

# Food Security In Nigeria: The Role Of Biodiversity

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***Abstract:** This paper examines biodiversity and its support to modern day agriculture and human well-being in Nigeria. The growth of modern day farming systems has led to a broader conversion of land alongside biodiversity loss. In order to feed the ever growing population of the country, incorporating biodiversity conservation and food production need to be done in a forward-looking and acceptable ways. The paper also examines the contribution of diverse production systems to nutrition and livelihood as one way of achieving food security in Nigeria. Such systems are also readily recoverable from shocks due to human-related activities and climate change. Biodiversity, if properly managed, can serve as an important source of food and other resources that can contribute toward food security.*

***Keywords:** Biodiversity, Land conversion, Food production, Food security, Agriculture*

## I. INTRODUCTION

Conservation biologists and ecologists concentrate on biodiversity conservation mainly in non-agricultural lands, although it has been observed that a strictly conservation focus has a limited range, particularly when it comes to fulfilling production needs (Godfray et al. 2010). This is true given that most of the world's biodiversity remains outside of protected areas, especially in the tropics, often in complex, multi-functional landscapes occupied by people and their associated farming systems (Padoch and Pinedo-Vasquez 2010).

The conventional pattern to attain food security has been the conversion of wild land areas to intensive commercial agricultural system (Green et al. 2005) resulting to the increased homogenization of natural landscapes (Heitala-Koivu et al. 2004). The immediate consequence of this type of land use is the drastic loss of habitats, the biodiversity they contain and the ecosystem services they provide (Lamarque et al. 2011). Almost 30–40% of the earth's surface is now under some sort of agricultural system (Chappell and LaValle 2011). The Green Revolution was aimed at increasing production in already existing agricultural lands, however, it is estimated that 20% of the yield increases lead to direct land conversion (Evenson and Gollin 2003). It is suggested that there is a need

to increase food production two- to three-fold (Green et al. 2005) especially with the human population estimated to reach nine billion by the year 2050 (Godfray et al. 2010). However, further expansion of industrial agriculture through land conversion could have a continuing devastating effect on the world's remaining biodiversity (Lambin and Meyfroidt 2011).

In a quest to prevent the ongoing biodiversity crisis, protected areas have increased over the past 20 years in both number and size and now cover 13 percent of the world's land area (IUCN 2011). In Nigeria, the present network of protected areas includes 7 national Parks, 15 game reserves (Usman and Adefalu 2010) and 36 forest reserves (Ezealor 2001). Other protected areas include sanctuaries and game reserves meant to conserve wild life and to supplement protein from domestic sources (Federal Government of Nigeria 2001). Although, protected areas are seen by many as the primary means of preventing ongoing losses of species and habitats but have failed to halt biodiversity loss (Mace et al. 2010), since most of the protected areas are in fact encroached upon by food production (Scherr and McNeely 2005). Hence, more integrated and inclusive approaches need to be more actively followed in order to attain biodiversity conservation and food security goals (Brussard et al. 2010).

## II. BIODIVERSITY: A NECESSARY ELEMENT OF AGRICULTURAL SYSTEMS AND HUMAN WELL-BEING IN NIGERIA

Biodiversity comprises all species of plants, animals and microorganisms, the ecosystems and the ecological processes of which they are parts. It is considered by some to be the same as species richness; some consider it as species diversity, while many consider it to be the complete variety of life on this planet (Tackacs 1996). According to the International Convention on Biological Diversity (2003), "Biodiversity" (biological diversity) means the variability among living organisms from all sources, including among other things, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part including within species-diversity, between-species diversity and ecosystem diversity.

Most of today's modern crop and livestock species are derived from their wild relatives and it is estimated that products derived from genetic resources (including agriculture, pharmaceuticals etc.) is worth \$500 billion per annum (ten Kate and Laird 1999). During times of food insecurity, particularly during times of poor agricultural production (Karjalainen et al. 2010) or during periods of climate induced vulnerability (Cotter and Tirado 2008), biodiversity serve as an important safety-net. Many rural communities source 30–80% of their protein from bush meat (Pimentel et al. 1997), particularly in the absence of domesticated alternative sources. According to the World Health Organization, about 80% of the population in many developing countries depends on biodiversity for primary health care (Herndon and Butler 2010) and the loss of biodiversity has been related to the increased emergence and spread of infectious diseases with harmful effects on human health (Keesing et al. 2010).

