same family size. However, with increasing family size the land holdings are no longer adequate for the sustainable management of the sequential agroforestry system of the gum arabic shifting cultivation. The rotation period of the bush becomes shortened to the extent that the soil fertility cannot be restored. Farmers in the gum belt are hardly able to give the *hashab* garden a 20 year rotation before they have to convert it once again for annual agricultural cropping. In many cases the period of *hashab* is reduced to only 10-12 years, which is much too short to allow the development of fertile soil that formerly took 20 years. Similar conditions also apply to the traditional bush-fallow system in which other indigenous tree species, like *Acacia seyal* on clay with rainfall 400 - 800 mm/annum, are integrated in the sequential agroforestry system.

1.3. Co-existence of trees and crops

A change from the bush-fallow system towards simultaneous co-existence of trees and agricultural crops seems to be a promising alternative and a solution to the problem of land constraint. The new Agroforestry system takes various forms depending on the spatial arrangements of the trees on the agricultural land. Parkland, shelterbelt, boundary and canal side planting and small woodlots are examples. This type of agroforestry is in most cases ecologically based (parkland) and it develops by starting from a high tree density and diversified species composition. With time, the density declines and the species composition changes. This is an important subject area for research. Human induced activities in agroforestry based on tree planting need some efforts as well. Tree species like *Acacia (Faidherbia) albida* are becoming more popular as agroforestry components in parkland systems in western Sudan. *Cordia africana* is also becoming more popular as an on-farm tree, being preferred for food production in west Darfur.

2. Current forestry education in Sudan

At present, between 55-60 forestry and forestry related subjects constitute the undergraduate program of forestry education in the Sudan at ten faculties of forestry and faculties of agriculture and natural resources based on 180-200 credit hours. Selected courses include aspects of agroforestry, environmental and socio-economic issues. Eleven courses are either complete courses or containing material on these issues. A list is presented in Table 2 below:

Table 2. Forestry related courses in forestry professional education in Sudan

1. Agroforestry systems
2. Introduction to agriculture and forestry
3. Introduction to rural extension and sociology
4. Forest policy law and organization

5. Forest inventory (inventory and management of trees on agroforestry system)
6. Extension and social forestry
7. Planning and development in forestry
8. Windbreaks, shelterbelts and farm protection in drylands (part in general forest protection)
9. Technology and industry of forest products (industries in non-timber forest products)
10. Desertification and forest environment (the role of agroforestry in combating desertification)
11. Land use

The above may indicate the possibility of incorporating environmental, social or agroforestry dimensions into forestry subjects. Surveys and interviews indicated that almost all faculties of agriculture, forestry, animal production, natural resources and environmental studies at the universities in the Sudan have courses that can accommodate agroforestry and other forestry related issues. This is in addition to separate courses which are already part of the forestry curricula in some of these faculties and is possible to be introduced in the others. However, there is a need for curricula developments that will not result in repeated contents, instead, integration are necessary.

Training by research for MSc. or PhD is presently the only training mechanism, at only a few of the universities, in the field of forestry, agroforestry, socio-economics and environment in the Sudan. The need for the development of postgraduate training courses is conceived as important due to the increase in the number of undergraduates, from different universities in the Sudan and from abroad in addition to the increasing number of applications from the Arabic and African countries. Moreover, the concern about land use, land use changes and related environmental and climate problems necessitate policy changes in the education strategy.

3. Integrated agroforestry education

With the understanding that agroforestry is the integration between people, crops, trees, animals and the land, agroforestry education will be required to incorporate the sciences of plants, animals, zoology, chemistry, economics, sociology, mathematics and engineering within an integrated approach. This means that agroforestry education has to built upon an integration of knowledge through collaboration between institutions. The training and education program mission will, accordingly, strengthen and support the capacity of institutions to generate, disseminate and apply agroforestry knowledge and skills to contribute to the welfare of farming and rural communities, particularly in the dry areas, in sustainable systems. The benefits must be clearly identified and demonstrated to all stakeholders. Within this framework, agroforestry education should have effective and positive impacts on land productivity as a result of this integration of knowledge for suitable land use practices. To be so, the education institutions have to consider farmers' knowledge and experience and use these to improve the education material.

Agroforestry education is, accordingly, based on collaboration between all stakeholders who can contribute to curricula development covering education, training, research and extension linkages and involving mathematicians, economists,

social scientists, foresters, agronomists and animal husbandry specialists. In addition, the development of medicinal plants produced through agroforestry systems requires the inputs of veterinarian and medical scientists. In these ways the strategy of agroforestry education becomes a truly "integrated approach" and the objectives are to satisfy farming communities needs for food, fodder, wood and non-wood forest products.

