Status and Challenges of Soil Management in Nigeria

Provision of adequate food supply to satisfy the needs of the whole population has always been one the pressing need of every country's government. In Nigeria, one of the reasons for the failure of agricultural plans is underestimating the importance of soil status and, therefore, mismanagement of the nation's soil. This paper deals with the present status/state of Nigeria's soil and the challenges of soil management in the country.

Status of Nigeria's Soil

According to Agboola (1986), Nigerian soils are generally light textured and low in cation exchange capacity (CEC); clay content range from 9 to 43% in more than 60% of the area, clay content is less than 15%. The CEC range from 2,40 to 5.95 me/100g of the soils, the value being less than 5 in the majority of the area. Soil PH ranges from 4.2 to 8.1:; combined Calcium (Ca) and magnesium (Mg) content varies from 0.5 to 5.55 me/100g; potassium (K) is generally low (0.07 to 0.45) tending to be lowest in soil sandstones . Organic matter content varies from 1 to 2.55%.

The status of soil is measured using its rate of productivity and can be classified into five different classes; very high productivity, high productivity, medium productivity, low productivity, and very low productivity. According to Nigeria Country Profile (1997), the country's soils are found to be of medium to high potentials. Table 1 below shows the classes of soil in Nigeria.

Table 1 Soil Zones and there Coverage in Nigeria

Soil Type	Area in S Sq Km	%
1. Very high productivity		0

2.	High productivity	8,802.82	5.52
3.	Medium productivity	50,741.45	31.75
4.	Low productivity	73,318.00	46.45
5.	Very low productivity	28,098.55	16.31
	Total	159,866.27	100.00

Source: Agboola (1986). “Planning for Soil Productivity without Planning for Soil Fertility Evaluation Management”

Under improved farming systems, the soil productivity could be improved. According to Agboola (1986) the productivity of the soil could be improved as shown in Table 2 below.

Table 2 Soil Zones and their Coverage under Improved Farming Systems

	Soil Type	**Area in S Sq Km**	**%**
1.	Very high productivity	5,474.18	5.52
2.	High productivity	72,848.73	45.53
3.	Medium productivity	48,530.73	30.27
4.	Low productivity	15,576.27	9.73
5.	Very low productivity	17,685.82	11.05
	Total	160,119.82	100.00

Source: Agboola (1986). “Planning for Soil Productivity without Planning for Soil Fertility Evaluation Management”

Challenges of Soil Management

The lack of soil knowledge by Nigerian farmers has led to a lot of soil damage and abuses. However, the challenges to soil management is not only management but climatic and environmental as well. The challenges facing the country's soil management are as follows;

1. Soil Erosion

Gully erosion is particularly severe in Abia, Imo, Anambra, Enugu, Ondo, Edo, Ebonyi, Kogi, Adamawa, Delta, Jigawa and Gombe States. Anambra and Enugu States alone have over 50 active gully complexes, with some extending over 100 metres long, 20 meters wide and 15 meters deep (Nigeria Country Profile, 1997).

Coastal and marine erosion and subsidence occur particularly in the coastal areas of Ogun, Ondo, Delta, Rivers, Bayelsa, Akwa Ibom and Cross River States. The most significant case of coastal erosion and flooding is the overflow of the Bar Beach of the Atlantic Ocean now a regular feature since 1990, threatening the prime property areas of the Ahmadu Bello Way, Victoria Island, Lagos.

To reduce erosion rates on farmlands, reliable and proven soil conservation technologies could be adopted and these include ridge planting, no-till cultivation, crop rotation, mulches, living mulches, agroforestry, terracing, contour planting, cover cropping and installation of wind breaks (Primentel, 1995).

2. Soil Salinity

Excessive soil salinity reduces productivity of many agricultural crops, especially vegetables that are particularly sensitive throughout the ontogeny of the plant. Salinization does not result to immediate treats but effects on soil only become apparent on

crops after a period of time (Nwankwoala, 2011). According to the Department of Agriculture United States (USDA), onions are sensitive to saline soils, while cucumbers, eggplants, peppers, and tomato are moderately susceptible. The factors that contribute significantly to salinity are soil salinity, wet breeze from high tide especially between June to August (peak of rainy season in Nigeria) and direct watering of crop with saline water. Salinity affects crop and vegetable growth, leaf length, and number of leaves, which reduces yields and, in severe cases, total loss of crop yield.

