

Environmental Changes in Borno State, Nigeria: Implication for Farming Population, Livelihood and Resilience

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Abstract

This research examines the issue of climate change in northern Nigeria and the Sahel as a whole, examining its impact on livelihoods and resilience on the farming community. Using a conceptual framework for resilience adopted from *DFID: Disaster Resilience Framework*, secondary data was analyzed to identify major causes of the environmental changes in Borno State, role of the environment and natural capitals in livelihood and resilience as well as the impact, nature and causes of these changes on the environment. Various research on the Sahel have acknowledged how the increase and effects of climate change in the region, mostly tends to affect agriculture and farmers, who are the most vulnerable and still remain the main source of food for the Nation. The study explores and analyses major contributing factors such as Land degradation and insecurity as critical elements influencing the vulnerability and resilience of farmer communities in the Sahel. The ensuing result of this environmental disorder, has led to an increase in the cost of farm produce, which mostly underscores the insufficiency in crop yield and increases in pest and weed attacks, forcing many farmers around the Sahel to explore alternative sources of livelihood. In as much as human activity appears to be the fundamental problem driving Borno State to desertification and degradation, the components of the livelihood assets have demonstrated needs to engage capitals as a vital factor to bolster livelihood, resources, capacity (Dorward et al, 2001) as well as access, and the timely utilization of services and interventions, to lessen vulnerability and strengthen resilience.

1.0 Introduction

By ecology, we are referring to the body of knowledge concerning the economy of nature and the investigation of the complex relationships between organisms/humans and their inorganic and organic environments, which includes friendly and inimical correlations within these species. These co-relations occurring directly or indirectly in respect to the conditions of dependence and struggle for existence underline the unity of nature. 'Monitoring Environmental change has considerable relevance at a time when human activity is having wide-spread and long-term impact on nature' (Spellerberg, 2005). The 1968-1973 droughts in the Arid and Semi Arid zone of Africa brought worldwide attention on the increase of land degradation. The FAO 2005 Global Forest Resources Assessment showed that 'forest and woodlands in sub Saharan Africa presently cover about 530 million hectares, compared to 710 million hectares in 1975' (Farauta, Idrisa, Agu. 2011:P7).

The Millennium Development Goal has shown the need for a 'global framework for collective action to reduce poverty and improve the lives of people' (UN 2015), although much success has been achieved across all the eight clear goals, much still needs to be done to improve and save more lives in the face of environmental changes. Similar to the MDG's, international approaches like the Hyogo Framework for Action in which 'governments around the world came together to take action in reducing disaster risk, and adopted a guideline to reduce vulnerabilities to natural hazards' (Preventionweb 2015) have been on the forefront of global interventions to make communities more resilient and better equipped to cope in the face of hazards that threatens their environment and sustainability. 'The acceptance of disaster risk management (DRM) as a mainstream paradigm for thinking about disasters is evidenced by the commitment by 168 countries to implement an action plan, the Hyogo Framework for Action (2005–2015)' (Pain and Levine, 2012:5).

The natural tendency of any ecological system whether at micro or macro level is to maintain a balance or equilibrium of symbiotic relationships between organisms and their natural environment, the Semi arid ecological zone cover 2/3 of the entire landmass of Borno State, rainfall variation and drought as well as over grazing and desertification have developed complex interactions in Borno were millions of grazing animals perished and large numbers of peasants and pastoralist suffered immense economic hardship, hunger and starvation leading to over 10 million people migrating from their traditional habitants to become environmental refugees during the 1970s Sahelian drought. For Tannehill, as far back as 1947 science has not yet solved the problem of weather, and there may be good reasons to question whether it ever will (Tannehill 1947:P.98).

'Ecology is striving for new dimensions: The recent processes of global climate change, demographic change, and the consequences of globalization have yielded to slow and extremely complex environmental modifications'. (Muller et al, 2010). The ecology of Borno State has continuously been subjected to stress due to both natural and man-made factors. The changes in ecological stability and the view from space, signifies and makes emphasis about the steady and rapid changes shaping the natural world. The need to monitor both natural and human caused changes occurring on our planet and the state of our terrestrial system cannot be over

emphasized; ecology for over 50 years now has been betting above the earth.

The fragile environment of the North Eastern Nigeria, particularly the dry land of Borno State is under constant threat from both human and natural vegetation. Forest reserves, which protect some of the areas, are also under threat as the vegetation continues to disappear; the annual loss of forest cover in Nigeria from the 1990-2000 was recorded 4000km. The satellite image of the global land cover characterized a data base produced by the US Geological survey in 1992 and 1993 shows clearly how lake chad on the borders of Nigeria, Chad, Niger and Cameroun is drying up, the outline of the lake can be seen as the area of barren or sparsely vegetation land with water now only covering a small area in the Nigeria portion of the lake chad. Reforestation rates are now 10km Square per year while Desertification in Nigeria is currently 0.6km every year.

1.1 Aims and Objective of the Study

The Aim of the study is to examine the effect of Environmental Changes on the livelihood and Resilience of the people in Borno State with the following specific objectives:

1. To establish the role of the environment and natural capitals in livelihood and resilience.
2. To evaluate the impact of climate change on livelihood and resilience.
3. Identify the nature and causes of the changes in the environment in Borno State.
4. Assess the impact of the changes in Borno State.
5. Proffer solution on the way forward.

2.0 Literature Review

‘Our massive tampering with the world’s interdependent web of life coupled with the environmental damage inflicted by deforestation, species loss, and climate change could trigger widespread adverse effects, including unpredictable collapses of critical biological systems whose interactions and dynamics we only imperfectly understand. Uncertainty over the extent of these effects cannot excuse complacency or delay in facing the threats’. (UCS 1992)

Human society ‘is unthinkable without its environment’ (Bukharin 1926: 104). The interconnection between society and nature has been long established (Dickens 2004:1, Moore 2000: 123). Yet the result of this interaction has been both vital and negative as human action puts the environment at clear risk that grows daily. Annually ‘6 million hectares of productive dry land, turns into worthless desert. By three decades, this would amount to an area roughly as large as Saudi Arabia. More than 11 million hectares of forests are destroyed yearly, and this, over three decades, would equal an area about the size of India. Much of this forest is converted to low-grade farmland unable to support the farmers who settle it’ (UN 2015:1). Human ecology is a distinctive research practice in the environmental social sciences presenting critical theoretical and methodological sources to understand the impact of human interactions with nature (York and Mancus 2009). Within its diverse sciences perceiving our diverse interfaces with the natural world, human ecology helps us to determine how our activities have and continue to effect environmental changes that shift climatic conditions and doubly affect and alter lives and livelihoods of the world’s population.

