

THE INTERNATIONAL JOURNAL OF SCIENCE & TECHNOLEDGE

Forestalling the Gloomy Food Security in Nigeria through Conservation of Soil Resources

Maton, Samuel Mark; Nesla

Principal Tutor, University of Jos, Kwara University Wukari, Nigeria

Ruth Asheazi; Olaku

Principal Tutor, Department of Remedial Sciences, University of Jos, Nigeria

Olaku Maga Zacchariah

Assistant Lecturer, Department of Geography, University of Jos, Nigeria

Dodo Juliet Dingsen

Assistant Lecturer, Department of Chemistry, University of Jos, Nigeria

Abstract:

Soil forms the basis of most living things in the biosphere by providing food nutrients to plants, animals and human beings. This paper has examined ways and processes in which Nigerian soils are being over used mercilessly in an attempt to raise sufficient food to meet the dietary requirements of the teeming population. The paper argued that the traditional methods of bush burning, clean clearing continuous cropping and over-grazing exacerbate soil erosion which can negate the food security agenda the successive regimes have been trying to attain. The paper appraised the impact of soil mismanagement across the world on the past and present societies and then concluded by recommending the conservative measures to pursue in order to rejuvenate Nigerian soil resources and avert the gloomy, looming food crisis.

1. Introduction

Nigeria is a country located in West Africa Sub-region on the Gulf of Guinea. Geographically it is found between latitudes 4⁰N and 14⁰N of the Equator; and between longitudes 3⁰E and 15⁰E of Greenwich Meridian (Atlas of Nigeria 2011:18).

According to Avav and Uza (2002:92), Nigeria has a landmass of 98.3 million hectares. The population census of 2006 put the total number at about 140 million, made up of 50.78% male and 49.22% female. Between 70-80% of the entire population is basically agrarian as the country has a cultivable land of 72 million hectares which have been under rain-fed agriculture while only 1 million hectares are said to be under irrigation, mainly in the northern parts of the country.

Although Nigeria is within the tropics with tropical soil types, Avav and Uza (2002:92) have recognized three broad categories namely, wetland soils, forest soils and savanna soils. The wetland soils are generally derived from alluvial materials since they readily form in nearly level plains and gently undulating relief of the coastlines, the Niger Delta region and flood plains of major Nigerian rivers and their tributaries. The soils vary in depth, texture and porosity but generally are susceptible to water-logging hence productivity cannot be assured. The forest soils comprising terralitic and ferralitic soil dominate the southern forests of Nigeria and extend northwards into parts of Kogi, Benue and Nasarawa States. Heavy rainfall of the southern Nigeria accelerates leaching hence the soils are generally reddish- yellow in colour and too acidic to guarantee continuous crop production. The Savannah soils on the other hand consists of ferruginous tropical soils and lithosols. According to Akinbode (2002:21), the ferruginous soils developed on basement complex rocks in the north and western parts of the country and that the surface horizon is sandy underlain by a clayed layer. He pointed out that lithosols which dominate mainly the Kano-Kaduna and Kaura Namoda-Jos zones are wind- blown sandy, materials derived from the desert. Although, the savanna soils support the production of grains and legumes, they have no guarantee for continuous agricultural potentialities.

From the background of Nigerian soils, it is clear that their fertility for continued food production cannot keep pace with the growth in population. With her current growth rate of 3.3% per annum and the food production rate of only 1.2%, it is quite obvious that about half of Nigeria's food requirements have to be imported (Onyenze, 1999:55). The billions of money that Nigerians do spend in the importation of rice and wheat actually confirms that Nigeria's food security is under threat as there are today many food insecure people; most of whom either have nutritional deficiency, anaemia or are chronically malnourished. This unfortunate development is no doubt linked to the decline in food supply caused by careless farming methods that accelerate soil erosion.

This paper set to examine ways and processes of soil deterioration in Nigeria, the resulting impact on past and present societies and then recommend measures to be taken in order to rejuvenate and conserve the soil resources. The paper is sequentially arranged thus: introduction, clarification of concepts, theoretical framework, ways and processes of soil deterioration, the resulting impact on the past and present societies and recommendations on measures to be taken to rejuvenate and conserve soil resources.

