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Social Studies**

*Erasmus*

**“Exploring the effects of climate change on crop productivity in Northern Ghana. A case  
Study of Maize in Nyankpala community”.**

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***Disclaimer:***

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## ABSTRACTS

The Sustainable Development Goal (SDG) goal 2 aims to “end hunger and ensure access by all people in particular the poor and people in vulnerable situations including infants to safe, nutritious and sufficient food all year round”. A number of categories stated in the goal 2, relates with the current threats to food security faced in some parts of sub-Saharan Africa, Africa and Asia and this threats are brought about by climate change. Climate change is explained by various scholars to mean the periodic shifts and change in atmospheric conditions, rainfall patterns, increasing global warming and emission of heat radiations from the earths’ surfaces which are as a result of human activities and actions.

The commonest of these actions are burning of fossils, emission of carbon-monoxide into the atmosphere which all reduces the ozone layer, makes it thinner and affects overall rainfall patterns and the amount of rains in some area. The impacts of climate change according to various scholars are not central but are felt more in some areas or warmer regions such as sub-Saharan African than other areas. In sub-Saharan Africa, there are seasonal changes, thus the rainy and dry or harmattan season. This has limited agricultural productivity and has made production of food crops only seasonal. In most parts of the sub-Saharan Africa region including Nyankpala and the northern part of Ghana, farmers are limited to single-season production, coupled with low income and earnings of the region and more recently the impacts of climate change are all contributing factors to decline and reduced crop yields in the region. In the earliest studies and reviews conducted prior to this research, the findings informed the aim of this research which was to investigate the effects of climate change on the general production of maize in Nyankpala among smallholder, peasant or subsistence farmers. These groups of farmers usually produce for household consumption and also sell out a small portion of their produce to generate some income to support other expenses. Additionally, the research aimed to understand the knowledge gaps of the peasant farmers on climate change and the issues leading to the significant decline of their crop yields.

The study employed purely qualitative tools such as interview guides and observation to understand the patterns, and the results of climate change on the productivity of the peasant, smallholder and subsistence farmers living in the region. The study scope was limited to Nyankpala as it is a typical traditional society which represents and has all the characteristics of a typical northern society such as majority of its people engaged in maize farming.

Also the dominance of agriculture research institutes and practical fields informed the choosing of the study location. Data was analyzed using thematic and critical content analysis. The findings of the research showed that climate change has adversely affected the production of farmers in the region, especially for farmers’ stuck with old and traditional methods of farming. The adaptive practice in Nyankpala was the adoption of genetically modified species (GMS) that can withstand drought and harsh weather conditions. The effects of climate change as well has led to a decline in the overall quality of life of farmers living in the area.

**KEYWORDS:** Climate change, Peasants, Farming, Agriculture, Food security and Maize production.

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## **Relevance to Development Studies**

The relevance of this research, “a study of the effects of climate change on maize production of farmers in the northern region of Ghana-A case study of Nyankpala” includes;

Filling the gap in literature on climate change impacts on maize production in the northern part of Ghana, narrowing the scope to a community study. Previous studies conducted were not representative of the typical northern societies, since its study scopes included major towns and district capitals. This study fills in the gap in understanding how the farmers of Nyankpala are affected by the changes in climate in their area.

Additionally, the study revealed an interesting findings which reduced quality of life of the farmers which was attributed to the rising climate change and its rather declining and decreasing crop yield. The decreasing crop yield and the percentage decline recorded as stated in the findings of the study indicated that climate change was indeed a threat to the livelihoods of farmers who farm on a small scale. Indicatively, it also revealed that the decreasing maize yields has and is continuously leading to food insecurity in the community and the region at large. This contradicts the aims of the Sustainable Development Goal (SDG) 2, which is targeted at ending hunger and ensuring everyone irrespective of their location, status and their income levels have to safe, nutritious and sufficient food all year round. This makes it an interesting and very relevant topic to explore.

The findings of this research can inform the work of government, Non-Governmental Organizations, International and development organizations, development practitioners and partners in agriculture, agribusiness and the field of sustainable livelihoods and food security and influence their interventions to enhance maize production in the area, the district, region and Ghana at large. The government of Ghana (GoG) additionally can rely on the findings of the study to strengthen agriculture, research and extension institutions to deliver on their mandate and ensure that the interventions of government reach those truly in need of the intervention. This work is therefore important to development studies because it can inform government policy, policy directions interventions and development work in Nyankpala, the northern region and Ghana at large.



## **CHAPTER ONE (1) PRELIMINARIES**

### **1.0 Introduction**

This is the opening chapter of this study which starts with the background of the study, presents the problem statement by describing the details of the problem existent which this research is based on. It contains the research problems, study objectives, research questions and methodology which are all outlined properly to ensure the work flows well.

