

Research, Science and Technology Development in Sustainable Forest Management within the Southern Africa Context

By

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1. Introduction

The total forest area of the 14 SADC member countries is estimated at 262.8 million ha, representing about 29% of the total land area. Annual rates of deforestation in the member states range from 0.75% to 2.2% with Angola and Malawi having the lowest and highest rates of deforestation, respectively. While existing statistics on forest resources have to be updated through detailed and nation-wide vegetation mapping and forest inventory exercises, the current statistics nevertheless highlight a serious threat looming over the region's forest resources through deforestation, forest degradation and desertification, with the resultant negative implications to the environment in general. This degradation is contributing to pervasive poverty within rural communities, who depend, so much on the environment. SADC aims to reverse this situation. The Forestry Sector aims to promote sustained regional self-sufficiency in forest products through sustained forest management and biodiversity conservation.

In Southern Africa, the importance of natural woodlands in supporting the livelihoods of people living within or adjacent to them has been appreciated for many years. While the woodlands are important for soil and water conservation, provision of animal habitat, beautification of the countryside and the enhancement of eco-tourism in the region, they also provide a diverse range of wood and non-wood products. These attributes make management of the woodlands potentially attractive to local communities that reside within or beside them. Although there is a good level of ethno-botanical knowledge, precise usage figures have only recently begun to emerge. The woodlands are scarcely understood ecologically. Although basic characteristics, such as coppice and sucker regeneration and the importance of fire and grazing control are common knowledge, the precise response of individual species to light, competition and cutting is not well understood. The impact of treatment of the tree component on the ground/shrub flora and the possibility of altering the species balance through manipulation of the growing stock is nowhere documented, although such a technique is of fundamental importance to effective management.

The role of government in regulating natural forest resource exploitation in the region is being questioned, both from pragmatic and ethical viewpoints. The basis of the pragmatic viewpoint is that central government resources are becoming increasingly limited, to the point where the central government is unable to effectively manage large tracts of the country. The basis for the ethical views rests in the new paradigms, which see local people and their welfare as critically important. The last years of this century are seeing a clear move away from the centralised state-driven forest and woodland management of the colonial and post-independence periods towards decentralised and mainly community-based regimes.

In the course of this shift, the social formation of 'community' and the institutions and mechanisms that support its functioning as a management entity, are being defined in new and significant ways. Overall, the lead institutional transformations appear to be at local level, with government and NGOs accordingly reshaping their own functions away from direct management functions towards supporting technical and advisory roles. This work has been initiated in the form of co-management of state-owned forest reserves or community based management of natural forests outside the government reserves within the SADC region. To alleviate pressure on the natural forests, some research initiatives have also been undertaken with respect to tree planting in homesteads or farms generally referred to as agroforestry. This paper outlines the results of such initiatives and draws some recommendations based on the lessons learned through such initiatives.

2. Forestry Research Initiatives in Southern Africa: Towards Involvement of Communities in Forestry Management

2.1 Sustainable Management of Miombo Woodlands by Local Communities

One of the most comprehensive studies with respect to involvement of local communities in sustainable management of natural woodland was undertaken by the Forestry Research Institute of Malawi (FRIM), through an FRP DfID-funded Research Project (R6709), between 1992-2001. The study broadly addressed four areas: silvicultural and forest management prescriptions for miombo woodlands which allow utilisation and regeneration; socio-economic and cultural factors determining miombo woodland use and management; development of guidelines for planning community-based management of forest resources and production of model forestry plans for community-based forest resource management.

Through this study, it has been demonstrated that coppicing can be employed as means for regenerating and managing miombo woodlands (Lowore, 1997, Ngulube *et al* 2000). However, the choice of which silvicultural systems to use will largely depend on the nature and management objectives of the forest resources. Socio-economically, non-timber forest products (NTFP) are the most important for the livelihood of the rural communities, particularly mushrooms, fruits and firewood, were noted as the overall most important commodities (Abbot, 1997; Ngulube *et al* 2000). Curios, construction material, implements, bamboos, reeds and pharmaceuticals are also some of the major products, but it was noted that the importance of such products varies with site and culture (Coote *et al* 1993; Lowore *et al* 1993).

