



Geography in Development

Issues and Perspectives

S. L. Tilakasiri

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Editor

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Dedicated

to Geographers around the World

for their Contributions

towards Development of Geography

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CHAPTER 11

ECOLOGICAL ZONE AND AGRICULTURAL DEVELOPMENT

R. M. Olanrewaju, E. A. Adeleke and G. P. Akpan

Introduction

According to the International Food Policy Research Institute (IFPRI) press release of October 13th, 2014, about two billion people scattered across different ecological zones of the world are faced with severe hunger and poverty. This fact was corroborated by the United Nations Food and Agriculture Organization which put the ratio of people suffering from chronic under nourishment as one in nine between 2014 and 2016. Almost all the hungry people of the world live in developing countries. The Al Jazeera news of May 21st, 2017 reported twenty people dead of hunger in Southern Sudan. To eradicate this especially in sub-Sahara Africa, agricultural productivity must be developed in a sustainable way throughout all ecological zones. This will lead to production of enough food for the ever increasing world population. Besides, it will enhance preservation of the life supporting systems for future generations.

Based on the United States Development of Agricultural Library (USDA, 2015), ecological zone is a term used to describe a large bio-geographical units of land/water characterized by their distinct species and communities. Smaller eco regions are born out of the major eco zones. Each eco region shares similar natural

communities, climate, meteorological factors, and topography elevation, soil types, edaphic factors and/or other physical characteristics. Various criteria have been used in defining an ecological zone depending on location. For instance, in terrestrial eco system, rainfall, soil and relief are the major factors while salinity and depth are used for marine and continental water environments.

Agriculture has remained the mainstay of the Nigerian economy providing 65 per cent of the Gross Domestic Product (GDP) as far back as in the 1960s (Iyanda, 1988). The ecological conditions determined the main agricultural systems practised in Nigeria. Thus shifting cultivation, permanent cultivation, terracing along mountain/ plateau slopes and livestock production farming systems determine which of the above ecological conditions farming system is best adapted to in each ecological zone. The diversity in the agricultural zones of the country is responsible for why.

Agricultural development is synonymous with provision of assistance to crop producers with the help of various agricultural resources (Agricultural Development/Economy Watch, 2010). The above definition can be further modified to include animal husbandry and agro forestry. The aim of agricultural development is to reduce hunger and poverty all over the world especially the sub-Saharan in particular. Development in agriculture has to do with methods adopted and all steps taken by people to improve agricultural productivity. The world population estimated at 7.4 billion requires that food production must increase from 70 per cent to 90 per cent to be able to feed them. There is therefore the need for various government and individuals to invest in agriculture.

The level of severe hunger and food insecurity faced by some parts of the world has been anticipated in the past and this has necessitated the mounting up of many programmes to alleviate the problem. In Nigeria for instance, some of the efforts made in the past to develop the agricultural sector include:

- i. National Accelerated Food Production Programme of 1972. The program was designed to accelerate the production of maize, rice, guinea corn, millet, wheat, cassava and cowpeas;
- ii. Agricultural Development Programme (ADP) of 1975/1976 aimed at contributing to rural livelihood and food security in Nigeria;
- iii. Operation Feed the Nation (OFN) of 1976 with the goal of increasing local food production and thereby reduce importation of food;
- iv. River Basin Development Authorities (RBDA) aimed at providing sustainable access to safe and sufficient water and water resources that will enhance public health, food security, poverty eradication while maintaining the integrity of freshwater ecosystem of Nigeria;
- v. Agricultural Credit Guarantee Scheme of 1976. The goal is to provide a guarantee cover of up to 75 per cent of any outstanding balance upon default in respect of loans granted to agricultural sector by banks;
- vi. Green Revolution of 1979 aimed at ensuring self sufficiency in food production and to introduce modern technology in Nigeria agricultural sector largely through the introduction of modern inputs as high yielding varieties of seed, fertilizers and tractor;
- vii. Directorate for Food, Roads and Rural Infrastructure of (DFRRI) 1985. The Directorate was established for food, road and rural infrastructure designed for mobilisation of rural communities and the development of rural areas of the nation. The directorate is charged with various functions directed towards the improvement of the quality of life in rural areas;
- viii. National Agricultural Land Development Authority (NALDA) of 1991 established to provide among other things strategic public support for land and development;

- ix Youth Initiative for Sustainable Agriculture (YISA) of 2011. The programme aimed at redirecting the youths towards agriculture;
- x. Agricultural Resilience in Nigeria (ACARN) of 2013. Its main focus is to assure food and nutrition security, eradicate rural poverty and create social stability;
- xi. Agricultural Transformation Agenda (ATA) of 2014. The major aim is to refocus Nigerian's attention on agriculture; and
- xii. The Agricultural Promotion Policy (APP) of 2016 has the vision of building on the successes of the ATA, closing key gaps by Federal Ministry of Agriculture and Rural Development (FMARD) latest by the year 2020.