The coastal areas of Nigeria are gets affected heavily by salinization. Saline soils occur in small patches in the semi-arid belt of northern Nigeria. Such soils rarely occur in the southern parts of the country where high ran fall affords considerable leaching of the salts beyond root zone. Salinity surveys of irrigated schemes in the northern Nigeria have shown that certain soils in Borno, Gongola, Kano and Sokoto states vary from non-saline to moderately saline. The level of salinity around South Lake Chad is generally very low. Yau'Sheme soils on lowlands or in slight depression areas are seriously affected with salinity problems.

Soil salinity can be controlled by use of irrigation system that supplies the farmland with large quantity and quality (fresh) water and also installing drainage systems to reduce the high water table of saline waters will also reduce the salinization of farm lands during rainy season (Bresler and Hoffman, 1986). In addition, the government should erect salinity control units as has been adopted in other countries such as Mexico and United

States of America to solve salinity problems in farmlands (Backlund and Hoppes, 1986).

3. Flooding

This 2012, Nigeria experienced flooding like never before. Flood washed away farmlands in 20 states out of the 36 states plus the FCT. Nasarawa lost over 2,000 hectares of farmland to flood (Punch Editorial Board, 2012).

Flooding occurs throughout Nigeria in three main forms: coastal flooding, river flooding, and urban flooding, Coastal flooding occurs in the low-lying belt of mangrove and fresh water swamps along the coast. River flooding occurs in the flood plains of the larger rivers, while sudden, short-lived flash floods are associated with rivers in the inland areas where sudden heavy rains can change them into destructive torrents within a short period.

Urban flooding occur in towns located on flat or low lying terrain especially where little or no provision has been made for surface drainage, or where existing drainage has been blocked with municipal waste, refuse and eroded soil sediments. Extensive urban flooding is a phenomenon of every rainy session in Lagos, Maiduguri, Aba, Warri, Benin and Ibadan.

Virtually every Nigerian is vulnerable to disasters, natural or man-made. Every rainy season, wind gusts arising from tropical storms claim lives and property worth million of Naira across the country. Flash floods from torrential rains wash away thousands of hectares of farmland. Dam bursts are common following such flood. In August 1988 for instance, 142 people died, 18,000 houses were destroyed and 14,000 farms were swept away when the Bagauda Dam collapsed following a flash flood. Urban flooding such as the Ogunpa disaster which claimed over 200

lives and damaged property worth millions of Naira in Ibadan, are common occurrence.

Problem of flooding in Nigeria can be handled if the appropriate steps are taken immediately. Flooding is a result of two factors; environmental factor (climate change and man-made factor. Since the climate change is not just a result of practices in Nigeria but a trans-continental factor, our focus in containing the problem will be in the man-made factor. Urban planning, removal of obstructions floodplains, proper waste management to avoid blockage of drainage systems, and construction and maintenance of more drainage channels should be adopted (Babatolu; 1997). Particular, the government at all levels should engage in the provision of integrated drainage systems in informal settlements, which are often regarded as being outside accepted urban regulation and planning systems while they are, however, recognized as farmlands (Douglas et al, 2008; Oriola,1994)

4. Desert Encroachment and Drought

Population pressure, over grazing and the continuous exploitation of marginal lands have aggravated desertification and drought which has resulted in severe loss of farm land. Nigeria is presently losing about 351,000 square kilometers of its land mass to the desert which is advancing southward at the rate of 0.6 kilometers per year. According to a recent survey by the Centre for Arid Zones Studies in Nigeria, desertification is by far the most pressing environmental problem in the northern states along the Niger Republic border. The outward and visible sign of the desertification process is the gradual shift in vegetation from grasses, bushes and occasional trees, to grass and bush and in the final stages, extensive areas of desert-like sand. Entire villages and major access roads have been buried under sand dunes in the northern portions of Katsina, Sokoto, Jigawa and

Borno States. With about 55 percent of its land under siege from desert encroachment, Borno State which suffered from a protracted fifteen-year drought in 1972-1978, is one of the most threatened land areas of Nigeria. Perhaps more spectacular, and of grave consequence are the persistent droughts which, a number of times, have resulted in famine in the northern part of the country. During the drought of 1972-1973 for instance, about 300,000 animals died and farm yields dropped by up to 60%.

Control of desertified lands can be achieved by rehabilitating the land. This could be done by passing rivers through them and planting big desert trees and legumes which survives in the intense it as well as fixes nitrogen to the soil (Xue-Yong *et al.,* 2002). According to Sinha *et al.,* (1997), controlled grazing, introduction of fast growing exotic species of trees and grasses from isoclimatic regions of the world for stabilization of shifting sand dunes, creation of 'microclimates' through shelterbelt plantations, and creation of 'fencing and enclosures' for regeneration of indigenous species can be adopted in desert prone areas. However, the government needs to make and enforce laws guiding the control of desertification in order to successful tackle the problem.