In Nigeria, forests serves as a source of ripe fruits, vegetables, and different types of leaves that can be used as dietary supplements. For instance, the leaves of baobab tree (*Adansonia digitata*) are used in the preparation of soup. The flower is eaten raw, the seed also provide flour which is very rich in vitamin B and protein and can be used as baby food (Gabeur et al. 2002), while the seeds of *Pakia biglobosa* are used for making delicious sauce in Northern part of the country. The bark of *Faidherbia albida*/ *Acacia albida* tree is used to cure diseases such as cough, pneumonia, vomiting and diarrhea while the leaves and the gum are used for the treatment of haemorrhage and ophthalmia. Various parts such as the roots, flowers, pods and the seeds are used in the treatment of influenza, toothache, and rheumatism. Some other known medicinal plants in the country includes Mango (*Mangifera indica*), Hogplum (*Spondias monbin*), Arrow poison (*Strophantus hispidus*), Goatweed (*Ageratum conyzoides*), Pawpaw (*Carica papaya*), Siam weed (*Eupatorium odoratum*) (Bhat et al. 1985). Also, wild animals such as antelope, hippopotamus, and bird are hunted for their meat as source of protein and other nutrients (Ezealor 2001). Native plants such as *Terminalia superba* (Afara), *Nauclea diderriichi* (Opepe), Mahogany and Iroko have been of continued importance as raw materials for timber industries. They are also used for the construction of buildings and

furniture. Latex, which is produced by rubber tree, also serves as a raw material for rubber industries for the production of plastics, gums, cables etc. Insects like bees play a vital role in agriculture as pollinators of crops, aside the production of honey. Ecologically and culturally important sites like National parks and Game reserves are used for research into ecology and for comparisons with other areas under different system of use (Ezealor 2001). Some forests areas are set aside and protected by rural communities mostly in the south for cultural purposes (Ezealor 2001).

## III. WHAT IS FOOD SECURITY?

According to the World Bank, food security is defined as "access by all people at all times to sufficient food for an active, healthy life" (Maxwell and Wiebe 1999). Although, in a simple form, a country is food-secure when most of its population has access to food of adequate quantity and quality compatible with decent existence at all times (Idachaba 2004). At the World Food Summit, the most usually agreed and used definition for food security, agreed upon is as follows: "people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary and food preferences for a healthy and active life" (Pinstrup-Andersen 2009).

These definitions show that food must be available to the people to an extent that will meet some acceptable level of nutritional standards in terms of a calorie, protein and minerals which the body needs; the possession of the means by the people to acquire (i.e. access) and reasonable continuity and consistency in its supply (Davies 2009). If a household has current access to adequate food to meet immediate nutritional demands while depleting the natural capital that would have made available future resources, it cannot be considered food secure (Perrings et al. 2010). Also, some argued that even if food availability is satisfactory, the achievement of human well-being is closely linked to access to broader environmental health such as sanitation, access to clean water and diverse productive ecosystems, hence food security does not always equate to *nutritional* security (Pinstrup-Andersen 2009). According to Semba and Bloem (2001), nutritional security is also dependent on the diverse ecosystem services biodiversity and forests provide which serve to limit infection and disease transmission as a result of the strong cyclical relationships between nutrition and infection.

Some selected policy and legislative frameworks related to biodiversity and food security which Nigeria has ratified are as follows:

- ✓ *CONVENTION OF BIOLOGICAL DIVERSITY*: "Biodiversity is essential for food security and nutrition and offers key options for sustainable livelihoods. Existing knowledge warrants the sustainable use of biodiversity in food security and nutrition programmes, as a contribution to the achievement of the Millennium Development Goals". <http://www.cbd.int/agro/food-nutrition/>.
- ✓ *UNIVERSAL DECLARATION ON HUMAN RIGHTS ARTICLE 25(1)*: "Everyone has the right to a standard of living adequate for the health and well-being of himself

and of his family, including food” which is a main cross-cutting initiative on biodiversity for food and nutrition. <http://www.un.org/en/documents/udhr/index.shtml>.