2.1 Human Ecology

It’s important to conceive human ecology as an approach to understand Human interactions with their natural environments (Young 1974). This method allows ecologists to study the effect of human behavior and its ecological impacts. Human ecology is thus the study of human interactions with the environment’ (Young 1974:1). This description situates ecology, which is simply understood as the relations of organisms within their environment (Berry 1976) to human ecology as a process determining the effects of our correlation with nature. Human ecology is closely linked to our biological and cultural attitudes as a process that acknowledges the influences of our activities and as a center that stations theories from anthropology, economics, and human biology and political science to understand and make sense of their connections and determinations to the environment. Nature has from the beginning of time been the single most important human source for survival, subsistence and maintenance of social processes, from food production, shelters to art, every procedure of human existence is hinged on the exploitation of ecological resources (Griffin 1988). Cultural ecology has especially sought to establish this interaction and emphasize how our behaviors are particularly connected to nature and the systems in our natural environment (Vayda 1969).

2.2 Political ecology

Political ecology is a critical ecological paradigm observing our responses to nature’s variations amid needs to mitigate the impacts and build resilience to ever- dwindling ecosystems, beset by overdependence. Political ecology pays attention to the administrative, ‘social, economic and political developments motivating environmental changes’ (Bryant 1991:2). Stressing the impacts of environmental policies and implementation, political ecology has drawn attention to the implications of conflicting interests, between economic development

and nature. Political subsequently avows diverse actors and ideas in its approach to ‘interests and rationalities to environmental change’ (Tilt 2007:3)

Tilts (2007) research of the *Futian case* exploring the effects of structural environmental enforcement on pollution in china, specifies an important case into the problems political ecology seeks to resolve. Located between economic development and the mitigation of pollution, Futian has both gained and disadvantaged from the result of china’s policies on rural industrialization and pollution. And whilst rural industrialization remains the key driver of income in the countryside, besides being the primary source of income for several local and national administrations; most industries still lack the capacity to introduce new technology to mitigate emissions and pollution.

The story of a modest farmer settlement, Futian reflects the need to marry national environmental intervention with sound local policies that integrate privatization and industrialization with local sustainability requirements. Industrialization continues to significantly deplete natural environments and harm human health. The reduced productivity and prospect of agriculture has badly hurt local livelihoods like Futian.

2.3 Human ecology and the socio-political economy

That the global economy is tied directly to the world’s natural resources and eco- system is indisputable (Mulligan 2010:1, Kopnina 2011), yet international politics has constantly evaded this reality even as the world’s ecology continues to deplete; the result is a massive shift in climatic conditions that hugely affects and displaces people and livelihoods around the world (Mulligan 2010). Mulligan draws the picture of politics, consistently refusing to relate threats on livelihoods and waning natural resources to the consequence of massive dependence and exploitation. The human impact of Katrina throws light on private sector contribution to the building or fragility of resilience.

Political ecology came under a huge attack after the Katrina due to what Boettke et al (2007) observed as the massive failure of political structural response to the disaster. Katrina emphasizes two things; firstly the political concentration of national resilience policies in need of a decentralized integrated approach and the need to engage more local actors. Katrina also stressed the ‘rigors that emerge from administrative incapacity during ecological disasters’ (Boettke 2007:363). Through methods, which examine natural events that shape our world, human ecology theory enables us to shape a practical and functional course towards sustainability. As capitalism continues to restructure the worlds ecology, others like Moore (2000) have proposed ‘a new research agenda organized around the concept of systemic cycles of agro-ecological transformation’ (Moore 2000: 2) to not merely attain sustainability but a discerning equilibrium between the economy and nature (2000: 1). A 2009 UN study of Tanzania showed how the overlooking of natural resources linked to national wellbeing, led to intense structural and ecological collapses that hugely affected its overly agricultural dependent communities (Winrock International 2006).

2.4 Causes of Ecological changes and the phenomena of shifting climate conditions

‘An ecosystem is an interdependent system of plants, animals, and microorganisms interacting with one another and with their physical environment’ (EPA 2010). Eco- system studies enables us to situate life as one and the world as a shared planet that sustains all of us and vice versa (Catton and Dunlap 1978). Our interactions with nature impact not just the environment but climate systems, which also alter weather conditions. Climate change has been related to the occurrence of increased forest fires that are depleting the world’s tropical woodlands due to the intense collection of heat which has warmed the earths oceans and shifted habitats and temperatures (EPA 2010).

Moran (2008) emphasized that ‘climate change is here and we are experiencing its impact’ in ways resulting from ecological collapses caused by ‘purposive human actions’ (Moran 2008:1) that leads to land degradation, deforestation and persistent sea level rises. A primary question human ecology seeks to answer is the reason behind the environmental changes that have shaped both ancient and present civilization. What then are the root causes of ecological changes, is a question answered perhaps by M A (2005) which noted the effect of intense cultivation of terrestrial surfaces, precisely 24% of the worlds land-dwelling in agriculture leading directly to land degradation.

Another purposive factor that immensely alter nature is the building of dams that intensely pressure natural wetlands, resulting in the degeneration of water resources. Persistent exploitation has further accelerated deforestation as tropical reserves continue to deplete and lose invaluable cover. The loss of vegetation has also included a 35% loss of the worlds Mangrove population as well as a 20% depletion of coral reefs (M A 2005:6).

