



Changes in tropical forest vegetation composition: The long term impacts

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Abstract

The world system tends to pursue the ideology that 'tomorrow will take care of itself'. Little is done for the interest of the future. Current climatic and environmental phenomena are due to changes in forest ecosystem. When vegetation undergoes changes, the environment or ecosystems on which plants and animals populations depend on undergo changes as well. All resources available for man are sustained by the environment, forest being a major store-house. An important aspect of environment is the soil which is the anchor of vegetation. Forest keeps the soil intact and biologically active, and actions that impacts on the environment negatively bring negative impacts on resources. The manner and methods of utilization of resources is a factor leading to environmental degradation. Fast changes in vegetation composition are majorly due to human activities, which on the long run threaten the existence of life. This paper highlight factors responsible for changes in vegetation composition, and discusses the long term impacts, which include poverty and hunger, environmental degradation, loss of biodiversity, accelerated climate change effects and outbreak of medication-defying sicknesses and diseases. It offers approaches that should be adopted to maintain and protect forest, to avert the long term impacts.

Keywords: Forest composition; Forest vegetation; Climate change; Loss of biodiversity; Environmental degradation; Resources

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1. Introduction

Changes in vegetation composition of the tropical forest are both natural and anthropogenic phenomenon which results to destruction of biomass and alteration of the structure and composition of forest ecosystem (Attiwill, 1994; Pickett et al., 1997). The forest is often believed to be unchanging because of tree's long life span, however, the forest have been changing due to human activities. When vegetation undergo changes, the ecosystems on which plants and animals populations depend on undergo changes as well and these changes on the long run impacts on human.

It has been reported (Winjum and Schroeder, 1997) that changes in vegetation composition of the forest could threaten the existence of large number of species. Forest vegetation stores about 2/3 of above-ground terrestrial organic carbon and over half of the carbon present in the worlds' soil. Change in vegetation composition could therefore be grave as few trees on the landscape will contribute little carbon to the terrestrial stock (MacDonal et al., 1993). The extent of identified causes of changes in tropical forest vegetation composition, its long term impacts and suggested remedy are *inter alia* discussed.

2. Anthropogenic causes

2.1. Deforestation

Harvesting and unregulated exploitation of forest products have been major factors to changes in species composition and distribution of forest vegetation (Colombo et al., 1998), especially in the tropics where there is high dependent on non-timber forest products for various use values including health-care-delivery. Once a plant has been found to be useful for a purpose or multi-purposes by the local communities, such plants automatically comes under unregulated harvest pressure. On the process of harvesting the desired plants, much of the vegetation is eventually destroyed alongside, resulting to changes in the vegetation as well as its composition. Food production is as a result of farming activities that take place on the land. However, this has led to the loss of vast forest area, which imposes negative impacts on man. Many pristine forests are being clear- felled to provide land for food crops.

2.2. Application of chemical fertilizers

The application of pesticides and chemical fertilizers which forms nitric acid leads to soil toxicity such that only few tree species could subsists to form forest, thus resulting to changes in forest structure and species composition.

2.3. Bush burning

Bush burning is still a cultural practice in most of the third world countries. Shift cultivators or encroachers refers to people who have moved into, and established small-scale farming activities in the forests in other to

sustain themselves and their families, and in time shift to other areas. They are landless peasants who have followed roads into forested areas. They cause additional damage to the composition and structure of the forests and are currently being blamed for 60% of tropical forest vegetation loss (Apade, 2003; FAO, 2010).

2.4. Fuelwood extraction

The United Nation's Food and Agriculture Organization estimated that 1.5 billion of the 2 billion people worldwide who rely on fuelwood for cooking and heating are overcutting forests. This problem is worst in drier regions of the tropics (FAO, 2007). Wood is the major source of fuel for domestic cooking for nearly half of the world's population and as they are removed, the forest vegetatively undergoes alteration. In some parts of West Africa, availability of fuelwood is an essential element in community welfare (Nwoboshi, 2002). According to FAO (2007) more than 90% of the trees cut in Africa were burnt as firewood. Cline-Cole (1994) observed that the fuel wood - human needs relation does impede forest conservation/protection, and gradually alters the composition of forests vegetation.

2.5. Logging

Logging roads are used by landless farmers to gain access to forest areas which process involved the destruction of vast area of forest vegetation. These access roads once created becomes permanent such that the existing vegetation is lost. Heavy trucks are used in cutting and extracting logs which brings about soil compaction, destruction of young plants as well as make regeneration difficult. For this reason, commercial logging is considered by many to be the biggest single agent of change in vegetation and composition of the tropical forest. Apart from domestic fuel demand in Africa, Fairhead and Leach (1997) reported that the highest cause of forest and tree depletion in the region, resulting to vast changes in vegetation composition is timber export to the Western countries.

2.6. Urbanization / industrialization

Civilization and culture dynamics have resulted in industrial revolution and global commerce in the modern world. This has led to the rise of heavy industries and factories, large cities and their accompanying pollution. Increase in areas occupied by the cities forces the forests to recede. As the world turned to the forest to obtain the majority of the raw materials to sustain the industries, the search for raw material from the forest becomes an occupation especially to rural dwellers that traverse the forest gathering such material for sale. As a result of this emerging market there is constant removal of the vegetation causing an alarming rate of changes in forest composition.

