Cascading Threats of Climate Change on the Food System in Nigeria: An Overview

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> "When risk cascades through a complex system, the danger is not of incremental damage but of runaway collapse or an abrupt transition to a new, suboptimal status quo" (WEF, 2018:6).

Abstract

The cascading threats of climate change on food production, procurement and distribution and the resulting vulnerability and reduction of people's access to food (physical accessibility, quality of food available and purchasing power) have become issues of compelling attention in contemporary times. Increasing temperatures, declining and more unpredictable rainfall, more frequent extreme weather and higher severity of pest and disease are among the more drastic changes that would impact food production (Parry et al, 2007; Kotschi, 2007; Morton, 2007; Brown and Funk, 2008; Lobell et al, 2008). The paper utilizes a qualitative, informal approach and participant observation in examining the cascading threats of climate change on the food system in Nigeria. Content analysis was used in analysing secondary data captured through various books, academic journals, Internet reports and newspaper clippings. The paper adopts the vulnerability-hazard-risk framework as a conceptual approach. Integration of the food system and food planning within the Green and Brown agenda through participatory governance, collaboration and authentic dialogue provides an eco-efficient approach to minimising the ecological footprint and foodprint. A secure ecological foundation guarantees food planning within a cascading complex and interconnected threats of climate change.

Introduction

Climate change is defined as "a sustained shift in the average value of climatic elements (temperature, sunshine, precipitation, wind etc.) either singly or in combination, the shift must be maintained for sufficient time to be measurable by Climate Normals, which are calculated over 30 year periods by the World Meteorological Organization and other bodies" (Smith, 2013:408). It is an outcome of human-induced driving forces such as the combustion of fossil fuels and land use changes, but with wide-ranging consequences for the planet and for human settlements all

over the world (UN-Habitat, 2011). Climate change is caused by natural processes (biogeographical) and human activities (anthropogenic) (IPCC, 2007). Climate change impact on land uses is one of many complex and interconnected challenges that Planners deal with in the built environment. Paradoxically, failure of urban planning, failure of regional or global governance and increasing urbanization are among the interconnected risks of climate change (WEF, 2018).

World Economic Forum 2018 report indicates the most pressing threats that are perceived as having the biggest impact in the next ten years are extreme weather events and natural disasters, failure of climate change mitigation and adaptation, water crises, biodiversity loss, and air and soil pollution (WEF, 2018). For example, the Intergovernmental Panel on Climate Change (IPCC) report predicts the probability of more heat waves, heavy rainfall, droughts and other extreme weather throughout the 21st century (Parry et al, 2007).

The food system constitutes a critical and sensitive part of climate change. The connection between climate change and the food on your plate, our diet and global warming (Lappe, 2009) is, therefore, very profound. Climate change threatens biodiversity and ecosystem services across the planet (Millennium Ecosystem Assessment, 2005) and is a threat to the ecological foundation of agriculture and the food system. Climate change threatens the livelihoods, food availability and health of the population (Bassey, 2013:101). Destruction of forests for farming, mining, and oil and gas production, not to mention infrastructure development, remains the main driver of biodiversity loss" (Lancet, 2018:e51).

Climate change presents the food system in Nigeria with challenges for physical planners especially, land use and infrastructure planning. Planners are faced with the task of planning, shaping and designing liveable, equitable and sustainable communities as well as ecologically secure food system for future generations. As the population of Nigeria grows (about 195 million) and agriculture declines in importance, national attention to food production and food prices become compelling issues of attention.

The paper is structured in four parts. It gives a background to climate change as a threat to the food system, discusses briefly the food system in Nigeria, conceptualizes climate change and food security and suggests food planning as an eco-efficient approach to securing the ecological foundation in Nigeria's food system.

Cascading Threats

Mark et al. (2008) highlighted some of the direct impacts of climate change on agricultural system as: (a) seasonal changes in rainfall and temperature, which could impact agro-climatic conditions, altering growing seasons, planting and harvesting calendars, water availability, pest, weed and disease populations; (b) alteration in evapo-transpiration, photosynthesis and biomass production; and (c) alteration in land suitability for agricultural production. Some of the induced changes are expected to be abrupt, while others involve gradual shifts in temperature, vegetation cover and species distributions.