- ✓ **MILLENNIUM DEVELOPMENT GOALS 7A:** which aims to “Integrate the principles of sustainable development and reverse the loss of environmental resources”. Also 1C: “reduce by half, by 2015, the proportion of people who suffer from hunger” which is particularly expected to contribute to achieving the MDGs when connecting biodiversity, food and nutrition issues. <http://www.un.org/millenniumgoals/>.
- ✓ **INTERNATIONAL COVENANT ON ECONOMIC CULTURAL AND SOCIAL RIGHTS:** Regarding the ICFCRS, in particular Article 11: the right to “an adequate standard of living, including adequate food”. Also in relation to Article 12: the right to “the highest attainable standard of physical and mental health” which to a greater extent depends on access to adequate food and nutrition. [https://en.wikipedia.org/wiki/International\\_Covenant\\_on\\_Economic,\\_Social\\_and\\_Cultural\\_Rights](https://en.wikipedia.org/wiki/International_Covenant_on_Economic,_Social_and_Cultural_Rights).
- ✓ **FAO'S STRATEGIC FRAMEWORK 2000–2015:** Here the Organization is expected to fully report the “progress made in further developing a rights-based approach to food security” and in accomplishing its mission “helping to build a food secure world for present and future generations.” <http://www.fao.org/righttofood/>
- ✓ **ABUJA DECLARATION ON FERTILIZER FOR THE AFRICAN GREEN REVOLUTION** specifies that “African union (AU) Member States resolved to increase fertilizer use from 8.0 kilograms to 50.0 kilograms of nutrients per hectare by 2015”. <http://www.fao.org/3/a-am054e.pdf>
- ✓ **SHARM EL-SHEIK DECLARATION ON THE HIGH FOOD PRICES – 2008:** Here African Union Assembly is “committed to reduce by half the number of undernourished people in Africa by 2015, eradicate hunger and malnutrition in Africa and take all necessary measures to increase agricultural production and ensure food security in Africa, in particular through the implementation of AU-NEPAD CAADP and the 2003 AU Maputo”. <http://www.fao.org/3/a-am054e.pdf>
- ✓ **ROME DECLARATION ON WORLD FOOD SECURITY-** 1998 stipulates that “Agricultural production increases need to be achieved while ensuring both productive capacity, sustainable management of natural resources and protection of the environment.” <http://www.fao.org/DOCREP/003/W3613E/W3613E00.H TM>.
- ✓ **INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE (IFPRI) 2020 VISION:** “is a world where every person has access to sufficient food to sustain a healthy and productive life, where malnutrition is absent and where food originates from effective, efficient and low-cost food systems that are compatible with the sustainable use of natural resources”. <http://www.ifpri.org/book-753/ourwork/program/2020-vision-food-agricultureand-environment>.

#### IV. TRENDS IN AGRICULTURE AND IMPACT ON BIODIVERSITY IN NIGERIA

Food production started around 12,000 years ago and about 7, 000 plant species and several thousand animal varieties have been utilized historically for human nutrition and health requirements (Toledo and Burlingame 2006). There has been a significant global trend towards diet simplification since 1900 (Frison et al. 2006). Presently, 12 plant crops and 14 animal species provide 98% of world’s food demands with wheat, rice and maize alone accounting for more than 50% of the global energy consumption (Ehrlich and Wilson 1991). Agricultural expansion has adversely affected biodiversity, particularly agro-biodiversity (Belfrage 2006) contributing to the loss of many wild relatives of crop plants and livestock (Pilling 2010). The FAO reveals that in the past 100 years three-quarters of the varietal genetic diversity of agricultural crops has been lost (FAO 2008).

In Nigeria, the need for an extensive agricultural production has increased the total land area dedicated to that sector from 16.5 million ha in 1960 (Agboola 1979) through 21.9 million ha in 1970 (Office of Statistics Nigeria 1972) to 35.3 million ha in 1980. In spite of that, the estimated land requirement for food and cash crops in 1995 is 55.6 million ha (Federal Government of Nigeria 1987). This shows that agricultural production in Nigeria is largely land extensive. By 1995, 56 percent of the land in the country is devoted to agriculture. The consequences are all the pressures from cultivation will be placed on a larger part of Nigeria’s land cover whose population density has grown beyond levels that can be supported by shifting cultivation (Osemeobo 1988). Hence, the negative effects of such practice under high population of smallholder farmers which include uncontrolled bush burning, unplanned human interference with the soils and changing land tenure systems have gradually and systematically depleted native species and therefore, caused the extinction of wild fauna and flora in the natural ecosystems over the years (Osemeobo 1988).