2.5 Resilience: A dynamic and multi- layered process

Resilience is mostly considered as a ‘normative concept to build capacity’ and adaptivity (Holling and Gunderson 2002). Besides its many definitions, Holing describes it as ‘the measure of the ability of an ecosystem to absorb changes and still persist’ (1973, (White and O’Hare 2014:2). Today’s demands for resilience mostly

refer to the management of particular risks such as climate change whose effects are hugely shifting and reclaiming the natural environment. Whilst shouldering its multi-disciplinary definitions, it's important to explore the overlapping approaches that have formed resilience policy and implementation along a broad look at the evolution of specific resilience systems have emerged to mitigate environmental complications (Endfield 2012).

Building resilience for nation's and people was the central objective of the UN's 2005 Nyogo framework for action, formulated to accomplish strategic disaster management and practice (Unisdr 2005). The conference among others focused attention on promoting strategic and systematic approaches to reducing vulnerabilities and risks to hazards. Nyogo underlines a critical global action to achieve and build resilience for countries and communities as natural disasters continue to affect lives and livelihoods. The aftermath of such calamities like the tsunami that struck South Asia has increased focus on resilience and the global demand for early warning systems to prepare people and communities against the full havoc of disasters (UNESCAP 2007).

Resilience theory has constantly sought to signify the unity between human systems and natural systems, which underline the connectivity that relate humans to their interactions with their eco-system (Walker 1995). The divisions between nature and culture are therefore seen as 'artificial' (Unisdr 2005). 'Ecosystem effects from resource expenditure, and mutual responses of people to modifications in ecologies, constitutes paired and dynamic systems showing emergent properties of the whole socio-ecological system' (Holing and Gunderson 2002).

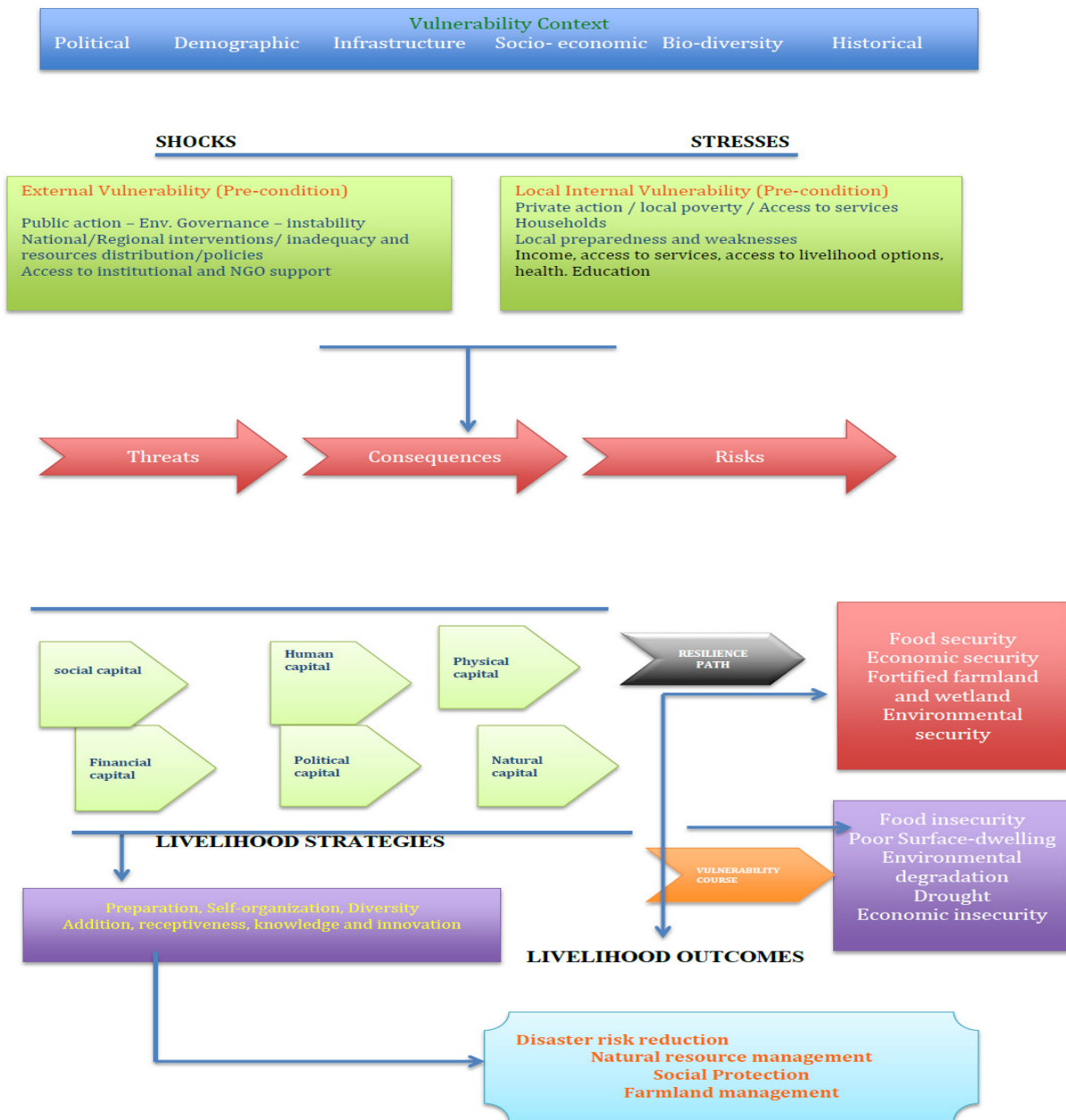
3.0 Methodology

This paper analyzed data acquired using both qualitative and quantitative processes of research, for the fact that 'quantitative methods can provide a high level of measurement precision and statistical power whilst qualitative approaches supply a grater depth of information about the nature of communication processes in a particular research setting' (Matveev A, 2002). This has given the researcher, the opportunity to sample variety of data's for a better understanding of the areas the research questions seeks to answer as the credibility of this research is the key goal of the researcher. Variety of secondary data were used, a comprehensive review of empirical existing literature from textbooks, journals and reports mostly acquired online were analyzed to examine the major causes of ecological changes in the study area; the major environmental problems and their impacts on the peoples source of livelihood and resilience, as well as the adaptation strategies on the way forward. This research is based on the Deductive approach, as the research does not involve the introduction of new theories but the use of good and credible qualitative empirical data's from different sources. The philosophical method observed is the interpretivist method.