Climate change is the second type of systemic shock threatening cities with prospective unparalleled short to long-term impacts. Climate change comprises two complementary elements namely (a) the increasing frequency and severity of extreme weather events with short durations (e.g., hurricanes, storm surges or heat waves); and (b) slow-onset changes that are semi-permanent or permanent (e.g., sea level rise, falling groundwater tables or desertification) (UN-Habitat, 2010**)**. These two complementary elements of climate change bring about unprecedented levels of food insecurity especially among the poor and vulnerable groups who are always at the receiving end of extreme weather events because of their exposure. Climate change due to anthropogenic global warming (AGW) is commonly perceived as the greatest contemporary environmental threat facing the world. Urbanization and climate change are co-evolving in such a way that populations often in densely packed urban areas will be placed at much higher risk from climate change as well from other profound societal and environmental changes (UN-Habitat, 2011:2).

When the food infrastructure (land, soil, vegetation, water) is threatened by climate change, food security (availability, access, utilization and stability) is also threatened. Climate change according to WFP (2018:2) affects:

- "Food availability: Changes in climatic conditions have already affected the production of some staple crops, and future climate change threatens to exacerbate this. Higher temperatures will have an impact on yields while changes in rainfall could affect both crop quality and quantity.
- Food access: Climate change could increase the prices of major crops in some regions. For the most vulnerable people, lower agricultural output means lower incomes. Under these conditions, the poorest people — who already use most of their income on food — sacrifice additional income and other assets to meet their nutritional requirements, or resort to poor coping strategies.

- Food utilization: Climate-related risks affect calorie intake, particularly in areas where chronic food insecurity is already a significant problem. Changing climatic conditions could also create a vicious cycle of disease and hunger. Nutrition is likely to be affected by climate change through related impacts on food security, dietary diversity, care practices and health.
- Food stability: The climatic variability produced by more frequent and intense weather events can upset the stability of individuals' and government food security strategies, creating fluctuations in food availability, access and utilization".

Cascading Effects

Climate change exacerbates the risks of hunger and undernutrition through:

- Extreme weather events
  Climate change increases the frequency and intensity of some disasters such as droughts, floods and storms. This has an adverse impact on livelihoods and food security. Climate-related disasters have the potential to destroy crops, critical infrastructure, and key community assets, therefore deteriorating livelihoods and exacerbating poverty.
- Long-term and gradual climate risks
  Sea-level will rise as a result of climate change, affecting livelihoods in coastal areas and river deltas. Accelerated glacial melt will also affect the quantity and reliability of water available and change patterns of flooding and drought (WFP, 2018:2).

Vulnerability, Hazard and Risk Framework

"Food systems encompass all the people, institutions and processes by which agricultural products are produced, processed and brought to consumers. They also include the public officials, civil society organizations, researchers and development practitioners who design the policies, regulations, programmes and projects that shape food and agriculture" (FAO, 2013:x). The food system comprises the 5A's of food security namely; accessibility (effective distribution), availability (sufficient supply), acceptability (culturally acceptable/nutritionally adequate), appropriateness (ecologically sustainable) and agency (enables action).

Vulnerability to climate change manifests in three ways: people/population vulnerability, resource/infrastructure vulnerability and spatial/locational vulnerability. The co-evolving partners

(urbanization and climate change) place a large proportion of the population, especially the poor, destitute and inadequately housed people, to much higher exposure and risk in urban areas. As Rosenzweig et al (2011: xvi) observes:

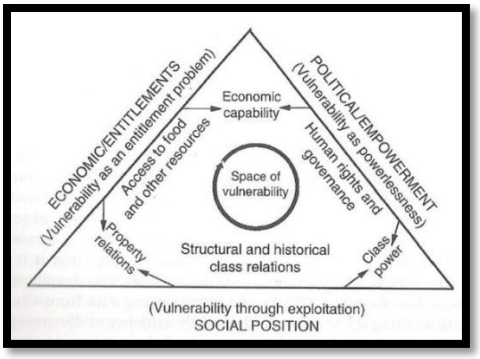
> "climate change exerts added stress on urban areas through increased numbers of heat waves threatening the health of the elderly, the infirm, and the very young; more frequent and intense droughts and inland floods compromising water supplies; and for coastal cities, enhanced sea level rise and storm surges affecting inhabitants and essential infrastructure, property, and ecosystems. At the same time, cities are responsible for no less than 40% of global greenhouse gas emissions, and given current demographic trends, this level will likely only increase over time".

The vulnerability, hazard and risk framework provides a conceptual basis to situate the vulnerability of the food system to climate change and its subsequent impact on agriculture and food production. This framework seemingly could be applied to agriculture and food production both in urban and rural areas.

Vulnerability is defined as the characteristics and circumstances of a community system or asset that make it susceptible to the damaging effect of a hazard (UN/ISDR 2009). Vulnerability is a dynamic concept rather than a constant state; it is constantly in flux due to changing interactions between geophysical and social processes through time and space (Smith, 2013).

