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BIODIVERSITY LOSS IN THE TROPICAL RAIN FORESTS OF NIGERIA AND ITS EDUCATIONAL IMPLICATIONS*

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ABSTRACT

This article examines the concept of biodiversity and species within the context of the tropical rain forests of Nigeria. It briefly examines the origin of species and attempts to explain major causes of biodiversity loss, both direct and indirect. The article further discusses the ecological importance of biodiversity in Agriculture, Medicine, and Economic. Additional benefits, include aesthetics and cultural benefits such as food. Organizations concerned with biodiversity conservation and local strategies for the management of threatened and endangered species are also focused upon. The researchers conclude by suggesting some conservation strategies, as well as sustainable methods of utilizing biodiversity. Ways of creating awareness and sensitizing the public on the ecological consequences of biodiversity loss are also examined.

INTRODUCTION

The tropical rain forests of Nigeria, like other rain forests of the world, have incredible biological diversity. Anijah-Obi (2001) defines biodiversity in line with

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Texas Environmental Magazine's definition as a variety of life and its processes which include all life forms such as fungi, protozoa, bacteria, and organisms such plants, insects, fishes, and mammals (p. 131). In these forests, different forms of organisms live in special locations termed niches, in distinct layers based on their need for sunlight (Miller, 2004). Found in the canopy of the layers is a variety of animal life such as insects, bats, birds, abundant shelter, and supply of leaves, flowers, and fruit (Miller, 2004). The stratification of specialized plant and animal niches in various layers of a tropical rain forest enables coexistence of a great variety of species or biodiversity.

Miller (2004) observes that although the tropical rain forest occupies about only 2% of the earth's land surface, it acts as habitats for 50% of the earth's terrestrial species. These forests in Nigeria are located in Ikom, Akamkpa, Obudu, Oban among other places in Cross River State. Rainforest and tropical moist forest are often used synonymously to mean the same thing. Our planet earth is found to be the only one that supports life on earth. Invariably, it is made up of different ecosystems. There exists a variety of organisms from the direst deserts to the rain forest, mountain peaks, and the deepest oceans and trenches which interact within and among ecosystems. Here one finds life existing in a tremendous spectrum of colors, shapes, forms, and sizes.

The tropical rain forests of Nigeria are believed to inhabit the greatest number of varying species. The flora found there include a community of broad leaves, evergreen hygrophilous trees, usually with two or more layers of trees and shrubs with different types of life forms such as vines and epiphytes. The forests are home to millions of organisms, and the preservation of these tropical rain forests is vital for the conservation of biodiversity.

There also exists ecological diversity, which refers to the wealth, abundance, or the richness, and the complexity of organisms within a particular biological community. These include the number of niches, ecological processes, and trophic levels that capture energy, sustain food webs, and recycle materials within the ecosystems (Cunningham, Cunningham, & Saigo, 2005).

THE CONCEPT OF SPECIE

Specie is described by Cunningham et al. (2005) as all the organisms of the same kind which are capable of breeding in nature to produce live and fertile offspring. There are, however, problems with specie definition based on reproductive isolation. This is not very scientific because mating between species during hybridization occurs in nature and may produce varieties of offspring. It is also assumed that investigation may not scientifically determine the fact that it is not possible for two groups of organisms that live in different places to have the ability of interbreeding. It is therefore concluded that specie identification should be based on morphological characteristics such as size, shape, color, skeletal structure, and also on either chemical or genetic traits (Cunningham et al.,

2005). Finding out how many differences exist before organisms can belong to different specie groups is highly subjective. Currently, there are still debates by scientists who are involved in the study of classification to decide which organisms are most closely related, and which ones should be treated as separate species.

MAJOR CAUSES OF BIODIVERSITY LOSS

Cunningham et al. (2005) observe that the rate at which species are disappearing appears to have increased dramatically over the last 150 years. They identify human activities as being responsible for the extermination of two or three per decade.

The Nigerian Environmental Study Team (NEST, 1991) estimates that humans are pushing 20,000 species a year to extinction. However, we cannot actually be sure of this rate because many parts of the world have not been explored. Since 90% of all known species are in the tropical rain forest, it should not be surprising to note that the greatest percentage of losses are within the tropical rain forests of the world, among which is Nigeria.