3.1 Method of Data Analysis

Data were analyzed using a conceptual framework for agricultural resilience to attain sustainability adopted from DFID disaster resilience framework.

Conceptual Resilience Framework for Agricultural Community



Source: Adapted from *DFID Disaster resilience framework* (2011)

‘The challenge to reduce rural poverty and food insecurity by improving agricultural production systems requires integrated and holistic approaches considering social, economic and environmental issues together, and recognizing that food production, access, distribution and consumption are equally important components of the challenge’ (Okoth et al, 2013:ii), the above framework integrates both social, economic and environmental issues as well, with respect to food production, access distribution and consumption. To effectively access the vulnerability of the study area, vulnerability is studied at different levels as illustrated by the framework above.

3.2 Data Collection Method

Data for this research were collected through an extensive review of already existing literature focusing on themes identified in the framework defined above with the hope of answering the respective research questions by the end of the research, ‘in as much as secondary data review is where you re-analyze data in other to answer the original research question in a better way or an entirely new research question with the same data to produce a good and credible research’ (Glass, 1976:3).

4.0 Case Study Analysis

'The ability to identify and understand the extent of vulnerability to climate change is an essential pre-requisite for reducing climate change impacts. A 'reasonable starting point for any climate adaptation process is to assess the vulnerability of the target community or stakeholders' (Modu I 2012:2). To have a better understanding of vulnerability in the study area, vulnerability will be contextualized both at the National, as well as the community level (external and internal), down through the hazards and threats in the study area both at national and community level as well as their consequences. Vulnerability will also be analyzed through the stages of livelihood assets using the conceptual framework for resilience sampled in the methodology. Various studies have shown how climate change is impacting negatively in Borno where farmers tend to be the most vulnerable as they form the majority in Nigerian rural communities which are largely medium to low-income earners.

4.1 External Factors Causing Vulnerability in The Study Area

As factors that trigger vulnerability at a level higher than just the community itself they include components beside desertification, land degradation, erosion, which are caused in most cases by human activity. According to some estimates two-third of Bauchi, Borno, Gombe, Jigawa, Kano, Kaduna, Katsina, Kebbi, Sokoto, Yobe, and Zamfara states could turn desert or semi-desert in the twenty-first century' (Sayne 2011:4) if proper intervention plans are not put in place. Major external factors influencing vulnerability in the study area are as follows:

(SSR Resource Centre)

4.1.1 Political Instability: Borno state has never in its history encountered massive insecurity until the year 2002. In fact locals popularly call it the Home of Peace before Boko Haram started clashing with the army and government officials. By the year 2006 the group was fully armed and was killing innocent civilians in multitudes. This caused a great displacement in the rural communities around the state, as the daily lost of lives became unbearable and people had to flee from their villages to stay alive. According to Sani, 'the main target of the group is to take over the city of Maiduguri as half of the population forcefully flee their homes for safety. This crisis has made farming in the rural communities impossible (Sani D 2014; SSR Resource Centre 2014).

4.1.2 Conceptual Framework for Action using the Present Assets in Borno

Since independence in 1960, the Nigerian government has pushed to improve state infrastructure, services. Yet whilst economic growth should reduce poverty, in the case of Nigeria it tends to favor only the middle class citizens and the rich. Infrastructural development is generally poor around local communities in the country and Borno state continues to lack good roads, hospitals with qualified doctors, schools and adequate teachers, electricity and portable drinking water. People leaving in the local communities walk long distances to access portable drinking water. Various National development plans have been created with the hope of solving the problem of rural infrastructure but to date the problem is far from resolved.

4.1.3 Environmental Governance, Politics and Policy.

The attainment of democratization concurred with the governments struggle with agricultural policies and the implementation of effective environmental programs to manage the nations resources, yet to date every program and most policies have failed to address key issues faced by local and small-scale farmers (Okoro and Ujah 2009:8) 'Policy making in Agriculture in the country have been through changes, although to a certain level it has demonstrated its importance, the emergence of petroleum as a major source of revenue had meant that more revenue was available for funding of programs. It also meant that agriculture no longer commanded the same amount of attention it did in the earlier periods' (Nwagbo 2002).

4.2 Internal Factors Influencing Vulnerability in Borno State

The internal issues driving vulnerability and decline of capital indicators in Borno state are connected and sometimes informed and determined by external factors mentioned above. These expand to include other effects that are locally specific as listed below.

- a. Population Influx
- b. Community Insecurity
- c. Climate change
- d. Poverty
- e. Poor access to social services
- f. Poor health
- g. High mortality
- h. Community fights
- i. Scarcity of education and knowledge
- j. Food insecurity
- k. Land degradation and deforestation

4.3 Hazards and Threats in the Study Area

Extreme weather events are being increasingly experienced as a result of climate change. These changes have manifested itself in different ways; Rainfall, temperature, Humidity etc. over the past few decades global average temperature increased by 0.6 degree centigrade, over the last century was an increase of 0.3 degree centigrade – 0.7 degree centigrade, with an estimated increase of 1.4 degree centigrade – 5.8 degree centigrade by end of 21st century (IPCC, 1991). These changes in turn have affected precipitation and as a result rainfall patterns now fluctuates on a regular basis (ward et al, 1999; Duru, 2008) climate change has brought about a mandatory change in both natural and human activity round the clock whilst triggering a shift in the various ecological zones around the country and their respective wildlife's. Studies have shown Borno state currently facing the dilemma of increasing temperature backed up by ageing dry conditions of the zone causing wind erosion. Climate change has driven desertification in Borno to a level that really needs urgent attention (Onyenechere 2010).

4.4 Consequences of Ecological Hazards and Vulnerability

Reports from world resources 1990-1991 shows a deforestation rate of about 400,000 hectares per year as far back as in the 1980s, whereas reforestation was just at 32,000 hectares. This record shows how desertification in Nigeria is not a recent issue. Initially, climate change was the only factor, driving the northern part of Nigeria towards food insecurity as the area became unfavorable for agriculture. Farmers are left with no options but to migrate in search of other means of survival. In as much as the cost of farm inputs has increased there have been decreases in crop yield and a rise in pest and disease. Another factor contributing to the vulnerability of the north is insecurity, which can lead to collapse if adequate care is not taken.