### **1.1 Background of the study**

According to the United States Environmental Protection Agency (2016), climate change poses challenges for “farmers and threatens food security” and makes it difficult to grow crops and raise animals with ease as it was in the past. “Indirect temperature estimates from 1989 to 2019 show that this was the warmest decade ever since the establishment of the instrumental record in 1850” (USEPA, 2016 p.1). Again, the CCIR-NYC (2005 p.1) defined climate change as a “natural occurrence or because of persistent anthropogenic forcing such as the release of greenhouse gases, sulphate aerosols, black carbon or through land use change. These are evident in the recent industrialization, increase in industrial activities, mining, felling of trees and urbanization”. The impacts are severe leading to environmental temperature changes or heating, disruptive weather or rainfall patterns, and inconsistent and remarkable seasonal changes. For instance in most parts of the world, the global north specifically, they contribute immensely towards climate change but experience the impacts less. The impact is felt in the sub-Saharan zone, and in most parts of African countries. According to research, Africa is the least contributor to climate change, however, the continent feels the impact the most (Aydinalp and Cresser, 2008). The global climate change has effects on agricultural production, which can be small or moderate however, regional impacts could be significant in most parts of the world and in Africa.

The global research conducted on agricultural productivity predicts losses but improvements can be made when the necessary adaptive measures are taken (Pinto et al, 2012). Africa is heavily on agriculture and the majority of Africans are economically dependent on primary sector productivity for food, fiber and income (Pereira, 2017). Heavy reliance and dependence on this and disturbing when over 70 per cent of the population is dependent on agriculture for survival and the seasonal, climate change and rapid rate of global warming, production will surely decline. The vulnerability of Africa’s agricultural sector is due to the continent’s excessive reliance on rainfall for production (Pinto et al, 2012). This brings the need to conduct this research to reveal the effect of climate change on Food crops (Maize) and the peasant farmers in Nyankpala in the Northern region of Ghana.

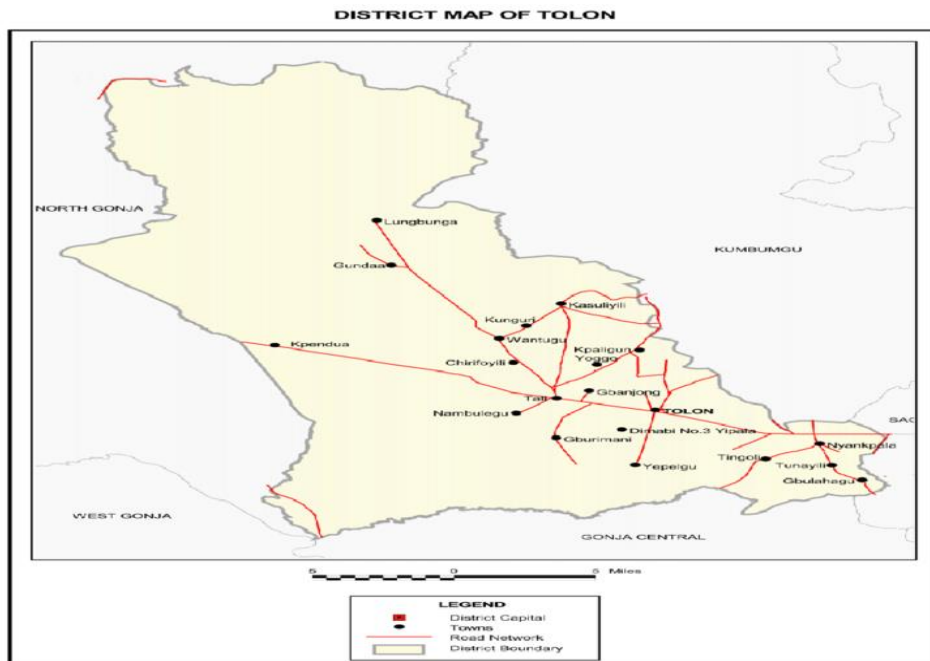
Nyankpala is a community located in the Tolon District in the Northern region of Ghana and the capital town is Tamale. Its inhabitants are Dagombas from the Mole Dagbani ethnic group. Their major source of income is farming. The sector remains key to the overall economic growth and development of the country, and it is expected to lead to the growth and structural transformation of the economy. In 2017, the agricultural sector contributed 18.3per cent to the GDP as against the 25.5 per cent industry sector and 56.2 per cent service sector (Ghana Statistical Service (GSS), 2018). Although the agricultural sector’s quota to the GDP of the country is low, which effect of the sector on the livelihood of farmers regarding food security and other gains cannot be underscored in Tolon District in the Northern Region of Ghana? The locality covers a total land area of 2,741 km<sup>2</sup> with an estimated people of 72,990, with 36,630 females and 36,360 males. For about 88.8 per cent are into the fishery, Forestry and Agriculture, 47 per cent are into related trades workers and crafts, 3.3 per cent in sales and service, 1.6 per cent are into Technicians, Professional work and as manager (GSS, 2010) where 75 per cent are farmers who grow crops such as Yam, maize, rice, beans millet, okro, soya beans, and Guinea corn (GSS, 2012). The area

remains the major (14.2 per cent) contributor of the agricultural sector to the GDP of Ghana (GSS, 2018). Despite such a significant role, crop productivity in Ghana has remained low.  
**Figure 1: Map of Ghana and Northern region**



Source: [https://www.google.com/search?q=negative+effects+of+climate+change+on+crop+production&source=lnms&tbn=isch&sa=X&ved=2ahUKEWjl1afA5YX\\_AhUJR8AKHZvED80Q\\_AUoAXoECAIQAw&biw=1366&bih=600&dpr=1#imgrc=ty3Ly3nSITMIBM](https://www.google.com/search?q=negative+effects+of+climate+change+on+crop+production&source=lnms&tbn=isch&sa=X&ved=2ahUKEWjl1afA5YX_AhUJR8AKHZvED80Q_AUoAXoECAIQAw&biw=1366&bih=600&dpr=1#imgrc=ty3Ly3nSITMIBM).

