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PLACE BIODIVERSITY IN ECOSYSTEMS' EFFICIENCY IN NIGERIA

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ABSTRACT: *Nigeria is highly endowed with a lot of biological resources of both plants and animal species. There have been many studies to document these biological resources in terms of quantity and location across the country. There had also been several efforts by the Nigerian government towards the conservation of these resources. However, this effort is not gaining the desired outcome, as the biological resources are constantly at the risk of depletion or even threatened with extinction. It was identified that lack of clear understanding of the ecological utility of these natural resources is the main reason for their abuse. This work is therefore an attempt to bring out the numerous uses and importance of biodiversity to the Nigerian ecosystem. It started with an overview of the biodiversity, then went ahead to review the causes of its depletion, before dwelling on the various utilities of the biodiversity in sustaining the ecosystem integrity of the Nigerian fragile environment. The impact of biodiversity in reversing the process of desertification was explained. Similarly, the role of biodiversity in water conservation, erosion management, soil fertility, food security and domestic energy were explained. The paper is hoped to serve as an advocacy tool for environmental conservation*.

KEYWORDS: Ecosystem, Biodiversity, desertification, flora, dryland, Fauna.

INTRODUCTION

According to Article 1 (g) of the United Nations Convention on Biological Diversity (CBD) Biodiversity is defined as "the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. Diversity within species, between species, and of ecosystem is the treasures of nature; which must be preserved. Generally, Nigeria's plants and animals' species are of diverse categories, taxas and communities. Most of the species are situated in the forest reserves of the country, there are about 445 gazetted forest reserves located in different parts of Nigeria with a total area of 9,651,800 ha, accounting for roughly 10 % (UNDP 2009) of the total land area of the country, only 20% of these forest reserves are located in the southern part of the country. The bulk of the forest reserves are in the savanna region. It is important to note that flora biodiversity appears to increase with annual rainfall that forms part of the reason why species abundance and evenness is at variance in many areas. However, the faunal biodiversity carries the reverse order.

The trend of northwards increase in faunal biodiversity is changing. Both the higher and lower animal species are fast reducing in quantity especially in the savannah. A recent study (Awosika, 2009) conducted on diversity of 2 species each from the main classes of savanna fauna indicated a diminishing status of the species in their natural habitats.

On the other hand, of the 5303 plant species identified in Nigeria, only few hundred are

encountered in the savannah areas. Similarly, many of the plant species identified in 1960s in these areas are reducing in population, especially those with value in health care and edible qualities such as *Khaya Senegaleses* and *Mitragyne* Spp.
Except in gallery forest and areas of high water table, large trees are few in the dryland ecosystems. It is only shrubs and small trees with a wild variety of grasses that predominate. These have highly adjusted to the aridity of the zone and are useful to the community either as food, livestock feed or medicinal purpose. Only few studies were however made to the present status of the indigenous plants or their useful traits, and how to sustain their contribution for the sustenance of quality environment. No major study has, however, been done even on selective processes. For example, fast growing traits of the plants, let alone agronomic traits on their stress capacity and yet the loss of germplasm of the indigenous plants would be a major calamity to the society (Gadzama,1990, Perry 2002).

On the other hand, it is noted that some of the exotic trees, shrubs and weeds are increasingly attaining evasive status. For example, the success of such species like *Azadirachta Indica* and *Prosopis Juliflora* are very significant. Similarly, many introduced economic plants such as *psidium guajava* (mango) *Mangefera Indica* (orange) citrus spp and (pawpaw) *carica papaya* have been integrated as native tree/shrub crops in view of their important nutritional and commercial status in the local communities. The objective of this work is to present the statistics and status of Nigeria's biodiversity with the view to pointing out the various contributions it makes it ecosystem stability of the country.

STATUS OF THE NIGERIAN FAUNA

Not even Nigeria, generally global fauna is at a very serious risk. A comparison of species abundance of buffalo, water bulk, zebra and hippopotamus between 1979 and 1990 shows that buffalo are down from 55,000 to fewer than 4,000, waterbuck from 45,000 to fewer than 5,000. zebra from 2.720 to about 1,000 and hippopotamus have been reduced from 1.770 to about 26 (FMEnv, 2009).