4.5 Natural Capital

Intervention capacities in the Sahel have focused on restoring its depleting bio- diversity through a host of interdisciplinary reforestation schemes. As available natural resources, natural capitals are derived from the bio-diversity within the community, which effectively contributes to the communities' livelihoods. The diversity of Sahelian eco-system, which includes everything from dry rangelands to rivers with mangrove forests and woodlands, has been a major source of income and survival for communities. Natural capitals are derived from such entities like water bodies, farmlands, forests, fisheries and environmental services' (Tango 2006). With a diversity of depleting natural capitals that include water bodies, rangelands and forests Borno state has been encountering periodic droughts and erratic rainfall patterns that have significantly affected its resources. Yet frequent droughts have spurred local adaptive capacities contingent on seasonal environmental patterns.

4.6 Physical Capital

Concerned with the physical infrastructure of a community such as its roads, power grid, hospitals, schools and key facilities, physical capitals play an important role in building resilience and safety for communities (Mayunga 2007; 2009). Resources like power grids and roads might not always be in the control of the community but persistently affect its condition and health. The operations of these facilities are vital during the mitigation of disasters and emergencies. The dearth of physical services has consequently highlighted the inefficacy of political capitals and its persistent marginalization of resources leading to effective deprivation. In conflict prone regions like Borno this has become even more challenging as physicals capitals come under attack and over-use with a direct effect on human capitals, which rely on these resources daily. Von Braun et al. (1999) 'hold governments liable for famines, economic disasters, and political regime performance'. Conflicts have been directly related to the exhaustion of physical capitals in the Sahel.

4.7 Human Capital

Human capitals define skills, services, information, labor capacity, and the conditions required for the materialization of livelihood strategies (TANGO 2006). Human capitals are critical because their effective function determines the success of other capitals all of which connect in determining resilience and community wellbeing. A community's lack of knowledge or timely information might consequently affect its responsiveness to problems. Mayunga (2007) has stressed the connections between human capitals and the development of economic capacity and progress. Indicators of human and social capitals have been waning and hugely constrained by a recurring cycle of poverty, conflicts and endemics in the Sahel. Whilst conflicts impact on human assets by cutting them from important services and physical capitals, they become even more problematic in their delimitation of social capitals undermining communication and community networking.

4.8 Political Capital

Political capitals refer to relationships and structures of power, and the influences and access to these systems, institutional and administrative processes at both local and national levels (TANGO 2003). The structures of

political capitals have not only been inefficient in the Sahel but have also carved a culture of political transgression that continues to undermine the performance of this critical asset. Political capitals serve as key decision making center that revolves around such dynamics like participation and effective processes and legislation. It is important to observe political capitals in order to understand how well policies at both local and national levels are appropriated to build resilience. Conflicts like the Boko Haram are already linked to a broader global debate on terrorism whose emergence within the Sahel has changed the nature of political economies. Other breakdowns of political capital in Borno are seen in enduring community conflicts over land distribution and grazing. When they fail Von Braun et al (1999) holds the government guilty, but the workings of decision-making structures have since shifted to accommodate wider international interests that as well impact on the indicators of political capitals.

4.9 Financial Capital

OCHA (2015) stresses how persistent droughts, floods remains a threat to many households in the Sahel whilst erratic rainfall continues to affect agriculture and deplete livelihoods. Livelihoods greatly advantage from financial capitals, which denote the resources, incomes and communities and households rely on to access and fulfill social needs. Finances play a critical part in resilience, becoming primarily handy during emergencies to speed up recovery and allay vulnerability. It is also an important factor in safety processes such as insurance and poverty reduction schemes through community credits programs. Poverty has been a major deterrent of resilience in Borno whose constant environmental problems significantly reduced its economic and coping capacity. In the management of post-disaster shocks and stresses Gill and Ritchie (2011) perceive financial capitals as an important facility to support mitigation.

Social capitals are distinctively studied as broader and more critical components of community assets that refer to the quality and quantity of social resources (Chaskin 2008). Social capitals are seen as the connection binding communities together. Whilst community action can help to build and strengthen social capitals, its measurement is a crucial process and part of resilience building, which also attends to the recognitions of social conditions (Gutberlet 2010). Borno's water scarcity and absence of strategies to mediate this deficit, is a direct reflection of the low quality of social capital in the state. Chaskin has emphasized the relation between social structure and social interaction in the provision of timely information, support and opportunity (Chaskin 2008 cited in Gutberlat). All other capitals rely on the development and strengthening of social capitals that boost tangible skills and labor under human capital and the efficiency of physical and natural capitals.

4.10 Outcome of Capital Interventions Supporting Resilience

Under the conceptual framework, communities are expected to experience reinforced resilience, ecological self-reorganization and recovery in response to the stresses and shocks caused by vulnerabilities. This is however inconceivable without an inclusive contextualization of the vulnerability, faced by the community as one functioning unit in Borno state, Nigeria, the Sahel and vice versa. I will as such situate resilience in this study as the attainment of livelihood outcomes conceptualized in the framework through the following intervention strategies;

1. Disaster Risk Reduction
2. Innovative approach to education and knowledge
3. Social protection and security
4. Environmental management and public services

5.0 Conclusion

The above critical analysis into the impact of climate change in Borno State and the Sahel has demonstrated various changes in climate conditions in the study area and their impacts on the livelihood and resilience especially of local farmers who are perceived to be the most affected as they 'still produce about 80% of the total food round the country, about 30.7 million hectares (76 million acres), which is about 33% of Nigeria's land area are under cultivation' (www.NationsEncyclopedia.com 2015). Farmers as a result tend to be the most vulnerable to the impact of climate change in as much as it directly affects their major source of livelihood. In 2001 farmers' contribution to the GDP dropped to about 32% from 65.7% in 1957, this shows the lack or absence of workable interventions that are urgently required.

