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Habitat fragmentation in Nigeria: A cryptic but devastating phenomenon that requires urgent attention

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Abstract

In Nigeria, habitat fragmentation, the division of natural habitat into progressively smaller and more isolated fragments separated by a matrix of human-transformed land cover, continues at an accelerating rate and accounts for most biodiversity losses. It implies a loss of habitat, reduced patch size and an increasing distance between patches. The causes of habitat fragmentation through anthropogenic activities are many and the effects of habitat fragmentation on biodiversity are huge. These effects are so diverse that different authors measure fragmentation in different ways and draw different conclusions. Some of the effects on ecosystem include; edge effect, reduction of gene pool, extinction, climate change and total collapse of an ecosystem. In Nigeria, local and international organizations and agencies have responded to this situation in so many ways, but cannot be said to have recorded any meaningful success. The failure of these measures to produce the desired results calls for concern and has been attributed to public apathy, low level of funding, inadequate game laws and weak enforcement of existing legal provision. It is expected that improvement on the aforementioned limiting factors will go a long way in reducing habitat fragmentation in Nigeria.

Keywords: Habitat Fragmentation; Cryptic; Devastating; Nigeria; Phenomenon; Urgent Need

Introduction

The important causes of declines in global biological diversity have been found to include destruction and degradation of natural ecosystems (Pereira *et al.* 2010, Rands *et al.* 2010) [21, 23]. Degradation and destruction of habitat in turn, ultimately lead to habitat fragmentation, the division of natural habitat into progressively smaller patches isolated from each other by a matrix of human-transformed land cover. According to Lindenmayer *et al.* (2006) [17], the loss of area, increase in isolation, and greater exposure to human land uses along fragment edges initiate long-term changes to the structure and function of the remaining fragments. This change in structure and function of habitat often leads to total collapse of an ecosystem. This is because, habitat, including availability of shelter, space, water and food determines the diversity of species and therefore, serves the basis for conservation of several species.

Globally, this phenomenon occurs naturally on a geologic time scale and by human activities, but in Nigeria, it is mostly caused by human activities especially when habitat vegetations are cleared for agriculture, rural development, urbanization, creation of hydroelectric reservoirs, etc. The dominance of mankind is quite notable and has produced dramatic and swift transformation of landscapes resulting in a level of habitat fragmentation that has induced reduction in biodiversity and interruption of substantial yields of natural resources.

It is an axiom that human impact is often responsible for producing a major change to a single component of an ecosystem, which in turn can threaten the whole community.

The effects of habitat fragmentation vary among ecosystems. Since fragmentation affects biodiversity by reduction in the amount of available habitat (such as rainforest, savannah, and marshlands) for all organisms in an ecological niche, it then follows that animals and other sessile organisms in these areas are usually destroyed. This causes the aggregation of mobile animals especially birds and mammals in the remnant patches of habitat. This in turn leads to overcrowding effects and increased competition (Sahney *et al.*, 2010).

According to Augustine and Spriner, (2013), the size of a fragment determines the number of wildlife species existing in it, therefore the abundance and diversity of wildlife in any given habitat is directly dependent on the size. In addition to size, environmental risks such as disease, prolonged draught, fire, flood and scarcity of food which would have caused no danger in terms of extension in a large population can be catastrophic in small isolated

population (Augustine and Springer, 2013) ^[4]. This phenomenon leads to faunal collapse, invasion of exotic species, and disruption of ecosystem processes (William and Cameron, 2000) ^[27].

As daunting and challenging as the task of mitigating the rate at which habitat fragmentation is progressing in Nigeria is, the Nigerian government has been taking bold steps in tackling the menace. This it has done by taking measures like formulation of policy on environmental consumption, creation of natural parks and game reserves, enactment of wildlife laws, signing of international treaties, inclusion of conservation studies in school curriculum and manpower development (Anadu, 1987) ^[3]. It is unfortunate however that despite the aforementioned efforts by the different administrations, the desired result of drastically reducing the high rate of fragmentation remains elusive.

The need therefore to sensitize the populace and policy makers on the increasingly cryptic but devastating effects of habitat fragmentation cannot be overemphasized.

Major Causes of Habitat Fragmentation in Nigeria

Urbanization

Among the many human activities that cause habitat loss, urban development produces some of the greatest local extinctions rates and frequently eliminates the large majority of native species (Czech *et al.*, 2000) ^[7]. This is because; urbanization is more or less permanent as it lasts more than other types of habitat loss. In Nigeria the rate of social and economic inequality is very high; as a result, rural dwellers tend to migrate to urban areas for greener pasture. This in turn puts additional pressure to poor and inadequate facilities in these areas and directly results to destroying more habitats for expansion to accommodate the teeming rural migrants. This would not have been so if the facilities were amicably distributed. Invariably, Nigeria has focused on infrastructural development in recent times as evident in her budgetary allocations for this purpose. The implication has been that more habitats have been fragmented to achieve this goal.

