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Impact of Land Use on Biodiversity Preservation in Nigerian Natural Ecosystems: A Review

ABSTRACT

This paper reviews the effect of rural land use in biodiversity preservation in Nigeria. It argues that the future of effective, biodiversity preservation in natural ecosystems is constrained by factors arising from overharvesting of resources, population increase, unequal land tenure systems, reliance on wild biotic resources by rural economies, and a land extensive technique of agricultural production. The situation will remain unchanged unless the Nigeria government encourages public participation in natural resources conservation.

INTRODUCTION

The greatest threat to the conservation of wild biotic resources is loss of natural habitats.¹ The immediate impact will be the inability of rural communities to sustain their economy from wild biotic resources in terms of food supply, health care delivery, domestic energy supply, leisure and financial income. The abuse of natural resources stems from the belief that wild biotic resources are God-given; hence, a free-for-all exploitation pattern of resources use exists in Nigeria.

Many factors influence the patterns of conserving wild living resources. The inherent urge to sustain life under uncertain economic situations often conflicts with environmental preservation. Most often natural resources exploitation is motivated by cash flows within the market economy. Unfortunately, because tropical forests lock their mineral nutrients in trees,² their unplanned exploitation over time has led to environmental degradation which endangers wild plants and animals.

The objective of this paper is to discuss land use issues which affect the sustenance of wild biotic resources in natural ecosystems of Nigeria.

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1. World Wide Fund for Nature, *The Importance of Biological Diversity* (1990).
 2. B. Harvey & J. Hallett, *Environment and Society: An Introductory Analysis* (1977).

LAND USE PRACTICES

Data on land use patterns in Nigeria is scanty and fragmentary. However, the dominant land use is rural agriculture. It is a land extensive system of production by smallholders practicing shifting cultivation. This is a land use system in which short periods of cultivation are followed by relatively long period of fallow to allow the land to recuperate through biological process.

Shifting cultivation is based on a trial and error approach. It is characterized by small holdings (0.2-2.2 ha), discontinuous farm units, unequal land tenure, low energy input, absence of modern inputs (improved strains of seeds and chemicals), low operating capital, clear-felling of the natural vegetation and application of fire in land preparation.³

Population increase poses a burden on the natural ecosystems. Nigeria's annual population increase of 3.5 percent continuously decreases the ratio of man to land thus encouraging abuse and misuse of soils, increased land value, land use conflicts and unstable investments.⁴ The quest for an extensive agricultural production has increased the total land area devoted to that sector. This rose from 16.5 million ha. in 1960⁵ through 21.9 million ha. in 1970⁶ to 35.3 million ha. in 1980. Yet the estimated land requirement for food and cash crops in 1995 is 55.6 million ha.⁷

The above data shows that agricultural production in Nigeria is largely land extensive. By 1995, 56 percent of the land in the country will be devoted to agriculture. The implications are first, all the pitfalls of shifting cultivation will be vested on a larger proportion of the Nigerian landscape. The Nigerian population density has risen beyond levels that can sustain shifting cultivation.⁸ Over the years, the negative elements of shifting cultivation under high population of smallholder farmers (uncontrolled bush burning, unplanned human interference with the soils and changing land tenure systems) have gradually and systematically depleted native species and, hence, caused the extinction of wild fauna and flora in the natural ecosystems.⁹

3. G. Osemeobo, *Smallholder Farmers and Forestry Development: A Study of Rural Land use in Bendel, Nigeria*, 24 *Agric. Systems* 35 (1987); G. Osemeobo, *Why People Don't Grow Trees: A Case Study of Nigerian Smallholders*, 29 *Q. J. Agric.* 309 (1990).

4. J. Bruce, *Land Tenure in Project Design and Strategies for Agricultural Development in Sub-Saharan Africa* (Land Tenure Paper No. 128, 1988).

5. S. Agboola, *Agricultural Atlas of Nigeria* (1979).

6. Federal Office of Statistics Nigeria, *Results of Crop Estimation Survey 1968-1971: Rural Economic Survey of Nigeria* (1972).