Most of these programmes failed in Nigeria because they were not properly articulated (Augustus, 2014) as the noble ideas were not rightly implemented. Besides, a change in climate also put additional stress on agricultural productivity of the sub-Saharan Africa to which Nigeria belong (Amujoyegbe, 2012). To overcome such stress farmers put up various adaptation strategies. For instance, Odjugo (2009) noted that climate change has led to a shift in crops cultivated in northern Nigeria. As a means of adaptation to the changing pattern of rainfall and temperature in year 2007, farmers in northern Nigeria shifted to the production of millet, maize and beans as against the preferred crop grouping of guinea corn, groundnut and maize. Again it is a noted that climate change has affected the configuration of farm lands by causing reduction of arable lands cultivation in Nigeria. Amujoyegbe (2012) also emphasised the need for the proper understanding of the farming system within each agro-ecological zone for adequate agricultural development program planning. Based on this, agricultural development of each eco zones in Nigeria, its potentials and limitations and the way out to increase a sustainable crop production is discussed in this chapter.

Agro-Ecological Zones of Nigeria

Nigeria has an area space of 923,768sq.km that extends to 1,127km east to west and 1,046km North to South. Nigeria therefore is characterized by high degree of agro-ecological diversity due to its large size and geographical location. It is bordered in the South by the Atlantic Ocean, in the North by the Sahara desert. This position makes Nigeria comes under the influence of two prevailing winds. The moisture laden South-west Monsoon and the dry North-east continental wind. These winds determine the rainfall pattern which to a great extent controls the ecological zones of Nigeria. Other important features are topography and soil. Thus the climate, topography and soil confer the environmental conditions to the advantage of Nigeria farmers.

The Agro-ecological Zone of Nigeria can be viewed under three major classes of forest, savannah and montane vegetations. Both forest and savannah can further be classified into eco regions. While forest zone can be subdivided into Mangrove/ Coastal region also known as saltwater swamp, Freshwater Swamp and High forest and the savannah eco zone can be regrouped into Derived guinea savannah, Guinea savannah, Sudan savannah and Sahel savannah, respectively. The major highlands of Nigeria are the North-central Plateau, the Eastern and North-eastern Highlands and the Western Uplands. When put together Nigeria is such a country that is blessed with a variety of ecological zones that provide natural agricultural land.

Agricultural Development in the Saltwater Swamp

These are areas near the coast which are under the influence of blackish water. The soil is water logged, muddy and poorly aerated with high salt content. Some of these areas include the creeks and Lagoons of South-west Nigeria, Southern Niger Delta and Bonny in the South-eastern part of the country. Fish farming has higher prospects here and the people of the Creeks concentrated on fishing with economic yields higher than cropping. The area is usually not widely cultivated except for swamp rice commonly found on a more stabilized- non saline

soil. Maize and cassava are also grown in the drained areas. Rudimentary irrigation takes place to develop vegetable garden in some areas within this eco zone. Permanent cultivation is common in most of this region because of limited farmland area.

Availability of water is not the limiting factor to crop production in this region but poor soils. Coastal regions are also vulnerable to incessant floods, destruction of mangrove ecosystems, contamination of water by hydrocarbon and transmission of water borne diseases, leading to displacement and communal crisis (Odjugo, 2010).

To improve the agricultural sector of this area requires the overhauling through the provision of refined fishing equipment and introduction of sophisticated method of fishing to fish farmers by government. Since the ecological condition of this region permit only permanent cultivation within the limited non saline areas, new breeds of early maturing crops such as maize that will enable year round cropping should be introduced to farmers in these areas.

Agricultural Development in the Fresh Water Swamp

Located North of the salt water swamp is the fresh water swamp. The plain extends northward to the apex of the Niger delta. Fresh water from rain and rivers flood inundates this region most especially during the rainy season. Part of Nigeria under the influence of fresh water swamp includes part of Ogun, Benin, Imo, Niger Delta and Cross River States.