In Nigeria however, despite the obvious pressure on the ecosystem, especially on the fauna, Nigeria possesses mammalian fauna of over 247 known species. Estimated also are about 831 spices of birds, 648, species of fish, 109 species of amphibians and 135, species of annelids and 134 species of 300 planltons are estimated (HBS, 2009; FMEnv-National Biodiversity status,2009). Most of these animal species are located in the wildlife conservation areas of the country, which are the National Parks, Game Reserves and Birds sanctuaries. About 5% of Nigeria total area is reserved for this purpose. It is important to also note that wildlife biodiversity in Nigeria appears to increase from the high forest northwards, with the greatest diversity being in the Sudan savanna.

However, as the effect of southward movement of the Sahara desert is progressing. The trend of northwards increase in faunal biodiversity is changing. Both the higher and lower animal species are fast reducing in quantity especially in the dryland of Sahel and sundan savannah. A recent study (Al-Amin, 2003) conducted on diversity of 2 species each from the main classes of dryland fauna indicated a diminishing status of the species in their natural habitats of the dryland

ecosystem. For instance, *syncerus caffer* (Buffalo) which was available in all the 6 wildlife reserve as at 1993, it is now found in only 3 of such reserves. While *Gazelle dama* which was available in 3 of the 6 wildlife reserves as at 1993, is only found in the Chad Basin National Park. Similarly, in the bird's family, the status of *Aegypius occientalis* (vulture) has changed from its existence in the 6 wildlife reserves in 1993 to only 3 reserves as at 2003. Also, the *Agama agama* species (lizard) is absent in 3 of the 5 reserves studied in 1993(Ried et al 2007).
However, any loss in animal population could be provided as estimated. The only report that could be precise is that of extinction. For instance, zebra has become extinct not only in the drylands of Nigeria but the whole of West Africa. Similarly *orgy dammah* (antelope) has now become extinct in the dryland ecosystems of Nigeria. Infact majority of the animal species known to exist in this region are either vulnerable or endangered. At present, species such as giraffe, cheetah, lion, sitatunga, hippopotamus, red-fronted gazette, crown-crane ostrich and bustard are all endangered. Conversely, the livestock density in the dryland ecosystems of Nigerian is the highest, in fact as mentioned earlier this region is the main producer of Nigeria's livestock (cattle, goast, sheep, camels, horses, donkeys).

Causes of Biodiversity loss in Nigeria.

Indiscriminate exploitation is the major ecological problem that have contributed to the loss of Plant and animal species in Nigeria. Floral and faunal species in the country have been classified as rare, vulnerable, endangered, threatened and extinct. An estimated 484 plant species in 112 families are threatened, while about 30 species are facing extinction. Most disturbing however is the rate of faunal species loss in the dryland ecosystem. For instance, available literature indicates that presently 75% of the total mammalian form have migrated to the forest region, while very low percentage remain in the Sudan and Sahel savannah.

Such over exploitation activities like unplanned and intensive land use, uncoordinated expansion of settlement, clearance for farming, right of way for infrastructural development over exploitation and wasteful practices in use of forest and wildlife, over grazing and over lapping for normal and fuel wood are all implicated.

Another significant cause of biodiversity loss in the ecosystem is loss of the natural habitat. This is especially exacerbated by indiscriminate bush burning which change the natural habitat in amazingly short time. Direct burning kills various plant species that are not fire resistant. Even the fire resistant ones are reduced to minimum before they could regenerate. A chain of reaction from bush burning renders, forest cover bare, thereby exposing fauna to enemies and harsh environment conditions, as also does the fire will reduces the food stock on which the fauna depends.