This clear need for an integrated management approach at education institutions and at the national level requires also the harmonization of laws and policies, regarding agroforestry education and training at the undergraduate and postgraduate levels in the Sudan.

Agroforestry education material can be based on three main axes:

- Conservation of the environment
- Participation in food security and income generation and poverty alleviation
- Better ways of utilization of the potentials of the resources to help in meeting the needs of various users

Emphasis on suitable species for various ecological zones in the dryland areas and description of recent land use practices in association with selected tree species will be necessary to facilitate species selection and good practice guidance. Here also agroforestry education and suitable supporting research, play a significant role.

4. Institutional support in Sudan

Forestry education is required to consider the lessons and experiences of the previous traditional systems of resource management were a purely formal ,government system. The negative consequences of the formal management system are reflected in:

- Decline in land productivity
- Decline in the resource base and stocking
- Increased poverty
- Climate change

The lessons gained from pilot collaborative management involving government and projects in collaboration with people in integrated land use systems provide innovative material for forestry education in the Sudan and elsewhere in the drylands. Many examples have been cited to indicate the success of integrated management systems. Lessons and experiences gained from local knowledge and practices and lessons gained from donor -funded projects have resulted in changes in government attitude from traditional (formal) management systems towards the involvement of communities and individuals. Many farmers, encouraged by agricultural and forestry extension programs, have adopted agroforestry practices.

To positively utilize such lessons and experiences and to strengthen the institutional support to forestry and agroforestry education in the Sudan, changes in policy, legislation and institutional organization should be focussed on important issues at the Forest service institutions, the Universities and the Research Institutes. Forest development and sustainable management in the Sudan requires strategies, policies

and practical actions related to forestry in general and land use in particular, that take into account the participation and involvement of all concerned parties. Forest education is one of the most important areas of activities that support such development

5. International Support

Various conferences, seminars and workshops held internationally or in Sudan, on the issue of land rehabilitation and drylands management, provided recommendations that support agroforestry development in drylands. Of interest in this field is the workshop on "Trees for Farmland Rehabilitation" held from 27, October to 7 November 2000 in Khartoum. The workshop recognized the importance of locally occurring tree species, the importance of local knowledge about them and the need for their conservation, management and development. Considering the role of institutions in this field, the workshop addressed legislators, researchers, national governments, donors and international institutions to support policies, legislation, research, in-service training and curriculum development.

4. Future Outlook

It is becoming important to re-examine previous practices, experiences and knowledge as well as more recent developments and research findings in agroforestry and to use the material for training and education at the professional and grassroots levels under drylands conditions. The Sudan dryland conditions provide a strong case in this field. The past experience and present developments in forestry, agriculture and land use practices indicate the need for revision of the education facilities so as to recognize the new developments.

- The revision of forestry curricula in general and agroforestry in particular at the undergraduate level, in the Sudan, is becoming necessary and urgent. Training in this field contributes to rehabilitation and development of all degraded land in the dry zone. This will serve the Sudan, African countries and other dry regions.
- Development in agroforestry training at the post-graduate level by research and by courses.
- Revision of policies at the relevant institutions is needed in order to support agroforestry education at the universities and agroforestry practices at government and community institutions.
- Studies and evaluation of past experience of projects, local communities and governments provide rich material for training and curricula development on:
 - Sustainable agriculture
 - Sustainable forest management
 - Economic valuation of forest and tree products and services
 - Socio-economic and gender analysis and stakeholders involvement
- Recognizing the fact that the dry tropical conditions, specially in the Sudan, could provide a wide and varied field of knowledge and facilities of training and education in agroforestry, it is recommended that:
 - An agroforestry education centre is to be established in the Sudan to promote agroforestry education under drylands conditions. At present, the Faculty of Forestry, University of Khartoum could accommodate

such a proposed centre. The existence of the faculties of Forestry, Agriculture, Animal Production and Veterinary Sciences of the University of Khartoum, on the same campus, and with about 400 staff members, can provide strong support to education and research.

- International and local support is needed to strengthen the Network of Field Research Sites established in the Central Region in Sudan and also to support the establishment of a permanent field camp. An advanced electronic station that monitors various climatic variables and soil physics parameters has been installed at Demokia Research Station in Kordofan as part of the co-operation between the Agricultural Research Corporation and Lund University. These facilities will support research, education and training in agroforestry.