The soil is derived from the deposition of silt, mud and sand material during flood episodes. The soil type is alluvial in nature and it is very fertile. Consequently, agriculture becomes more extensive, field sizes larger than in the salt water swamp and hence farming system of the rotation or bush fallows is predominant. The farming system of crop combinations such as cassava, maize and melon is common. Some migrant farmers of Urhobo and Igbo origin combine crop farming with the exploitation oil palm. Food crops cultivation sites are restricted to the better drained areas; include cassava, yam, swamp rice,

banana and sugar cane. Double cropping is possible depending on the local climate. The two cropping seasons recognised by Udo (1970) which still operate are January to March, and August to September. Maize constitutes the first crop on newly cleaned farm land while cassava is planted just before the land reverts to fallow. Rice is cultivated in the swamps bordering the lagoon and creeks around Epe and Okitipupa, Sapele-Warri Axis. Timber and lumbering is a common occupation because of the presence of trees of various species found in the area.

The major agricultural problem however is that of erosion and soil leaching resulting from high rainfall. Other is oil spillage which has damaged the ecological system of some areas in this region through pollution of land and water with hydrocarbon thereby causing failure of life supporting system. These have led to soil impoverishment in such areas. Nevertheless, the land supports the cultivation of tree crops such as mango, coconuts, cashew and oil palm.

The fertile alluvial areas focus on intensive and extensive food crop cultivations while new early maturing breeds of fruit crops can be introduced in addition to the existing ones to improve productivity. Again government should make soft loan available to farmers to enhance their farming activities and as well curb illegal oil discharge that is rampant in the area. However, the ongoing cleaning up of Ogoni land of Delta State by the Federal Government of Nigeria is a right step in the right direction.

Agricultural Development in the High Forest

This eco region stretches from the South-western border of Nigeria to Benin Republic through a narrow stretch on the Niger-Benue river system into the extensive area of the South-east of the country. The rainy season is prolonged with an annual rainfall above 2000mm. The soil is ferruginous, though acidic but fertile.

This zone is the major source of timber for the large construction and furniture making industries. This one-time

highly forested area is gradually being degraded due to human activities such as agriculture, urbanization and bush burning among others. For instance, the drier end of its inland side is becoming reduced to derived Guinea Savannah because of tree felling for timber, fuel wood and charcoal production. A number of timber trees such as the African Mahogany, the scented Sapele wood (*Entandrophragma cylindricum*) and Iroko (*Chlorophora excelsa*) to mention but few are found in this zone. Sapele is the centre of the timber industry in Nigeria because it is located in the most wooded area of this region. As a matter of fact, tree crops constitute the economic cash crops in the region. Such include Kolanut (*Cola nitida*) and Cocoa (*Theobroma cacao*) are found in the South-west, Oil palm (*Elaeis guineensis*) south-eastern side, Rubber (*Hevea brasiliensis*) in the Benin low land and Banana/Plantain (*musa spp*) in the Calabar region.

Some major staple food crops found in the region are yam (*Dioscorea spp*), maize (*Zea mays*), cassava (*Mani hot spp*), sweet potatoes, cocoyam and upland rice. Swamp rice is also found in some parts of the region.

Most of the farm work is done by men. Women assist in planting and harvesting. Farm size is small hardly exceeds a quarter of an acre in this area. This is largely as a result of the difficulty usually encountered in clearing the forest for farm land preparation as well as weeding farm land. This is because farmers still depend on primitive farming implements such as hoe and cutlasses. Odemerho (1992) explained further that the expansion and intensification of agriculture into marginal lands and wetlands have continued to rely on the agency of small scale peasant farmers who use traditional farming practices and technology that are known to malfunction under conditions of high population pressure on the land resource and escalating markets demands. The farming system practised is bush fallowing and mixed cropping. Fallow periods are a function of availability of farmland and soil. Farm land may be cropped for three years and left to fallow for 3-5 years. Also two cropping of maize is practised (the early and late season maize). Oyenuga (1967) described this region as very important in terms of food production and timber for construction and cabinet making. Some of the principal staple food crops of this area are Yam,

Cocoyam, Sweet Potato, Maize, Rice, Groundnut, Cowpeas and Beans.

