

IMPACT OF CLIMATE CHANGE, VARIABILITY AND ADAPTATION  
STRATEGIES ON AGRICULTURE IN SEMI-ARID REGION

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## **DEDICATION**

To my parents, the reason of what I am today. Thanks for your great support and continuous care.

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In the name of Allah, the Most Gracious, the Most Merciful. First and foremost, praises and thanks be to Allah, the Lord, the Almighty, the All-Knowing and the Glorious who bestowed upon us all the blessings and the faculties of thinking, searching, and learning.

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## **ABSTRACT**

This study objectives intended to examine the farmer's perceptions of climate change variability, assess the adaptation strategies employed for agricultural production, and examine the impact of climate change variability on agricultural production in northern Nigeria. A total of 100 randomly sampled respondents were selected to participate in the study. The findings show that there is widespread knowledge on the severity of climate change, and its impact is largely negative on both crop and livestock production. The study also found out that various adaptation mechanisms have been adopted in both crop and livestock production to deal with the effects of climate change, and that the adopted mechanisms are largely believed to be effective. The study also found out that a number of impacts of climate change variability are felt by farmers all around the country and the state specifically, which require urgent institutional support in implementing the mechanisms for adaptation to climate change in Kaduna state, Nigeria. The study concluded that people understand the existence of climate change and its long-term impact on their livelihood, and also understand the need for adaptation. It also concluded that local farmers have adopted a number of effective mechanisms to deal with the impact of climate change. It also concluded that the impact climate change is felt by all farmers and it affects agricultural production and threatens food security. The study recommended that government should engage rural smallholder farmers, non-governmental organizations and civil society in this effort, and that it should encourage local mechanisms in order to ensure sustainability of the adaptation efforts.

## ABSTRAK

Kajian mengenai kesan perubahan iklim dan strategi penyesuaian di kawasan semi-gersang dilakukan di Kaduna, Nigeria. Objektif kajian ini bertujuan untuk mengkaji persepsi para petani tentang kebolehubahan perubahan iklim, menilai strategi penyesuaian yang digunakan untuk pengeluaran pertanian, dan mengkaji kesan perubahan iklim terhadap pengeluaran pertanian di Utara Nigeria. Sejumlah 100 orang responden secara rawak dipilih untuk mengambil bahagian dalam kajian ini. Hasil kajian menunjukkan terdapat pengetahuan luas tentang keterukan perubahan iklim, dan kesannya adalah negatif terhadap pengeluaran tanaman dan ternakan. Kajian itu juga mendapati bahawa pelbagai mekanisme penyesuaian telah digunakan dalam kedua-dua pengeluaran tanaman dan ternakan untuk menangani kesan perubahan iklim, dan mekanisme yang diterima pakai sebahagian besarnya dipercayai berkesan. Kajian itu juga mendapati beberapa kesan perubahan iklim yang dirasakan oleh petani di seluruh negara dan negeri khususnya, adalah yang memerlukan sokongan institusi dengan segera dalam melaksanakan mekanisme penyesuaian terhadap perubahan iklim di Kaduna, Nigeria. Kajian itu menyimpulkan bahawa orang memahami kewujudan perubahan iklim dan kesan jangka panjangnya terhadap kehidupan mereka, dan juga memahami keperluan untuk menyesuaikan diri. Para petani tempatan juga telah menggunakan beberapa mekanisme yang berkesan untuk menangani impak perubahan iklim. Kajian juga menyimpulkan bahawa kesan perubahan iklim boleh dirasai oleh semua petani dan ia memberi kesan kepada pengeluaran pertanian dan turut mengancam keselamatan makanan. Kajian mencadangkan agar kerajaan berurusan bersama dengan petani pekebun kecil, pertubuhan bukan kerajaan dan masyarakat sivil dalam usaha ini, dan menggalakkan mekanisme tempatan untuk memastikan kesinambungan usaha didalam penyesuaian terhadap perubahan iklim.

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## **LIST OF ABBREVIATIONS**

CCA	- Climate Change Adaptation
FRIN	- Forestry Research Institute of Nigeria
IFRC	- International Federation of Red Cross and Red Crescent Societies
IPCC	- Inter-Governmental Panel on Climate Change
LGA	- Local Government Area
NASs	- National Adaptation Strategies
NESREA	National Environmental Standard Regulation & Enforcement Agency
NGOs	- Non-Governmental Organizations
SSA	- Sub-Saharan Africa
UK	- United Kingdom
UNDP	- United Nations Development programme



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# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

This study aims to assess the impact of climate change variability and adaptation strategies on agriculture in the semi-arid region of Northern Nigeria. This chapter presents the background of the study, the statement of the problem, purpose of the study, objectives, research question, scope and significance of the study.