5. Declining Soil Fertility

The term soil fertility is the intrinsic ability or capability of the soil to provide plant nutrients and water in adequate amount and when required, for good growth and development of the crops (Agboola, 1986). While soil fertility decline (also described as soil productivity decline) is a deterioration of chemical, physical and biological soil properties and subsequent reduction in providing

the crops with adequate nutrients and water. The main contributing processes, besides soil erosion, are;

- Decline in organic matter and soil biological activity.
- Degradation of soil structure and loss of other soil physical qualities.
- Reduction in availability of major nutrients (N, P, K) and micro-nutrients.
- Increase in toxicity, due to acidification or pollution.

According to FAO (2001), Nigeria is one of the countries with high declining soil fertility. The country was estimated to be losing an average of 24 kg nutrients/ha per year (10 kg N; 4 kg P2O5, 10 kg K2O) in 1990 and 48 kg nutrients/ha per year in 2000, that is, a loss equivalent to 100 kg fertilizers/ha per year. However this figure is postulated to have dropped appreciable since the government and other foreign organizations started investing heavily on fertilizer. Soils in most of Nigeria have inherently low fertility and do not receive adequate nutrient replenishment. With Nigeria falling under sub-Saharan African countries with low mineral fertilizer consumption, about 10 kg nutrients (N, P2O5, K2O)/ha per year, compared to the world average of 90 kg, 60 kg in the Near East and 130 kg/ha per year in Asia.

The nutrients in a fertile soil are nitrogen, phosphorus, potassium, organic carbon, zinc (DTPA), boron (Hot H_2O Sol) and pH level. Using available chemical data, a first approximation to the soil fertility map has been produced for nitrogen, phosphorous and potassium for the various ecological zones of the country (see Figure 1 - 7). The criteria for soil fertility classes are as defined bellow;

Low - The value below criteria level

Medium - The range above criteria level where variable responses to fertilization is expected.

High - The rang where response is unlikely and fertilization may not be necessary.

Nitrogen is defined in terms of total nitrogen, phosphorous in terms of Bray 2 P, and potassium in terms of NH_4 OAc exchangeable potassium and organic matter in terms of Walkley and Black total organic matter. The maps below shows soil chemical composition according to ecological zones in Nigeria.