2. Clarification of Concepts

The concepts that need to be clarified are four namely: Soil, soil conservation, food security and gloomy food security.

2.1. Soil

There is no single universally accepted definition of the term soil. This is because it means a different thing to various disciplines. However, the farmer's perceptive of soil as a medium in which his crops are grown is more practical and would be adopted in this paper. In other words, soil refers to the loose material which forms the upper layer of the earth's crust into which plant roots grow and derive nutrient elements and water to yield fruits and seeds for consumption.

2.2. Soil Conservation

As used in this paper soil conservation refers to the totality of the various efforts which are being taken to protect the soil resources from further damage that can affect the present and future generations from benefiting. In other words, the term means sustainable management of soil resources so that they could yield the greatest sustainable benefits to present generation while still maintaining their potential to meet the needs and aspirations of future generations.

2.3. Food Security

The antithesis of food security is famine, hunger, starvation or food insecure. World Bank (cited in Adejuwon, 2006:1) sees food security as "access by all peoples at all times to enough food for an active healthy life". The paper upholds the World Bank's definition of food security.

2.4. Gloomy Food Security

The paper regards 'gloomy food security' as a threat to continued food supply to feed Nigerian society. In other words, it refers to potential failure of agricultural production to provide the required food to all Nigerians at all times for active healthy life.

3. Theoretical Framework

Understanding man's continued dependence on the dictates of the environment and his ability to avert and even transform the adverse effects arising from his interaction with his physical environment can be achieved within the concepts of environmental determinism and environmental possibilism.

The doctrine of environmental determinism, whose proponents include Hippocrates, Strabo, Bodin, Hackel, Montesquier, Buckle, Fredrick Ratzel, Ellen Churchill, Semple and Ellsworth Himtington emphasizes the influence of environment on economic life and social progress of mankind (Barry and Imo, 2003:86). Environmental Determinism purports to explain the complexities and variations in human society in terms of non- human constant. Determinism looks for the mechanistic chain of direct cause from particular physical conditions of the human environment. In other words, the version of the philosophy, according to Obasi (1999:202) 'rests on the various connections and interdependence of things and events' as typified by biotic-abiotic relationships. A good example of environmental determinism can be cited in circumstances where dependence on soil resources to raise food crops can lead to impoverishments, decline in productivity and threatens food security. It should be noted that between 70- 80% of Nigerians are farmers who depend largely on tilling the soils to raise food crops. Unfortunately, the process of tilling the soils involves clean clearing of bush, burning bush and felling down of trees: Consequently, causes soil erosion, reduces crop yield as well as threaten food security. Farmers in Nigeria depend so much on the soil to raise food crops because of the rapid rate in population of 3.3% per annum which according to Makama (cited in the New Standard, Wednesday July 29, 2009) translates to an annual increase of 5.5 million people. The concept of environmental determinism poses a challenge to Nigerians to begin to make alternative arrangement to get food without destroying "the goose that lies the golden egg" (soil).

While environmental determinism sees man as a product, a child and a slave of the earth that mothers, feeds and restricts his utilization of soil resources, environmental possibilism whose proponents include Paul Vidal, de Blanche, Jean Brunhes, Albert Demangeon, Emmanuel de Martonne and Roger Dion 'suggests that man can alter the environment in any manner as a consequence of his technological and scientific skills as the environment is passive' (Barry and Imo, 2003:87). Environmental possibilism purports that man no longer sees himself as being under the grip of nature but a product of change to suit him (Obasi, 1999:204). This means that it is possible for Nigerian farmers who have already destroyed soil resources in their quest to raise food to meet their dietary requirements can still revert the misfortune. Hence this paper's position is that as Nigerians try to avoid further mismanagement of soil resources and take necessary measures to rejuvenate the soils, food security will certainly be assured.

4. Ways and Processes of Soil Mismanagement in Nigeria

Soil erosion has long been recognized as a serious national problem, which varies in degree, extent and severity. The social and economic losses that result from soil mismanagement have been noted by many scholars (Faniran & Ojo, 1980; Ohiaeri, 1988; Oranekwulu 1993; Akinbode 2002; and Olusola 2009).

