REQUIREMENTS FOR AND FACTORS AFFECTING BIODIVERSITY: A WEST AFRICAN PERSPECTIVE

A. B. OGUNTALA

FORESTRY RESEARCH INSTITUTE OF NIGERIA, JERICHO, IBADAN. NIGERIA

ABSTRACT

In West Africa, due to over-exploitation of natural resources there is threat of loss of biodiversity. Biodiversity is a matter of survival as it is the source of food, fuel, medicines, housing materials and economic security.

Ecological principles necessary for the management of biodiversity must be clearly understood before they can be applied. Critical species, habitats and ecosystems exist throughout the West African landscape ranging from parks, pasture lands, forest reserves to fallow fields. Much of West Africa's biodiversity exists outside the protected area system and they require urgent protection. Improvement in resource management needs to be applied across the full spectrum of ecosystems and habitats within each country.

A multi-disciplinary approach is needed in the development and implementation of strategies for the management, conservation and utilization of biodiversity resources on a sustainable basis. More research is however needed and very urgently too in the taxonomy, ecology and utilization of West Africa's biological resources, before they become extinct.

Key words: Biodiversity, exploitation, conservation,utilization research.

INTRODUCTION

Biological diversity must be treated seriously as a global resource, be indexed, used and above all preserved. Three circumstances make it imperative for this to be given an unprecedented urgency, particularly in West Africa. Firstly, exploding human populations are degrading the environment at an accelerating rate in the sub-region. Secondly, science is discovering new uses for biological diversity in ways that relieve both human suffering and environmental destruction. Thirdly, much of the diversity is being irreversibly lost through extinction caused by the destruction of natural habitats, which is occurring more in Africa than elsewhere (Wilson, 1988).

Biodiversity is a vital resource because it is the gateway to better and faster supplies of matter and energy to humans (Lal, 1991). Unfortunately plant biodiversity survey, documentation and conservation activities are not keeping pace with this rate of forest exploitation and destruction in West Africa. The pressure on land as well as the impact of the land-use patterns have led to the destruction and erosion of many valuable plant germplasms that are of current and future potential importance.

Most urgent attention is however needed on the tropical moist forest ecosystems because, of all the major habitats, they are richest in species and are in greatest danger of destruction (Wilson, 1988). The fundamental problem of loss of biodiversity in West Africa may have less to do with the amount of land under protection than with the forms of land-use taking place on the remaining portions of the landscape which in most cases represent far larger areas than those classified as protected.

In Africa, about two-thirds of the land that could support habitats for wild plants and animals is now used for other purposes (Mackinnon and Mackinnon, 1986). Nevertheless, Africa still contains a wealth of biodiversity. Whereas in certain parts of the world it may be too late to

stem the loss of much of the biodiversity that formerly existed, in most of Africa (West Africa inclusive) the opportunity still exists for proactive intervention (Biodiversity Support Programme, 1993).

Efforts to protect the natural environment must have a holistic approach in West Africa and elsewhere. New strategies for conserving biodiversity in West Africa are urgently needed that:

- respect and incorporate African values, knowledge, systems and priorities;

- involve the local people in the management and use of biological resources;

- can control or reverse the loss of biodiversity in every country in the region; and

- treat biodiversity conservation and economic development as integral aspects of the same process of sustainable development.

In this paper, an attempt is made to focus on the requirements for the conservation, management and utilization of biodiversity resources in West Africa on a sustainable basis.

Requirements for Biodiversity

The ecological principles relating to biodiversity have to be understood before they can be applied effectively particularly in the management of forest resources. The fundamental principles related to biodiversity according to Lal (1991) are:

- The greater the diversity of an ecosystem, the more stable it is in terms of resilience to the human impact. The West African forestry practices which in the past gave preferred treatment to some selected so-called economic species at the expense of others reduced the stability of the forest ecosystems leading to their complete conversion to monoculture plantations, which are less stable.