7. Federal Government of Nigeria, *Agricultural Policy for Nigeria: Strategies for Implementation* (1987).

8. G. Osemeobo, *The Human Causes of Forest Depletion in Nigeria*, 24 *Envtl. Conservation* 120 (1988).

9. International Union for Conservation of Nature and Natural Resources, Nigeria: *Conserving of Biological Diversity* (1988).

Second, because shifting cultivation operates within the limits of traditional tenure systems, alienation of land through inheritance has led to subdivision of land beyond production levels.¹⁰ The traditional land tenure systems under high population densities depicts overuse of resources. Farmers are forced to cultivate a unit of land without reverting it to fallow or are inevitably forced to migrate to areas of abundant farmlands. In both cases, the soils are mined, and the natural vegetations are either depleted or are made to exist in pockets of fragile biotic communities.¹¹ These practices have endangered 512 species of wild plants and 16 species of wild animals in Nigeria.¹²

Livestock production is operated by smallholder nomadic herds-men. They respectively graze their animals in seasonal migration in southward and northward directions in the dry and wet seasons in favor of fodder. The activities of these nomads negatively impact the conservation of the environment. They involve: (a) excessive looping of tree branches to provide fodder to livestock in the dry season; (b) massive tramlings of grazing routes thus causing soil erosions; (c) over-grazing of the vegetation to a near-breakdown in biomass formation; and (d) indiscriminate setting of the vegetation to fire to stimulate fodder production. In the social vein, because the nomads have neither tenure rights to the grazing routes nor to the farm residues, violent conflicts are common between nomads and farmers in the dry season.

Commercial fuelwood production in the savanna zones of Kano, Kaduna, Bauchi, Sokoto and others are influenced by dominant user rights under an individual land tenure system. Land ownership gives full control over wild biotic resources. The landowner is not answerable to abuse nor misuse of land or made to rehabilitate the environment. All costs of misuse and abuse are passed onto the society.

BIOLOGICAL CONSIDERATIONS

Diverse types of plant communities exist in Nigeria. There are about 4,600 plant species of which 205 are endemic. The composition of these plant communities were grouped by charter,¹³ into 11 ecological zones on the basis of structural features of trees, shrubs and grasses. Today the ecological zones are profoundly modified and degraded by man. The forests are replaced by savanna while the savanna woodlands

10. L. Chubb, *Ibo Land Tenure* (1961).

11. Bruce, *supra* note 4.

12. International Union for Conservation of Nature and Natural Resources, *supra* note 9.

13. J. Charter, *Nigerian Vegetation: Ecological Zones, An Explanatory Note* (July 1969) (unpublished manuscript, on file with the Forestry Research Institute of Nigeria).

have been degraded into Sudan savanna. The question is what biological characteristics impede plant preservation under present usage?

Data on the various indigenous tree species in Nigeria are scanty. Studies on individual tree species in relation to flowering, fruit formation, seed germination, mode of regeneration, leaf formation and fall, coppicing ability, level of resistance to drought and fire, growth rate, nutrient requirement, nitrogen fixation capacity and human usage are not adequately known. The existing information is not sufficient to base management strategies. From various studies, the summary of indigenous trees tends to suggest: (i) slow growth rates of between 1.5 m³/ha./year and 2.5 m³/ha./year; (ii) irregular fruiting within species of the same type and among species of different types; (iii) low viability rates of seeds; (iv) low quantity of seed production among majority of trees; (v) few number of species of the same kind in a unit area of land; and (vi) low coppicing abilities.¹⁴

The indigenous tree species are fragile in terms of regeneration through either artificial or natural methods. Artificial regeneration of wild plants has not succeeded in Nigeria due to high costs and poor growth rates in plantations. The natural regeneration methods, involving the Tropical shelter wood systems (Tss), which were applied between 1940 and 1960 failed to achieve desired results due to factors such as: (a) long waiting periods for the inducement of seedling germination and the assumed long rotation period of 100 years; (b) slow growth rates of established crops,¹⁵ persistent climber growth and poor survival rates of tree species which could not provide high rate of return on investment;¹⁶ and (c) pressure on forest lands for apparently more profitable forms of land uses, namely cocoa, rubber, coffee and oil palm production.¹⁷