**Figure 2: Map of Tolon District (Nyankpala)**



District map of Tolon (Source: GSS, 2011).

Sub-Saharan African farmers' production has significantly decreased, there are a number of causes for the drop in food crop output, including climate change, irregular rainfall patterns and temperature, governmental policies (Heisenberg and Yaro, 2006). The recent rapid ways of climate change and the unwillingness of Ghanaian governments to assist small-scale or peasant farmers in overcoming the negative impacts of climate change on their crop yield or output. This endangers the community's, regions and country's overall needs for a living and food security (United Nations, 2021). Climate change is defined as "changes in atmospheric temperature and conditions caused by the emission of carbon monoxide and other gases into the atmosphere." This reduces the thickness of the ozone layer, resulting in global warming, increasing sea levels, and inconsistency in rainfall patterns (CCIR-NYC, 2005 p.1). Human actions such as bush burning, emission of carbon monoxide from motor engines, burning of fossils, tree cutting, and smoking, for example, contribute to climate change and pollution from industries. Moreover the research is conducted to analyze the effect of climate change on maize productivity of farmers in Nyankpala. The research will be conducted using qualitative techniques, where qualitative data collection techniques such as interviews, content analysis and report reviews will be conducted at the CSIRSARI to get data on how climate change has affected the food crop for the past years and now, which is an agricultural research institute, located in the centre of Nyankpala, data collection tools will be used to collect data on the farmer's productivity over the past years in the community.

### **1.2 Problem statement**

Asante & Mensa (2015) recent climate change has gained the world's attention as it is a disruptive pattern in the agricultural sector, for crops and animal production. Again, Aydinalp and Cresser (2008, p.1) defined climate change as the "release of 'greenhouse' gases into the atmosphere, these gases accumulate with time in the atmosphere and cause global warming". Despite the recent transition of Ghana into an industry and service sectors-led economy, agriculture still plays and holds a key role in the economy, contributing to about 30 per cent of the country's GDP and employing about 50 per cent of the country's population (De Pinto et al 2012). The World Bank (2021) report noted that in Ghana, about one-fifth of the country's total GDP is from agricultural productivity and also the sector employs more than half of the working population in the country. Based on the above-noted statistics, it is noted that subsistence farming and peasant agriculture is one of the most important sectors of the economy in Ghana, just like the other service delivery sectors. Also, weather patterns and temperature (climate change) across the globe, which most economies have switched to practicing climate-smart agriculture but the case is different in the sub-Saharan Africa region specifically the northern region of Ghana. These recent changes have made declining crop yield necessitate the study of climate change impacts on crop production in the northern part of Ghana (Pereira, 2017). The effects of climate change on agriculture in the northern region of Ghana, if not researched thoroughly and a sustainable solution applied has the tendency to lead to food insecurity, hunger and shortage of food and malnutrition in the region. This will be a threat to the survival of peasants in the region and a threat to food security and the nation at large.

### **1.3 Justification of the Study.**

There are so many reasons why conducting this study is necessary. However, some of the very important ones are;

Climate change poses challenges for farmers, threatens food security and makes it difficult to grow crops and raise animals with ease as was in the past (United States Environmental Protection Agency, 2016) It is my belief that if this is not researched thoroughly and solutions sought, climate change with its rapid growth and its noticeable effect on the recent decline in agricultural productivity such as maize has the tendency to drain peasant farmers in Ghana as well as lead to food insecurity and poverty in the Northern region of Ghana. If corrective measures are taken, there are chances to mitigate the problems of climate change that lead to disruptive weather and rainfall patterns (Antwi-Agyei et al, 2016) This means if long-lasting solutions are sought and

implemented for example is climate-smart Agriculture the peasant farmers in the Northern part of Ghana have to adopt some coping strategies, such as “rainwater harvesting”, “small-scale irrigation”, and “water conservation practices” (Antwi-Agyei et al,2016 p .16) however, these strategies are often inadequate to address the growing water scarcity and degradation problems caused by climate change. The effect of climate change can be mitigated, and food security improved in Nyankpala and the Northern region at large. This research will fill the research gap on the issue of climate change and its effect on agriculture and crop productivity in Nyankpala and the Northern region. Maize is selected because it is the most common crop grown in Nyankpala and the northern region as well. It is the most-grown crop in the region, its production has seen a significant decline in recent times. (Adjei and Kyerematen, 2018).

#### **1.4 Research Questions**

The main research question of this study is;

- What are the impacts of climate change on the agricultural productivity of peasant farmers?

The specific research questions for this study are;

- What factors have led to the severity of climate change felt in the Northern region?
- To what extent has agricultural productivity declined in the Northern region over the past 10 years?
- What are the knowledge gaps of farmers in Nyankpala on climate change?
- What are the effects of climate change on the quality of life of peasant farmers?

