

BIODIVERSITY CONSERVATION AND DESERTIFICATION CONTROL IN SUDANO-SAHELIAN ECOSYSTEM

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Abstract

Desertification from time immemorial has been a serious environmental problem in our society. The focus is on the concept of desertification, its causes and its consequences on the environment. The paper also highlights on the control measures adopted to combat the effect of desertification. It emphasizes on some factors which cause desertification problem in our environment which are classified into natural factors, anthropogenic factors and socio-economic factors. Some of the natural factors are: drought, climate, pest and disease outbreak. Those caused by anthropogenic factors which human induce are: increasing in population, over-grazing, deforestation, fuelwood exploitation, forage and collection of plant species for medicinal purpose, social, cultural, political, economic structures which trigger the menace of desertification in a particular geographical location. Other factors that cause threat on desertification are greed and ignorant about environmental issues. The paper also stresses on some indicators of desertification which constitutes the problems caused by desertification which are classified into physical factors, biological factors and socio-economic factors. Those of the physical factors are rainfall pattern, temperature variation, wind speed, sunlight duration, sand storm and other soil factors. Those of the biological factors are plant and animal distribution, abundance and diversity, species composition, vegetation type, land cover reduction and decline in livestock production and yield. Others are socio-economic which involves change in land and water uses, abandonment of villages, change in social processes and increase in conflicts amongst the populace. It is therefore, necessary to adopt some control measures such as annual tree planting, conservation of existing vegetation, improvement in soil nutrient status, alternative energy source, shelter belt establishment, sand dune fixation and farm forestry practice.

Keywords: Desertification, Biodiversity Conservation, Environmental Amelioration

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Introduction

Environmental problems are of a great concern to the people all over the world today. Many nations and non-governmental organizations are committing a lot of human and material resources towards proffering lasting solutions to these problems. The problems can only be prevented when people are well enlightened and therefore, individuals need to be educated on the need to adopt some environmentally friendly actions that can ensure ecosystem protection and sustainability (Huston, 2002). Education in

environmental studies is very fundamental for human continuous existence on planet earth. We can only consider ourselves educated when we have acquired substantial knowledge about the world in which we live, about what we are doing to harm it, and about what we can do to save and preserve it from collapse for the future generations (Magome, 2000).

Tropical rainforest over the years has been known to be the richest in biodiversity, but the destruction of rainforest abundant bioresources is due to poor land-use pressure as a result of increase in human population and other anthropogenic activities (Etuk *et al*, 2013). These have drastically reduced the abundance of biodiversity and its functions thereby exposing the ecosystems to different kinds of environmental perturbations such as desertification, erosion, land slide, genetic erosion, flooding, destruction of trophic levels, loss of biodiversity, leaching of plant nutrients, ozone layer depletion, green house effect, global warming and climate change (Etuk *et al*, 2009).

Biodiversity according to Agabi (1995) refers to the wealth of the living world, the variety of life-forms occupying the earth and the millions of plants and animals. According to Saba and Dore (1991), biodiversity is the combination of renewable natural resources and the ecological services, which arise from normal functioning of the ecosystem, may be considered as the biological resource endowment. This refers to the variety in numbers and prevalence of ecosystems, species and genes, thus implying genetic diversity, species diversity and ecosystem diversity (Joshua and Umoren, 2009). Biodiversity also refers to the number, variety and variability of all living organisms in terrestrial, aquatic and arboreal ecosystems and to the ecological complexes in which they are part. On the other hand, biodiversity conservation involves a wide spectrum of activities and behaviours including protection of plant and animal species from reckless exploitation, sustaining food production without damaging the soil, maintaining or even raising the level of cleanliness and the aesthetics of the environment (Agabi, 1995). Conservation is concerned with the protection, preservation and wise use of resources (Okebukola and Akpan, 1999). Without the adoption and practice of conservation may lead to serious environmental degradation such as desertification.