Akin to the collapse of ancient Maya civilization, the Sahel is undergoing similar factors that played major roles in the collapse of the former ancient city whose problems included land degradation, political issues (conflict) and climate change in general. Even though Nigeria has many policies to combat climate change, adaptation and resilience is vastly required in various vulnerable sectors. The primary system of information flow is largely inadequate considering the fact that 'the closest to having an acceptable adaptation response framework in Nigeria is a working document on adaptation strategies of action prepared by Henrich BÖll

Foundation (HBS) for the Special Climate Change Unit (SCCU) of the Federal Ministry of Environment, The National Designated Authority for climate change in Nigeria' (Farauta et al, 2012:6. No 34). This document has been hardly implemented towards any National Action Plan. There is the need for a coordinated National Action Plan based on an informed resilience framework built on local and national integration. Coordinating the action of all actors under one platform in a way and manner that will produce a meaningful impact is critical to paving a way forward to attain resilience and sustainability.

With the impacts of climate change drastically raising the cost of farm harvest and productivity in the study area as farmers suffer from insufficient crop yields, and high cost of inputs, as well as various weed and pest attack it is urgent to create sustainability policies and programs to complement and augment the livelihoods and resilience of farmers in the Sahel. The phenomenon forcing youths to migrate in search of other source of livelihood leading to some engaging in criminal activities while striving to survive could be overturned through a revision and building of strategic livelihood strategies constructed on the vulnerabilities they face. These issues can be adequately addressed by the Federal Government through the engagement of integrated research programs to conduct studies and further research into workable adaptation strategies whose outcomes will help farmers at local community levels to improve and reinforce adaptive strategies with their present coping capacity to boost production. In as much as little or no attention is given to farmers at the local community level the fact that they remain the main source of food for the country poses more vulnerability, particularly during disaster periods as increasing demands outweigh supply and production.

The major adaptive strategies adopted by farmers in the rural communities in the study area include the following 'planting early maturing crops, changes in planting and harvesting dates, use of resistant varieties, multiple cropping and the use of chemicals such as fertilizers' (Farauta et al, 2012:7 No. 34; No. 15, 2011:29). Respondents however in an empirical research in the study area gave their opinion as to the immediate issues at hand are not the strategies alone but the lack of basic infrastructure, a good and proper agricultural plan as well as funds to support these strategies. Proper planning, adequate infrastructure, good flow of fund as well as new adaptation strategies to climate change can once again revive agriculture in Borno State if properly managed. Constraints to climate change adaptation strategies identified in the study area include absence to finance, government policy, adequate adaptive measures, as well as lack of access to information.

Climate change from this analysis in Borno State has proven to be on the increase as reflected by uncertainties in the onset of farming seasons, extremities of weather conditions and rises in agricultural problems', the various issues identified to be associated to climate change include the 'loss of crops and revenue, loss of forest resources, poor crop yield and quality, increase in weed infestation, escalation in pest attacks and delays in planting time' Farauta et al, 2011:29 No.15. These factors have also been combined with the perceived causes of climate change that are mainly 'human activities like bush burning, indiscriminate cutting of trees and overgrazing of farmland by livestock among others' (Farauta et al, 2011:29 No.15).

5.1 Recommendations

The above analysis has established the fact that loss or reduction in the land capacity to provide resources for human livelihood is a threat in Borno State, that can be seen through a loss of actual productivity, loss or changes in vegetation cover and soil nutrient. The following recommendations are perceived necessary for farmers to adapt and prepare against the impacts of climate changes. These recommendations also include measures required to restore and reorganize the natural vegetation in the study area, to a moderate condition amid stable livelihoods and resilience structures at the local community level.

- d. - Creating New Risk Reduction Plan: In-cooperating interventions such as 'disaster risk reduction, conflict management, social protection, natural resource management and management of public goods' (Constas and Frackenberger 2013:1) to produce new adaptive processes is how ever important, there is the need to properly align social capital to all livelihood strategies in the study area so as to allow access flow of information on climate change and create awareness.
- e. - Developing New Reforestation Programs and Agricultural Policies: The implementation of Reforestation Programs such as Quality Social Forestry, Agro Forestry Practices at community level and Agricultural Policies guiding deforestation will not only restore natural capital but social capital as well, in as much as innovative agriculture can help restore Borno State, the livelihood assets depends on the scope of the social capital, the Sahel's journey to sustainability depends on its flexibility and cooperation.
- f. - Develop new strategies towards Political Instability: There is the need for the Federal government to re-strategies the approach given to the issue of insecurity in Borno State, although much has been put into fighting Boko Haram little attention is given to human right violation as the number of innocent victims violated keeps increasing.
- g. - Early Warning Systems: Warning systems should be put in place backed up with support from the

Metrological department with forecast for local farmers so they can have an idea of the success of every season even before the start, and appropriate adaptive measures.

- h. - Promoting Sustainable Livelihood Programs: The shifting ecological risk has increased the vulnerability of the environment or people of Borno to destruction and crisis, effort should be made by the federal government to reduce poverty level in Borno through reducing unemployment and promoting sustainable livelihood programs.

5.2 Recommendations For Further Research

The following recommendations are perceived necessary to put into consideration for further research in the same field in other to obtain a more credible result:

- i. - In conducting research of this kind, the need to use current and on-going information is critical. This can only be achieved through primary data collection, conducting direct interviews with respondents and focus group discussions, as this will enable access into wider and related problems in the analysis of current issues faced at the local community level. The local peoples view on climate change as well as their traditional knowledge and understanding of the changing climate is an important well of knowledge that needs to be utilized in any study to determine resilience and sustainability processes.
- j. - The use of aerial Photographic remote sensing data for further research will additionally provide a comprehensive picture of the changes in vegetation cover as well as monitor the changes through time and space so as to properly analyze the patterns in which these changes occur in the study area and the Sahel, in as much as it has been perceived by some researchers that the Sahel is prompt to disasters during hot seasons.