Any management options for forest resources should therefore evolve around improving productivity of the major NTFPs if the communities are to be fully involved. Such management options should aim at selecting the optimum combination for realising sustainable production of the major products with ease. Good inventory data on growth rates, distribution and density of different products in the forest ecosystems is a prerequisite in this respect (Malibwi, 1999). Without good yield data and matching data on extraction rates (the flow) per unit area, it is almost impossible to decide whether a given practice is sustainable in the long run or not. In this respect, the study revealed that a participatory approach in developing guidelines and management plans for community-based forest resources is ideal (Probyn, 1997). All stakeholders should actively be involved at all stages of the process for successful implementation of forest resource management plans.

Several issues were identified for further attention in order to complement the results achieved in this study. Institutional arrangements, policy framework, tenurial and collaborative arrangements, costs and benefit sharing mechanisms, monitoring and evaluation mechanisms and conflict management, were some of the urgent issues requiring attention.

2.2 Management of Miombo Woodlands: Policies, Governance and Harvesting

CIFOR leads a project entitled “Management of Miombo Woodlands”, funded by the European Union, being implemented in the miombo woodland countries of Malawi, Mozambique, Tanzania, Zambia and Zimbabwe. The focus of the research is to increase the understanding of the management and use of the miombo woodlands and how different policies influence man-woodland interactions in order to guide sustainable management of the woodlands. The outputs of the project, shall among other things, include new information to guide decisions on the involvement of local communities and local populations in the management of the woodlands, as well as guidelines on appropriate harvesting procedures. In addition, the project is expected to increase the understanding of how policies impact on people and eventually on the woodland resources.

Useful results are already emerging (Kowero, 2001) with respect to community empowerment, institutional change and factors driving change, institutional change and capacity for community-based management and conflicts and their resolution. Experiences in the region on community-based natural resources management (CBNRM) vary greatly and CBNRM appears to be successful where there are high value resources such as for CAMPFIRE in Zimbabwe. Imposition of rule systems and institutional frameworks on communities as observed for the colonial era generally results in a general breakdown of the existing community institutions (Kowero, 2001). Both formal and informal woodland resource use rules exist, but enforcement mechanisms and penalties in both cases are unclear. Multiple institutions with unclear mandates exist and a history of empowerment and disempowerment of resource management institutions have been revealed. The major drivers of change include: policy reforms and changes that come with different governments, pressure on land or resources from increasing population and nature of the resource base.

In terms of conflicts and their resolution, the study has revealed that population pressure on the resources has potential for promoting conflicts. Land-based sectoral policies and legislation are sometimes conflicting and have potential to create conflict. However, it has been noted that conflict and conflict resolutions in the management of miombo woodlands are complex issues requiring a clear understanding of socio-economic and environmental fundamentals. It has also been revealed that most CBNRM initiatives are externally facilitated or imitated. Evidence indicates that the complex interactions among the characteristics of the woodland resource, the property rights regime, the institutional arrangements and the socio-economic environment determine the degree of success of CBNRM.

2.3 Adaptive Collaborative Management of Forests

This project is led by CIFOR with major funding from the European Union and is being implemented in Malawi and Zimbabwe in this part of Africa. The project seeks to improve the ability of forest stakeholders to adjust their systems of management and organisation to respond more effectively to the challenge of dynamic complexity. The research therefore focuses on developing concepts, management principles, tools and policy recommendations. In this respect, three questions underpin the concept of adaptive collaborative management (ACM):

- ? Can collaboration among stakeholders in forest management, enhanced by processes of conscious and deliberate social learning lead to both improved human well-being and maintenance of forest cover and diversity?
- ? What approaches can be used to encourage sustainable use and management of forest resources?
- ? In what ways do the processes and outcomes of ACM impact social, economic, political and ecological functioning and how does this feedback reinforce or weaken forest management?