Akinbode (2002:20) has noted that apart from the natural processes of leaching and laterisation, man-induced activities such as over cropping, overgrazing and annual burning in Nigeria help to strip the soils and thereby lower their fertility potentials. On the other hand, Ohiaeri (1988:332) has recognized felling down of trees that help to cushion the impact of raindrops and solar energy on soil as well as non-agricultural activities like road construction, tracks and footpaths, excavation of sand for construction, surface mining and

clean sweeping of compounds, village squares and premises as the causes of soil deterioration with deleterious consequences in Nigeria.

Faniran and Ojo (1980:302) earlier posited that soils that have been over worked easily become unstable when exposed to weather effect like rain-water and wind. They maintained that on impact, the raindrop splashes some of the soil particles upon which it drops, moving them both vertically and horizontally. Wind erosion is very active where anthropogenic activities make the soil loose, without adequate vegetation cover. The process of wind involves dislodgement and initiation of the movement of soil particles, transportation of these particles and their deposition.

Population stress on land results in reduced fallow time and thus, the degradation of the status of vegetation cover has been shown as major cause of accelerated erosion in most parts of Nigeria generally and the south-eastern states in particular (Imevbore, Ogunkoya and Sagua, 1988:250). Overgrazing in hilly and semi-arid areas and fires such as the annual dry season which is particularly prevalent in the Savanna Zones of Nigeria have also been found to be the major causative factors of soil erosion.

On the whole, there is no doubting the fact that Nigerian agricultural lands are prone to accelerated soil erosion: consequent upon human abuse of the environment that accommodates, feeds and cloth humanity. Furthermore, the high isolation of the tropics causes rapid evaporation and desiccation thus, leaving exposed soils friable to the mercy of weather effect which threatens food security.

Reinforcing the position of other scholars, Olusola (2009:239) averred that soils that are exposed to the full blast of rainfall and temperature through abuses like inappropriate land clearing, burning, overgrazing, flooding and irrigation schemes have their resultant effect of rendering the soils infertile, hence very low crop yield thus threatening national food security. He (ibid) further identified the consequences of soil abuses of which some of them are worth mentioning as follows:

- Rapid rate of organic matter decomposition which brings about decline in its content in the soil and change in soil structure;
- Excessive leaching of nutrients down the soil profile beyond the reach of plants and crop plants;
- Reduced water infiltration due to the blocking of both macro and micropores caused by the solubilisation of clay particles resulting in flooding;
- The exchange sites of these low activity clay soils are easily saturated when fertilizer is applied thus, making the soil prone to nutrient imbalance;
- There may be surface compaction of the hard setting structurally unstable A- horizon, resulting in reduced profile storage of water and surface erosion; and
- Erosion of various types, resulting in infertile soil and very low crop yield.

It is worthy of note that although, Nigerian soils vary slightly in their fertility, they all share common fate of being acidic, low cat ion exchange capacity, leaching losses of nutrients (in the south) and are inherently infertile and readily affected by environmental factors. This calls for the need to take precautionary measures as a nation to rejuvenate the soil resources through appropriate use of lands in order to guarantee continuous supply of food to avert the impending and imminent hunger and starvation. It is the opinion of this paper that the sooner the nation conserves the soil resources the better for the present and the incoming generations.

5. Impact of Soil Abuses on Past and Present Societies

Careless use of soil resources has led to the loss of land, decline in agricultural productivity, food insecurity, severe and lower standard of living and even collapse of many societies, not just in Nigeria but across the world. Peckham (1991:25-26) has attributed the collapse of the ancient Greece that thrived well in 400BC, the Roman Society 500BC- 500AD, the Indus of Pakistan 2500BC, the Mayan of Guatemala 500BC- 900AD and Sumerians of Iraq 2000 BC to the damage done to global resources, without knowing the repercussion their actions might cause.