Globally, it is observed and recorded that deserts are expanding. Wind transported sand has now covered considerable areas of the earth's surface. Archaeologists have shown that the Sahara Desert covers a greater area today than it did some decades ago and it is still expanding. Continuous drought over the years along the desert margin of Mauritania, Niger, Senegal, Chad and Mali have recently lowered the water table, killed enhance encroachment. Desert encroachment gives rise to loss of plant and animal species as a result of loss of natural environmental features especially in some northern states in Nigeria (Okebukola and Akpan, 1999). Therefore, desertification refers to the process of

gradual loss of vegetation and moisture ultimately resulting at bare land with a few patches of vegetation, if any (Adeniyi, 1997).

Causes Of Desertification And Control Of Desertification

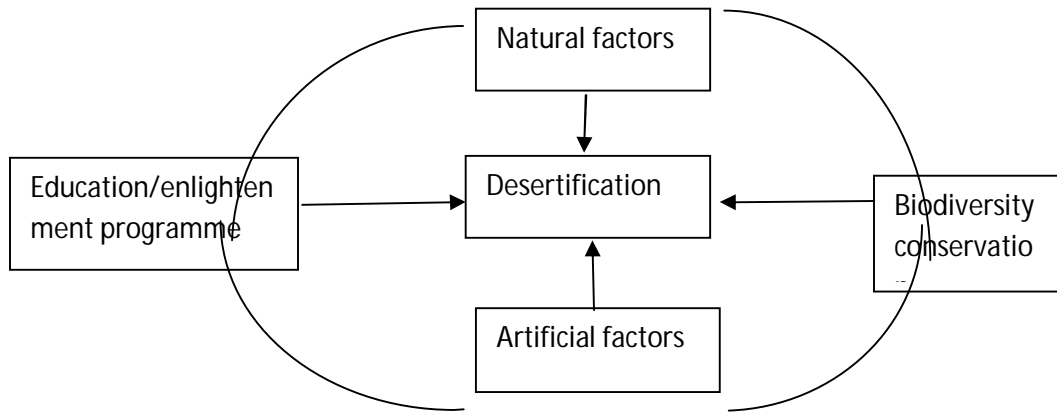


Fig. 1: Organogram Illustrating causes and control of desertification

Causes of desertification are both natural and artificial (anthropogenic) factors. There are three major natural causes of desertification:

Climatic factors: Extremes and prolonged occurrence of advisers weather conditions due to absence of rainfall, resulting in drought.

Edaphic factors: This refers to soil types, mostly sandy, with low organic matter content due to scanty vegetation cover, low in fertility, high susceptible to wind and water erosion.

Biotic Factors: This refers to the nature of man and animal dependence on vegetation for survival. Man from his actions, directly or indirectly on the ecosystems, interacts with his environment and is the chief agent of desertification (Gwandu, 1990; Okebukola and Akpan, 1999).

Anthropogenic Factors in Desertification

- 1) **Population expansion:** The ever increasing human and animal populations calls for corresponding increase in the demand for forest resources. This results in over exploitation, which leads to desertification
- 2) **Over-exploitation of natural vegetation through deforestation:** The irrational action of man in exploiting forest resources for fuelwood, poles for electricity, and

livestock fodder has resulted in the depletion of soil fertility, floristic compositions and the entire ecosystem

- 3) **Over-grazing of the land:** The destruction of natural vegetations through over-grazing by livestock of high demographic number coupled with the decrease in the amount of rangeland available which results at selective grazing, premature grazing and trampling.
- 4) **Bush burning:** The intensification and practice of slash and burn agriculture as part of the traditional farming system causes loss of undergrowth, valuable species of trees that are of important medicinal values, destruction of soil micro-organisms- both flora and fauna, dissipation of some vital nutrient elements to the atmosphere and general loss of soil fertility.
- 5) **Continuous cropping and over cultivation:** The cultivation of crops repeatedly on the same piece of land especially on the marginally productive areas of Borno, Kano, Katsina and Sokoto state poses a serious threat to the vegetation cover and environment. For example, ploughing and irrigation, which may produce a few good harvests in short term may also lead to ecological degradation in the long run (Gadzama, 1991; Okebukola and Akpan, 1999).