Extractive industries and their activities

Closely related to urbanization is the activity of extractive industries in Nigeria. They are those companies saddled with the responsibility of searching for and exploiting resources which are naturally stocked in the earth's crust (Nenibarini, 2004) ^[19].

The Niger Delta is the seat bench of oil and gas production in Nigeria. Virtually, all aspects of oil and gas exploration and exploitation have deleterious effect on the ecosystem and local biodiversity (Nenibarini, 2004) ^[17]. According to UNEP report from 2006-2011 on shell petroleum development company (SPDC) and Ogoni land released in August 2011, the occurrence of oil spill on land brings about fire outbreaks that leads to the killing of vegetation and creation of crust over the land, making remediation and re-vegetation very difficult (UNEP, 2011) ^[26].

Deforestation

As of 2005, Nigeria had the highest rate of deforestation in the world according to Food and Agriculture Organization of the United Nations (FAO). Between 2000 and 2005 the country lost 55.7 of its primary forest and the rate of forest change increased by 31.2 to 3.12 per annum. According to Omofonmwa, (2008) ^[20], the main reasons for clearing of

forest in Nigeria are logging, timber export, subsistence agriculture and notably the collection of wood for fuel which remains problematic in Western Africa. Deforestation has negative implications on the environment in terms of soil erosion, loss of biodiversity ecosystem, loss of wildlife and increased desertification. A lot of damage has been done to Nigeria land through deforestation, notably contributing to the overwhelming trend of desertification (Akinbami, 2003) ^[1].

Pollution

Industrial processes, pesticides and chemical fertilizer from agricultural and domestic purposes, liquid and solid waste, oil spillage that release toxic substances into the air, soil or water have catastrophic effects on many species (Amadi *et al.*, 1996) ^[2]. Heavy metals and persistent organic pollutants such as polychlorinated biphenyls, dioxins and DDT are of particular concern since they do not degrade easily in the environment, they accumulate and are lethal to plants, animals, fish and human beings resulting disruption in the ecosystem loss of species.

Agricultural activities

The dramatic increase in the number of humans in recent times has led to conversion of wildlife to croplands, massive diversion of water from lakes, rivers and at the same time, has polluted water and land resources with pesticides, fertilizer and animal wastes, which has resulted to destruction, disturbances disabling of terrestrial ecosystem (EPA, 2011).

The impact of agricultural activity such as bush burning -to clear vegetation for agricultural activities- has greatly encouraged fragmentation of habitats (Wuethriuch, 2000) ^[28]. These fires often get out of control and burn large areas and extend into the forest interior and inhibit edge regeneration by killing pioneer forest vegetation. Most farmers in Nigeria are subsistence farmer who still used crude implements. Their reliance on bush burning to clear massive plots of land for cultivation has been observed and is the cause of destruction of many habits in the country.

Soil erosion

Soil erosion occurs as a result of natural vegetation being removed from an area. As a result, surface water, or winds can carry away top soil, the surface layer of soil that is rich in nutrients and beneficial microorganisms (Hemphill and Delbert, 1993) ^[13]. Soil erosion has a direct effect on habitat quality, making an area barren and unsuitable for plants and animal that was native to that habitat. As well, soil that is washed away gets deposited in water ways, destroying fragile aquatic habitat (EPA, 2011).

According to Lekwa and Whiteside (1996) ^[15], soil erosion in Nigeria is caused by the following; increased population density and pressure on agricultural lands, overgrazing due to increased stocking rate, wide spread deforestation due to reduced fallow period, incompatible and unsustainable agricultural practices, increased use of fertilizers and other agro-chemical.

Some Direct Effects of Habitat Fragmentation that Affect Biodiversity

Isolation effects

One of the more immediate effects of habitat fragmentation is disruption of movement patterns and the resulting isolation of individuals and local populations (Bender *et al.*, 2003) ^[5]. As

habitat is fragmented, it is broken up into bits that are isolated to varying degrees. The degree of isolation for any fragmented habitat distribution will vary among species depending on how they perceive and interact with landscape patterns (Marsh *et al.*, 2004) ^[18].