Predation by higher mammals especially human beings is a major biodiversity loss. The traditional use of wildlife as food delicacy is long rooted in the culture of Nigerians living in the dryland ecosystems. It is estimated that 25% of all the meat consumption of animal products in the rural areas comes from wildlife. Similarly, a lot of floral species are over harvested as food due to their nutritional values. Fruits, leaves, stem and roots are all utilized as wild food sources. This has negative effect on biodiversity. Such indigenous shrubs and tree species of *parkia bioglobose* (locus bean), *Vitellaria Paradona* (Shea Butter tree), *Adansonia Digitata*, baobab),

Tamarindus Indica (Tamrin tree), are all under pressure as valuable food source. These are disappearing with time especially by reoccurring of draughts in the region.

In the same vein, many parts of indigenous and exotic plant species are lost to medical purposes the increase in the contribution of traditional herbal medicine in health delivery has indeed put extra pressure on some plant species such as *Khaya Senegaleses* (Mahogany), *Aegyptiaca* (desert date) and most recently *Cordia Africana* are over harvested and therefore threatened. Even the fast adapting *Azadirachta indica* (neem tree) is under threat with regard to over harvesting for medical purposes.

Function of Biota in Combating Desertification.

Biological species of plants and animals are often shortened as BIOTA for convenience. These life forms constitute the most important asset of the Biosphere. They determine to a large extent, all the phenomena-taking place on the earth surface, including that of desertification. Desertification is a result of complex interrelationship between social and natural systems. Figure 3 shows the inter-play among them. However, central to both the social and natural systems is the role of biological resources (biota) in neutralizing the agents that causes desertification. The principal function of biota is neutralizing desertification process is through tackling the causes of the desertification phenomena. This is achieved In many ways as detailed below.

Several studies have indicated the relevance of biota in desertification processes. Equally shown are the ways in which the biota could be exploited in neutralizing or reversing the desertification processes. This is generally achieved through the roles that can be played by either plants or animals or both in checking the causes of desertification. For instance, desertification is caused due to climatic problems of draught. and several ways were documented in which plants help in ameliorating such climatic problems, thereby, neutralizing that cause of desertification, therefore those inputs the biota can make in improving soil quality are invariable neutralizing desertification process.

The importance of vegetation cannot be overemphasized. They are natural air fliers, they enrich the air with humidity and regulate the local climate and they control ground and surface water by collecting storing, filtering and distributing it. They also regulate the water table. Vegetations blind soil and prevent erosion. They prevent landslides, rock falls and avalanches, provide effective wind breaks, control the passage of air into otherwise vulnerable areas, and provide protection against forest. They support a complex of community of wildlife. Vegetation are also a major economic resources.

Function of Biota in Water Preservation

Water in its various forms plays a great role in preserving the trend of desertification. The use of vegetation in climate amelioration cannot be over emphasized Because of erratic nature and high inter annual variability of rainfall, the arid and semi -arid regions of the world are consequently prone to recurrent and sometimes intense and persistent draught.

The use of vegetation in conserving both the atmosphere and soil water cannot be over

emphasized. It has been established that lack of vegetation causes modification to the microclimate as reported by Ledesma (1983) and Ritcherzagen et al 2007. Associated with plant cover impoverishment is air temperature (which is a measure determinant of cloud cover and rainfall). Air temperature is higher in degraded forest than in virgin one, temperature ranges are also wider in a degraded forest. Therefore, lack of plant cover entails drier and more fragile ecosystem.

Similarly, as mentioned earlier that biota help tremendously in many processes which ensure good control of ground and surface water by collecting, storing, filtering and distributing it and regulating the water table. Such biota management practices of range management, agro forestry, rotational grazing, water resources planning arid management ensures good exploitation of biota in water preservation. This will in turn limit the exacerbation of desertification due to lack of precipitation.

Function of Biota in Erosion Management

Natural Vegetation of the desertification prones areas as sparse or scarcity sparse or scanty due primarily to lack of sufficient precipitation. Nevertheless, however scanty the vegetation in the region may be, it protects and to a large extent stabilizes the ground surface. Such species of shrubs, under shrubs and grasses play an important role I protecting soil surface from erosion.