Watts and Bohle (1993), described vulnerability as an aggregate measure of human welfare that integrates environmental, social, economic and political exposure to a range of potential harmful perturbations Vulnerability is a multilayered and multidimensional social space defined by the determinate, political, economic and institutional capabilities of people in specific places at specific times. Vulnerability arises from a complex web of economic (vulnerability as an entitlement problem), political (vulnerability as powerlessness) and social conditions (vulnerability through exploitation) (Figure 1) which vary over time and space.

Figure 1: Dimensions of Vulnerability



Source: Adapted from Watts and Bohle, 1993.

Vulnerability can be seen in terms of exposure, capacity and potentiality (Watts and Bohle,1993). Or in terms of exposure and defencelessness (Chambers 1995:175,189) comprising of two sides: "the external side of exposure to shocks, stress and risk; and the internal side of defencelessness, meaning a lack of means to cope without damaging loss. Loss can take many forms from becoming or being physically weaker, economically impoverished, socially dependent, humiliated or psychologically harmed". Or in terms of exposure to risk and ability to cope (World Food Program 2002). Vulnerability context refers to the seasonality, trends, and shocks that affect people's livelihoods and it is the result of many factors some of which relate to policies and institutions and a lack of assets, rather than particular trends, shocks or aspects of seasonality per se (Guidance Sheets, 1999, 2000).

Thus, vulnerability can be summed up as the predisposition or susceptibility to any hazard that could cause harm or loss to human and/or physical and natural resources. In regard to the food system in Nigeria the complex interrelated and cascading threats and effects of Lake Chad Basin shrinking, Tomato Ebola, Boko Haram insurgency (conflict) and climate refugees among others, continue to impact on people's livelihoods and their vulnerability.

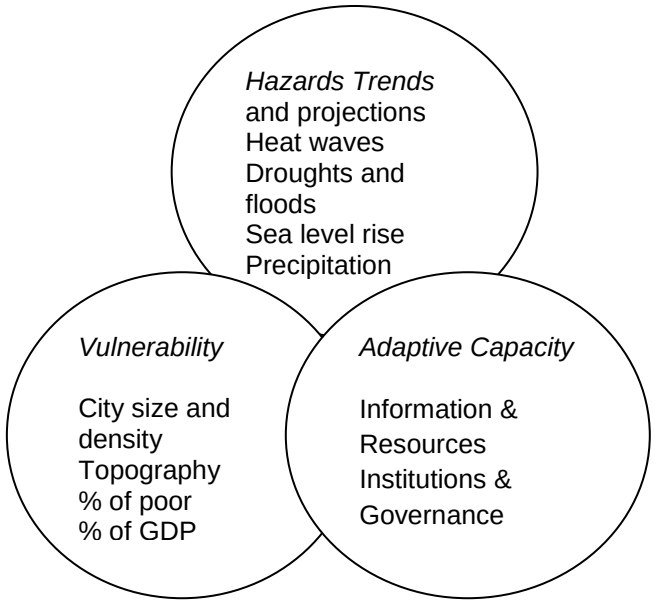
In any climate change event (land degradation, pollution, flood, drought or desertification) people become vulnerable and food insecure. As a result there is the need to access food and this need hinges on entitlement. The various institutions machinery set up to ease the impact by providing resources sometimes exert their power over the powerlessness of the situation and thereby exploiting the weak and poor who lack economic capability during this period. Ultimately, this increases the space of vulnerability in terms of people, property, resources and

infrastructures. Vulnerability seeks to capture the underlying causal processes that led to the actual status and which will probably influence future conditions (Lautze et al, 2003). Vulnerability is dynamic and describes how people move in and out of poverty and food insecurity (Frankenberger 2003; Brown and Gentilini, 2007).

The UCCRN climate change vulnerability and risk assessment framework (Figure 2) is composed of three sets of indicators:

- Climate hazards facing the city, such as more frequent and longer duration heat waves, greater incidence of heavy downpours, and increased and expanded coastal or riverine flooding;
- Vulnerabilities due to a city's social, economic, or physical attributes such as its population size and density, topography, the percentage of its population in poverty, and the percentage of national GDP that it generates;
- Adaptive capacity aspects, factors that relate to the ability of a city to act, such as availability of climate change information, resources to apply to mitigation and adaptation efforts, and the presence of effective institutions, governance, and change agents

Figure 2: Urban Climate Change Vulnerability and Risk Assessment Framework.