Causes of biodiversity loss may be direct or indirect. Direct causes include:

- *Hunting for animal products:* Meat, oil, eagle and ostrich feathers, fur, tusks, hyde and skins from seals, leopards, tigers, crocodiles, pythons, ivory from elephants, form the major causes of biodiversity loss in these groups of organisms. It is on record that each year the trade in wild life affects about 1 million orchids, 10,000 primates, 350 million tropical fish, 3 million birds, and thousands of reptiles (Grumbine, 1997). Trapping or shooting of specimens sometimes constitutes an important drain on population of endangered species.
- *Museum collecting:* Museum collecting may also include pet trade, zoos, and medical institutions. A wide variety of animals are also hunted for superstitious reasons as some of their parts are believed to cure some ailments, or used for ritual decoration. Some are needed as foot rests in the king's or ruler's palaces. Snakes are pursued and killed once they are sighted, which constitutes persecution.

INDIRECT CAUSES

Indirect causes can be observed through destruction, modification, or alteration of the ecosystem. Most human activities within the environment result in the modification of the natural environment, which consequently affects the relative abundance of species and in most extreme cases lead to a great loss or even to the extinction of the species (Miller, 2004). Most often the habitat may become fragmented.

Other factors include industrialization and technology, rapid urban development, life styles, landscape alteration through:

1. agricultural clearing;
2. defoliation with 2, 4-D, 2, 35-T, cacodylic acid (herbicides); and
3. public works projects like expressway, highways through forests, airport construction, housing estates, land-reclamation dams, waste treatment and disposal, as well as resort development also result in biodiversity loss.

Fuel wood gathering is also a critical factor in biodiversity loss as most Nigerians especially in rural areas, depend on fuel wood for cooking.

Pollution of air, water, and land by municipal, domestic, and industrial wastes also cause biological diversity loss by killing off organism and plant. Deforestation, through tree felling and intensive logging, bush fires, over grazing, and harvesting of forest resources as commercial products equally lead to biodiversity loss.

Some forms of commercial exploitation are highly destructive and constitute a serious threat to certain rare species. These include smuggling of hydes, horns, live specimens, elephant tusks, and folk medicines which bring in a lot of wealth to the dealers but cause biodiversity loss. While developing countries in Asia and Africa among others have the richest biodiversity in the world (Cunningham et al., 2005) and are the main sources of wild animals and plants and their products, other developing countries, like Japan and Taiwan are the main importers.

Thus, the greatest cause of loss of species today in Nigeria is the ever increasing exploitation of our forests and other natural ecosystems by man. Therefore, the niche of mankind is expanding at the expense of most other animals which have become more isolated as their habitats are degraded, reduced, and fragmented for expansion of cities (Smith, 1997). It is estimated that about 67% of all endangered and rare species are threatened by physical features.

Human activities identified as major causes of biodiversity loss in the tropical rain forests of Nigeria include:

1. logging;
2. urbanization/road construction;
3. farming/deforestation by forest peoples;
4. bush burning; and
5. over grazing and hunting.

All these, among other factors, cause habitat destruction, thereby sending away or killing some species of plants and animals.

Diseases, genetic assimilation, the introduction of exotic specie interactions, predator, and pest control, as well as pollution, contribute to biological diversity loss. For instance, the nippa palm, which was introduced into the coastal areas of South East Nigeria has gradually displaced the rich mangrove forest that harbored a wide range of fish and crustacia.

ECOLOGICAL IMPORTANCE OF BIODIVERSITY

Human beings derive tremendous benefits from biodiversity, some of which include the following.

Aesthetic and Cultural Benefits

The diversity of life on planet earth makes many people take pleasure in hunting, fishing, camping, and wild life watching. This nature appreciation is of economic importance as people often pay to participate in destinations that offer the activities, especially in tourism. Contact with nature can also be psychologically and emotionally restorative. In some cultures nature carries some spiritual connotations with respect to sacred groves, streams, rocks, and trees.