### 1.2 Background of Problem

Climate change variability resulting from increase in greenhouse gases are foretold to end in growth in temperatures and shifting precipitation patterns, critically touching human livelihoods (IPCC, 2007). In its Human development report 2007/2008, UNDP (2008) attention on the crucial connections between climate alternate and financial condition and its interference on livelihoods. weather alternate may be a world bother in a trial to the touch all countries in some ways (IPCC, 2007). The Intergovernmental Panel on climate exchange (IPCC) indicates that Sub-Saharan Africa (SSA) is and will be most stricken by weather changes no matter being the final word contributor to worldwide warming. Its climate is warming quicker than the relief world and it is also the poorest section socio-economically (IPCC, 2007). The continent's packaging to changes in climate could also be terribly high with the maximum amount as forty to keep with cent of the full people residing in semi-arid and arid regions and twenty-five consistent with cent of the people living in coastal areas, places outcasted to be additional vulnerable to climatic changes (IPCC, 2007).

There still exists some uncertainty on how climate change variability is connected to and have an effect on excessive events but in step with O'Brien et al. (2008), there's need for further understanding on the connection, with a read to

facilitate motion that lessens the vulnerability. Frequencies, intensities and effects of disasters are received dramatically over the recent years, touching the unhealthy people's terribly bad within the underdeveloped international locations the most (IPCC, 2007). These disasters are the impact of the subjection of vulnerable families, communities and ecosystems, to shocks or stresses that they won't get over it without the assistance of external agents (Ireland, 2010). Climate trade has become useful in redefining development and therefore the potentialities for increase of the world so it'll be determined through however they reply to the impacts of weather adaptation.

The relation among weather exchange variability and disasters isn't clear, but introduced intensity of high weather occasions along with improved precipitation and heat waves are classified because the main indication and sure influences of weather exchange variability in SSA, and had been spot because the basic disasters cause (IPCC, 2007). Moser et al., (2010) word that environmental refugees touched with the help of weather stressors are already bumping the tide of rural-city migration in several components of SSA. IPCC (2007) brought that, a number of the locations specially in SSA are stricken by climatic changes like will increase in probability of flooding, landslides, droughts, warmth waves and strains on neighbourhood meals producing. seasoning failures are socially designed and are touched closely through vulnerability and model. seasoning dangers are the motive of the exchange into danger and talent for catastrophe is contingent upon human exposure and lack of capability to be in chain with poor affects. For humans with excessive fragility and occasional adaptive potential and resilience, such events are also prejudicial primarily (Ireland, 2010)

Adaptation to the impacts of weather exchange variability calls for adjustments in response to numerous stresses, throughout numerous scales and via many organisations (Crane, 2013). weather exchange model (CCA), via Garnaut (2008), is the exchange in human or natural structures to an expected weather adjustment or their results that control their dangerous effects or makes the most of its useful opportunities. it's far the taking of motion of responses to the impacts of weather exchange which cannot be lessens. Aakre and Rubbelke (2010) concluded that, CCA movement is performed by means of organizations in both the authorities and non-governmental sectors the use of regulations, improvement of infrastructure and

technologies and thru behavioural change. There is numerous analysis that categorise edition sports such as based on purposefulness of version (spontaneous vs. deliberate), timing (anticipatory vs. reactive), adapting agent (personal vs. public) and scope (brief-term vs. lengthy-term; localized vs. regional).

According to Sultan et al. (2013), for 8 compared websites in the Sudano-Sahelian sector of Burkina Faso, Senegal, Mali and Niger using a system-primarily crop model, and state a negative impact on farming of millet and sorghum of up to -41% through the yr. quit underneath a situation with improved temperature and decreased rainfall. according Muller (2011) and Roudier et al. (2011) West Africa crop yield reduces of up to 50% because of extra temperature. Furthermore, whilst warming reaches 2°C, negative impacts resulting from this temperature rise could not be capable of counteracted via any ability high-quality alternate in rainfall (Sultan et al., 2013).

On top of low soil fertility, restrictions related to these and future climate change variability influence agricultural production. Indeed, in the beginning of 1990s IPCC have proof of evidence of fast going global warming and climate change variability. The IPCC's Fifth Report (AR5) presents latest proof of climate change (IPCC, 2013). The worldwide average temperature showed a warming of 0.78 (0.72 to 0.85) °C over the period of 1850 to 2012, and predictions for the end of the 21<sup>st</sup> century are that global average temperature increase will be between 1.5°C, and 2°C (IPCC, 2013). Global warming in Africa is likely to be even more than the global mean warming yearly, and this across the whole Africa and across all seasons (IPCC, 2013).

Whereas amazing rainfall will increase were regarded in the Japanese vicinity of North and South America, in northern Europe and in northern and primary Asia, a decrease and drying has been noticed in Africa's Sahel location (IPCC, 2007b), Towards the background of sturdy multi decadal variability in rainfall (Dai and Trenberth, 2004; Le Barbé et al., 2002). Inside the Sahel region, wet seasons in the Sixties in collection with drier seasons in the Seventies and 1980s. Evidence of modifications in rainfall at an international scale are complex due to high and big local distinctions, gaps in spatial insurance and unavailability of long-term statistics. Weather predictions indicate that the variation in rainfall among wet and dry regions



and between wet and dry seasons will growth (IPCC, 2013) even though the projections of rainfall are unreliable for the West African area because of uncertainty within the quantification of ability vegetation-weather links.