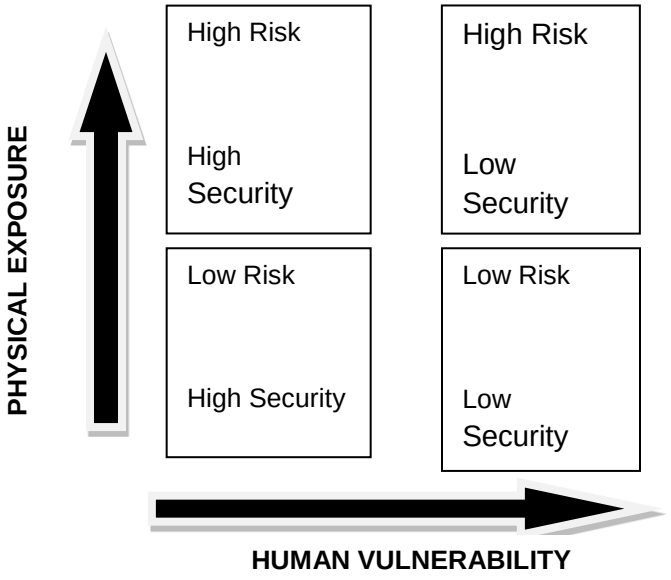


Source: Mehrotra et al. (2009).

Smith (2013) explains risk as: RISK= Hazard Probability x Elements at Risk x Vulnerability. "Hazard is a potential threat to humans and their welfare arising from a dangerous phenomenon or substance that may cause loss of life, injury, property damage and other community losses or damage while Risk becomes the combination of the probability of a hazardous event and its negative consequences" (Smith, 2013:11).

Smith (2013:9) affirms that "human sensitivity to environmental hazards (natural or technological) is determined by the physical exposure of people and their assets to potentially damaging events and by the degree of human vulnerability (or resilience) to such damaging events. Exposure and vulnerability are hazard specific in any one location, such as a river floodplain, but broader relationships can be displayed in a simple matrix (Figure 3). As physical exposure increases, human vulnerability also increases. Nigeria, with high exposures to risk especially in the coastal communities, find it difficult to fund hazard protection and to reduce exposure.

Figure 3: A Matrix Showing Possible Combinations of Physical Exposure to Hazard and Human Vulnerability in Relation to Risk and Security



Source: Smith (2013:9)

The food system in Nigeria is vulnerable to internal and external shocks presented by climate change. Natural and human vulnerability to the impacts of climate change are very high. Adaptive measures through food planning could be put in place to secure both the natural systems and human environment. Reducing the exposure to risk enhances the ability of the population, particularly, the vulnerable groups to cope. Vulnerability and exposure to risk could be mitigated through effective land use planning and food planning that facilitates accessibility (effective distribution, availability (sufficient supply), and appropriateness (ecological sustainability).

People/Population Vulnerability

The population groups most vulnerable to climate change and food insecurity include the low-income, poor, marginalised or indigent people in both developed and developing countries. Within this group are men, women, children (households, individuals), the elderly, homeless or inadequately housed, lone parents, disabled (physically challenged, mentally retarded), the poor living in food desert areas or do not have access (physical or economic) to food. These vulnerable groups do not have access to basic infrastructures and lack assets and do not have shocks to climate change impact. Lack exposes people's vulnerability. Lack, whether physical, financial, health, or otherwise, is profound among low-income, poor and no-income groups. The poor's resources and livelihoods become vulnerable to climate change impact particularly when there is flood, drought or other disaster occurrences. They do not have the shocks or safety nets to absorb the impact of climate change. These vulnerable groups skip meals, go on compulsory fasting due to erratic nature of access to food, unemployment and are always at the receiving end of climate change impact which subsequently makes them food insecure.

Correspondingly, the vulnerable groups' spatial location predisposes them to direct impact of climate change devastation. Evidently in most cities in Asia, Latin America and Africa most of the vulnerable groups are located in slums, squatter and informal/illegal settlements, marginal lands, hillsides/slopes, swampland with no infrastructures and facilities. The living conditions expose them to the vagaries of climate change and food insecurity. With poor assets, unstable livelihoods, and no entitlements, the vulnerable groups experience the complete onslaught of climate change and food insecurity. Low-income households often lack the resources to mitigate damages after they occur-for instance, through healthcare, structural repair, communication,

food and water (Adger, 1999, 2000). In the absence of adequate recovery assistance, the poor often sacrifice nutrition, children's education or any remaining assets to meet their basic needs thereby further limiting their chance of recovery and escape from poverty (UNDP, 2007). When the poor's vulnerability increases, livelihoods become less securely sustainable; safety nets are weakened, and there is little or no family support.