Similarly, decreased vegetative cover increasingly express the surface to impact of torrential rains that usually succeed draughts. Large raindrops accompanying these rains disperse the fine elements of surface soil aggregates, with increase in runoff, sheet and gully erosion may set in, especially on sloping grounds. The combination of long gentle slopes with crops requiring periodic weeding of soya bean, maize and sun flower) determines water erosion process of every kind (sheet, rill and gully erosion). This problem is exacerbated in undulating lands with 1 to 4 percent slopes or even steeper (up to 16 percent). In the later case gully erosion occurs.

The use of biota resources especially of plant in erosion management against desertification have proved very effective. Biological sand dune fixation techniques for soil binding as well as development of efficient shelterbelt against agents of wind in erosion and transportation sands are excellent examples of the function of biota\ in erosion management.

Function of Biota in Soil Fertility

The fertility of a soil is a function of its physical and chemical properties, these are being affected when agents of desertification sets in. the effects of desertification on soil fertility are enormous, which consequently have a multiplier effect on soil status. Such problems like loss or organic matter, compaction, crust formation, soil erosion and Stalinizations with all their attendant efforts are generated.

On-site degradation process due to agents of desertification are many. Of particular importance here are:- soil encrusting, patches, water erosion, wind erosion and increased density of arable layer. Soil encrusting is a wide spread degrading agent of desertification which consequently results in loss of organic matter of soil. It also causes deficiency in structural index thereby resulting in high loam content of soils. Similarly, patches are generated where crops grow irregularly as a result of land clearance (i.e. the areas where worthless deforested material is accumulated and then burnt). This result in a slight soil alkalinization and salinization with an

increase in contents of potassium (k) and magnesium (mg). There will also be a substantial increase in calcium carbonate (CaC03) coming from the sub-soil layers when trees and shrubs are uprooted. Similarly, a lower water holding capacity of the soil and crop chlorosis will all be generated on such affected soils.

A systematic land use and soil management practices will surely eliminate soil degradation which serves as an agent/impact of desertification in the dryland ecosystems of Nigeria. Such programme of soil conservation using plant and animal resources are very promising. For example, the use of animal dung as a source of soil organic matter have proved very effective since time immemorial, similarly the use of relevant plant species as hedges have been very effective in sub-soil binding, as well as force-breakers against agents of sheet and rill erosion.

4.4 Function Of Biota In Food Security

A major cause of desertification is the over exploitation of plants and animals for human consumption as food and also the overgrazing of herbaceous plants by domestic livestock. This process overstretches the copying capacity of the environmental elements thereby pushing them to degradation, which in turn becomes limited in its ability to support the ecosystem against desertification. Plants and animals are the main source of food for human beings and therefore must be sustained and adequately managed. An adequate management of biota will ensure sustainable supply of food for plants and animals. This will in turn halt desertification due to over exploitation of biota for food supply, as well as overgrazing of pasture by domestic livestock.

Livestock grazing is a major economic activity of the desert-prone areas. As the human population grows, the number of livestock tends to grow at about the same rate in order to meet the minimum subsistence level of 2 to 4 standard stock per person (Oladipo, 1999, Le Hoverra 1975). The overall tendency of such a trend is that animal population densities are far beyond the carrying capacity of the land. Although, the natural capacity of grazing lands in arid areas usually low and it decreases rapidly during periods of draught, thereby setting in desertification.

Human exploitation of wild fauna as food through hunting or pouching endangers many species thereby pushing it to extinction or migration. Similarly, over exploitation of plants of high nutritional value threatens species abundance or evenness. However, the fact remains that man must feed and with such increasing trend of human population, food security must be ensured in order to save wild life. The function of biota in ensuring food security is surely a step towards neutralizing desertification phenomena. When plants and animal resources are well planned and managed both human and domestic livestock will get the need supply of food, without necessarily upbringing on the wild floral and faunal species. Such biotic practices of agro forestry, irrigation farming, managed ranches/posture, modem livestock management etc. are measures of using biota for food security, thereby eliminating the dangers of over exploiting the wild plants and animals for food.