Preliminary results indicate unclear policies negatively affecting implementation of ACM activities in Malawi (Ngulube, 2000) and Zimbabwe. Other emerging key issues include: low collaboration among the various stakeholders and management institutions, conflicts on benefit sharing mechanisms and resource use, power imbalances among local management institutions and poor communication and information flow among stakeholders.

2.4 Agroforestry and Community Forestry Initiatives

A project on Agroforestry Research for Development in the Zambezi Basin with major funding from CIDA is led by ICRAF (International Centre for Research in Agroforestry) and being implemented in Malawi, Tanzania, Zambia and Zimbabwe. The objective of this project is to improve land use productivity in the miombo eco-zone through agroforestry technologies for improved soil fertility, fodder production, rotational woodlots and domestication of indigenous fruit trees. A participatory rural appraisal was undertaken to identify constraints and some comprehensive studies have been undertaken to facilitate identification and selection of suitable agroforestry species in the miombo eco-region. A series of species and provenance trials involving indigenous species, lesser-known Central American dry zone species and Australian dry zone acacias were undertaken (Maghembe and Prins, 1994; Ngulube, 1990; 1994; Ngulube and Mwabumba, 1992; Ngulube *et al* 1993).

The regional programme embarked on intensive participatory on-farm evaluation of a range of species and management options associated with priority technologies in each of the participating countries. Several NGOs and development agencies and national research institutions are collaborating with ICRAF in evaluating agroforestry technologies and disseminating information. To achieve this, informal adaptive research and dissemination networks have been established in a few critically selected extension pilot areas in each country. The networks involve ICRAF, national extension networks, research institutions and farmer groups. They are the focal points for participatory evaluation and dissemination of the technologies by farmers and for training farmer groups. Formation of these networks followed a consultative approach involving all stakeholders, including farmers and policy makers.

Promising results have been achieved with improved fallows using *Sesbania sesban* in Zambia, both on the station and with farmers. This system has proved beneficial on subsequent maize yields over ordinary fallows or unfertilised plots, continuous monocropping or rotational cropping. Mixed intercropping with *Gliricidia sepium* is also being evaluated and has so far shown great promise. *Tephrosia vogelii* and *Cajanus cajan* have also been used for improved fallows with positive results compared with continuous maize cropping. Fodder banks using *Acacia angustissima*, *Caliandra calothyrsus*, *Cajanus cajan* and *Leucaena leucocephala* have been tested and promising results have been reported with regard to improvement in milk production in both Tanzania and Zimbabwe (ICRAF, 1996). Browse species being evaluated include: *Leucaena pallida*, *L. diversifolia* and *Gliricidia sepium*.

Rotational woodlots are being tested in this programme and such woodlots have four phases as follows: establishment (two years during which crops may be grown between the trees), tree growth (2-3 years during which prunings may be used for fodder or fuelwood), harvest for fuelwood/ poles and cropping, during which resprouts are used for fodder or green manure and decomposing roots and litter may improve soil fertility. *Azadirachta indica*, *Leucaena leucocephala*, *Acacia polyacantha*, *Senna siamea* and *Albizia lebbbeck* are some of the species being evaluated. Evaluation of indigenous fruit trees for domestication is being undertaken with several species, *Sclerocarya birrea* and *Uapaca kirkiana* being the major species (Maghembe *et al* 1994). Provenance evaluation of the two species is being undertaken on station and with farmers and useful results have already been indicated.

3. Emerging Research Issues

3.1 Ecological Dynamics

A number of questions on forest/woodland ecology remain to be answered. To what extent do the details of ecological functioning of woodland vary across the geographical range in Southern Africa and what are the associated environmental driving forces? Are the woodlands a nutrient – limited system or are they primarily water – and therefore carbon-limited? What are the ultimate constraints to ecosystem productivity? Are nutrients critical to functioning of the woodlands and what are the patterns of their availability, what controls these and how do they vary across the diversity of woodlands type? Another set of questions concerns ectomycorrhizae. What are the various functions of these mycorrhizae and why are some woodlands dominated by ecto- rather than endo-mycorrhizae? What is their contribution to mineral nutrition of the host plant? These are particularly critical when it comes to domestication and management of indigenous trees.