UN-Habitat (2011) notes that poorer groups are disproportionately at risk for a variety of reasons such as:

- Greater exposure to hazards (Ruth and Ibarraran, 2009);
- Lack of risk reducing housing and infrastructure (poor quality housing, lack of drainage systems);
- Less adaptive capacity (lack of income or assets that allow to move to less dangerous sites or more quality housing);
- Less state provision for assistance in the event of a disaster (e.g. needed emergency responses and support for rebuilding or repairing homes and livelihoods; indeed, state action may increase exposure to hazards by limiting access to safe sites for housing) (Syukrizal et al, 2009);
- Less legal and financial protection (lack of legal tenure for housing sites; lac of insurance and disaster-proof assets) (Bartlett et al, 2009; Hardoy and Pandiella, 2009).

However, the vulnerability, risk and exposure of rural areas and its inhabitants to climate change and food security is different. Rural areas constitute the food production engine because of the vast land available for agriculture and food production. The components of a food system, i.e. production, processing, distribution, consumption and waste management are severely disrupted when there is drought, flooding, heat wave or rise in sea levels.

Climate change effects place additional stress on the already stressed agricultural land and the vulnerable groups, particularly poor farmers, become worse off. The most profound and direct impacts of climate change over the next few decades will be on agriculture and food systems (Brown and Funk, 2008). Climate change will adversely affect food security as shown by all quantitative assessments (Schmidhuber and Tubiello, 2007). Climate change threatens this engine base and the livelihoods of many who are dependent on land for survival and sustenance are compromised when there is soil erosion, landslide, and/or environmental degradation.

Resource/Infrastructure Vulnerability and Food Production

Olaniyi et al. (2014) opined that the dearth of statistical data and non-collection environmental data in a systematic manner make it difficult to estimate in concrete terms the overall effect of climate change on agriculture and food supply, flooding and erosion, health risks diseases spread, water resources, wildlife, level of CO2 emission and trends in temperature increase, and their effects on the social and economic systems of the country. In Nigeria, Odjugo (2008) shows that climate change has led to a shift in crops cultivated in the northern region as well as reduction of arable lands.

In Nigeria with regards to food availability, utilization, access and utilization, climate change affects food production, procurement, processing, distribution, consumption and waste management/disposal. A disruption of any of this leads to a cascading disruption of the entire food system. The cascading effects of climate change on food security include: Disruption in food production: irregular cycles of production; disrupted from the regular pattern of planting, harvesting; threat to national food security (local production is impacted, reliance on imports); global food security; Erratic food supply; Epileptic food access and availability; Increase in food prices; Artificial food scarcity/shortage; Market failure; Food-borne diseases from bacterial growth; Poor food quality; Declining incomes; Nutritional inadequacy and deficiency; Declining health/wellbeing and Increase in hunger and malnutrition.

The negative impact of climate change erodes the assets base of many countries and dislocates the food system as well as the human, natural, physical, financial and political capital of many. The components of a food system, i.e. production, processing, distribution, consumption and waste management are severely disrupted when there is drought, flooding, heat wave or rise in sea levels. The connection between soil erosion and food production, or flooding and food availability and access, or extreme heat, inadequate soil moisture and crop yield, or the destruction of micro-organisms which helps improve soil fertility and burning are part of the intricate web of food production.

Agriculture also provided gainful employment and a satisfactory livelihood to over 90 percent of the Nigerian population (NDHS, 2009). Agriculture remains a major driver of economic growth in Nigeria. It is composed of four subsectors: arable crops (including food crops), forestry (including tree crops), livestock (including poultry) and fishery. Agriculture contributed 41.5 per cent to GDP in 2008. The sector has continued its dominance in the economy, in terms of its

size and contribution to the GDP. The policy thrust during the first National Implementation Plan (NIP) (2010-2013) was to enhance total factor productivity in the agricultural sector through the application and diffusion of knowledge and improvement in the technology base.

However, the agricultural sector remains weak despite its contribution to the GDP. The inefficient production system is characterized by poor input; weak inter-sectoral linkages; ageing operators and an informal production and marketing structure and the agricultural sector remains strategic for national food security, employment generation, wealth creation and poverty reduction as over 65 per cent of the labour force is engaged in the sector (FRN, 2010).

Spatial/Locational Vulnerability

- *Desertification*

Climate change has started impacting on desertification (Odjugo and Ikhuoria, 2003) and it is impacting negatively on plant species composition in Northeastern Nigeria (Ayuba et al., 2007). Desert encroachment with its associated sand dunes is depriving farmers of their agricultural farmlands and grazing rangelands. It has also led to uncertainties in yield predictions, implying that crop productivity could either increase or decrease in a changing climate. Other potential impacts linked to agriculture include erosion that could be exacerbated by expected increased intensity of rainfall and the crop growth period that is expected to be reduced in some areas (Campbell et al., 2014). Odjugo and Ikhuoria (2003) observe that Nigeria north of 12^{o}N is under severe threat of desert encroachment and sand dunes are now common features of desertification in states like Yobe, Borno, Sokoto, Jigawa and Katsina. The migrating sand dunes have buried large expanse of arable lands, thus reducing viable agricultural lands and crops' production. This has prompted massive emigration and resettlement of people to areas less threatened by desertification. Such emigration gives rise to social effects like loss of dignity and social values.