This trend has significant consequences for food security, nutrition and health (Vinceti et al. 2008). Society depending on a fewer genetic base for nutrition makes it considerably vulnerable to peril and there are several examples of the risks of monoculture agriculture resulting to past observed crop failures and suddenly, famine, as a result to genetic homogeneity (Thrupp 2000). It is important to note that an issue of concern is not *how much* food is needed to attain food security but *what kind* of food; therefore food composition is also as significant as food access and availability (Frison et al. 2006). For instance, increased handiness and intake of cereals, especially in developing countries have resulted to heightened micronutrient deficiencies (Frison et al. 2006). Forest diversity, fallow and agricultural margin foods can often help provide the array of micronutrients required for the human food (Padoch and Pinedo-Vasquez 2010).

## V. CHALLENGES TO BIODIVERSITY-FRIENDLY AGRICULTURE IN NIGERIA

### POPULATION GROWTH

According to Perrings et al. (2010), human population is expected to grow to nine billion by the year 2050. Population size, growth and density are often regarded as important factors in explaining the loss of species (Cincotta and Gorenflo 2011). Biodiversity is generally threatened most where population density is highest, and regions rich in endemic species have higher-than-average population densities and population growth rates (Cincotta and Engelman 2000). This is true in many parts of Asia and Africa where humans and threatened species are often concentrated within the same geographical locations (Vié, et al. 2010.). Threat to biodiversity is likely to rapidly increase in regions where human population growth rates are high due to the predicted increase in demands for resources of a growing population in these regions (Vié, et al. 2010). If the current pattern of commercialized monoculture is to be pursued, feeding the world's population has begun to need the conversion of yet more wild lands, at the detriment of biodiversity and ecosystem service provision (Lambin and Meyfroidt 2011). Many countries in the developing world are facing rapid growth in population, with related pressure on natural habitat and their native fauna and flora (Soderstrom et al. 2003).

According to Food and Agricultural Organization (FAO 2001), the population of Nigeria is expected to increase by more than 50 percent in the coming two decades. During this 20 year period, the rural population is expected to rise by 25 percent and the agricultural component is expected to also grow. Agricultural expansion and other human-related activities such as logging, illegal exploitation, and collection of fuel wood as a result of population pressure have continued to pose serious threats to the country's biodiversity (Federal Government of Nigeria 2001).

### CLIMATE CHANGE

One of the greatest contemporary threats to food security is climate change and its potential impacts (Gregory et al. 2010). According to Juma (2010), crop yields are affected by climate change and by estimation, agricultural produce in Africa alone could decrease by more than 30 percent by 2050. The world's poor, who will not only lose direct access to food but are less able to absorb the global commodity price changes that characterize a reduction in supply will mainly be affected by such yield decline (Cotter and Tirado 2008). For instance, Devereaux (2009) argued that the three of the most recent famines in sub-Saharan Africa, although mainly brought about by non-production or supply issues, were worsened by climate change that pushed already vulnerable livelihoods into major food insecurity and, ultimately, famine.

According to Adejuwon (2006), a Nigerian study using the Erosion Productivity Impact Calculator (EPIC) crop model to project crop yield during the 21st century modeled worst case climate change scenarios for maize, sorghum, rice, millet and cassava. These projections indicated that, in general, crop yield will increase across all low land ecological zones as the

climate changes during the early parts of the 21st century. Towards the end of the century, nevertheless, the rate of increase will tend to slow down. This could result in lower yields in the last quarter than in the third quarter of the century which could be explained in terms of the very high temperatures which lie above the range of tolerance for the current crop varieties and cultivars (Adejuwon 2006).

### GENDER INEQUITY

According to the United Nations (2011), women are crucial to ensuring food security. Maxwell and Wiebe (1999) estimated that women primarily in small-scale farming systems produce more than 50% of the food grown globally. Women comprise up to 80% of farmers in sub-Saharan Africa and 60% in Asia, ratios that are increasing due to male emigration and moves towards off-agriculture sources of livelihood, however, their right and control over land and resources is generally low to that of men in the same household or community (Mathur 2011).

Also women are primarily responsible for food preparation and sharing therefore, are usually the "*guardians of household food security*" (Maxwell and Wiebe 1999). Despite their prominent role in agriculture, women in Africa, remain discriminated by culture in terms of their access to productive resources especially in area of land inheritance. In places where women do not own or inherit land for instance, they always experience difficulties in their expanding farming activities and reaping the benefits of innovation (Anyanwu and Agu 1995).