The major challenge faced by farmers in this region is their inability to have large farm lands in spite of the fertile nature of the soil. Again because weeds grow fast and labour is scarce as a result of the competition that exist between tree crop and food crop farmers there is the need for farmers to apply weed control measure. Government at all levels be it National, State and Local should make fund available for farmers through loans so that farmers will be financially empowered to make way for mechanised farming and improved land management techniques

Agricultural Development in the Derived Guinea Savannah

The derived savannah represents the transitional zone between the high forest and the savannah eco-zone. This eco region is in the northern end of the tropical forest and has been drastically tampered with by activities of man. It has a mean annual rainfall of 1314mm and temperature of 25.5°C. It shares the characteristics of both high forest and that of savannah. Thus this region supports the cultivation of both root and grain crops. The climatic and ecological conditions permit the cultivation of root crops in the areas that are close to the forest belt and grain crops in areas close to the North. The major crops grown are maize, cassava, yam and rice.

The major problems to agricultural development in this zone are those of annual bush burning, overgrazing and erosion which often lead to soil impoverishment. Government should discourage bush burning, so that there will be more fodder for animals to feed on. In addition this will reduce erosion and prevent overgrazing.

Agricultural Development in the Guinea Savannah

This ecological region is the most extensive of all of the ecological zones in Nigeria. The rainfall distribution is single peak and is about 1051.7mm per annum. It has annual temperature of 27.3°C. The topography consists of an open undulating landscape with scattered inselbergs. This ecological zone is suitable for the cultivation of grains like millet, maize and guinea corn. Root crops such as yam and cassava are cultivated along with other crops such as cowpea. Swamp rice is grown along the river Niger and Kaduna areas. Mixed cropping system is practised with yam, maize, pumpkin, pepper, and beans. Tobacco, cotton, rice, cashew and pineapple are important economic crops of this region.

The major limitations to agriculture in this area in addition to those listed for the derived guinea savannah region above are the lateritic outcrops and iron pan which occur close to the surface. This makes farm land preparation hectic for farmers who depend mainly on primitive farm implements. This may partly explain why there is shortage of labour in this region. The solution to the above predicaments lie in government's intervention by either making funds available so that farmers can buy modern farm implements to work with or by direct supplying of these farm tools to farmers. Future agricultural development on a large scale depends on the opening up of the vast arable land in this ecological zone that can support many of the food crops consumed in Nigeria.

Agricultural Development in Sudan Savannah

This region is located in the Northern part of Nigeria. It stretches from Sokoto plain in the West through the Northern sections of the central highlands. Rainfall is low and erratic in nature about 657.3mm per annum. The rainy season is short while the dry season is between 6-9 months of the year. The vegetation is almost continuous grass land which has undergone severe destruction in the process of land clearing for farming. The soil shows a profile of sandy top soil and clayey subsoil in which concretions are common. However soils along fadama

and seasonally flooded river valley are more fertile for farming.

In this eco region bush clearing is unnecessary, farmers cultivate large acreages of land because farm land preparation is relatively easy to prepare unlike in the forest belt. Dams are built to sustain agriculture in this region. Examples are the Tiga Dam in Kano, the Kafinzaki Dam in Jigawa and the Galala Dam in Bauchi. Millet and guinea corn are important food crops of this area constituting the first crops usually sown during late May and early June. Other important food crop grown in this region are groundnut (June) and cowpea (July) (Udo, 1970). Upland rice, maize and cotton are also produced here. Inter cropping is a common practice in this area. Usually both millet and guinea corn are grown on the same plot of land and groundnut may be intercropped with any of the grain crop above. Mixed farming is common whereby farmers keep cow, donkeys, goats and sheep. Cattles are kept for several purposes ranging from milk production, ploughing, beef and manure from their drops.

The agricultural problem of this region is the erratic and unreliable rainfall pattern that results in drought and/or flood episodes. The late onset and early cessation of rainfall oftentimes makes farming risky for the people. Fadama cropping practised along river valleys are sometimes flooded and crops worth of thousands of naira destroyed. The uplands drought is more fearsome for most farmers engaged in crop production and as well as in animal rearing. Bush fallow is practised in most of these areas mostly in Kano and Katsina corridor.