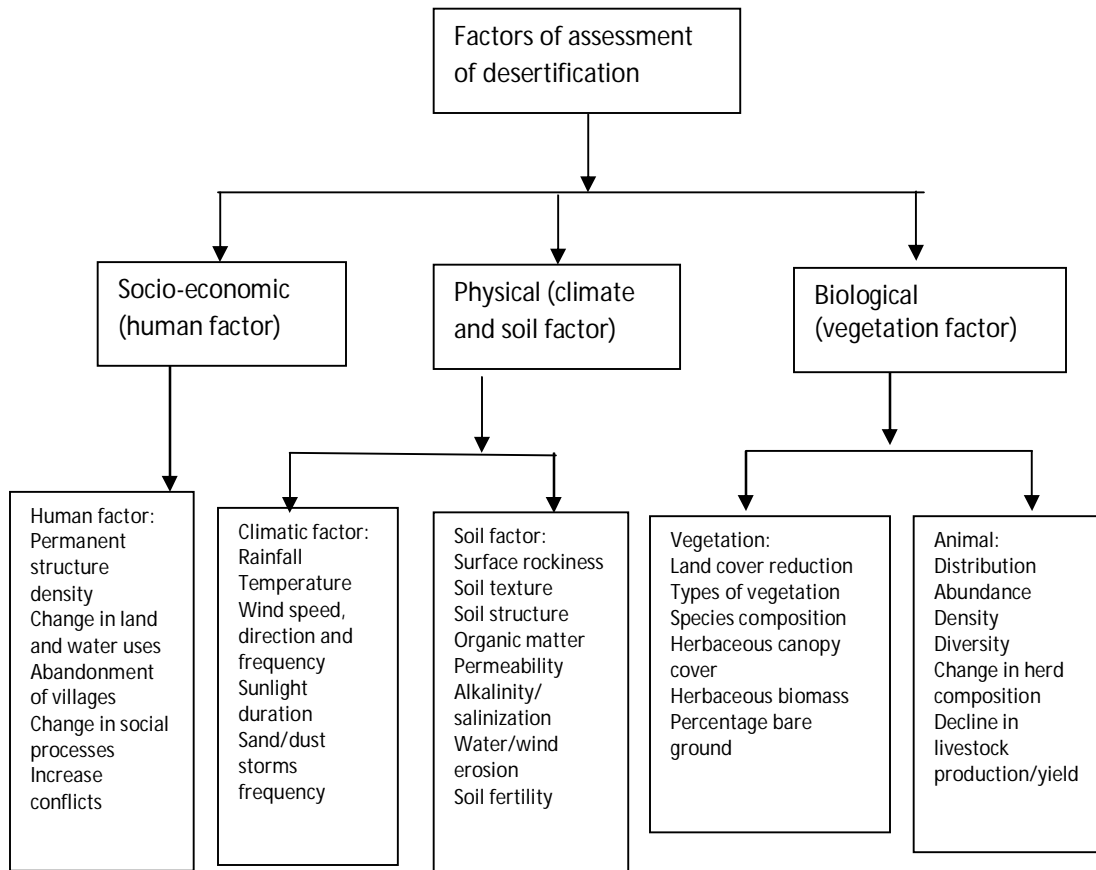


Fig. 2: Organogram for assessing and mapping of indicators of desertification

Desertification is usually the outcome of stress and disturbances on ecosystems which may be natural or artificial. When ecosystem remains undisturbed, it is said to be stable and the stability here may be viewed in two perspectives.