#### **1.5 Research Objectives**

The main research objective of this study is;

- Examine the impact of climate change on the agricultural productivity of peasant farmers.

Other research objectives are;

- Assess the factors contributing to the severity of climate change felt in Nyankpala.
- Examine the decline in crop productivity in Nyankpala.
- Examine the knowledge gaps of peasant farmers on climate change.
- Examine the effects of climate change on the quality of life of peasant farmers.

#### **1.6 Research methodology**

The research adopted qualitative research techniques to dissolve and research thoroughly to understand the nature of the problem and propose lasting solutions to the issue of climate change impacts on peasant farmers in Nyankpala and the Northern region of Ghana. The researcher used three weeks for the fieldwork and interviewed 10 farmers and 5 officers from SARI, however at the time of conducting the data collection, majority of the staff were unavailable and only one research staff was interviewed.

##### **1.6.1 Research Design**

The design of this research employed the use of flexible techniques in all facets of the research process, from data collection to data analyses and interpretation (Nachamias et al 2004) Qualitative data procedures were used in this research work.

##### **1.6.2 Target Population**

The population of this study consisted mainly of the maize farmers only in Nyankpala in the Northern region and researchers at the CSIR-SARI. Additionally, the study sample was selected using a purposive sampling technique. A purposive sampling technique usually involves the hand-picking of subjects based on certain required features that cannot be obtained from other sources (Taherdoost, 2016).

##### **1.6.3 Sample size**

A sample size of 11 respondents was selected for the purpose of this study. These are the 10 maize Farmers and an officer from CSIR-SARI.

#### **1.6.4 Instruments of Data Collection**

According to Chaleunvong (2009) stated that techniques in data collection allow us to gather information reasonably on the study subjects; thus, people, objects and on the settings in which they occur. Instruments used for data collection to be used are mainly interviews.

#### **1.6.5 Data Analysis Techniques**

Data analysis and processing involve studying the acquired information and making a conclusion on the kind of data the researcher is working on. Data generated from the field was qualitatively analyzed by organizing it according to the objectives of this study. The data was separated, labelled, and compiled through coding (Baxter and Babbie, 2003). To aid the data analysis, the interviews was subjected to critical content analysis based on themes and comparative analysis with theories and renowned research works conducted in the field.

#### **1.7 Limitations**

In every research work or academic writing there are limitations that are bound to happen and this research work is simply no exception in this regard. Some of the challenges encountered during the course of the research work were;

- Unavailability of the farmers; most times due to the farming season. The interview was done at the time farmers are busy on their farm and since cultivation is only a single season in Nyankpala, getting the farmers will not be an easy task.
- The research assistance needs a lot of patience in the conduct of the research since most farmers are not willing to respond to the interview as well, until they will be well-educated and enlightened on the nature of the research.
- The language barrier; the researcher faced another issue with regard to the issue of language. The language mostly spoken is Dagomba and due to this, the researcher had to contract research assistants to translate the language into English for the researcher to understand and analysis the work and support in the data collection.
- Unavailability of the SARI staff at the time of the research data collection.

#### **1.8 Research outline**

This section focuses on the presentation of the research work from Chapter 1 to Chapter 5.

Chapter One (Introduction); This is the opening chapter of the research. It presents the background to the study, the problem statement, the research justification, the research question, the research aims, the research objectives, the definition of terms used in the research, the methodology or the procedure of the study, the scope, and limitation of the study as well as how the various chapters are presented in the organization of the study.

Chapter Two (Literature Review); This is the second chapter of this research work. This chapter focuses on reviewing past research works and theoretical frameworks related to the topic of study.

Chapter Three (Methodology); This chapter focuses on the procedures that will be used in carrying out the entire research work. It involves the research design, sample size and techniques, the data type used (primary and secondary data) data collection tools and techniques as well as tools and techniques which will be used in the analysis of data collected/gathered during the study.

Chapter Four (Results and Discussions); This chapter focuses on the discussion of the results obtained during the study. The results of the study will be discussed based on the primary data collected in the course of the work in relation to already existing views, theories, ideas, and concepts as well as findings of other research works conducted in the field. There will be a qualitative analysis.

Chapter Five (Conclusion and Recommendation); This is the concluding chapter of the research which summarizes the entire work as well as explains and summarizes the findings obtained in the course of the work.

## **1.9 Chapter conclusion**

Chapter one of this work focuses mainly on the introduction, background to the study, briefly describing the research problem and stating the research questions and objectives of the study, the study justification and the methodology adopted in carrying out this research work. The chapter concluded with the outline of the research explaining briefly what's contained in each chapter.

## **CHAPTER TWO (2)**

### **LITERATURE REVIEW**

#### **2.0.0 Chapter introduction**

This chapter focused on relevant literature on climate change and its impacts on crops specifically maize productivity across the globe and in Ghana, particularly the northern sector. It presents concepts, theories, and the findings of these past research works as well as identifies the gaps that must be thoroughly investigated to be able to mitigate the severity and impacts of climate change on maize productivity in the Nyankpala community. Therefore, it reviews the literature on Crop productivity, subsistence farming, and the impacts of climate change on crop production, and presents an empirical review of some works conducted in this study. The section also presents the theoretical framework used as a guide to this study.