Under these biological constraints, poor land use practices inhibit the conservation of indigenous tree and shrubs which have economic value to man. Commercial logging of the indigenous savanna trees for pulp and paper mill at Jebba, local sawmills and fuelwood have depleted the savanna ecosystems. For example, all commercial loggings are concentrated on only 15 species of plants including *Azelia africana*, *Anogeissus*, *Schimpesi*, *Daniellia Oliveri*, *Parkia biglobosa* and *Prosopis africana*. Unfortunately, once these trees are felled, they hardly coppice, and their regeneration process tends to zero. The failure of

14. G. Osemeobo, *An Assessment of Forest Land use in Bendel State of Nigeria 1985* (unpublished Ph.D dissertation, University of Ibadan); H. Lamprecht, *Desirability, Potential and Problems of National Regeneration in the Tropics*, 7 *Plant. Res. & Dev.* 10 (1978).

15. G. Ogbe, *Management in the Tropical High Forest* (1968).

16. O. Ntima, *Some Economic Aspects of Forestry in Nigeria* (1967) (unpublished Diploma thesis, University of Oxford); Lamprecht, *supra* note 14.

17. R. Lowe, *Experience with the Tropical Shelterwood System of Regeneration in Natural Forest in Nigeria*, 73 *Forest Ecology & Mgmt.* 52 (1978).

the trees to regenerate is due to many factors. These factors are the inherent characteristics of the trees themselves (biological composition), the use of fire in bush burning, poor felling methods, grazing of trees by livestock, low rainfall and activities of wild animal pests.

SOCIAL FACTORS

Wild biotic resources are crucial in the sustenance of rural, Nigerian economies. The occurrence of wild living resources and their range of diversity determines the level at which the resources can support human existence. Basically, wild plants and animals are useful to man for food, cultural advancement, medicine, agricultural development, domestic energy, shelter and financial income. In many communities, the utilization of wild biotic resources determines life and death. Wild biotic resources are treated as common property, and their utilization is based on a set of rules and regulation exercised at the local level. These sets of rules specify joint use.

Common property utilization thrives under three conditions, namely, rural poverty, an agricultural economy and a high degree of uncertainty with respect to income streams.¹⁸ More importantly it is based on communal land ownership systems.¹⁹ In these systems, community leaders hold the land and its living resources in trust for the entire community. Access to exploit a resources is derived from being a member of the community by birth or by settlement over a long period of time. However tensions arise from joint use of resources as a result of population pressure, changes in technology, political forces and changes in beliefs in which common rules and regulations are based. Thus free rider behavior leads to overgrazing, deforestation, poaching, over-hunting of game and other abuses of natural resources.

The introduction of cash crops into the traditional agriculture in the 1950s led to massive deforestation of Nigeria's natural vegetation.²⁰ Large hectares of natural forest were clear-felled, and by 1995, 55.6 million ha. of the natural forest may be cleared for agricultural.²¹ The drawbacks of this land use policy are loss of resources: plants, water

18. F. Runge, *Common Property and Collective Action, in Economic Development, Proceedings of the Conference on Common Property Resource Management 31* (National Research Council ed., 1985).

19. G. Osemeobo, *Tenure Issues on Natural Resources Conservation in Nigerian Rainforest Ecosystems, Proceedings of Twenty First Conference of Forestry Association of Nigeria 318* (F. Akinsanmi ed., 1991).

20. G. Williams, *Taking the Part of Peasants Rural Development in Nigeria and Tanzania, in African Modernization and Development 1. The political Economy of Africa 8* (P. Gutwind & T. Wallerstein eds., 1975).

21. Federal Government of Nigeria, *supra* note 7.

and animals in the natural ecosystems. Yet these are the resources which keep rural communities together.