In Nigeria, there are ways to the difficulty of weather change variability. the primary, already mentioned through families and communities throughout Nigeria, and mentioned via the Nigerian Meteorological organization (NIMET, 2008), are the changes that have already been located in climate parameters consisting of temperature, rainfall and extreme weather events. the second offers with adjustments which might be to be anticipated within the destiny. consistent with NIMET (2008), between 1941 and 1970, best patches of the united states of America, inside the northeast, northwest, and southeast skilled late onset of rains. however, from 1971 to 2000 overdue onset of rains had unfold to most parts, leaving most effective a slim band within the middle of the USA with normal conditions. From 1941 to 2000 there was evidence of lengthy-time period temperature boom in maximum parts of the USA. the principle exception became within the Jos place, in which a mild cooling became recorded. The most full-size will increase were recorded in the intense northeast, excessive northwest and excessive southwest, in which average temperatures rose with the aid of 1.4-1.9 °C. weather change variability is having extensive results at the population of society in Nigeria, causing screw ups of unknown proportions.

### **1.3 Problem Statement**

In Sub-Saharan Africa, agricultural production remains the source of livelihood for most rural communities, providing employment to more than 60 percent of the population and contributing to about 30% of gross domestic product (FAO, 2012). Agricultural production is dominated by rain-fed production of food and cash crops. Farmers experience low yields resulting in increasing uncertainty about being able to produce the food needed for their families (Breman and Sissoko, 1998; Drechsel et al., 2001). fundamental segments contributory to such vulnerability and low efficiency are atmosphere changeability, negative soil fruitfulness, awful horticultural administration and worldwide environmental change. In Federal Republic

of Nigeria uniquely and topographical locale in which, soil richness is characteristically low (Bationo and Buerkert, 2001; Giller et al., 2011; Piéri, 1989; Vanlauwe et al., 2011) and speaks to the principal requirement for horticultural improvement. This occurrence is bothered by the decrease of neglected lengths, development of delicate terrains, kept utilization of inorganic compound due to high world commercial center synthetic charges and confined inspire right of passage to credit (de Graaff et al., 2011; Ehui and Pender, 2005).

In addition, low availability of organic fertilizers contributes to the decline in soil fertility. Land degradation including both water and wind erosion further impoverishes the soils in this region (Cleaver and Schreiber, 1994). Changes in rainfall are expected to constrain agricultural production and therefore detrimentally impact food security. An example of this might be a reduction in the growing season length or increased uncertainty in the start of the growing season. As consequence agricultural yields in some countries are projected to fall by 50% by 2020 and overall crop revenue might decrease by 90% by 2100 (Boko et al., 2007). Thus, farmers are likely to be the worst affected by these decreases in revenue because of their low adaptive capacity (Boko et al., 2007). This study aims to evaluate the impact of climate change variability and adaptation strategies on agricultural production in northern Nigeria.

#### **1.4 Objectives of Study**

The main objective in this study is to examine the impact of climate change variability and adaptation strategies on agriculture in the semi-arid region of Northern Nigeria, with specific reference to Kaduna state. Therefore, the specific objectives of study are:

- a) To evaluate farmer's perceptions of climate change variability in northern Nigeria
- b) To assess the adaptation strategies employed for agricultural production in northern Nigeria.

- c) To examine the impact of climate change variability on agricultural production in northern Nigeria.

### **1.5 Research Questions**

The research questions of this study are as in the following.

- a) What are farmer's perceptions of climate change variability in northern Nigeria?
- b) What are the adaptation strategies employed for agricultural production in northern Nigeria?
- c) What is the impact of climate change variability on agricultural production in northern Nigeria?

### **1.6 Scope of the study**

The study was conducted in Kaduna Local Government Area, in Kaduna state, in the Northern region of Nigeria. This region is among the most affected by climate change, with various occurrences of prolonged drought, irregular rainfall, temperature raises, heat waves among others. Adaptation to these extreme conditions go a long way in improving the livelihoods of farmers in this region over a long-term period. Therefore, the people here were in position to provide information that was relevant to the study. The study examined the farmer's perceptions on climate change variability and the adaptation strategies adopted by farmers and how these impact on agricultural production in Kaduna state, Nigeria. The study examined the climate change variability situation in the region over the period of the last 16 years from 2001 to 2017.

### **1.7 Significance of Study**

The study will be useful in understand the severity of climate change variability in Nigeria, the region and the continent as a whole. The findings of the study will also help by exploring its impact on farmers in the country at the local, regional and national scale, thereby informing decisions about how to tackle it. The study will also be instrumental in exposing and evaluating the role of stakeholders in supporting

adaptation strategies for climate change in the country, examining the strengths and weaknesses of the various stakeholders.

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