The problem of drought can be resolved through establishment of more irrigation project schemes organised by government to assist farmers. Again the awareness of how to harvest and store rainwater during the short rainy season for similar purpose needs be created among farmers. Reservoirs for storing rain water can be built by communal or/and through government efforts for farming families. This water can be used by farmers to irrigate their farm during the prolonged dry season. The issue of flood can be resolved by building embankment to curtail the water from overflowing its bank and confine it within its valley. These are some ways by which farmers can adapt to the options of drought and flood imposed by climate of the eco region.

Agricultural Development in Sahel Savannah Region

This region is located in the extreme North of the country. In this region dry season could be prolonged to as long as nine months. Borno and Chad depression fall within this eco region. In Chad basin the soil is fertile but cultivation is limited by short duration of rain. Thus, these zones are not cultivated without irrigation. The people here are the nomadic herdsman and their main occupation is crop farming and animal rearing. Only one cropping season is possible because the rainy season is short in duration. The soil supports the growth of millet, sorghum, groundnut, sesame, cotton and indigo while market garden crops and rice are produced on the irrigated plots.

The major limiting factor to farming is climate and of recent the security issue of terrorists' insurgence. Crop failure is a common occurrence usually caused by late onset and early cessation of rain and flooding of farm land along river basins. The common farming system practised in this region is crop rotation but field size is larger than those in the forest region. The suggested adaptation strategies for farmers in the Sudan savannah above also hold for farmers in this region.

Montane Ecozone and Agricultural Development

This zone is located in the high altitude areas of the country like Jos plateau (1,500-1,800m), Adamawa plateau (1,000m), Biu plateau (600-900m), Mambilla plateau (2,419m), Obudu plateau (over 1,200m), the Western plateau (1,000m), Enugu Escarpment (1,000m), etc. The climate is influenced by altitude and latitude. Generally this area is characterized by low average annual temperature with heavy rainfall relative to the surrounding plains.

The soil in Jos Plateau is skeletal in nature and it is derived from two sources. One of schist and gneiss and the other of basalt which is of a volcanic origin. Both are fertile and are heavily cultivated. Potatoes, lettuce and cassava are cultivated. Farmers who live on hills practise terrace farming to check erosion. Crop

production activities in Biu plateau is concentrated on the foot of slopes of some outcrops which have been laid out in terraces. The soil is dark-brown and rich in gravel. The basalt plateau of Biu is fertile and also rich in nutrients. Ground nut and guinea corn constitute the major crops while swamp rice is cultivated in the alluvial plain of the valley floors. At the central plateau where rainfall decreases northward towards Zaria through Kontagora, crops such as millet, guinea corn, ginger, brown sugar, beans and swamp rice are cultivated. The soil of Udi plateau is acidic with a poorly developed profile. It is structurally unstable readily given to degradation and erosion. The best grazing area is found in Mambilla, Bamenda and Obudu uplands located in the eastern boarder land of Nigeria. This is because the areas are well-watered and also free from tsetse fly. Agricultural development in these areas as noted by Udo (1970) involved introduction of new crops such as coffee and bananas which are cultivated in plantation. Food crops are cultivated in these areas by the adoption of contour ridging to reduce erosion.

Conclusion

It is obvious that the major ecological zones in Nigeria identified above have a lot of implications for agricultural development in Nigeria. Root crop characterized the crop economy in the south while in the north it is grain. In between these two extremes is the guinea savannah area referred to as the middle belt of Nigeria where production of these two groups of crop overlaps because the ecological condition of the guinea savannah permits this.

The pattern of food production and challenges observed is unique to each ecological zone. In the rain forest of the south, water is not as limiting as in the north but stable land to cultivate in some parts and difficulty in land clearing in the other. Thus the problems of agricultural development in Nigeria vary according to each ecological zone and all we need to do is to proffer lasting solution to them. Late onset of rain and early cessation leads to shortened length of growing season which results into crop failure mostly in savannah ecological zones. Flood on the other hand ravages farm lands with the loss of crops worth of billions

of Naira in the coastal areas and in flood plains areas while the upland agriculture is faced with the dilemma of erosion and land degradation. Again poor Nigeria farmers depend on primitive farm implements to accomplish their agricultural development. To develop agriculture in a sustainable way in various ecological zones in Nigeria requires understanding of the changes that is taking place in climate (most especially rainfall and temperature), soil and topography. Thus the agricultural planners must take into consideration these variations in addressing policy issues for the county.

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that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over a comparable time periods (IPCC, 2001)