- *Rising Sea level*

Coastal settlements like Bonny, Forcados, Lagos, Port Harcourt, Warri and Calabar among others that are less than 10 m above the sea-level are now seriously threatened by a metre rise of sea-level. The sea incursion due to sea-level rise means salt-water intrusion into the fresh water, invasion and destruction of mangrove ecosystems, coastal wetlands and coastal beaches (Odjigo, 2010). Sea incursion is reducing the arable land of the coastal plains. The

coastal inundation and erosion with their associated population displacement are currently major environmental problems in Nembe, Eket and other coastal settlements in Bayelsa, Delta, Cross River, Rivers, and Lagos States of Nigeria. It is estimated that a metre rise in sea level will displace about 14 million people from the coastal areas of Nigeria (Abu, 2007).

- *Shrinking Lake Chad*

The regional impact of Lake Chad shrinking, flooding and drought have significant impact on the food system and food security in Nigeria and increasing numbers of climate refugees.

Lake Chad provides water and sustenance to around 30 million people in four neighbouring countries. The crisis afflicting the strife-torn Lake Chad Basin is rooted in decades of neglect, lack of rural development and the impact of climate change. Some 7 million people risk suffering from severe hunger in the Lake Chad Basin, which incorporates parts of Cameroon, Chad, Niger and northeastern Nigeria.

In the latter, some 50,000 people are facing famine. Conflicts, environmental degradation and climate change including repeated droughts, are exacerbating the situation. Lake Chad has lost some 90 percent of its water mass with devastating consequences on the food security and livelihoods of people depending on fishing and irrigation-based agricultural activities. (FAO UN, 2017). The Chad Basin is one of the irrigation food baskets in northern Nigeria and it serves the whole country. The federal Government's efforts at augmenting food production at the Chad Basin have also come under serious threat causing food instability from the activities of Boko Haram insurgents.

Food Stability

Food stability in Nigeria is also threatened by Boko Haram insurgency, herdsman influx, the shrinking of the Lake Chad Basin, Tomato Ebola and the destructive impact of the extractive industry sometimes causing climate induced flooding, desertification and erosion.

Boko Haram Insurgency

The Boko Haram insurgence, the Fulani herdsmen intrusion have contributed to the fragility of the food system and increased the number of food poor and food insecure people. Boko Haram insurgency is a threat to food security in Nigeria. Citizens cannot go to the market or access

food whenever and wherever they want, and farming activities are disrupted. The North Eastern part of Nigeria has been ravaged by Boko Haram insurgency displacing over 2 million people, causing hunger and poor food diets for several millions including children, women and nursing mothers; and killing over 17000 people since 2009. Several hectares of land prepared for rice cultivation and other grains have been abandoned in Borno because of insurgency and the multibillion Naira irrigation project is under threat (Soriwei and Okechukwu, 2013). Vast expanse of arable land has been destroyed and for two season farmers have been unable to go the fields to plant for fear of being attacked (Soriwei and Okechukwu, 2013).

Conflict between Boko Haram and the Nigerian Armed Forces has escalated since 2012 and is concentrated in the northeast and around Lake Chad in Borno State (Figure 6). The impacts of conflict on livelihoods, market functioning, and humanitarian response have severely limited access to food for both resident populations and displaced households. Acute food insecurity is widespread in northeast Nigeria, with the March 2016 Cadre Harmonisé estimating that more than 3 million people are in crisis (CH/IPC Phase 3) or worse and in need of humanitarian assistance. There is also visible malnutrition among adults and children, an extreme scarcity of food and water, very limited health facilities and a lack of functioning markets.

The impact is also felt in the south west. The south western region relies on the north for food grains. Olufemi and Ojo (2015) notes in the South west of Nigeria the impact of the insurgency is being felt in Lagos and Oyo States. Prices of foodstuffs like yam, beans and onions have skyrocketed. The open market became a space of insurgent citizenship where pandemonium breaks out between ethnic traders. In May and June 2013 about 14 Yoruba traders from Bodija market in Ibadan (Oyo State) were killed in Borno State by Boko Haram and this led to clashes between Hausa and Yoruba traders at the market. Food produce worth millions of Naira were destroyed.