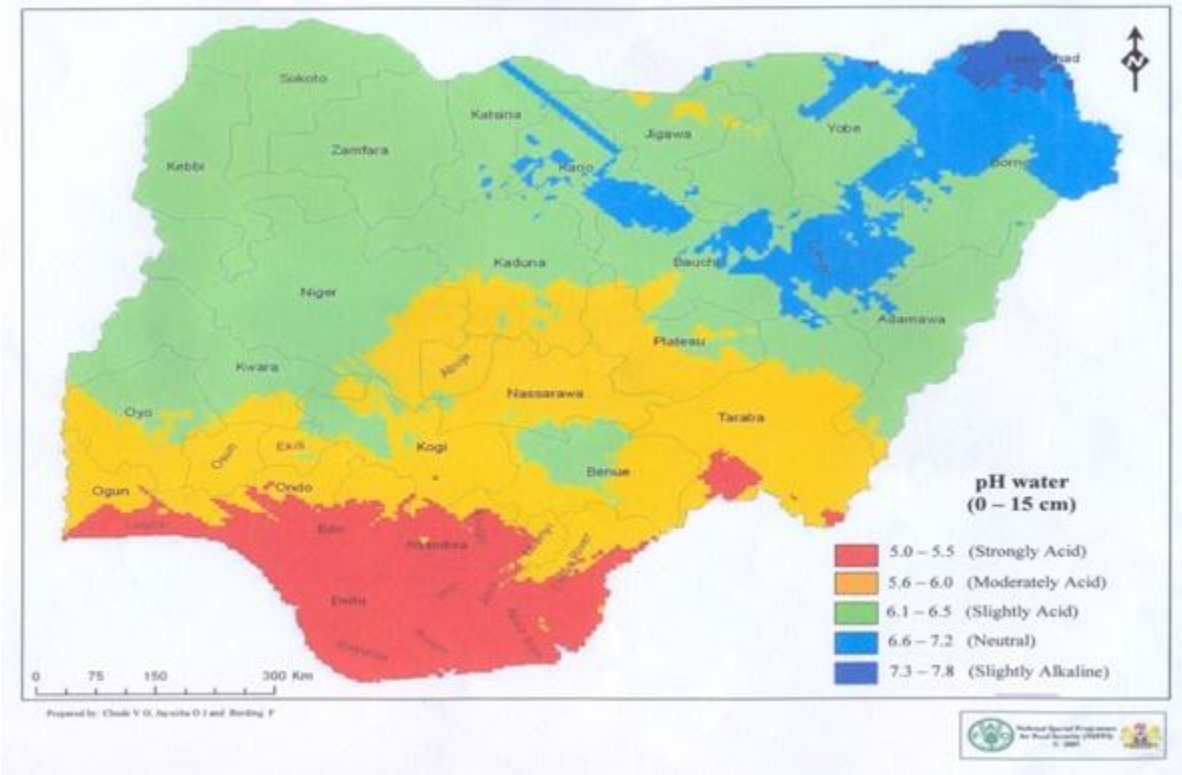

Figure 1 pH Water Fertility Map of Nigeria

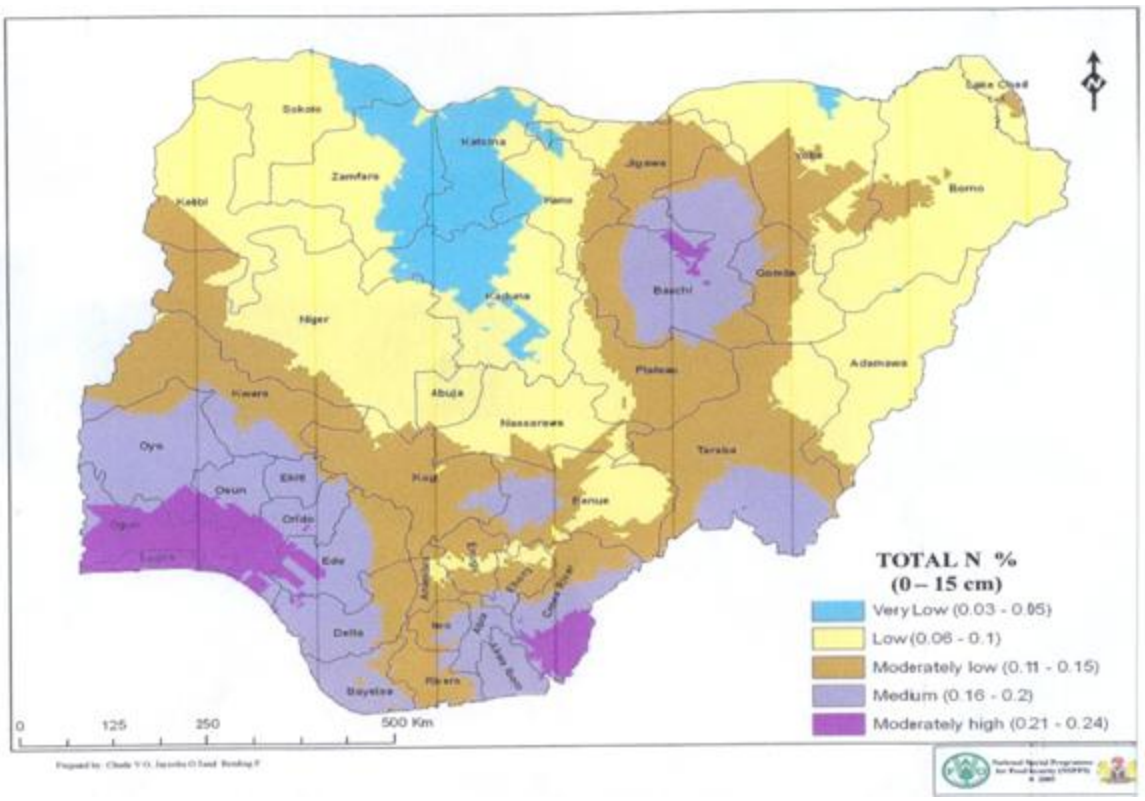

Figure 2 Total Nitrogen Fertility Map of Nigeria

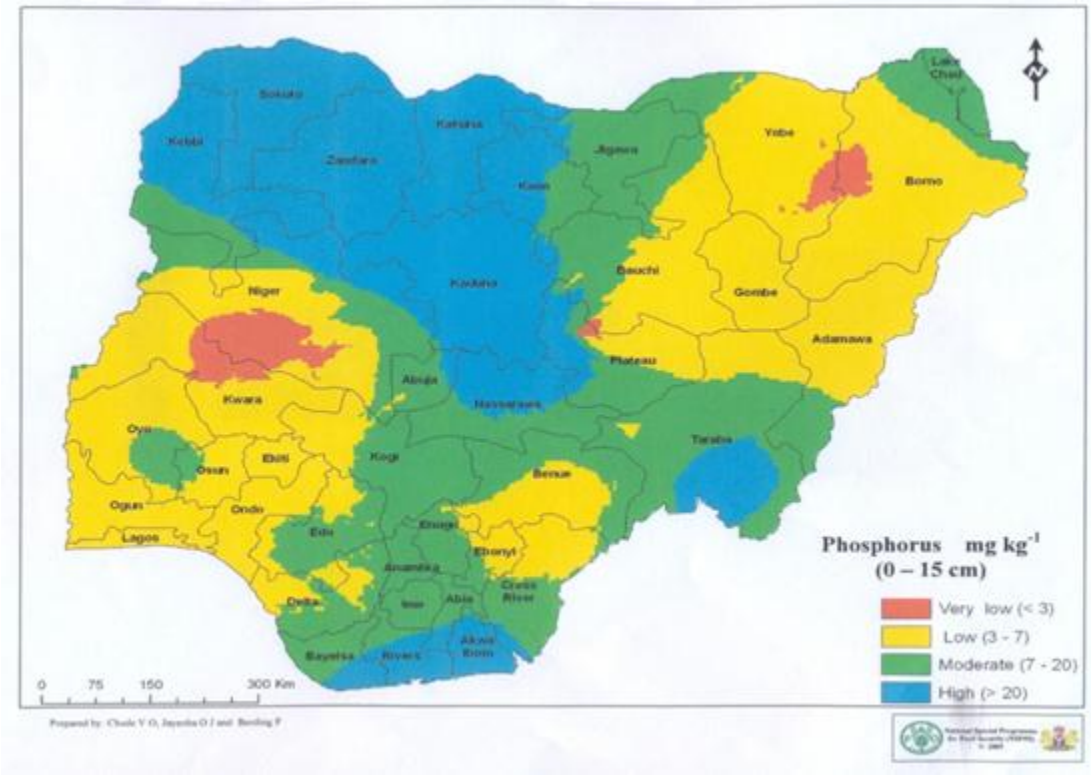

Figure 3 Phosphorus Fertility Map of Nigeria

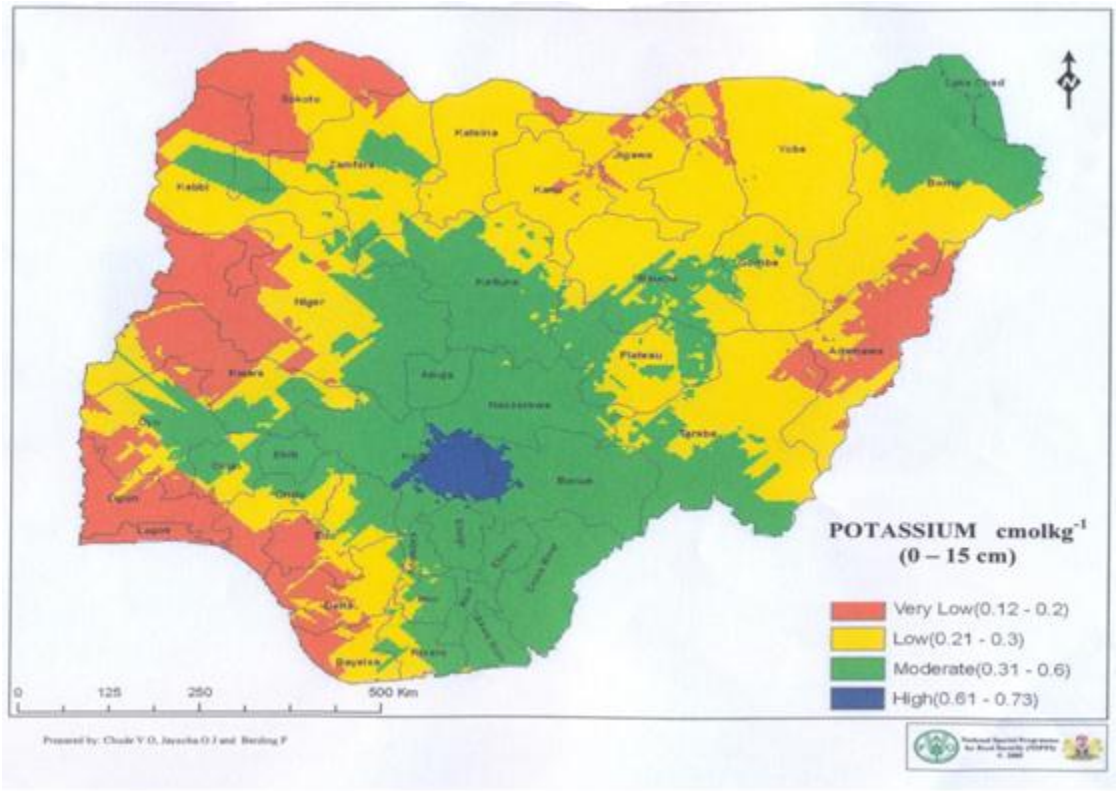

Figure 4 Potassium Fertility Map of Nigeria

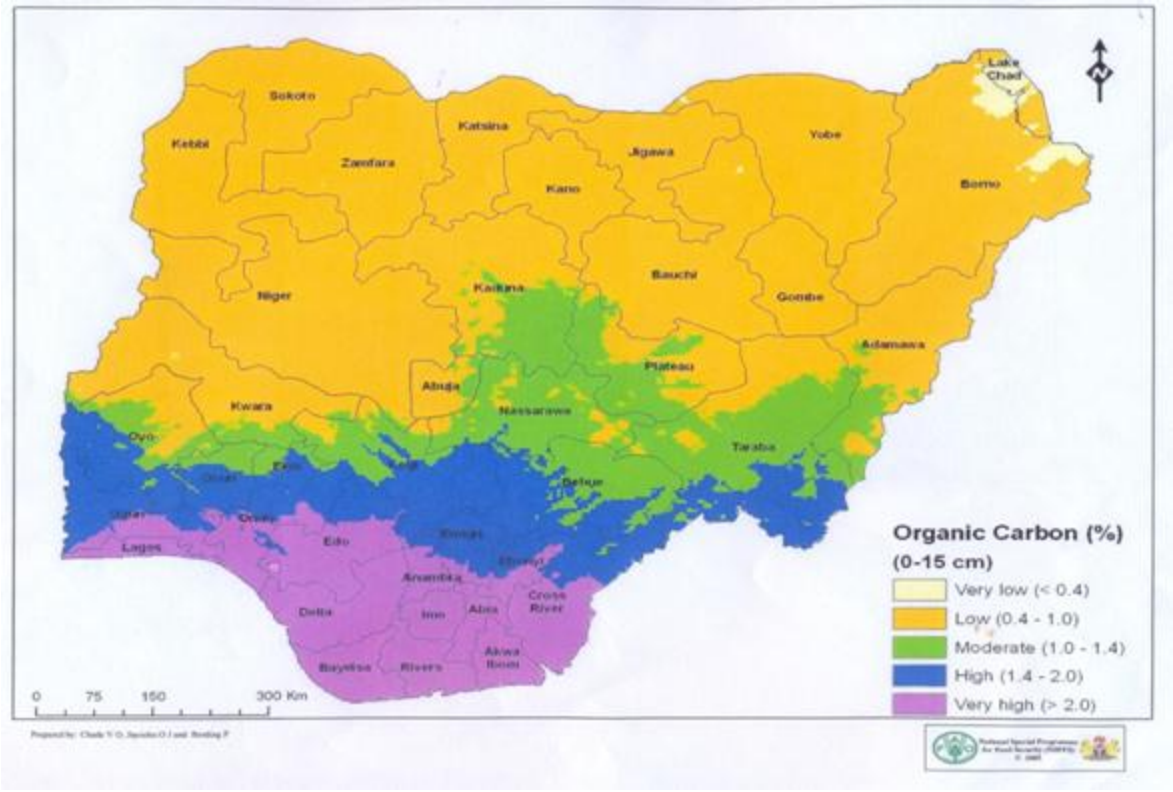

Figure 5 Organic Carbon Fertility Map of Nigeria

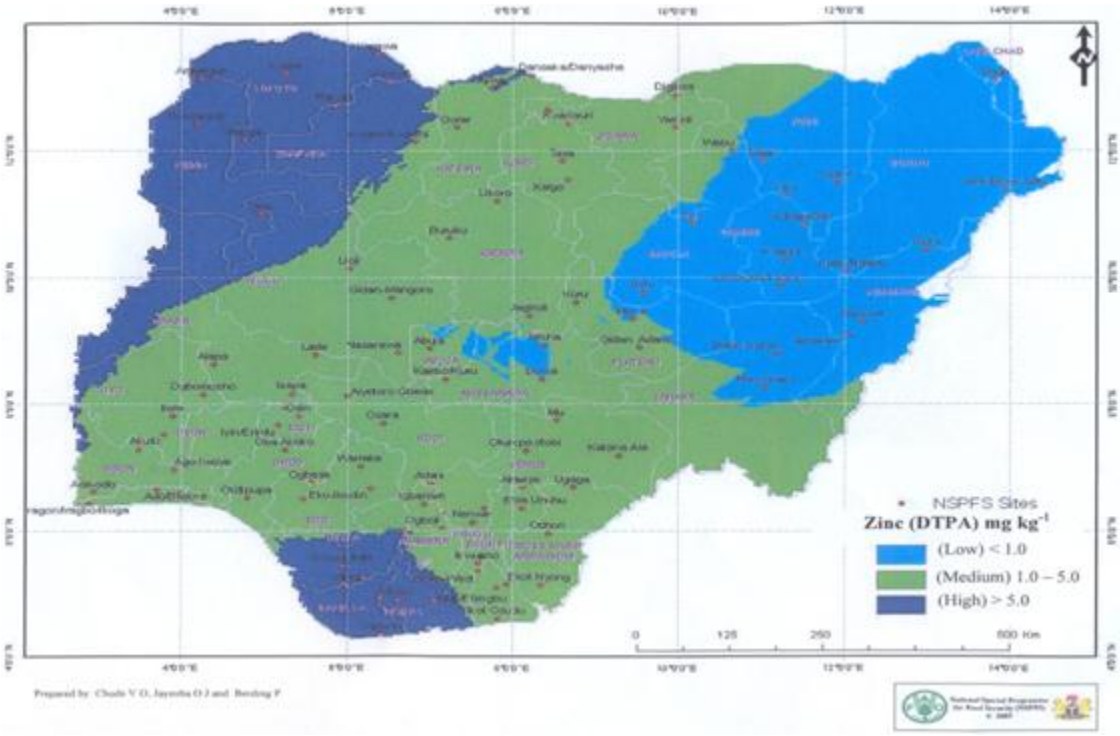

Figure 6 Zinc Fertility Map of Nigeria

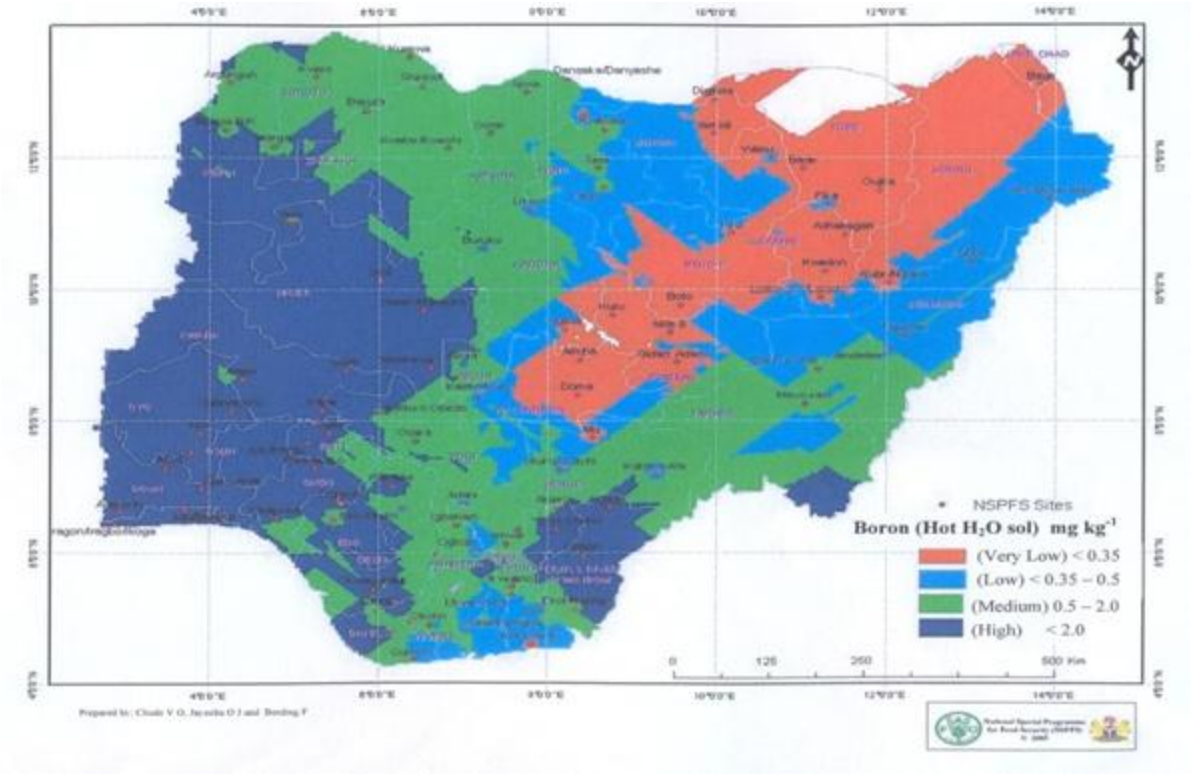

Figure 7 Boron Fertility Map of Nigeria

Declining soil fertility can be adequately managed by proper practice of soil rotation, bush fallow, application of the right fertilizer and general proper management of the farmlands.

6. Non-use of Soil Specific Fertilizers

As of now, Nigerian farmers still apply fertilizers without knowing without knowing the quantity of soil nutrients and the appropriate fertility to use. Usually, the farmers in Nigeria are only recommended straight N, P, or K fertilizers. That is, urea, SSP and urinate of