#### **2.0.1 The nature of Agriculture and crop production in Ghana**

Like other developing countries in sub-Saharan Africa, in Ghana, agriculture is a major sector contributing greatly to socio-economic development. The sector contributes 27 per cent of the Gross Domestic Product (GDP) and employs about 60 per cent of the labour force, particularly those residing in rural areas (ISSER, 2014). According to this report, Subsistence farmers dominate Ghana's agriculture sector, with an estimated 90 per cent of farms being less than 2 hectares. Smallholder farmers operate family-owned farms and engage traditional subsistence techniques, exposing them to significant climate risks when seasonal changes and droughts are linked to climate change. Food crop productivity varies across the geographical regions of the country, particularly in the northern regions Crops such as millet, maize, rice, groundnut, soya beans, as well as yam are some major crops produced. For example, cash crops such as cocoa, coffee, plantain, cassava and cocoyam are widely cultivated in the southern parts of the country. This notwithstanding, agriculture is the most vulnerable sector to climate change impacts because of its over-reliance on rain-fed systems (Government of Ghana, 2015). Therefore, it is one of the key priority sectors identified by the Ghanaian government in its Nationally Determined Contribution submitted under the Paris Climate Agreement. This signifies the important role of the agricultural sector in meeting the adaptation and mitigation commitments set out by the Ghana government to address climate change (Antwi-Adjei and Stringer, 2021).

#### **2.0.2 Subsistence farming**

Divergent views have been expressed with regard to the concept of subsistence farming. For instance, subsistence farming has been defined as “farming and associated activities which together form a livelihood strategy where the main output is consumed directly, where there are few if any purchased inputs and where only a minor proportion of output is marketed”(Morton 2007, p. 1). Subsistence farmers depend on rain-fed agriculture and also this is the case for Nyankpala farmers in the Tolon district where agriculture is highly dependent on rainfall and it is one of the poorest areas in northern Ghana. For instance, it is estimated that about 42 per cent of the rural population in this area resides below the poverty range in Ghana (Amuda and Thompson, 2010). Also, many farmers particularly the smallholders as a result of poverty cannot afford to purchase farm tools such as tractors and combine harvesters and therefore only use simple tools such as hoe and cutlass in their production process (Tonah, 2006)

#### **2.0.3 Climate change**

Various scholars have provided different explanations for the concept of climate change. According to Jakpa et al., (2019 p. 175), it represents “change in the climatic state recognized (using statistical tests) by changes in the average and fluctuations of climatic conditions happening over extended periods of time, often decades”. Also, Aydinalp and Cresser (2008, p .672) defined climate change as “releasing carbon or ‘greenhouse’ gases into the atmosphere”. This release disrupts the natural climate cycle causing changes in weather conditions and certain climate situations which normally affect food crops. However, according to them, there are no reliable predictions on global climate change. The reliability of projections on the impacts of climate

change on agricultural systems has increased substantially since the first Intergovernmental Panel on Climate Change (IPCC) (Pereira 2008). Despite this “In Africa, much work has gone into downscaling global climate models to understand regional impacts, but there remains a dearth of local level understanding of impacts and communities’ capacity to adapt” (Pereira, 2008 p. 1). It is widely disclosed that Africa is vulnerable to climate change, not only due to high exposure to climate change but also because many African communities cannot respond or adapt to the impacts of climate change.

As Pereira (2008) has argued, Africa’s vulnerability to climate change is because the agricultural systems are highly rain-fed coupled with low technology and therefore have limited capacity to adapt to climate change (ibid 2008). In addition, Ghana has witnessed significant increases in temperature and varied rainfall patterns and recent studies suggest the country’s climate has become gradually drier over the last century and is prone to drought conditions (Abbam et al., 2018; Asante and Amuakwa-Mensah, 2015). For instance, a 2010 baseline study according to the Ghana’s Environmental Protection Agency has projected that rainfall is expected to decrease across all agro-ecological zones by an average of 18.6 per cent 2080, while temperature is expected to increase on average by 3.9 °C by 2080 (Antwi Adjei and Stringer, 2021).

#### **2.0.4 Impacts of climate change on crop production.**

“Climate change has a significant impact on agricultural systems as it affects both plant and animal health. Increased temperatures, especially in the number of extremely hot days, as well as changes in precipitation, are the main climatic variables affecting agriculture on the African continent” (IPCC, 2017, p.3). Although some uncertainty remains in terms of the direction of climatic changes that Africa will face, especially with regard to precipitation projections, the confidence in projected impacts of climate change on agricultural systems has increased substantially since the initial Intergovernmental Panel on Climate Change (IPCC) (ibid, 2017). According to Kotir (2010), sub-Saharan Africa is considered to be the region most vulnerable to the adverse effect of climate change due to its reliance on agriculture, which is extremely sensitive to weather and climate variables like temperature, precipitation, and light and extreme event, as well as its limited capacity for adaptation. Overland et al., (2022) note that, even though African countries have made some of the smallest contributions to the cause of climate change, the continent is warming up more quickly than the rest of the world and has a large population that is extremely vulnerable to the effects of climate change. In Ghana, Chemura et al., (2020) reveal that unpredictable and variable rainfall, rising temperature and prolonged dry season are key impacts of climate change on agriculture especially in the northern region. Also Leal Filho et al. (2015 p .4), have indicated that the impacts of climate change which are greatly experienced in Africa is as a result of two major factors, (1) “the geographical location and features of Africa having major lands lying in the warming tropics and (2) the limited social, economic and technical capacities of African countries to respond to climate change”.