Plato, the great philosopher has indeed, left us with a vivid idea of the damage that human beings have been imposing on the environment when he exclaimed that “the soil of Greece which surpassed all others around the world in its yield, with abundant water got eroded by torrential rains which carried the eroded materials from high levels off to the depths of the sea and left the land like a body wasted by diseases. (Peckham, 1991:25; Barry and Imo 2003:82). Affirming Plato’s position over the ancient Greece, Odetola, and Egundeyi (1970:76) posited that centuries of cultivation of exploitative crops and animal husbandry in areas of long dry summers have led to the ruin of about 30% of arable land which undermined Greece’s self-sufficiency in food and success of its civilization.

The Roman Society of Europe which thrived in glory from 500BC – 500AD destroyed their forests for farmland and other purposes, hence exposed their productive soils to erosion and food insecurity. Over 2000 years ago now, Peckham (1991: 25) said the Italian slopes and North African lands that used to supply food to Rome have not recovered from the stress and pressure put on them by Roman agriculture hence, its civilization has diminished.

In the same vein, careless handling of environmental resources in the Indus area of the modern-day Pakistan in the quest to raise food for the teeming population led to decline in its civilization in spite of the fact that it flourished around 2500BC. Its decline has equally been linked to the cutting down of trees along river banks for food production to meet the dietary requirements of its teeming population hence, triggered soil erosion that devastated the society.

Mayan civilization in Guatemala which thrived from 500BC to 900AD also suffered similar environmental stress of deforestation for food production. The society declined as bush clearing was followed with accelerated soil erosion such that the sediments recovered from the bottom of lakes near Mayan ruins, according to archeologists show that over-use of land actually reduced food supply that devastated the society.

The Sumerians of present day Iraq, flourished about 4000 years ago on the banks of Rivers Tigris and Euphrates, famous for wheat production also declined in its glory as soil became less capable of supporting crops due to over use. The decline of the great Sumerian

cities around 1700BC could be attributed to too much demand of the population on the soil resources which resulted in the disappearance of great buildings under the desert sands.

However, the misuse of soil that led to the collapse of ancient societies is even on-going in many parts of the world including Nigeria. For instance, in East Africa, the soil has been over worked by farmers in their restricted native reserves. The curtailment of the old practice of shifting cultivation by the growing population has accelerated the pace of soil erosion for several decades especially in Malawi. In Kenya, many native and European – held areas have been badly eroded by overgrazing, even in areas where new methods of farming are being practiced; thus soil deteriorated, yield became very low and the farmers make poor income as a result.

In North Africa, the former rich corn- growing land of Libya has been badly eroded by a long period of neglect and misuse after the decline of Roman power. The carefully cultivated terraces and carefully planned irrigation channels were replaced by uncontrolled grazing sheep and goats whose action exposed the soils to erosive forces leading to devastation of land and thus, threatening food security.

In South Africa, soil erosion has been a great problem where estimates in 1951, indicated that the country has lost 30% of its soil fertility. (Odetola and Egundeyi, 1970:75)

The story is not different in Nigeria where the badly affected areas include the famous gullies of Awka, Agulu, Nanka, Udi Plateau, the scarp land of Anambra, the drier north of Nigeria, the broad river valley trenches in Sokoto – Rima Basin Region and also along the western and southern edges of the Jos Plateau. The causes of soil erosion have already been discussed: forest clearance, bush burning, clean clearance and over cropping which increase susceptibility to soil erosion by rain splash effect, running water and wind action. However, wherever soil erosion occurs, it leads to loss of topsoil, the destruction of land for agriculture, reduces food supply hence, threatens food security. This explains why poverty and hunger are getting high globally but much higher in Nigeria.

According to Macmillan and Gordon (1992:34), over 1 billion people in the world are chronically hungry and as much as 13- 18 million die from hunger every year. They further said 24 people die from hunger and hunger – related diseases every minute of every day and 18 of them are children. The BBC news (Hausa Section) of 23rd January, 2016 affirmed this poverty condition where it made known to the world that as much as 11 million children in Nigeria are malnourished, 7 million of them are in the Northeast and Northwest regions of the country.