Reduction of Gene Pool

Habitat destruction causes natural gene pool loss. Most species that were originally diverse in Nigeria are becoming extinct. Human activities such as overgrazing, fire, excessive use of systemic herbicides cause genetic erosion and affects biodiversity.

Edge Effects

In ecology, edge effect refers to the change in population or community structures that occurs at boundary of two habitats (Levin, 2009) ^[16]. It produces a transformation of the vegetation structure, the microclimate and the land cover in the fragments, which causes direct and indirect effects on the distribution of plants and animals species (Laurance *et al.*, 1998). If edge effects are strong and spatially pervasive penetrating into a habitat, then total habitat area may not be representative of the capacity to support species typical of that habitat (Laurance *et al.*, 1998).

Climate change

The multiple components of climate change are anticipated to affect all the levels of biodiversity, from organism to biome levels. Climate change is able to decrease genetic diversity of population due to directional selection and rapid migration, which could in turn affect ecosystem functioning and resilience (Botkin *et al.*, 2007) ^[6].

Endangerment of Animal Species

Habitat fragmentation is one of the largest causes of species extinctions (Ewers and Dilham, 2006) ^[9]. Habitat fragmentation often results in lack of food and it also eliminates habitat for species that used large unbroken blocks of habitat (Prugh *et al.*, 2008) ^[22]. This results in an increased risk of death by predation because the animals might be forced to venture outside its patch to find food in order to avoid starvation. Habitat fragmentation has driven many once contiguous animal populations into remnant patches of varying size and isolation and because the size of these patches is small, they can become extinct (Prugh *et al.*, 2008) ^[22].

In Nigeria, the elephant is almost extinct except some small population in Adone, parts of Okhimu National park in Edo state and in Cross River National Park. In most of the other states, the elephant is gone.

Some Measures taken by Nigerian Government to Mitigate Habitat Fragmentation

The national policy on conservation and sustainable use of biological diversity is an integral part of the national policy on environment. The policy was first developed in 1989 following the promulgation of the Federal Environmental Protection Agency (FEPA) decree no 58 of 1988 and revised in 1999. The decree provides the legal framework for the implementation of policies on environmental protection, natural resources conservation and sustainable development. Apart from the establishment of game reserves and national parks, which is one of the main thrust of the national policy on conservation, the Nigerian Government has formulated

policies on environmental consumption, enacted wildlife laws, signed international treaties, included conservation studies in the curriculum (across all levels of education) and prioritized manpower development (Anadu, 1987) ^[3]. Renewed efforts have equally been made by Nigerian government to enhance law enforcement capabilities of agencies and departments responsible for implementing conservation laws. Investments and sustained attention to the development of critical infrastructures in recent times are also aimed at discouraging the populace from indulging in activities that are capable of leading to habitat destruction. For instance, to discourage the use of wood as fuel government has invested heavily in recent times, to make natural gas and allied products available to the populace through subsidy.

Benefits of Conserving Biodiversity

- Ensures rich genetic diversity that can lead future discovery (FAO, 2010).
- Preserving genetic diversity ensures the continuing existence of wide range of crops and animals that may be able to withstand disease, and serve potentially useful biochemical substances, such as those used in health care (Groom *et al.*, 2006) ^[12].
- Genes regulate all biological processes on the planet and increase the ability of organisms to cope with environment.
- Biodiversity has greatly contributed to modern medicine and advancement in human health research and treatment.
- Many people derived value from biodiversity through leisure activities such as hiking in the country side, bird watching or natural history study. Biodiversity has inspired musicians, painters, sculptors, writers and other artists (UNEP, 1999).

Conclusion/Recommendation

The effects of habitat fragmentation on biodiversity in Nigeria are enormous and severe. This is because they lead to disruption of ecosystem processes and in turn cause habitat loss and extinction. These contribute to a decline in biological diversity. In Nigeria, the effects of habitat fragmentation have persisted despite concerted efforts by the government to curb the menace. There is therefore need for the Nigerian government to review the current strategies utilized to reduce habitat loss, with the view to understanding the impediments to these strategies and scaling up efforts to tackling these impediments so as to realize the set goals.

It is recommended, that the government should intensify efforts to create awareness among the populace on the need for habitat conservation; this is very important; as the desired "change in attitude" begins with the people and there is no way a sustainable achievement will be recorded without the participation and cooperation of the populace. Institutions and agencies responsible for enacting and enforcing conservation-related laws should be equally strengthened and empowered to perform at optimal level. Effective monitoring and evaluation mechanisms should be set up to evaluate the performance of different stakeholders in achieving the desired result of reducing the rate of habitat fragmentation.

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