In addition, Aydinalp and Cresser (2008) state that the changes or impacts of climate change will differ across regions in the world and determining how it will impact agriculture will be difficult but based on the changes climate change brings such an increase in temperatures, changes in rainfall patterns and the increase in CO<sub>2</sub> levels projected will have adverse effects on agriculture in areas in the tropical regions. Generally, the vulnerability expected to be faced is the difficulty in adaptation and the social, technical and economic capacity of the African continent (Aydinalp & Cresser, 2008) this will bring about a change in pests and diseases as well as suitable lands could undergo geographic shifts in responding to climate change. For instance, vulnerability to climate change will also depend on physical, biological and social characteristics with the poor regions likely to suffer most with the livelihood of the peasant farmers in the northern region of Ghana.



### **2.0.5 Climate change impacts on maize production in Africa and Ghana.**

Various studies conducted by a number of scholars have documented how climate change is likely to affect agriculture productivity, particularly in Africa and the developing world in general in which Ghana is one of them. In relation to Ghana, Maize is one of the common foods the Majority of the people use among all the cereals (Tachie-Obeng et al, 2013) Such as millet, wheat and Sorghum. For instance, a report by McKinsey Global Institute(2020, p.9) noted that African farmers are generally more vulnerable to climatic effects such as changes in rainfall, higher temperatures, and variable yields compared to farmers in developed countries, which easily can obtain crop insurance, adjust what they grow, as well as irrigate their farms or use crop-protection chemicals. Also, according to Jones and Thornton (2003 p. 53), “aggregate yields of maize in smallholder rain-fed systems in sub-Saharan Africa in particular are likely to show a decrease of about or over 10 per cent by 2055”. For instance, in sub-Saharan Africa, the production and impact of climate change have affected food crops such as maize is 5 per cent (Knot et al 2012). This shows a serious decline in maize production as compared to other cereals such as millet 10 per cent, Sorghum 15 per cent and wheat 17per per cent in Africa. It is important to understudy the real impacts of climate change on maize production in various parts of the world. For instance, Jones and Thornton (2003), according to their study show that by the year 2055, African and Latin American maize crop yields will reduce at least by 10 per cent or even more due to climate change. The production of maize, which the farmers are able to harvest will reduce drastically which will lead to a shortage of food and have a negative impact on the farmer's livelihood which on these food crops to feed their families. Contextually in the Nyankpala community in the northern region of Ghana for example, farmers depend on the weather such as the rainfall and the temperature to cultivate their maize so if this weather pattern changes it affects the maize production and the Farmer's livelihood.

Also Morton (2007) argued further to explain that the likelihood of the global scale and in areas of vulnerability and where subsistence farming is dominant, there is a possibility of a further increased decline in maize production due to adaptation challenges.

According to Jakpa et al. (2019), crop production in the Tolon district where Nyankpala is located has been affected by climate factors such as temperature and rainfall. According to their work, climate change factors such as increased atmospheric temperature and decreased rainfalls all on account of climate change have reduced the period of production for maize crops. Farmers have also been affected by this yield of producers of maize in the community. Moreover, the relationship between climate change and maize production in the Nyankpala community on maize production over the past five years has shown that climate change has a cross-relation change in the production of maize specifically targeting a decline that has been attributed to climate change. Again Xu H. et al. (2016) note that because of this change in climate conditions is as a result of the decrease in maize yields. In their work shows that this decrease is expected to occur in the 20th century and in the late 21st century.

The decline of these maize crops differs differently from different crops such as millet, soya beans and the rest of the crops to the extent that decreases range from 15 per cent to 50 per cent in a range of different levels in maize production in climate factors. Rainfall patterns and Temperature will be a problem for maize farmers in the future and now due to the changing of climate conditions (ibid 2016).

### **2.0.6 Mitigating the Impacts of climate change on maize production and Yield/ Adaptations to climate change**

The results of climate change on maize yields over the period 2008–2030 show that a combination of changes in temperature and precipitation can either bring positive or negative effects on maize yields. Furthermore, variation in regional climatic and economic conditions makes the impacts of climatic change on maize yields substantially different in different regions (Xiang et al, 2011). Various adaptation measures have been reported in several studies in Ghana. For

example, it is found that in Ghana farmers in the Sefwi Wiawso district in the Western Region plant maize that has shorter growth periods and can tolerate drought. Such types of maize include “Aburohemaa”, “Abontem” and “Enii-pii”. These varieties increase well in the current conditions (Boon and Ahenkan, 2011). Farmers within the transition zone were reported to be practicing similar adaptation measures (Fosu Mensah, 2012). It is observed that some maize farmers adjust planting dates in order to fit the rainy season. This enables the planting to correspond with the outset of the rains.