Another factor is changes in the land tenure system from communal to individual land ownership. These tenure changes have occurred in stages. First, tree crops such as cocoa, rubber, oil palm and coffee were allowed to exist in plantations within what was hitherto a communal land. The economic incentive of the cash crops changed the land use pattern. Second, because of the financial value of the crops, farms were being transferred to third parties by either inheritance or sale of plantations. In this context, an individual land tenure system evolved within the communal land ownership systems.²²

Apart from the dominant user rights of the individual land tenure system, the Nigerian communities are on the verge of losing control of natural resources management to private farms. Within the framework of common property utilization, all wild plants of cultural and economic value to the rural communities in and outside cultivated land, were under strict control by the communities. Plants such as *Parkia biglobosa*, *Chrystophyllum albidum*, all species of the *Palmae* family *Bustropermum paradoxica* and *Irvingia grandifolia* were protected from being felled, pruned, thinned or lopped without permission from elders of the communities: traditional chiefs, priests and the *oba* or the *obi*. In the face of changing land tenure pattern, land policies and state laws, owners of the cultivated lands now assume ownership rights over wild plants. The communal control of wild plants disappeared in stages before a total collapse. The first stage was for the community to have control over wild plants existing on the land before and after cultivation. The second was a control of only plants on the land before cultivation, and the third was lack of control of wild plants in cultivated lands. Nevertheless, these different stages of wild plant control still exist in various rural communities, but the main trend is towards free rider behaviors in resource utilization.

The approach towards hunting of game is different. It is optional for members of the community to be hunters or not. Nevertheless, over the years hunting communities have existed in many rural settlements. The controls on hunting game animals under the common property utilization are varied. Hunting of terrestrial and aquatic animals are based on sets of rules which vary from one community to another. In some, hunting can be carried out in all locations, but in others hunting is restricted to uncultivated lands. Only owners of cultivated lands can hunt in them, but they can also hunt in uncultivated land. Yet in other communities, hunting is restricted to seasonal or annual basis. The mode of hunting also is varied: selected species are hunted;

22. S. Famoriyo, *Land Tenure and Agricultural Development in Nigeria* (1979).

young and female animals are prohibited; while hunting materials are regulated. For aquatic animals, the use of chemicals and dynamites are prohibited. However, in seasonal or annual hunting, the forests are zoned and carcasses of major animals killed are shared between the community and the hunters. These sets of regulations unified the rural communities and served to protect wild biotic resources. With the disintegration of these regulations, abuses and overuse of resources have eroded gene resources and reduced the diversity of the natural forests upon which the rural economies depend and live.

FINANCIAL IMPLICATIONS

Nigeria treats environmental rehabilitation of abused and misused natural resources as a forestry issue. Unfortunately, this hypothesis is not backed up by financial support nor public education. Thus while the abuse and misuse of living resources is a free-for-all affair, the environmental costs are incurred by the society. The budgetary allocation to the forestry sub-sector between 1980 and 1990 was less than N80 million (U.S. \$8 million), and this did not cope with one hundredth of the land rehabilitation required to stabilize the environment. Yet individuals lack the capital for land restoration even in a situation where smallholders do not want to plant trees at little or no costs.²³

Because of biological and ecological limitations of regenerating the indigenous plants, the cost of raising wild plantations of plants is ten times higher than the cost for exotic plantation.²⁴ Again, the cost of planting trees in arid areas is twelve times higher than the cost in the rainforest region.²⁵ Yet because of financial gains, the natural forests are cleared for cash crops or exploited for timber and game animals. Governments also have used financial gains as a policy instrument for large scale agricultural productions in forest reserves. For example, oil palm, rubber, cocoa and coffee are respectively planted by governments in Okomu, Oban, Ijaiye, Idonre and Akilla forest reserves. Cattle ranches are established in game reserves. In Ivbi-Ada-Obi and in other regions, settlements are built in parks (Yankari). And, above all, semi-urban settlements are developed in the hearts of forest reserves (Oluwa and Omo) in the name of integrated geoforestry practices.

The spill-over effects of these land uses conflict with the maintenance of biodiversity in Nigeria's rainforest ecosystems. First, the volume of visitors to the reserves is increased because the laws are hardly

23. G. Osemeobo, *Effects of Common Property Resources Utilization on Wildlife Conservation in Nigeria*, 23 *Geojournal* 3 (1991).