- *Herdsman Influx*

Aside from the seemingly political undertone, the influx of herdsmen (Figure 4) into urban communities is partly a result of decreased fodder, famine, drought and desertification caused by both climate change and anthropogenic factors. Many farms and farmers have been driven out, displaced or killed by the herdsmen who take over these farms to graze their cattle.

Figure 4: Herdsmen in the City

Source: This Day Live 2018

In 2016 a Grazing Commission Bill was set up to propose a National Grazing Bill in the light of the Herdsmen incursion. The Bill aims at creating specific grazing areas as well as reducing attacks on states and communities by suspected herdsmen. Specifically, the National Grazing Reserve Bill seeks to institutionalize pastoral farming seeks to establish a commission which will take land in any part of Nigeria for use as grazing reserve. 75% of the farming population in Nigeria are women and there are about 50000 ha grazing reserve. There has been opposition to this proposed Bill due to its impact on the Land Use Act, grazing and ranching activities. Nigeria has about 84 million hectares of fertile land and agriculture accounts for two thirds of Nigeria's employment.

- *Tomato Ebola*

Tomato Ebola outbreak in 2016 led to scarcity of tomatoes. Tomatoes is used in almost every local dish/delicacy particularly stew and jollof rice. Its scarcity meant a lot deprivation for households. The moth 'Tuta absoluta' destroyed 80% of tomato farms in Kaduna State (Kaduna is the Tomato capital), and more than 90% of 17,000 hectares (42,000 acres) of tomato fields outside the northern city of Kano have been destroyed by the insect . More than 200 tomato farmers in the region have already suffered losses of more than 1bn naira ($5.02m) from the disease in Northern Nigeria (Agence France-Presse, 2016). This led the State to declare emergency, tomato processing factories shutting down and astronomical increase of tomatoes and scarcity of it as well. *Tuta absoluta*, which originated in South America and spread to Europe and Africa, quickly develops resistance to pesticides, making it difficult to contain. The brown moth lays eggs on tomato plants and develops into a hungry caterpillar that feeds on the leaves, stems and fruit.

- *Extractive industry*

Extractive activities make leads to the fragility of the ecosystems. Local droughts, relentless pollution, rise in temperatures, it is very clear that the continent is being cooked on carbon fires (Bassey, 2013:101). The exploration of oil in the Niger-Delta area has caused irreversible degeneration of the biodiversity and ecosystems, soil depletion and contamination as well as soil erosion. This is devastating for food production activities in the region and it has a cascading effect on the rest of the country. For example, the National Oil Spill Detection and Response Agency (NOSDRA) announced 2122 oil spill incidents were recorded between 2006 and 2009 (Bassey, 2013). The Niger-Delta region of Nigeria is one of the most polluted places on earth due to physical evidence of degradation, at least 10 communities in Ogoniland have contaminated drinking water with high levels of hydrocarbons, with 8cm layer of refined oil floating on the groundwater which serves wells and a depth of 5m hydrocarbon pollution in the soils (UNEP, 2011).

Food Planning: Preventing Runaway Collapse

The Federal Government of Nigeria established the National Fadama Development Project which is in its third phase and the presidential initiatives on rice, cassava, maize, vegetable oil, tree crops, tropical fruits, livestock and fisheries; and continues to maintain the National Strategic Food Reserve to meet food emergencies and for the stabilisation of income to enhance access of Nigerians to adequate food. There should be an emphasis on sustained policy and strategic food planning to ensure the achievement of the Sustainable Development Goal two to “End hunger, achieve food security and improved nutrition and promote sustainable agriculture” and the section 2.4 indicator to ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality” by 2030. “Security of our food supply will diminish unless we realize the central importance of the ecological foundation of the food system” (Achim Steiner**,** United Nations Under-Secretary-General, and Executive Director United Nations Environment Programme, UNEP, undated, p.vi). Securing the food infrastructure through food planning embedded in an eco-efficient approach will avert or prevent the runaway collapse or an abrupt transition to a new suboptimal status quo that will drive several millions to food poverty and hunger.

Food Planning

Food planning, the planning and spatial distribution of edible spaces to enhance accessibility, availability, ecological sustainability and reduction of foodprint in a way that fosters health and well-being, is the overarching strategy that could be adopted to secure the ecological foundation of the food system. Food planning would promote efficient and effective use of land, land use regulation and control; promote good environmental management practices to reduce land degradation, and enforcing land use laws among various land users. Physical planning could be effective in guiding food infrastructure, that is, what, where, when and how land is used for food production, procurement, processing, distribution and waste. This could be achieved by land use and environmental regulations to determine the spatial location of farms and edible food spaces without compromising future needs.