- 1) **Structural stability:** This is said to occur when the species composition of the ecosystem remains more or less the same at a given time in a particular place.
- 2) **Functional stability:** This is said to occur when ecosystem characteristics in terms of biomass composition and production, and nutrient cycling rates remain unchanged at a given time in a particular location.

According to Mortimore (1985), the following has been listed as some indicators of desertification in a given place such as:

- (1) The disappearance or permanent degradation of the vegetation
- (2) Soil erosion by wind
- (3) Sand dune formation or reactivation
- (4) Desiccation of the soil profile
- (5) Lowering of the ground water table
- (6) Decrease in soil depths
- (7) Low soil organic matter
- (8) Low soil fertility
- (9) Soil compaction/crust formation
- (10) Salinization/alkalinisation
- (11) Decline in quality and quantity of surface water
- (12) Increase seasonality of spring water and streams.

General effects of desertification on the environment are of two types namely, ecological effects and socio-economic effects:

Ecological Effects

- 1) **Vegetation loss:** Sparse population of vegetation cover makes the soil to be highly susceptible to wind, and water erosion, which automatically leads the formation of sand dunes and reduction in the capacity of the land support agriculture.
- 2) **Effect on water supply:** Because of lack of abundance of vegetation cover on the land, large amount of water are lost through evaporation which results at a high degree of desiccation.
- 3) **Effect on livestock:** This increases the mortality rate of animals because of travelling a long distance in search for food and water which may on the other hand, exposes the animals adverse weather conditions and diseases.
- 4) **Effect on soil fertility:** The continuous depletion or loss of vegetation cover on the land can lead to loss of organic matter content in the soil, resulting at a high degree of salinization, which may not favour agricultural production in the area.
- 5) **Effect on crop yield:** The general effect of lost vegetation cover which would have formed the bases for organic matter accumulation that would lead to the supply of nutrients to the will result at low yield of crops.

Socio-Economic Effects

- 1) **Migration:** Due to lack of food, portable water for both man and livestock, as well as employments, there will be a serious rural-urban migration at an alarming rate to where they can find favourable condition for their survival.

- 2) **Pressure on available infrastructure:** A high pressure will be mounted on the few available infrastructure in the area leaving the old men, women and children in a pathetic condition of inadequacy.
- 3) **Social vice:** In the absence of fertile land for agriculture and basic social amenities such as hospitals, schools, pipe born water, electricity, food, road, etc., there is bound to social vices. The cities will be filled with loiterers and beggars with high incidence of crime and truancy among idle immigrants from the affected communities.
- 4) **Famine and malnutrition:** Lack of food due to poor land for agricultural production leads to poverty, famine and lack of nutrient intake for both man and animals resulting at high mortality among them.
- 5) **Lack of industrial raw materials:** Since 1972 drought for example in Sokoto state, there has been irregular and inadequate supply of industrial raw material such as cotton, cotton seeds and tanning materials in the area (Olagunju, 1999).

Some Ways Of Controlling Desertification

There are several ways of controlling desertification which may be classified into short-term and long-term measures:

Short-Term Measures

- 1) **Conservation of existing vegetation:** The existing vegetation cover available in gazetted forest reserves and other wooded or reserve areas should be properly managed, policed and laws should be enacted against the indiscriminate exploitation of the resources through felling of trees, bush burning and over-grazing of animals on the land. The laws should also be enforced on the protection of planted trees in some gazetted areas. The proper management of the existing forest reserves and other vegetations through some scientifically approved methods such as enrichment planting and wildling can also in the conservation these bioresources in the area.
- 2) **Soil nutrient status improvement:** Soil mineral elements status should be improved by adding organic and inorganic manures to the soil. This will enhance the growth and development of the existing vegetation in order to continue to render sustainable ecosystem services.
- 3) **Alternative energy sources:** The use of wood for energy in both domestic and industrial purposes should be prohibited and alternative source of energy such as gas cookers, kerosene stoves, solar energy appliances should be provided. This will dramatically reduce the from the forest for fuelwood to generate energy and in this case, the forest and other vegetation will be allowed regenerated to its full capacity for sustainable environmental conservation and protection.