Then there are questions concerning vegetation dynamics. Is there a single equilibrium state in which the dynamics are strongly internally regulated and buffered against unpredictable changes in driving forces, or are there multiple states with or without non-equilibrium dynamics? Most woodlands are remarkably resilient to cutting and grazing because the trees produce profuse coppice shoots and root suckers. In addition, they have vast numbers of suppressed seedlings and saplings. The widespread clearance of these woodlands therefore affects the nature of plant cover since the eventual death of sprouts and rootstocks or exhaustion of seed resources will eliminate the species locally. Because of their low dispensability, they will not easily re-invade these areas making recovery slow and uncertain and lend the land susceptible to invasion by woody weeds.

Information on population ecology of individual species is lacking. Such information will be essential for developing technical options for woodland management as well as feed into models of woodland dynamics. In short the major task for ecologists in the region is to elucidate the biophysical framework within woodlands function as this framework will set the limits of utilisation. The whole host of ecological factors need to be investigated. And more important than single factor analyses, is the need to investigate how the factor interact in space and time, as it is believed that interactions of determinants are more important than determinants acting alone. Within this analysis of determinants, a major focus should be on ecological productivity.

3.2 Household Economy

While the descriptive aspects of woodland use and management have received much attention throughout the region, analytical work on the determinants of woodland resource use and management should now be given priority. Studies here should seek to link broader patterns of agricultural production and household economics with tree-related land-use choices. They should address the differential impact of the use of woodlands across groups of households. The focus should be on which household, when and under what conditions? In addition, substantive economic studies are required to consider the role of woodlands in diversifying household access to inputs into farming systems and its relationship to risk; the association between food security and a dependence on woodland resources; and the balance between subsistence and market demands for woodland products.

3.3 Commercialisation of Forest Products from Natural Forests

Many national forest policies in Southern Africa are geared towards limiting the commercial exploitation of woodlands. Control regimes, licensing, and royalty collection from users of woodland products feature prominently in approaches to limit woodland exploitation. These policies focused on regulating woodlands use rather than on creating an enabling environment for woodland management. While agricultural policies were geared towards increasing the supply of agricultural commodities, policies towards forest products are typically geared towards limiting supplies of woodland products.

From various literatures, it is quite clear that woodland products are an important part of the economy of countries in Southern Africa. The problem here is that there is little knowledge on the structure of trade for many of these products. Studies now need to focus on the constraints on sustainable woodland management for the market at the local level and how these constraints might be removed. Research is also required on individual products to find out how to improve handling and storage as well as improved utilisation of resources and expansion into new markets. We also need to increase our understanding of the temporal dimensions of markets and marketing channels, their contribution to livelihood strategies and gender differentiation, their impacts on local and institutional arrangements and on woodland structure and function. Lastly, market research should consider the extent of income and employment associated with particular markets; possible employment alternatives; social costs of limiting the operations of

these markets; what are the potential and comparative advantages of substitutes and what constrains communities and households from managing woodlands to provide supplies for the market on a sustainable basis.

3.4 Management of Natural Forests

The challenge here is to incorporate a variety of objectives in management operations i.e. elements of forestry, wildlife, livestock production and apiculture. A further challenge is to adapt management strategies within the context of common property resources. Several technical questions arise in this respect:

- ? What are the upper limits of production and how can these be achieved?
- ? How can we manage systems that may be partially event driven and in which interactions are more important than the determinants by themselves?
- ? How and to what extent can forestry principles be applied in communal areas?
- ? Is it possible to build on local indigenous management practices?

Woodlands are mostly used communally. Thus an analysis of the household use of woodland products has to be anchored in the debate on the status and use of communal resources, and the complex interactions among a number of factors, not least of which are the nature of tenurial control and the state of local and government institutions. The role of in regulating natural resource exploitation is being questioned, both from pragmatic and ethical viewpoints. What new or modified institutional arrangement for natural resources management is required? How can they be supported? Can devolution of authority over natural resources management be applied?

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