Function of Biota in Energy Supply

Deforestation, resulting from uncontrolled .cutting of wood for firewood and charcoal is a major cause of desertification. According to the "World Resources 1990- 1991 report, the rate of deforestation in Nigeria in the 1980's was of the order of 400,000 hectares yearly, while

reforestation was a mere 32,000 hectares. Similarly, cline-Cole et al (1990) asserts that 55 million m^2 of which 90% is fuel wood. On the other hand, the estimated annual supply on sustainable basis is about 40 - 45 million m^2. This imbalance between the supply and demand for wood fuel is most pronounced in the northern part of the country where the annual deficit it is estimated to be about 5 million m^3 to 8 million m^3 (Stern, 2006; Oladipo, 2008, UNDP, 2008). Similarly, Brown and Wolf (1985) have suggested that firewood demand in the arid and semi-arid areas of Nigeria is about 2.5 times the sustainable yield of forest.

A selective exploitation of biotic resources of trees for fuel wood will surely reverse the pressure of deforestation and thereby neutralizing desertification due to measure deforestation. If careful selections of tree species that produce good fire wood and higher yield per unit area are made, it will surely bring about sufficient ·energy supply. Special forestry for fuel wood could be established using their yielding tree species.

CONCLUSION

The over exploitation activities of biological resources such as unplanned and intensive land use, uncoordinated expansion of settlement, clearance for farming, right of way for infrastructural development over exploitation and wasteful practices in use of forest and wildlife, over grazing and over lapping for normal and fuel wood are all implicated.

From the foregoing, it is evident that the status of these biological resources is at various stages of depletion. While other nations of the world are working towards exploiting their biological resources for stabilization of ecosystems, in the Nigeria's focus should be first to salvage the resources while utilizing them at the same time for sustainability. The work has added another dimension to the conservation of natural resources and the need to face it from all angles.

REFERENCES

Awosika, L and Folorunsho, R., 2009: Biodiversity, Climate Change, Seal Level Rise and Coastal Adaptation. Paper presented at the The Lagos State Summit on Global Climate Change, Lagos. March 23-25.

Dregne, I I.E (1977) Desertification of Drylands 59, 322-331.

Federal Ministry of Environment, 2009: Biodiversity and Climate Change: Road to COP 15. Gadzama, S.N. (1990); Sustainable development in Nigeria dry belt: Problem and prospects.

In: K.O. Ologe (ed) proceeding of the 1990 annual NEST Workshop, Kan. Pp 7-21.

Heinrich Böll Stiftung (HBS), 2009: Response to Biodiversity loss: Adaptation Strategies of Action for Nigeria. Netherlands Climate Change Assistance Programme (NCAP) – Ghana (phase 1 and 2) – 2003 – 2006. OECD (Organisation for Economic Co-operation and Development), 1995: Donor assistance to capacity development in environment, Paris

Oladipo, E., 2008: Biodiversity and Sustainable Livelihoods – The Greening Options. Paper presented at the First National Summit on the Environment, Abuja Nigeria, 20 October.

Oladipo E.O. (1999) "Towards an Effective Management of Drought and Desertification in the Savanna Areas of Nigeria" In J.T. Parry (e.d) Land Degradation in the Tropics, Environment and Policy Issues. Mansell Publishing, London.

Perry, M., Arnell, N etc. 2009: Assessing the costs of Biodiversity adaptation to climate change. IIED.

Reid, H., Sahlen, L.., MacGregor, J., and Stage, J. 2007: The Economic Impact of Climate Change in Namibia. IIED Discussion Paper 07-02.

Richerzhagen, C. and Scholz, I. 2007: China's Capacities for Mitigating Deforestation. Deutsches Institut für Entwicklungspolitik, Discussion Paper 22.

Stern, N. (2006) Stern Review on the Economics of Climate Change and Biodiversity. October 2006. Crown copyright 2006.

UNDP (United Nations Development Programme), 2008: Adaptation to Deforestation: The New Challenge for Development in the Developing World.

UNDP/GEF, 2009: Ghana: Integrating Climate Change and Deforestation into the Management of Priority Health. Project DIFD.