2.7. Climate change

Climate change may be viewed as a progressive anthropogenic cause of change in vegetation composition. When atmospheric temperature and precipitation regimes is altered, coupled with elevated CO₂, it brings a

direct impact on vegetation composition through their effects on the physiology and population ecology of plant species as well as other processes. Increase forest fires and extreme weather due to climate change will exert a stronger effect on forest vegetation composition (Bazzar, 1996; Overpeck et al., 1990).

Models (Lenihan and Neilson, 1995; Mackey and Sims, 1993; Solomon and Bartlein, 1992) have predicted dramatic changes in forest vegetation composition due to changes in temperature and precipitation. Most plants are disappearing due to inability to withstand high temperature while some die off as a result of high rate of transpiration induced by abnormal day- time temperature.

3. Natural Causes

Changes in vegetation composition of a forest stand largely depend on the physiological, population, and community ecology of resident flora and fauna, as well as site disturbance characteristics (Bazzar, 1996). Forest fires, wind-throw and insects outbreaks has been identified (Peterson and Carson ,1996) as some natural causes of changes in tropical forest vegetation composition.

3.1. Wind storms

Wind –storms is capable of throwing down trees and a single thrown tree could form a gap of 100-400m². The canopy gap so formed could take between 120 to 190 years interval for the forest to return to its original composition (Dahir and Lorimer, 1996).

3.2. Land degradation

Land degradation reduces the quality and productivity of land and manifests in various forms, including changes in vegetation composition. In the Sahel and Northern Guinea Savanna of Nigeria, the predominant factors that brings about land degradation are wind erosion and sand dune formation, drought and desertification. Wind speed has become increasingly high and quite unpredictable. Sheet erosion is fast removing forest vegetation, especially in the sandy soil regions of South-Eastern Nigeria, ensuing vegetation changes (Anon, 2010).

3.3. Drought and high temperature

Drought and high temperature with low humidity easily resulted in forest fires especially in the savanna and savanna woodlands. This happens during October through February, when the fuel level is high on forest floor. Uncontrolled bush fire during dry period do spread long distances and sometimes only brought to a stop by natural barriers like rivers and streams. There is usually delay in vegetation recovery. By the onset of the growth season it is observed that many of the plant species could not recover and are completely eliminated from the community (Oni et al., 2010). Changes in temperature and precipitation have changed forest location, structure, composition, and productivity. Climate change could drive the migration in tree

species, resulting in changed in the geographic distribution of forest types and new combinations of species within forests (IPCC, 2007).

3.4. Rainfall and flood

The current global warming induces the melting ice from the Polar Regions which brings liquid flow into seas and Oceans thus increasing water levels. As this goes on, the low lying coastal regions start experiencing flood. The rise in sea level could be attended with excessive evaporation and excess moisture in the atmosphere leading to excessive rainfall. Forest vegetation generally requires certain amount of rainfall during the growth period. When this becomes excessive it leads to poor forest structure. While some areas experience excessive rains, and flooding, in other it could be severe heat and reduced rainfall. Flooding make the soil water-logged and could destroy standing vegetation. Excessive rainfall will induce erosion thus washing away the soils that sustain vegetation, leading to change in vegetation composition.

The north eastern Nigeria which is mainly a Sudan Savanna is gradually increasingly becoming an arid environment at the receding rate of 6 meters per year occasioned by fast depletion on the amount of flora resource on the land. In the same vein, in the Sudano-sahelian region, the annual rainfall during the most recent decades (1961 –1990) has been between 20 to 40 per cent less than it was from 1931 – 1960. There has been a net shift toward aridity, especially towards hyper aridity, and a consequent net loss of semi-arid and dry sub-humid land that were once highly vegetated.

4. The long term impacts

Changes in forest vegetation composition has both immediate and long term impacts that cut across all strata of life from micro-organism to man. The people of today may be better off, but the immediate long term impacts for man is that the rate of hunger and poverty especially in the tropics will rise, as majority of people here rely on forest vegetation for food, medicines and income. The impacts include the following:

4.1. Shortage in food, medicine and income – poverty and hunger

Forest vegetation comprises a host of plants species and their roles in livelihood are in many forms (Tee and Ageende, 2005; Tee, 2007) which include food supply, income resources, employment, education, medicines, and energy. In terms of food for example, African oil bean seed (*Pentaclethra macrophylla*); *Thaumatococcus danielli* and *Parkia biglobosa* (Okafor and Lamb, 1996) are being used for upgrading protein content of baby food, while *Irvingia gabonensis* fetches instant cash as the seed is used for making soup. *Thaumatococcus danielli* is used by over 80% (Anamayi, et al., 2000) of the rural people in Nigeria as spices in dishes and relishes. Non- wood resources like *Bridelia feriginea*, *Ceiba pentandra*, *Vitellaria paradoxa*, *Sida acuta*, *Annona senegalensis*, etc. (Awosusi, et al., 2010) are used in medicinal services by rural and urban people while 80% of rural communities in Africa (Adebisi, 2005; Sofowora, 1997; Popoola and Oluwalana, 1998) depend on traditional or herbal medicine for health care. Bush meat remains a major source of animal protein (Ayodele

et al., 1999) to rural dwellers and 90% of the poorest people (FAO, 2009a) rely on forest vegetation for subsistence and income. Hunting is still a major occupation of some rural communities and in the local markets (Olasupo et al., 2010) women are actively engaged in the sale of fresh and preserved wildlife meat and parts.