- The diversity of an ecosystem increases as a function of time during succession from an initial state where it had a minimum value to one where it has maximum, when the ecosystem is called a climax community. In the Nigerian or West African context it should be kept in mind that most of the natural forests are not climax, but seral communities which have been continuously disturbed by human activities. Climax forests are now rare in West Africa. If human interference in these ecosystems is stopped or controlled, the ecosystems will evolve towards more species diversity, while in the process their immediate economic value will decrease because conservation activities reduce economic gains in the short run.

- The biomass/productivity ratio of an ecosystem is proportional to its biodiversity. Man-made forests or disturbed natural forests though poor in species are more productive than undisturbed natural forests. Productivity of environment, nevertheless, is as important as its stability. Monocultures are however fragile and susceptible to environmental disturbances. It is therefore necessary that natural forests with high biodiversity values should serve as genetic pools after careful studies. Destructive human intervention should be excluded from such forests eg. Strict Nature Reserves or World Biosphere Reserves.

- Species diversity is dependent on the stability of the environment. Communities which evolve in stable environmental conditions or which have suffered only regular or foreseeable fluctuations show the maximum species diversities because of the influence of the nearby undisturbed forests.

- Ecosystems rich in diversity exploit ecosystems poor in diversity. In other words, mature, climax communities remove matter and energy from immature communities. For example, mature forests attract epiphytes like orchids, wildlife and other rare species. They also store water and nutrients removed from more disturbed areas.

Maintaining Structural and Functional Diversity

Preserving biodiversity in West African countries and in other countries requires the maintenance of all successional stages. Since early successional stages are typically well represented, a major concern is preserving or re-creating the mature forest. Such mature forests typically contrast with early successional stages in composition, structure and function.

Due to human pressure, most West African forests are disturbed forests that have developed after logging or silvicultural treatments; the composition and structure of these forests have changed in comparison with the original forests. The mahogany dominated forests of Sapoba Forest Reserve, for instance, in Edo State of Nigeria have changed to other species previously regarded as uneconomic.

Functional differences between mature and young forests are often qualitative rather than quantitative. That is, forests at all stages fix and cycle energy or carbon, regulate hydrologic flows and conserve nutrients. Mature forests present a very large crown surface and occupy an extensive volume of space, because dominant trees in West Africa are commonly taller than 50m. Such forests are particularly effective at gleaning moisture from clouds and fog, which can substantially increase precipitation (Harr, 1982). In addition, the mature forests provide several important sites for nitrogen fixation (eg. epiphytic lichens) and decomposing wood, which are more limited or absent in earlier stages of succession. Mature forests and the organisms and processes that they represent are an essential aspect of global biodiversity at risk. Thus preserving or re-creating mature forests should be a key objective of any conservation programme. Such efforts would be timely in West Africa since there are still opportunities to retain some mature forest ecosystems and to allow younger forests including man-made plantations to develop into mature natural forests.

Rate of Change in Tropical Forest Areas

The rate of change in tropical forests of all kinds has been discussed in depth by Lanly (1982) who made an effort to document the rate of increase in the area of secondary forests (by reforestation, afforestation and natural regeneration) as well as of the rate of forests loss. Other attempts usually emphasize conversion or modification of mature forests with little or no analysis of recovery (Myers, 1980). Lanly (1982) showed that of the 11.3 million ha of mature tropical forest land deforested annually, 5.1 million ha are converted to secondary forest fallow. He estimated that the total area of this forest type is 409 million ha and almost one million hectares of secondary forest is created annually on unforested land through natural regeneration or human intervention (Lugo, 1988). Such large forest areas cannot be dismissed as irrelevant to the conservation of species diversity because they support extensive biota and because under certain conditions they are capable of supporting more complex biota than the mature system they replace (Ewel, 1983). Lanly (1982) also showed that deforestation rates are higher in closed than in open forests. Within closed forests a large fraction of the conversion involves logged forests that have previously been modified by human activity. Moreover, recovering secondary forests are potential foster ecosystems for endangered species and their role in species conservation must be considered.

The Extent of Deforestation in Africa

Out of the total land area of Africa constituting 2,236 million ha only 568 million ha was covered with forest in 1980. In 1990 only 527 million ha of forests were left, representing an annual change within ten years of 4.1 million ha or - 0.7 percent annual rate of change. Comparative annual rate of change (ie. deforestation) in Latin America was - 7.4 and Asia - 3.9 million ha (FAO, 1993).