Biodiversity and Agriculture

According to Cunningham et al. (2005), the rainforest provides a rich reservoir of genes which can be incorporated by cross breeding into cultivated plants to improve their yields, disease resistance, environmental adaptations, and many other factors important to agriculture. A wild relative of maize, according them has been recently discovered that revolutionized maize farming in many countries.

Biodiversity and Medicine

A large number of living organisms provide us with many useful drugs as most of our drugs contain some natural medicinal products. The United Nations Development Programme estimates the value of pharmaceutical products derived from third world plants, animals, and microbes to be more than $30 billion per year (Cunningham et al., 2005). The total value of the periwinkle crop, which is used in the cure of cancer is roughly estimated at $150 million per year by most scientists, according to the authors. Their presentation of drugs derived from third world forests is presented in Table 1.

Vinblastine and vincristine are known to be invaluable in the treatment of cancer. These alkaloids are obtained from a plant called Madagasca periwinkle (Catharanthus roseus). They are known to stop or retard the process in the growth of cancer cells and therefore are very effective in the treatment of particular forms of cancer.

Other Medicinal Benefits from Biodiversity

Cattle products are used in the preparation of some hormones and drugs (e.g., the pancreas is a source of insulin which controls diabetic conditions). In northern Nigeria, blood from cattle is used to prepare albumen and amino acids used in human surgery and dizziness. Cattle liver extracts are used locally in the treatment of malaria and typhoid (though this is not yet scientifically confirmed).

Table 1. Some Natural Medicinal Products

Product	Sources	Use
Penicillin	Fungus	Antibiotic
Bacitracin	Bacterium	Antibiotic
Tetracycline	Bacterium	Antibiotic
Erythromycin	Bacterium	Antibiotic
Digitalis	Foxglove	Heart stimulant
Quinine	Chincona Bark	Malaria treatment
Biosgenin	Mexican Yam	Birth control drug
Cortisone	Mexican Yam Treatment	Anti inflammation
Cytarabin	Sponge	Leukemia cure
Vinblastine	Periwinkle plant	Anticancer drug
Vincristine		
Reserpine	Rauwolfia	Hypertension drug
Bee venom	Bee	Arthritis
Allantoin	Blowfly larva	Wound healer
Morphine	Poppy	Analgesic

Source: Cunningham et al. (2005).

In Cross River State, Nigeria, some lizards or reptile products are also used indigenously in the treatment of whooping cough and tuberculosis. In many parts of Nigeria, land snails (e.g., garden snails (Helix Aspara), Sharan snails (Eremina Desertorum), and the giant snails (Achitna achatina)) are used in the treatment of severe stomach ache. The slime of these snails is used in treating severe stomach upset; sometimes the slime is mixed with honey for the same treatment.

In South East Nigeria, the bark of bitter kola tree boiled with water or hot drinks is used in treating various identified ailments like malaria and typhoid. Burnt and ground periwinkle shells are mixed with pap to provide a source of calcium for growing children. Snakes, such as the African python (python Sehae), produce fat which is used to neutralize poisons. The fat from the snakes is also used to massage broken or fractured bones as well as swollen or fractured and dislocated joints. Hearts of dead tigers are a rich source of multivitamins. Some species of millipedes and centipedes, when boiled, taste like crayfish and the brew acts as a neutralizer of poison if taken orally.

Biodiversity and Economic Gains

Benefits from the earth's biological diversity include:

1. *Wood:* Wood is believed to be the third most valued commodity in the world besides petroleum and natural gas. From world records, export of tropical hard woods represent a very important source of foreign exchange among at least 15 developing countries, including Nigeria. Thus, importation and exportation of hard woods yield much revenue to the countries concerned.
2. *Food:* Much of our food is derived from other organisms. These are either eaten directly or provide some genetic materials which help in the improvement of our food situation and growth. A lot of wild plants exist in the forests which make up the food humans eat. Scientists have explored the possibility of domesticating a number of these wild fruits for possible cultivation. A study by the National Academy of Science (U.S.) according to Cunningham et al. (2005) found out that Indonesia has over 250 edible fruits with only a few of them being cultivated.