Reference:

- Berry, J.W. 1976. *Human Ecology and Cognitive Style: Comparative Studies in Cultural and Psychological Style*. New York: John Wiley. See also the Journal of Cross-cultural Psychology.
- Boettke P., Chamlee-Wright E., Gordon P., Ikeda S., P. Leson II, and Sobel R. (2007) *Political, Economic and Social Aspects of Katrina*. Southern Economic Journal 74(2): 363–76.
- Bryant L (1991) *Putting Politics First: The Political Ecology of Sustainable Development* Global Ecology and Biogeography Letters Vol. 1, No. 6 (Nov., 1991), pp. 164-166
- Bukharin (1926) *Historical Materialism: A System of Sociology*. First Published in English in 1926 by George Allen and Unwin Ltd, Routledge Revival, 2nd Park Square, Milton Park, Abingdon, Oxon.
- Catton Jr. and Dunlap E. (1978) *Environmental sociology: A new paradigm*. The American Sociologist.
- Chaskin J, George M, Skyles A Guilitnan S (2008) *Measuring social capital: An exploration in social research capital*, Journal of community psychology 489- 514
- Dickens P. (2004) *Society & Nature. Changing Our Environment, Changing Ourselves*. Cambridge, Polity.
- Dorward A., Anderson S., Clark S., Kane B and Moguel J (2001) *Asset Functions and Livelihood Strategies: A Framework For Pro-Poor Analysis, Policy and Practice*. Contributed Paper to EAAE Seminar on Livelihood and Rural Poverty. [Online] Available From < <http://r4d.dfid.gov.uk/pdf/outputs/r7823b.pdf>>
- Duru J (2008) *The Implications of Variability in Rainfall Over Imo State on The Little Dry Season (1975-2007)*. B.Sc. Original Essay, Unpublished. Owerri: Imo State University. Elasha BO, Med.
- Endfield (2012) *The resilience and adaptive capacity of social-environmental systems in colonial Mexico*. Proc National Acad Science U S Av.109(10); Mar 6PMC3309716.
- EPA (2010) *EPA Releases 2010 Toxic Release Inventory Analysis* [Online] Available From < <http://www.epa.gov/newsroom/leading-developments/1659-epa-reveals-2010-toxics-release-inventory-analysis.html#.VoAHx5OLTaY>> [20-11-2015]
- Farauta B., Egbule C., Idris Y and Agu V (2011) *Farmers Perception of Climate Change and Adaptation Strategies in Northern Nigeria: An Empirical Assessment*. African Technology Policy Studies Network. Research Paper No. 15. Kenya. [Online] Available From <<http://www.atpsnet.org/Files/rps15.pdf>>
- Farauta B., Egbule C., Idrisa Y and Agu V (2012) *Policy Changes of Climate Change and Adaptations in Northern Nigeria*. African Technology Policy Studies Network, Technology Brief No. 34. [Online] Available From <<http://www.atpsnet.org/Files/pb34.pdf>>
- Farauta B., Idris Y and Agu V (2011) *Climate Change and Adaptation Measures in Northern Nigeria: Empirical Situation and Policy Implications*; In African technology Policy Studies Network. Working Paper Series No62. Kenya. [Online] Available From <<http://www.atpsnet.org/Files/wps62.dpf>>
- Frankenberger T., Spangler T., Nelson S and Langworthy M. (2012) *TANGO International Enhancing Resilience to Food Insecurity Amid Protracted Crisis* [Online] Available From <http://www.fao.org/fileadmin/templates/cfs_high_level_forum/documents/

- Enhancing_Resilience_FoodInsecurity-TANGO.pdf>[27-12-2015]
- Gill D. Ritchie L and Picou J. (2011) *The bp Disaster as an Exxon Valdez Rerun* [Online] Available From <<http://contexts.org/articles/the-bp-disaster-as-an-exxon-valdez-rerun/>>[27-12-2015]
 - Griffin R (1988) *Introduction: The Re-enchantment of Science*. In *The Re-enchantment of Science* edited by D. R. Griffin. Albany: State University of New York Press.
 - Gutberlet J (2008) *Recovering Resources - Recycling Citizenship: Urban Poverty Reduction in Latin America*, Canada: University of victoria
 - Holling S & Gunderson H. (2002). *Resilience and Adaptive Cycles*. In *Panarchy; understanding transformations in human and natural systems*. : L.H. Gunderson & C.S.Holling (eds.). Washington DC: Island Press.
 - IPCC (1990) *United Nations Report*. Intergovernmental Panel On Climate Change, Geneva, Switzerland: WMO
 - MA. (Millennium Assessment). (2005) *Ecosystems and Human Well-Being: Scenarios*. Findings of the scenarios working group. Island Press, Washington.
 - Matveev A (2002) *The Advantages of Employing Qualitative and Quantitative Methods in Intercultural Research: Practical Implications From The Study of The Perceptions of Intercultural Communications Competence by American and Russian Managers*. In Collected Research Articles, Bulletin of Russian Communication Association "THEORY OF COMMUNICATION AND APPLIED COMMUNICATION" Issue 1/ Edited by I.N, Rozina, Rostov-on-Don: Institute of Management, Business and Law Publishing, 2002.-168. P.59-67. [Online] Available From<http://www.russcomm.ru/eng/rca_biblio/m/matveev01_eng.shtml>
 - Mayunga J (2009) *Measuring The Measure: A Multi-Dimensional Scale Model to Measure Community Disaster Resilience in the US Gulf Coast Region*. [Online] Available From <<http://oaktrust.library.tamu.edu/bitstream/handle/1969.1/ETD-TAMU-DISSERTATION.pdf>>[27-11-2015]
 - Modu I (2012) *Spatial Vulnerability Assessment of Rural House Hold to Climate Change in Nigeria: Towards Evidence-Based Adaptation*. Department of Geography, University of Nigeria Nsukka; Being a paper presented at the 2012 Berlin Conference on the Human Dimensions of Global Environmental Change held at Environmental Policy Research Centre Freie Universitat, Berlin from 5-6th October 2012. [Online] Available From<http://www.diss.fu-berlin.de/docs/servlets/MCRFileNodeServlet/FUDOCSS_derivate_000000002368/Madu-Spatial_vulnerability_assessments_of_rural_households-110_001.pdf>
 - Moore (2000) *Environmental crises and the metabolic Rift*. In world- historical perspective Organization & Environment, Vol. 13 No. 2, June 2000 123-157.
 - Moran (2008) *Human Adaptability, An introduction to ecological Anthropology*, Philadelphia: Westview press.
 - Muggillan (2010) *Reassessing the Crisis Ecology and Liberal International Relations*, Alternatives: Global, Local, Political vol. 35 no. 2 137-162.
 - Muller F., Baesslwr C., Schubert H and Klotz S. (2010) *Long Term Ecological Research Between Theory and Application*.
 - Nwagbo E (2002) *Agricultural Policy in Nigeria: Challenges For The 21st Century*. Journal of Tropical Agriculture, Food, Environment and Extension. Department of Agricultural Economics, University of Nigeria, Nsukka, Nigeria.
 - OCHA (2014) *2014-2016 Strategic Response Plan Sahel Region* [Online] Available From<http://www.fao.org/fileadmin/user_upload/newsroom/docs/Regional%20SRP%20Final.pdf>[06-12-2015]
 - OCHA (2014) *Humanitarian needs over-view* [Online] Available from <<http://reliefweb.int/sites/reliefweb.int/files/resources/2015%20Regional%20HNO%20Final%202014Dec17.pdf>> [06-12-2015]
 - Okoth J., Nalyongo W., Petri M., and Ameny T. (2013) *Supporting Communities In Building Resilience Through Agro Pastoral Field Schools: Food*
 - Onyenechere E (2010) *Climate Change and Spatial Planning Concerns in Nigeria: Remedial Measures For More Effective Responds*. Department of Geography and Environmental Management, Evan Enwerem University, Owerri Nigeria. [Online] Available From<<http://www.krepublishers.com/02-Journals/JHE/JHE-32-0-000-10-Web/JHE-32-3-000-10-Abst-PDF/JHE-32-3-137-2139-Onyenechere-E-C/JHE-32-3-137-2139-Onyendexhere-E-C-Tt.pdf>>
 - Pain A and Levine S (2012) *A Conceptual Analysis of Livelihood and Resilience: Addressing the 'Insecurity of Agency'*. HPG Working Paper. [Online] Available From<<http://www.odi.org/sites/odi.org.uk/files/odi->