potash. Yet, farmers find it much more convenient to apply fertilizer-nutrient needs in one single dose. For this reason, the use of compound fertilizer 15-15-15 has been very widely adopted by 70% of the Nigerian farmers. However, too much reliance on this fertilizer predisposes farmers to applying fertilizers low in N and P and totally lacks sulphur and zinc. This

happens to be the predominant practice even though supplementary sulphur and zinc appear to be necessary for optimum crop performance in many parts of the country, particularly the savanna grasslands. There is also indication that there is need for B in some parts of Nigeria. Applications of the wrong fertilizers have discouraged some the farmers from using fertilizer. For instance, Agboola (1986) wrote about some of the farmers in the south who have refused to apply fertilizer to any farmland used in yam production because they have noticed that using fertilizer to grow while yam changes the colour of the yam to brown during pounding.

This predominant practice of the farmers robs many soils of the essential nutrients; a problem that could have been solved very easily by applying the particular fertilizer needed by a particular soil. Development of soil testing centers within close reach of the farmers will enable them test the nutrient quantity of their soil, before knowing the specific fertilizer to apply. The government and, particular, private fertilizer manufacturers investing in this soil testing facilities will be very profitable to them while supplying the needed fertilizers to the farmers.

7. Mismanagement and Misuse

Human-induced soil degradation is now a major problem and one of the leading causes of environmentally induced displacement. Environmental consequences of poor farming are currently visible in the country. Examples of mismanagement of land in Nigeria are

a. Deforestation: Uncontrolled logging and tree felling from without restocking and rampant bush burning are the order of the

day in many parts of the southern states of Nigeria. These increase the leaching of precious soil nutrients.