The tropical rainforest of Africa occupies 118.5 million ha, compared with Asia 306 and Latin America 522.6 million ha. Deforestation is also continuing in the dry and very dry zones.

According to the FAO (1993), the total land area of this zone is 823.1 million ha, with a forest cover of 151.2 million ha or 18% of the zone. Annual deforestation rate in the zone is 1.1 million ha or 0.7%.

The total amount of operable productive forests in Africa (FAO, 1993) was 169.2 million ha, unfortunately only 2.0% of these forests were put under an organised management system. The remaining forests have no working or exploitation plans. Uncontrolled exploitation both legally and illegally have reduced the forests to derelict forests. Studies of the growing stock of productive forests in some selected African countries was carried out by FAO in 1984. Table 1 shows the estimated, current and projected values of growing stock in some selected countries including Nigeria. Three African countries, Cote d'Ivoire, Nigeria and Senegal may have nothing left in their closed productive forests, by the end of the century. Skoup (1986) reported that Nigeria has been losing on the average about 23,000 ha of gazetted forest estate per annum through Government dereservation alone.

Over 350,000 ha of forests and savanna woodlands are estimated to be destroyed each year through clearance for farming, uncontrolled fires, or conversion to some other forms of land use, (World Resources Institute, 1987). The cumulative effect of all these is that in Nigeria, which in 1897 had 60 million ha of forests and woodlands, now has only roughly 9.6 million ha of forest reserves, much of which is degraded and only 2.4 million ha are in the forest zone - a loss of over 50 million ha in less than 100 years. Between 1981 and 1985 closed forests were being converted at the rate of 5 percent per annum in Nigeria (World Resources Institute, 1987).

Causes of Deforestation

There are several agents of deforestation in Africa and Nigeria in particular. The main causes of deforestation are population growth and the expansion of economic activities including logging or timber extraction, farming, urbanisation, bush burning, firewood collection,

Table 1: Estimated growing stock in selected closed productive African forest (million m^3).

Country	1980	1990	2000	Variation 1980-2000
Angola	270	222	173	(97)
Ghana	198	165	132	(66)
Guinea Bissau	25	16	8	(17)
Cote d'Ivoire	766	99	0	(766)
Liberia	220	145	70	(150)
Nigeria	492	44	0	(492)
Senegal	2	0	0	(2)
Cameroon	4,645	4,434	4,223	(422)
Central African Republic	1,102	1,086	1,070	(32)

Source: Outlook for the Forestry Sector in Africa, FAO, 1984.

grazing and infrastructural development (NEST, 1991; FAO, 1993). During the oil-boom years of the 1970s in Nigeria there was a massive increase in construction activity which heightened the demand for timber. Most of the timber came from the high forest, inside and outside the forest reserves. There was a breakdown in the regulation of logging activities in these areas. Consequently the country's standing crop of valuable species has been severely depleted and in some cases have become endangered. Outside constituted forest reserves, the main deforestation agent is the farmer. Over 75% of the total forest area cleared yearly is by these farmers (NEST, 1993). The tendency is for farmers to encroach on forest reserves where the soils are relatively more fertile. More recently multinational companies have also joined the forest clearing bandwagon in the drive to derive raw materials locally and increase food production.

Bush burning is another notorious agent of deforestation in Nigeria and West Africa. The burning is done by farmers who use it for land

clearing, herdsmen who use it to regenerate grass, hunters to kill wildlife and some villagers to clear their surroundings (NEST, 1991).

Over-exploitation for firewood as well as overgrazing is a major cause of deforestation in the savanna. Clearfelling of trees for commercial firewood without any thought of regeneration is a common practice in many African countries. The rocky hill slopes are not spared. Overgrazing is a serious problem in the Sudano-Sahel where overstocking around watering points often results in serious damage to vegetation.