- assets/publications-opinion-files/7928.pdf>
- Sani D (2014) *Maiduguri is Surrounded by Boko Haram, Borno State Elders' Forum Cries Out*. This Day Live 11th sept 2014. [Online] Available From <http://www.thisdaylive.com/articles/maiduguri-is-surrounded-by-boko-haram-borno-elders-forum-cries-out/188733/>
 - Sayne A (2011) *Climate Change Adaptation and Conflict in Nigeria*. United State Institute of Peace, Special Report 274. 2301 Constitution Ave, NW- Washington DC.[Online] Available From http://www.usip.org/sites/default/files/Climate_Change_Nigeria.pdf
 - Spellerberg I. (2005) *Monitoring Ecological Change*. 2nd ed., Cambridge: Cambridge University Press.
 - TANGO International. (2003). *Socio-Political Analysis: Critical Information Needs for Addressing Underlying Causes of Poverty and Marginalization*. Prepared for CARE. Draft. August.
 - Tannehill I. (1947) *Drought, Its Causes and Effects*. Princeton: Princeton University Press. In the Journal For Economic History (1948) Volume.
 - Tilt B (2007) *The political ecology of pollution enforcement in china: A case study*. The china quarterly 192 Dec 2007 – 915-932
 - UCS (1992) *World scientists warning to humanity*, [Online] Available from <<http://www.ucsusa.org/about/1992-world-scientists.html#VgKdB7yW97x>> [28-09-2015]
 - UNESCAP, (2007), *Statistical Yearbook for Asia and The Pacific", United Nations Economic and Social Commission for Asia and the Pacific*. [Online] Available From <<http://www.unescap.org/stat/data/syb/CESCAP-syb.pdf>> [23-10-2015].
 - UN (2015) *UN Documents Gathering a body of global agreements*. [Online] Available From <<http://www.un-documents.net/ocf-ov.htm>>
 - Unisdr (2005) *Hyogo Framework for Action 2005-2015: ISDR International Strategy for Disaster Reduction: Building the Resilience of Nations and Communities to Disasters* [Online] Available from <http://www.unisdr.org/2005/wcdr/intergover/official-doc/L-docs/Hyogo_framework-for-action-english.pdf> [23-10-2015].
 - Vayda, A.P. (ed.) 1969. *Environment and Cultural Behavior*. Garden City NY: The Natural History Press.
 - Von Braun J., Teklu T., and Webb P. (1999). *Famine in Africa: Causes, Responses and Preventions*. Food Policy Statement No. 28. International Food Policy Research Institute (IFPRI), Washington, D.C., USA. [Online] Available From <URL: <http://www.ifpri.org/pubs/FPS/fps28.htm>>
 - Walker, B. (1995). *Conserving Biological Diversity through Ecosystem Resilience: Conservation Biology* 9 (4): 747-752.
 - Ward N., Lamb H., and Portis R (1999) *Climate Variability in Northern Africa: Understanding Drought in Sahel and the Mashreb Beyond El Nino: Decadal and Interdecadal Climate Variability*. Springer Verlag, Page 119-140.
 - White, I and O'Hare, P (2014) *From Rhetoric To Reality: Which Resilience, Why Resilience, and Whose Resilience in Spatial Planning: Environment and Planning C: Government and Policy*.
 - Winrock International (2006) *Original Document Prepared by Winrock International, From the Swahili "Hifadhi Ardhi Shinyanga."* [Online] Available From <<http://www.profor.info/Documents/pdf/livelihoods/TanzaniaCaseStudy.pdf>>
 - www.Nationsencyclopedia.com *Nigeria-Agriculture*. [Online] Available From <http://www.nationsencyclopedia.com/Africa/Nigeria-AGRICULTURE.html>
 - www.preventionweb.net *About The Hyogo Framework For Action (2005- 2015)*. [Online] Available From <<http://www.preventionweb.net/english/hyogo/framework/>>
 - York R and Mancus P (2009) *Critical Human Ecology: Historical Materialism and Natural Laws* - Article first published online: 5 MAY 2009 DOI: Sociological Theory > Vol 27 Issue 2
 - Young G. 1974. *Human Ecology as an Interdisciplinary Concept: A Critical Inquiry*. Advances in Ecological Research 8: 8-105.