ORGANIZATIONS CONCERNED WITH BIODIVERSITY CONSERVATION

The following organizations have contributed to biodiversity preservation in Nigeria:

1. The Yankari Game reserve in Bauchi, the only place in Nigeria where Gorilla is conserved Nigerian Environmental Study/Action Team (NEST, 1991);
2. Obudu Game reserve harbors an extensive specie of animals;
3. Pandam wild life park with unique lakes in Plateau State;
4. Gashaka-Gumti National Park, which is the largest in Nigeria for a variety of game reserve;
5. Baturiya Game Reserve in Kano State, found along the wet lands and also the Falgore game reserve still in Kano State;
6. There are also three game reserves in Borno State: Sambisa, Chinfurmi-Duguma, and Lake Chard Game Sanctuary;
7. The Kwiambana Game reserve and the Kamuku Game reserve, Kaduna State;
8. There is also the Nigerian Conservation Foundation (NCF);
9. Okomi wild life sanctuary in Edo State;
10. Hadejia – Nguru Game reserve in Kano – Yobe; and
11. Stubb's Greek Forest and the Cross River State National Park.

These protected areas help in the protection and conservation of biodiversity in Nigeria. However, they would need to do more, in terms of awareness. Creation

through enlightenment campaigns, via various communication media so that people would appreciate the value of biodiversity.

SOME STRATEGIES FOR THE PROTECTION AND MANAGEMENT OF ENDANGERED SPECIES

There appears to have been no concerted effort toward rehabilitation of extinct and endangered species in Nigeria. The general feeling appears to be that the creation of nature reserves is adequate. However the following strategies can be used in protection of endangered species.

1. Captive breeding programs should be established in zoos in order to enhance the introduction of extinct and endangered species in areas where they were formally found.
2. Decreasing our nasty and brutal meat production methods such as hunting and trapping of animals. This will probably reduce the demand for "bush meat" and consequently reduce the pressure on our wild life.
3. Developing indigenous plant breeds to increase their population.
4. Legislation on hunting, fishing, and trading on endangered and rare species.
5. Laws enacted should be seriously enforced by trained staff accompanied with serious penalties.
6. The highest priority of the conservation of biological diversity therefore is to enhance conservation of species in their natural habitats as well as close integration between ex-situ and in-situ programs.
7. Management of captive populations to ensure that they are genetically and demographically stable.

SUSTAINABLE METHODS OF UTILIZING BIODIVERSITY

According to NEST (1991), biodiversity can be prudently utilized through:

1. harvesting wild life and resources sustainably;
2. assessing stock and productive capabilities of exploited populations and ecosystems and using them within those capacities;
3. establishment of harvest levels that allow for ignorance and uncertainty about the biology of harvested species;
4. ensuring that where many species are harvested at once, harvest rates are sustainable for the species most vulnerable to over-population; and
5. ensuring that harvest of a resource does not exceed its capacity to sustain exploitation.

Many of these factors may be known today and it is important that research and monitoring are given due priority by government and supported by international

organizations. Lastly, social and economic influences in resource use can generally be evaluated as part of a national or sub-national strategy for sustainability (NEST, 1991).

CONCLUSION

Having thus realized the importance of biodiversity based on its ecological benefits, aesthetic values, foods, medicine, economic, among other benefits, it becomes necessary to create awareness in the proper use of biodiversity in order to maintain the ecological balance of nature.

REFERENCES

Anijah-Obi, F. N. (2001). *Fundamentals of environmental education and management.* Calabar: Clearlines Publications.

Cunningham W. P., Cunningham, M. A., & Saigo, B. W. (2005). *Environmental science.* London: McGraw-Hill.

Grants, W. E., Pederson, E. K., &. Martins, S. L. (1997). *Ecology and natural resources management: Systems analyst simulation.* New York: Wiley.

Grumbine, R. E. (1997). Reflection on what is ecosystem management. *Conservation Biology, II*(1), 41-47.

Miller, G. T. (2004). *Living in the earth* (13th ed.). London: Thompson Brooks/Cole.

Nigerian Environmental Study/Action Team (NEST). (1991). *Nigerian threatened environment: A national profile.* Ibadan: Nigerian Environmental Study/Action Team.

Smith, B. S. (1997). *Environmental science.* London: McGraw-Hill.

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