Conservation and Biodiversity Issues

There are a number of common issues which have bearing on the preparation of any biodiversity conservation Strategy Plan (ODA, 1991):

- There must be a common agreement in what is valuable. An ethnobotanical survey needs to be carried out in which the views and cultural values of the local inhabitants are incorporated. It is not the views of Government officials alone that determine the value of biodiversity.

- It is important to recognise the fact that biodiversity objectives will vary according to various communities for whom the forests in their locality have become their heritage. For instance, the values placed on the forests in Omo Forest Reserve in Ogun State are different from those of Taylor Creek Forest Reserve in Rivers State of Nigeria or from those of Ehor Forest Reserve in Edo State. Deforestation is quite rampant in Omo Forest Reserve compared to the other two reserves, where there are more conservation efforts.

- The objectives of biodiversity conservation must be precise to be useful. For example, the objective "to maintain as much diversity as possible" is very vague and unhelpful to forest managers. A precise definition of goals and measure of biodiversity needs to be set for the management of each forest reserve. Depending on the species composition and structure of the forests, the emphasis may be on shrubs, climbers or herbs rather than on trees.

The wider objective of any biodiversity programme is to maximize the conservation and use of biodiversity in order to provide sustainable, social and economic benefits to the generality of the people. For example, the most deserving habitat or forest reserve in one country might have a very low global priority. The reverse is also true. For instance the conversion of the Strict Nature Reserve in Omo Forest Reserve, Nigeria, into a World Biosphere Reserve has saved the most mature forest in Ogun State from destruction. Various adjacent plots have been seriously tampered with.

CONCLUSION

Species richness can be partially restored to lands previously used heavily for agriculture. Growing timber need not eliminate all natural richness on the site. Tropical lands respond to sensible care through management. The obstacles are social and rooted in poor training and education programmes, lack of commitment to forestry research and to enforcement of regulations and the absence of a land conservation ethic, because economic considerations far outweigh environmental issues. A strategy for forest and species conservation in tropical regions should focus on the restoration of forest production on former forest lands where food production is not sustainable. The weak forestry institutions also need strengthening. Sensible use of secondary forests and tree plantations will reduce pressure on forest lands with mature forests or with unique ecological characteristics and set us on a course to meet the needs of the needy while protecting species diversity.

REFERENCES

BSP (1993). African Biodiversity: Foundation for the future. A framework for integrating biodiversity conservation and sustainable development Biodiversity Program Support. Maryland USA p. 149.

Ewel, J.J. (1983). Succession. In F.B.Golley, ed. Tropical Rainforest Ecosystems. Structure and Function.. Elsevier, Amsterdam. p. 217-223

FAO (1984). Outlook of the Forestry Sector in Africa. FAO, Rome.

FAO (1993). The challenge of sustainable forest management: what future for the world's forests? FAO, Rome p. 128.

Harr, R.D. (1982). Fog drip in the Bull Run Municipal Watershed. Oregon Water Resources Bull. 18(5): 785-789.

Lal, J.B. (1991). Conservation and sustainable management of forest ecosystems as genetic resource. 10th World Forestry Congress. 2: 521-529.

Lanly, J.P. (1982). Tropical Forest Resources. FAO Forestry Paper 30, FAO, Rome. p. 106.

Lugo, A.E. (1988). Estimating Reductions in the Biodiversity of Tropical Forest Species In: Biodiversity. E.O. Wilson Ed. p. 58-70.

Mackinnon, J. and Mackinnon, K. (1986). Review of the protected areas system in the Agrotropical realm, IUCN Gland Switzerland.

Myers, N. (1980). Conversion of moist tropical forests. National Academy of Sciences, Washington D.C. p. 205.

NEST (1991). Nigeria's threatened environment: A National Profile Nigerian Study/Action Team p. 288.

ODA (1991). Biological Diversity and Developing Countries: Issues and Options. Overseas Development Administration p. 50.

Skoup (1986). Feasibility Studies for National Forest Resources Survey. Fed. Dept. of Forestry. Ibadan.

Wilson, E.O. (1988). The Current State of Biological Diversity. National Academy Press p. 521.

World Resources Institute (1987). World `Resources' New York basic Books.