This was observed among farmers in the Wenchi area (Adjei-Nsiah and Kermah, 2012) and Ejura (Fosu-Mensah, 2012) all located within the transition zone. Other farmers have switched to the cultivation of tree crops because they cannot withstand the changes in rainfall regimes and atmospheric temperatures. Examples include Oranges, cashews, teak and mangoes. Trees are also used to provide shade for the cultivation of food crops due to the increase in temperatures. Some farmers use trees for other commercial purposes due to declines in food crop incomes such as maize (Adjei-Nsiah and Kermah, 2012; Boon and Ahenkan, 2011). Based on the discussion educational programs are run by the government for farmers to understand the climate change system in the community to sensitize them to the need to conserve water and soil on their farms. They are encouraged to adopt practices like conservation cultivation and the use of cover crops in order to conserve moisture in the soil as temperatures keep on rising (EPA, 2000).

### **2.0.7 Knowledge gaps of peasant farmers on climate change**

Studies also reveal that global environmental change is one of the most significant research and policy issues facing humankind. Although vast financial and human resources are being allocated to climate change research, (Quentin and Johnston, 1995) there are numerous knowledge gaps between understanding climate variations and human responses, particularly in the area of farm adaptation. With current global climate change conditions, the urgency to provide agricultural knowledge on adaptation and mitigation measures has risen (Ngoepe et al, 2016). In addition, a study by Mosser (2007, p. 43), argued that “There is a need for effective communication, public outreach and education to increase support for a policy, collective action and behavior change is ever present and is perhaps most pressing in the context of anthropogenic climate change”. Furthermore, Cooper (2011,) also observes that the urgency to intensify ‘climate literacy’ is reflected through calls for climate science by federal institutions to spread climate change education. The challenges of communicating climate change to the masses are, however extensive (Akpan et al, 2012).

In their studies, Quesada and Rodríguez (2013) discussed their concerns about the serious gaps in climate change information, Climate change information dissemination to rural farming communities especially critical and its dearth could give rise to fear regarding the adoption of agriculture as a career since one of the major factors regarding agricultural production is lack of information. (Hassan et al, 2006).

### **2.0.8 Effects of climate change on farmers’ quality of life.**

As it is in Climate change is expected to adversely affect agricultural production in Ghana. A range of climate models suggests median temperature increases between 3 °C and 4 °C in Ghana by the end of the 21st Century, roughly 1.5 times the global mean response. This will likely result in significant yield losses of key staple crops, such as maize, sorghum, millet, groundnut, and cassava, between 8 and 22 per cent by 2050 unless key investments are made to improve agricultural production under climate risk (Schlenker and Lobell, 2010). In East Africa, there are very few places where rainfall means are likely to decrease; however, increases in rainfall are unlikely to increase agricultural productivity as a result of unfavorable spacing and timing of precipitation. Because of this variability, coupled with an expected increase in evapotranspiration “where water moves from the earth's surface to the atmosphere” due to higher temperatures (Herrero et al, 2010 p .27).

Despite that many countries in Sub-Saharan Africa are particularly vulnerable to adverse impacts from climate change, because of their limited capacity to adapt, the development challenges that many African countries face are already considerable, and climate change will only add to these through losses in farm profits (Kurukulasuriya et al, 2006). These impacts are particularly important for countries such as Kenya and Ghana, where the poverty rate is 52 per cent and 73 per cent of the labour force depends on agricultural production for their livelihood (FAOSTAT, 2010). In view of this agricultural production remains the main source of income for most rural communities in the northern part of Ghana, Adaptation is imperative to enhance the resilience of the agriculture sector, protect the livelihoods of the poor peasant farmers, and ensure food security (Howden et al, 2007; Schlenker and Lobell, 2010) At the national level, this will require greater investments in drought and heat-tolerant varieties, irrigation systems, disaster relief, insurance and social protection programs, and integrated strategies to reduce livelihood risks. It also requires adjustments at the farm household and community scales.

Also, Adaptation can greatly reduce vulnerability to climate change by making rural communities better able to adjust to climate change and variability, moderate potential damages, and cope with adverse consequences (IPCC, 2001). A better understanding of farmers' perceptions of climate change, ongoing adaptation measures, and the decision-making process is important to inform policies aimed at promoting successful adaptation of the agricultural sector. Adaptation will require the involvement of multiple stakeholders, including first and foremost, farmers, but also policymakers, extension agents, NGOs, researchers, communities and the private sector (Kurukulasuriya et al, 2007). Recent micro-econometric studies have examined the links between adaptation and agricultural productivity and net income from agricultural production under climate change. Others have focused on the factors influencing the adoption of adaptation strategies and have highlighted ways in which policymakers can support adaptation through the provision of credit, information, inputs, and extension services among other measures (Maddison et al, 2007).