It can be deduced from the appraisal therefore, that this scenario is not unconnected with the decline in productivity of the soils in recent times as a result of careless utilization. Hence the next section proffers solutions to soil abuses in Nigeria which, if implemented would no doubt help in rejuvenating the soils and assure continuous supply of food to meet the dietary requirements of the fast growing population which has been put at 165 million, growing at the rate of 3.3% per annum, that is 5.5 million yearly increase.

6. Soil Conservation Measures

The preceding section of this paper, has argued, that soil resources are being mismanaged and the action is threatening food security. Although the destruction of the resources cannot be stopped completely but certain measures can be taken to minimize the effects and intensity of soil loss. To this effect, the paper strongly recommends the corrective and preventive approaches as discussed below.

6.1. Corrective Approach

This takes measures that aimed at introduction of soil management ideas and practices into routine farming operations, including the promotion of wise use of the land so as to either conserve its natural fertility or replace it with artificial fertilizers. The measures suggested in this paper are as discussed below.

Firstly, where the exhaustion of nutrient status of the soil is brought about by repeated cropping, the land should be left fallow for a minimum of five years to enable the land to rebuild its nutrient elements because as the plant roots grow deeper into the sub-soil, the nutrients lost before from topsoil; will be recovered through leaf-fall for continuous production to fight hunger, famine and misery.

Secondly, where there is no plot of farm while the exhausted one is under fallow, crop rotation system should be employed to help rejuvenate the soil. It involves growing different crops belonging to different species on the same plot year after year in such a way that they follow one another in a definite order. The crops should be those that require different amounts of nutrient elements so that the stock in the soil will not be used up completely. In the light of this, leguminous and non-leguminous crops should be planted in succession to keep the soil productive to ensure regular supply of food to the nation.

Thirdly, afforestation combined with alley cropping can be effective in conserving Nigerian soil resources. The planting of trees on damaged soils can help to reclaim lateritic and compacted soils through the use of hoes and diggers to make holes in them. Once the crust is pierced, water can collect in and the trees are planted so that their roots make more holes and more water can percolate into the soil to help remobilize the nutrients and make the soils productive again for assured food supply to fight hunger and starvation.

Fourthly, damaged soil surfaces can be managed effectively with crop residue method where when farmers harvest their crops, they should leave the stalk to decay on the farm and form organic matter that would encourage soil microorganisms to work on it to produce the desired effect through mixing of the soil thoroughly.

Fifthly, where the soils have become acidic than is desired for maximum growth of crop plants, liming will help to replace the displaced cat ion as compounds containing such lost ions are added to the soil. The recommended liming materials for acidic soils is calcium of weak acids like carbonates while magnesium salt is suitable for basic compounds like oxides and hydroxides.

The last corrective measures involve the engineering techniques aimed at land reclamation generally and restoring badly gullied land in particular. The various engineering methods have been described vividly by Okagbue (1988:295 – 308) and other scholars like Upla, Ibiang and Ibiang (2013:103 – 106). The prominent methods are water spreaders; Check dams; revetments; vegetal cover;

retaining walls; and ponding. Although these methods differ from one another, their objectives are similar namely: increasing infiltration, reduction of velocity of water flow, recapturing of soil materials on transit and stabilizing slope movement.

6.2. Preventive Approach

The objectives of preventive measures of conserving soil resources are to maintain the status quo through the preservation and protection involving the participation of individuals, communities, non-governmental organizations and government at all tiers. Since most activities leading to soil destruction are through ignorance of the users of land, this paper strongly recommends that a national committee be established by Federal Government to create awareness about the importance of soil resources to the survival and overall development of the nation in terms of food security. The committee which should have state and local governments should take up the suggested functions listed below.

- a. Awareness campaign about the conservation of soil resources;
- b. Mass education especially through the media, hand bills and other print media;
- c. Maintenance of endangered soils through reclamation;
- d. Mapping of all Nigeria's soils to determine areas where there are threats to continued food production;
- e. Educate sellers of all brands of chemical fertilizers to always explain the appropriate type of fertilizers to be use on appropriate farm to avoid pollution;
- f. Ensure that only well-trained and qualified graduates are granted the license to sell genuine fertilizers to farmers for use in their farms; and
- g. Work with the agricultural extension services to help farmers learn the best techniques in raising crops without damaging the soil that accommodates, cloths and feeds the present generation and those yet to arrive.