24. Federal Government of Nigeria, *supra* note 7.

25. G. Osemeobo, *A Financial Analysis of Forest Land Use in Bendel, Nigeria*, 40 *Ecology & Mgmt.* 234 (1991).

enforced, and because the laws themselves do not support biotic conservation, illegal activities such as log theft, poaching and collection of nonwood forest resources daily occur.²⁶

Second, the resource base for conserving indigenous plants and animals is reduced by housing units, farms, road networks and other infrastructures within the reserves. With an increase in the population of settlers in these reserves, the quest of dereservation may increase.

Third, the meager financing of natural resources conservation is used to develop infrastructure within the protected forests. In the allocation of funds, priority is given to the satisfaction of workers for accommodation, health care, transportation, water and electricity.²⁷ Fourth, the location of human settlements in the reserves by the government has given a catalyst impact to agitations for dereservation among indigenous communities who gave up their lands for reservation. Because the bulk of living natural resources come from the reserves and because the supply of the resources cannot meet the demand, the prices of forest products is attractive since the resources are exploited free of costs.

POLICY ISSUES

Land use policies hardly favor biodiversity preservation in the face of poverty. This is derived from the fact that wild plants and animals sustain rural economies and even government in developing countries by generating foreign exchange earnings from timber and nonwood products. While it is acknowledged that intensive exploitation of resources maximizes resources use, it is at the expense of maintaining biological diversity. A vital question remains, should conservation of living resources deny people access to their resources to improve their welfare?

The fact remains that wild biotic species have extremely restricted ranges which make them easily susceptible to extinction.²⁸ Because adequate information on wild biotic resources is lacking and because the species are subject to the law of capture without identifiable property rights,²⁹ they are subject to open access exploitation. Thus biodiversity preservation is hampered by common property and free rider problems and by political and economic systems which are

26. G. Osemeobo, A Study of Problems Inherent in the Bendel State Forest Revenue Collection (1982) (unpublished M.S. dissertation, University of Ibadan).

27. G. Osemeobo, *Land Use Policies and Biotic Conservation: Problems and Prospects for Forestry Development in Nigeria*, 7 *Land Use Pol'y* 4 (1990).

28. International Union for Conservation of Nature and Natural Resources, *Conserving the World's Biological Diversity* (1990).

29. K. Miller et al., *Issues on the Preservation of Biological Diversity, in The Global Possible, Resources, Development and the New Country* 337 (R. Ropetto ed., 1985).

unable to guide conservation decisions. The debt burden of governments and the commonly unresolved issues of who should and how to spend loans or grants for conservation projects create conflicts at the execution level. In the face of these setbacks, the financing of conservation is not efficiently utilized.

Tenures of governments are fragile and short. They operate within lines of weak resistance with short-term economic motives and ad hoc policies. Governments are interested in investing money on projects that will win political support. As the struggle to relieve Nigeria from poverty subsides, there abound a host of logistical and institutional obstacles to biodiversity conservation. The total area of protected lands is less than 10 percent of the country's land area. Even the existing protected areas are not managed to maintain biological diversity. The lands are used amidst conflicts and contradictions which are social, economic and political in outlook. The questions are how can biodiversity be maintained in an unplanned land unit which is simultaneously used for logging, agriculture, hunting and grazing, even without capability maps? Can governments driven by poverty allow petroleum, coal or tin to exist without exploitation because the sites are habitats for endemic species? Yet the exploitation of these resources is synonymous with biotic destruction: spills, open cast mining and pollution of aquatic habitats.

The chorus of the sustained yield principle of forestry was undercut in Nigeria by a more dynamic land use system. Because the demand for forest products outpaced the forest yield under a diminishing resources base and increasing population, tree planting was extended outside the forest reserves. This introduced exotics into the environment. This process further depletes the natural systems even within the forest reserves. Monocrops of exotic species, *Gmelina arborea*, *Tectona grandis* and *Eucalyptus calmadulensis*, were established by mechanically clear-felling the natural vegetation in the savanna and by manually clear-felling the natural vegetation in the high forest.