In Zimbabwe, 253,000 people were employed in the forestry sector in 1997 while in Sri Lanka (Sim et al., 2004) between 2100 – 2200 persons are employed by rattan craft industry as a source of family income. Also in Sri Lanka (Liyanaarchachi, 2004) medicinal plants from forest vegetation have been used to treat or cure over 300 ailments with over 600 plants species in use in traditional medicine. Medicinal plants are being exported from Sri Lanka to other countries which in 1993 amounted to US\$2 million. Medicinal and health products from forest vegetation had an estimated turnover (Oei, 2003) of between 5 and 6 billion US\$ in 1995. An estimated 100 and 105 tons of *Dacryodites eludes* (bush plums) and *Gnetumafriicana* leaves are in export trade for West Africans living in Congo Democratic Republic, France and Belgium.

The United Nation through the Food and Agriculture Organization (FAO, 1991) is giving attention to the role of forest vegetation in food security due to the realization of the dependency of rural people on trees and forest to meet important needs such as food and income. The early man without any means of technology is reported to have gathered plants from the vegetation (Banjo et al., 2010; Hoskins, 1991) and hunted for animals from the forest for his daily consumption. Forest vegetation and its composition therefore plays very large role in poverty and hunger eradication, and its current changes will bring severe consequences if unchecked.

4.2. Environmental degradation

Forest vegetation stabilizes the soil. Negative changes in vegetation composition results into low tree population, more unregenerate gaps, thereby opening the vegetation to more direct and intense rain drops. Unshielded force of rain leads to sheet and other forms of forest soil erosion, paving way for various forms of environmental hazards to take their turn. In the next few years if nothing is done, people living in some part of Onitsha and Enugu in the South Eastern part of Nigeria may relocate voluntarily due to ensuing land sliding.

4.3. Loss of biodiversity

A change in vegetation composition either to the right or to the left, will results to corresponding changes in flora and fauna populations of the forest ecosystem. Wildlife populations depends on flora composition of the forest which serves as shelter and food and when forest vegetation undergoes changes in composition, depending on change factor, it will lead to migration, death and complete species extinction. Exposure of the forest soil due to changes in vegetation composition will lead to death of millions of soil micro-organisms that play major roles in the bio-geochemical cycles that support all forms of life on earth.

4.4. Accelerated climate warming effects

Warming effects of the climate is surfacing across the globe from the West to the East, ranging from flood to wind-storm. In Nigeria, relatively semi -arid zones like Jigawa, Borno and Sokoto, with very low annual rainfalls are undergoing flooding. But more severe effects are yet to surface. This is because tree population in the tropics, especially in Sub-Saharan Africa is on the decline (Unanaonwi, 2010), and trees among other roles, absorbs atmospheric CO₂ which mediates global warming.

4.5. Sickness and diseases

As a result of losses in biodiversity which equally affects micro-organisms, loss in decomposer populations would mean that our waste whether human or material, will remain un-decomposed, thereby becoming health hazards. Medication defying diseases and sicknesses may break out in the long run leaving the people of that era with no hope of survival.

5. Remedy

Many of these impacts are already on and some are still under human control and management for the moment, but in the long run they will become uncontrollable. However, a lot can be done today to arrest these grave impacts resulting from changes in forest vegetation composition. They include the following strategies:

- Campaign against indiscriminate bush burning and illegal logging activities should be set up, while the communities involved should act as vigilante groups enforcing rules and regulations.
- Communication strategies should be developed via person to person, small groups, crowd oriented, and mass media capacity building and conservation clubs be set up.
- There should be a waiting period in every forest area during which logging activities and harvest of timber products be suspended.
- The local communities should be exposed to some basic principles of modern forest management and also acquire the basic skills to implementing them, such as nursery practices and harvesting techniques.
- More forest land should be brought under protection for biodiversity conservation.
- Harvesting of non-timber forest products should be regulated and controlled.
- Reduction in all activities that induces changes in vegetation composition of the forest.

6. Conclusion

It may be difficult to attribute current world climatic and environmental phenomena to changes that have taken place in forest vegetation composition. But that is a fact. This paper has however, highlighted these, pointing out that more severe impacts are yet to come. Earlier predictions that climate change impacts will

not be much felt in tropical Africa has proved untrue with the current flooding in many of the tropical worlds and beyond. Efforts must be made to maintain the composition of forest vegetation to prevent the long term impacts which could be uncontrollable.

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