b. Inappropriate agricultural practices such as lack of crop rotation, adoption of maximum tillage, inadequate or total lack of fallowing, inadequate fertilization, overgrazing, and absence of mulching the destruction of watersheds, and the opening up of riverbanks and other critical areas have led to silting of riverbeds and loss of watercourses. In addition, uncontrolled use of agro-chemicals and the concomitant problems of chemical persistence in the soil in humid areas and soil-crust formation in arid climates have contributed to Stalinization and destruction of vast agricultural lands.

c. According to Etuonovbe (2009) petroleum corporations have been very instrumental in oil pollution problems (including spills, oil well blow-out, oil blast discharges, improper disposal of drilling mud) has created problems that has resulted in destruction of vast farmlands in the Niger Delta.

d. Over population has brought about conversion of rich farmlands into buildings and construction site (Nwankwoala, 2011)

d. The Nigerian government does not have a clean cut land planning act that protects rich farmlands from being converted into sites for other purposes (Teminski, 2012).

Problem of farmers' mismanagement of the soil could be mitigated by agricultural extension services. Extension services to educate the farmers on improper management of the soil have been going on the country for decades. Even though agricultural extension can be traced to the colonial era (1893), it has grown in strength till date, yet, the many of the rural farmers still behave in uninformed manner with regards to their generally soil

management attitudes (Arokoyo, 2003; Olajide, 2004). Since Word Bank funding has withdrawn funding in support of extension services in Nigeria, it is therefore right to expect that the government increase their extension budget so that education can soil management education can reach every farmer in the country.

Petroleum corporations' adherence to environmental laws of the federation on spill clean-ups and land reclamation will greatly reduce devastation effects their mining operations causes to the soil. Also, the review of the Nigerian Land Planning Act, making of new land laws and enforcement of the laws will protects the farmlands from mismanagement and abuse.

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