Long-Term Measures

- 1) **Shelter belt establishment:** The establishment of shelter belt is one of the important ways in which desertification problem can be controlled. The arid zone afforestation programme, ecological disaster relief programme, forestry II project, state forestry services, drought and desertification should assist in establishing a functional shelter belts especially in some sudano-sahelian areas of Nigeria.
- 2) **Agroforestry practices:** This is a form of multiple land use system whereby agricultural crops and forestry tree species are planted on the same piece of land. In agroforestry, trees and other shrubs that can protect the environment against agents of environmental degradation such as erosion and flooding are planted (King *et al*, 1997). The trees can also serve as a source of wood, energy, food, fibre, medicine, pole, and furniture, but with the sole aim of protecting the environment. Also, the planting of some selected fast grown species of leguminous tree in agroforestry also enhance the fixation of nitrogen to the soil through nodulation by nitrogen fixing bacteria to augment the nutrient status in the soil for better vegetation growth and development (Etuk *et al*, 2013).
- 3) **Annual tree planting campaign:** This practice should be carried out on yearly basis such that the trees capable of rendering environmental amelioration services should be planted in every location in some sudano-sahelian areas. Such exercise is backed up by government policies. Strategies for educating the general public on the dangers of an environment devoid of trees need to be addressed. Apart from this, the general public should be mobilized to make afforestation a people oriented programme.
- 4) **Sand dune fixation:** This involves the planting of grasses on the dunes to reduce movement of sand particles from one location to another after which the introduction of tree species should be accompanied. This will enhance the stabilization of sand particles in such locations.
- 5) **Communal/individual wood lots programme:** This is to enhance the provision of more tree species availability in the environment for the benefits of fuelwood, poles, fodder, shade, fruits, gums and resins and other commercial products from the trees.
- 6) **Farm-forestry practice:** Farm forestry practice is another important way of controlling desertification menace in some Sudano-Sahelian environment, it is a programme that involves the distribution of seedlings to farmers free of charge to plant on their farms in order to protect, water and nurture the trees to maturity. This in a way, enhance in-situ and ex-situ conservation, where existing trees are protected from destruction so as to protect the soil from wind erosion by serving as wind breaks.
- 7) **Integrated rural development programme:** This programme can assist in improving the living conditions of the people in the affected area because it involves the irrigation of the shelter-belts, it also includes other welfare services like

the provision of water for the rural folks and their livestock in the form of boreholes.

Conclusion

Desertification is a serious environmental problem which can declare land and the entire ecosystem and its resources useless. It is either caused by natural factors or artificial factors, otherwise called anthropogenic factors which human induce factors. Some natural factors that can cause desertification include drought, climatic factors, and pest and disease outbreak. It has been known that in dry lands where plants grow near their limits of tolerance, a slight change in environmental factors or a little disturbance can lead to more bare grounds, loss of species, genetic erosion, general land degradation and the entire ecosystem destabilization. Drought is a serious condition of the environment where there is insufficient supply of water or moisture to the soil to meet the requirement of the plants, animals including livestock and wildlife, and people. Therefore drought is one of the major signs or indicators of desertification in a particular geographical location. Human induce factors have been identified as another serious cause of desertification such as population increase, over-grazing of the land, deforestation, forage and collection of plants for medicinal purposes, socio-cultural, political and economic structures of a particular place. Other factors that can cause desertification are poverty, greed and ignorant about environmental issues. Therefore, in order to mitigate this environmental perturbation, enlightenment/sensitization programmes through education should be organized in form of workshops, seminars, symposia and conferences to the people about environmental issues. Apart from these, appropriate conservation strategies should be adopted, such as maintenance of existing forests through enrichment planting and wilding, community forestry practice, agroforestry practice, avoidance of over-grazing, bush burning, continuous cropping and deforestation.

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