Monoculture plantation were designed to support forest-based industries such as pulp and paper mills, transmission poles and swam timber. The implications of these monocrops are that first, they deplete the soils of valuable nutrients which marginalize the environment at the rotation age and renders the land unsuitable for biological production without fertilizer input. Second, because plantation establishments are not based on working plans, they introduce pockets of "forest failures" within the reserves which the rural people utilize for food production, thereby introducing bush fires into the reserves.

Nigeria's educational systems hardly support conservation programs. The Universities which offer agricultural and forestry degrees

do not include comprehensive conservation courses in their curricula; the few ones are listed as electives. The programs also lack an interdisciplinary approach. The Agricultural Officers in the Ministries do not comprehend why biodiversity should be preserved or why the Department of Forestry should exist or why rural people should plant trees.

Forest laws are outdated. They do not reflect the current trends in natural resources conservation. Worse, law enforcement is inadequate, and the support of the judiciary for conservation moves is non-existing. In cost-benefit analysis, it costs a hunter N80 (U.S. \$8) to kill an elephant which products are sold for N5,000 (U.S. \$500). The same hunter is fined only N100 (U.S. \$10) in the courts for killing the elephant. Thus because of the negative attitudes of the law, many hunters and even forestry workers have become game or timber chasers. They cannot be blamed because they are into a survival game. The courts tend to gloss over offenders since the forest officers are already in league with the poachers.³⁰

Generally, there is low morale amongst forestry workers which could be attributed to a variety of reasons including promotion of mediocrity, poor enumeration in the face of galloping inflation, inappropriate development of staff, stagnation due to lack of staff promotion, poor working environment, perpetual conflicts within the management hierarchy, frequent transfer of project officers and deliberate under utilization of honest and competent officers. Poor planning of projects and ignorance of the budgeting systems have made it difficult for managers to determine priorities, and judge resources requirements and how best to allocate them. Worse, strategic decisions cannot be taken because of lack of information.

CONCLUSION

This paper reviews the impact of rural land use on the preservation of biodiversity in Nigeria's natural ecosystems. It points out the major problem areas: (1) habitat loss and alteration, (2) overharvesting of wild biotic resources, and (3) land tenure issues. And it identifies the remote problem areas: (1) outdated laws and poor law enforcement, (2) rural poverty, (3) short term political administrations, (4) population increase and commercial oriented, and (5) industrial based forest exploitation.

Governments and the rural landowners perceive biodiversity preservation and development in terms of polar extremes and as points

30. G. Osemeobo, *Poaching in Wildlife Conservation: The Experience in Nigeria*, 20 Nig. J. Forestry 2 (1990).

along different continuum. These conflicting views derive from various factors which include lack of public education and awareness, lack of information on what resources exist, where they exist and how they can be conserved, lack of government will to commit money for conservation, conflicting and contradictory government policies and lack of public participation in the management of protected areas. Conservation programs have often treated local people as opponents rather than partners.

The rate at which the natural ecosystems are being depleted is daunting; for example, over 75 percent of the natural habitats in Nigeria were lost by 1985.³¹ Yet the remaining 25 percent of the natural habitats exist in pockets of forest which will not be suitable for conserving the remaining wild biotic resources unless intensive management techniques are undertaken.

Based on the above discussions, the following suggestions are made: (a) Conservation should be integrated into all forms of land use to promote cross-sectional cooperation among land users; (b) Research should be conducted in protected areas, botanical gardens and zoological gardens to document what resources exist, their forms and their locations; (c) The rural landowners should be fully integrated into the planning and execution of land use practices to minimize conflicts in resource utilization; (d) forest laws and educational systems should be reviewed to reflect the current trends in biotic conservation; and (e) public educational systems should be put in place to instill conservation ethics into the minds of the local land users and policy makers. This is important to generate funds for conservation and to formulate a long-term policy for preserving biodiversity.

31. International Union for Conservation of Nature and Natural Resources, *Review of Protected Area System the Afro-Tropical Realm* (1986).