Food Planning could be achieved in Nigeria and other regions within the global context by:

- Recognising and linking the food system to other systems and subsystems like health, education, culture, transportation, housing, environment, economy and the spirit (faith).food planning with effectively foster this linkage(s) by providing adequate plans, spatial mapping of the food system and suitability or not of land use for agriculture and food production.
- Reducing Ecological footprint: Integration of the Green and Brown agendas. The Green and Brown Agenda emphasises reducing the ecological footprint and ensuring that the ecosystems are not degraded by climate change or human endeavours. The eight trends of the Green and Brown agendas (UN-Habitat, 2009) which focuses on: developing renewable energy, striving for carbon-neutral cities, developing distributed power and water systems, increasing photosynthetic spaces as part of green infrastructure, improving eco-efficiency, increasing a sense of place, developing sustainable transport and developing slum free communities have significant relationship with food security and planning values. Both Agendas emphasise maintaining ecological health and sustaining the bioregional ecosystems on the long-term for future generations. Physical planning promotes the same core values of environmental management and sustainability in an equitable and efficient way. Embedding physical planning within the green and brown agendas helps to secure an ecological foundation for Nigeria's food system.

- Promoting eco-efficient communities: an integration of the natural, human and planning values would provide a secure foundation for an eco-efficient food system in Nigeria. Also by reducing, recycling and reusing food waste, communities can begin to be more eco-efficient. Adapting the cradle to cradle concept (developed by McDonaugh and Braungart, 2002) in Nigeria where resources and wastes can be shared like an ecosystem is a germane to an eco-efficient food system. This can be achieved through:
    - Food Infrastructure: Promotion of Green food infrastructure and Green Planning (eco-friendly planning), renewable energy, local food and fibre, and biofuels. There has been a positive trend in planning in the direction of an expanded notion of urban infrastructure that includes the idea of 'green infrastructure' based on photosynthetic processes. Green infrastructure refers to the many green and ecological features and systems, from wetlands, to urban forests, which provide a host of benefits to cities and urban residents-clean water, storm water collection and management, climate moderation and cleansing of urban air among others. Growing energy and providing food and materials locally is becoming part of urban infrastructure development. The use of photosynthetic processes in cities reduces their ecological impact by replacing fossil fuels and can bring substantial ecological benefits through emphasis on natural systems (UN-Habitat, 2009:119).

    - Food Governance: Encouraging Participatory food governance and collaboration. Planners should take the leadership role in fostering authentic dialogue, collaboration and interdependence within and among various role-players (Agriculturists, Local Governments, Research Institutes, Universities and other relevant institutions and professionals), stakeholders (private sector, small scale business owners, informal sector), and the civic society, Community Based and Faith-based organizations. Public-Private governance which encourages voluntary, private and mobilization could be a step in the right direction to securing the ecological base of the food system in Nigeria.
    - Food sovereignty is the principle that people have the right to define their own food and agriculture system (Food and Water Watch, 2009:42). Food sovereignty is the people's right to define their own policies and strategies for sustainable production, distribution and consumption of food that guarantee the right to food for the entire population (World Forum on Food Sovereignty, 2001). Food

Sovereignty is the people's right to voice their opinion on food issues and decisions, from farm to table (production to consumption) (Olufemi, 2013).

Conclusion

The importance of the ecological foundation of the food system for the local, national and global economy requires adequate and sustainable protection, otherwise, it will continue to diminish right in front of our eyes and the food security of generations to come will be threatened. Building a sustainable food system in Nigeria and elsewhere is a means to secure the ecological foundation of food security (UNEP, undated). Sustainable food systems, as part of a new Green Economy, provides an alternative to current food systems and can help secure the ecological foundation of agriculture and fisheries. Sustainable food systems enable the production of sufficient, nutritious food, while conserving the resources that the food system depends on and lowering its environmental impacts (UN-Habitat, 2009). Food planning secures current and future land use, food supply capacity and production,

Planning to secure the ecological foundation of the food system must focus on land use, land use regulation, reduce sprawl and encroachment of the agricultural lands, environmental management, governance, promoting green infrastructure and green planning (more trees, vegetation and greenery), and campaign to reduce ecological footprint and foodprint. These can be achieved by good and participatory governance (not representative governance) and effective leadership, appropriate financing to minimise waste and corruption, discipline on the part of all citizens (green mindset and integral ecology), political will, education and awareness, sustainable participation, collaboration and authentic dialogue at every level from household to highest level of government and effectively engaging cooperatives and associational life groups such as youth, town unions etc., through mutual cooperation and authentic dialogue.

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