In Nigeria, poor institutional/organizational pattern of agricultural institutions is one of the greatest challenges faced by women farmers. This limits female farmer's access to farm support services such as extension, education, information and cooperative services despite evidence suggesting that investment aimed at women leads to the increase of both farm and non-farm incomes at the household level (Godfray et al. 2010). Women rarely formed agricultural cooperative societies or other functional associations while agricultural extension programmes and other supporting services have traditionally focused more on male dominated cropping practices (Eboh and Ogbazi 1990) making women still greatly relying on their husbands for information related to farming (Raffety 1998). In the circumstance of agricultural development, such "gender blindness", is a major peril to future food security (Mathur 2011).

### AGRICULTURAL INVESTMENT

In many regions crop production have declined primarily as a result of declining investments in agricultural research, irrigation and infrastructure (Rosegrant and Cline 2003). In most developing countries, national investment in agricultural development also remains very low, often representing less than 0.5% of agricultural GDP, despite the important contribution of farming to their economies (Pinstrip-Andersen and Pandya-Lorch 1998). In Africa, it is estimated that the lack of agricultural development investment has resulted to yield declines of about 10% since 1960 (Juma 2010). Investment in national agricultural development also remains very low, often

representing less than 0.5% of agricultural GDP, despite the significant contribution of farming to most developing countries' economies (Pinstrup-Andersen and Pandya-Lorch 1998).

In Nigeria, compared to many African countries, the government's spending in agriculture as a share of total government expenditure and in proportion to agricultural GDP is low. For instance, between the year 2000 and 2010, agricultural spending as a share of total spending averaged only 3.8 percent. This figure is less than the continental average 5.4 percent, the West African average of 7.4 percent, and the 10 percent target set by the Comprehensive Africa Agriculture Development Programme. There is some improvement compared with the 1.8 percent share recorded for the period 2000-05 (Mogues et al. 2012), however, general public agricultural spending in Nigeria is among the lowest in West Africa, and the world when it is quantified as a proportion of agricultural GDP. Also, government's funding of agricultural research in Nigeria has been well below the average for Africa as a whole (0.85 percent of GDP).

According to Nigeria's House Committee on Agriculture (2005), percentage of the total budgetary allocations for agricultural research for the periods 1996-1998, 1998-2000, and 1999-2001 were 13.41 percent, 14.82 percent, and 12.42 percent, respectively, which are considered insufficient and therefore militating against the ability of research institutes to respond to the demands of poor farmers.

#### TENURE SYSTEM

Land tenure and food security have both, separately, been the subject of extensive research yet vital links between the two is still fairly unexplored (Maxwell and Wiebe 1999), however tenure rights have been conspicuous in debates surrounding conservation (Campese et al. 2009). In Africa, most people do not own farmland but held in trust by the present generation on behalf of their future descendants. It could be held by individual families, extended families or entire village communities and then divided to individual farmers, who only enjoy user rights. Outright purchase of farmland is not common, but it is possible to rent it for a period of time (Nweke and Enete 1999). The lack of secure access rights and land tenure may deter many poor or marginalized communities from investing in managing land more productively, investing in required inputs and making the raising of capital much more difficult (Godfray et al. 2010).

In Nigeria, according to IFAD (2007), about 90% of food is produced by smallholder farmers who cultivate small plots of land, usually less than 1 hectare of land per household. Any incentive from the state and the private sector will undoubtedly favours landowners with secure tenure, with smallholder farmers' marginalized (Campbell 2009).

#### VI. CONCLUSION

Food security to a greater extent depends on issues of sustainability, availability, access and utilization and not only production, however, there are evidence that "new agriculture" (Steiner 2011) is needed to supply the world's population with

food effectively and justly. Biodiversity serves as a significant source of food for households from farming, gatherer and forager systems over the years (Zareen and Jules 2010). Over the past fifty years, expansions of agricultural systems have been at the detriment of biodiversity and ecosystem services. However, there is significant evidence that agro-ecological systems if not more can be equally productive, in terms of original yield outputs, in spite of biodiversity benefits of such methods (Sunderland 2011). As such, FAO (2009) realizes that 'nutrition and biodiversity meet at a common path that leads to food security and sustainable development' and that 'wild species and intraspecies biodiversity have key roles in global nutrition. Biodiversity as a source of foods cannot completely bridge the existing supply and demand gaps, in term of food security; however, without it the differences would be much wider. In order to minimize the existing supply and demand gaps in term of food security in Nigeria, biodiversity conservation and restoration in human dominated ecosystems must strengthen the links between agriculture and biodiversity (Novacek and Cleland 2001). Therefore, know-how from biodiversity science and agricultural research and development need to be incorporated and enhanced through a systems approach for this to be achieved.

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