7. Conclusion

It is necessary to stress that soil is a precious resource that supports plants and animals that we depend on for our growth and development. The emerging abuses being done to soil resources in Nigeria is reducing crop yields and food supply: which is a vivid evidence of threat to food security. The paper is making a case for a rethink and take necessary measures that will rejuvenate the soils to ensure continuous food supply to forestall hunger, famine and starvation. In order to succeed, individuals, communities, corporate bodies and government at all tiers are being urged to join the crusade of conservationists.

8. References

- i. Adejuwon, J.O. (2006): "The Context of Food Security" in Adejuwon, J. O. & Ogunkoya, O.O. (eds) : Climate Change and Food Security in Nigeria (1st editon); Ile-Ife, OAU Press Ltd, pages 1-31.
- ii. Akinbode, Ade (2002): Introductory Environmental Resource Management (1st edition); Ibadan, Daybis Ltd, pages 20-21.
- iii. Avav, Ter-rumun and Uza, Daniel Verishima (2002): "Agriculture", in Atlas of Nigeria; Paris France, Les edition J.A., pages 92 – 95.
- iv. Barry, N.F. and Imo, J.E. (2003): Environment Continuity and Change (1st edition); Calabar St. Pauls Publishing & Print. Co., pages 86 – 87.
- v. Faniran, A. and Ojo O. (1980): Man's Physical Environment (1st edition); Ibadan, Heinemann, pages 304 – 306.
- vi. Imevbore, A. M.A., Ogunkoya, O.O and Sagua, V.O. (1988): "Effects of Soil Erosion on Aquatic Ecosystem in Nigeria", in Sagua, V.O. et al (eds); Ecological Disasters in Nigeria: Soil Erosion: Proceedings of National Workshop, Owerri, 8 – 12 September, 1986, pages 247 – 261.
- vii. Kemp, D. David (1998): "The Environment Dictionary" (1st edition); London, Routledge, pages 80, 374 – 375.
- viii. Macmillan, Bill and Gordon (1992): Atlas of Economic Issues; New York, Alex Ltd, page 34.
- ix. Obasi, M.N. (1999) "Man and Resources in Space and Time", in Agungoesi (ed); Introduction to Population & Environmental Education, Owerri, Grace of God Pub., pages 202 – 225.
- x. Odetola, T.O.S & Ogundeyi M.O. (1970): Review Notes on Geography For GCE Advanced Level (1st edition); Oshogo, On ward Commercial Press, pages 75 – 76.
- xi. Ohiaeri, G.E. C. (1988): "Prevention of Soil Erosion and Management of Erodable Lands in Nigeria", in Sagua, V.O. et al (eds): Ecological Disasters in Nigeria: Soil Erosion: Proceedings of the National Workshop, Owerri, 8- 12 September 1986; pages 332 – 339.
- xii. Okagbue, C.O. (1988): "Engineering Practices in Erosion Control", in Sagua, V.O. et al (ed) Ecological Disasters in Nigeria: Soil Erosion: Proceedings of the National Workshop, Owerri, 8- 12 September 1986, pages 295 – 306.
- xiii. Olusola O. Agbede (2009): Understanding Soil and Plant Nutrition (1st edition); Keffi Salmon Press & Co. Nig. Ltd., pages, 232- 233 & 237 – 240.
- xiv. Onyenze, J.N (1988): "Population and Infrastructural Services", in Agungoesi, C. (ed): Introduction to Population and Environmental Education, Owerri, Grace of God Publisher, pages 49- 59.
- xv. Peckham, Alexander (1991): Changing Landscape 1st edition; London, Gloucester Press, pages, 24- 27.
- xvi. Upla, J.I. Ibiang, E.I & Ibiang, E.E. (2013): Geography for secondary schools Book 2, Animashau, A.I & Iwara, E. (eds); Lagos Tanus Books, pages 103 – 107.
- xvii. The New Standard, Wednesday July 29, 2009.