### **2.0.9 Indigenous and modern methods used to mitigate impacts of climate change.**

Climate change is considered by many to be one of the most significant challenges to humanity, with Africa seen as one of the most affected continents. There is a growing recognition that purely scientific and modern approaches alone are not enough to mitigate the “multiple stresses” of climate change in Ghana. Nonetheless, the dominant thinking in climate change science appears to treat indigenous approaches to climate change impact mitigation as primitive or backward (Warren et al, 1992). Even though the debate around indigenous knowledge systems is a contentious one, some scholars have acknowledged that, if well harnessed, indigenous knowledge systems can help empower local communities to mitigate climate change impacts (ibid, 1992) The importance of indigenous knowledge has been realized in the design and implementation of sustainable development projects, but little has been done to incorporate this into formal climate change adaptation strategies. It is the basis for local-level decision-making in many rural communities. Indigenous knowledge has a value not only for the culture in which it develops but also for scientists and planners striving to improve conditions in rural localities (Mundy and Compton, 1991). The knowledge set is influenced by the previous generations' observations and experiments and provides an inherent connection to one's surroundings and environment.

Therefore indigenous knowledge is transferable and provides relationships that connect people directly to the environment and the changes that occur within it, including climate change (Woodley, 1991). Moreover, “Climate change cannot be separated from sustainable development as sustainable development may be the most effective way to frame the mitigation question and a crucial dimension of climate change adaptation and impacts” (Cohen et al, 1998 p .341). However, Integrating indigenous knowledge into climate change policies can lead to the development of effective adaptation strategies that are cost-effective, participatory and sustainable (Robinson and Herbert, 2001) Adaptation methods are those strategies that enable the individual or the

community to cope with or adjust to the impacts of the climate in the local areas. Such strategies will include the adoption of efficient environmental resources management practices such as the planting of early maturing crops, adoption of hardy varieties of crops and selective keeping of livestock in areas where rainfall declined. Local farmers in sub-Saharan Africa have been known to conserve carbon in soils through the practices of cultivation, mulching and other soil management techniques (Osunade, 1994).

Natural mulches moderate soil temperatures and extremes, suppress diseases and harmful pests and conserve soil moisture. Before the advent of chemical fertilizers, local farmers largely depended on organic farming, which also is capable of reducing GHG emissions. It is widely recognized that forests play an important role in the global carbon cycle by storing carbon (Stainback and Alavalapati, 2002). For Instance, Local farmers in Ghana are known to have practiced the fallow system of cultivation, which encouraged the development of forests. Netting (1993) argued that with population growth, lengths of fallow have been reduced to the extent that the practice no longer exists in certain areas. However, one must not forget that the importance of forests has been recognized by traditional institutions to the extent that communal forest reserves were very common in traditional societies. (ibid, 1993). Besides the fact that these well-managed forests provided food and timber resources to the community, they also served as carbon sinks. It is recognition of the role of forests in climate change that has influenced participants of how forest is very important to fight climate change.

### **2.1.0 Empirical review**

Asante & Mensah (2014) have noted that a review of the holistic literature on climate change and variability in Ghana. This was done by examining the impacts and projections of climate differences on agriculture, health and energy. The findings indicate that there are projections of high temperatures and low rainfalls in 2020, 2050 and 2080 and desertification is projected to be increasing at a rate of about 20 000 hectares per annum. Again, De Pinto et al (2012) also argued that there should be a comprehensive report in the International Food Policy Research Institute on climate change, agriculture and food production in Ghana. The report indicated the effects of climate change on agricultural productivity in Ghana as well as the implications on food security in Ghana as part of the Ghana strategy support program. This affects the farmers in their farming system due to the high temperature they face in the northern part of Ghana.

Additionally, Morton (2007) observed that, a review and conceptual framework on the impacts of climate change on the peasant farmers, smallholder or subsistence farmers in Ghana. The findings from his work state the impact of climate change will be severe in the years to come especially on the smallholder and vulnerable farmers in the sub-Saharan region, however, the impacts will be very hard to predict. Also, Pereira (2017) discussed trends to improve the confidence in the projected impacts of climate change on agricultural systems based on the first Intergovernmental Panel on Climate Change (IPCC) report. This paper included reviews on the strategies to help in climate change adaptation in Africa. Overall, however, the combination of climatic and non-climatic drivers and stressors will worsen the vulnerability of Ghana's agricultural systems to climate change, but the impacts will not be universally felt. Also, Aydinalp and Cresser (2008) argued on the role of human adaptation in response to climate change, possible regional effects on the agricultural systems in Ghana and potential change patterns in food production and prices as well as impacts on food sustainability.

### **2.1.1 Theoretical framework.**

The Theoretical Framework which is adopted by the researcher in the research work is the concept of Political Ecology to analyze and the role it plays in Climate Change which affects Food crops such as Maize in Nyankpala in the Northern region of Ghana. For the purpose of this research am concerned about climate change, so I will use the Political Ecology Approach or

framework to analyze climate change on food crops specifically maize in the Nyankpala community in the Northern region of Ghana.

### **2.1.2. Political Ecology of Climate Change (Understanding political ecology).**

Political Ecology in Agrarian studies plays a very vital role in Climate Change in general. The concept that is used by the researcher is political ecology. For the purpose of understanding the theoretical works of the study, the researcher chose to link the work in the context of political ecology to understand the variables from a political ecology Approach with the definitions from various scholars.

According to Peet et al (2011 p. 1); “Political Ecology examines winners and losers is narrated using dialectics, begins and or ends in a contradiction and surveys both the objective status of nature as well as stories about the Status of nature”. Again Blaikie and Brookfield (1987 p.17) also argued that Political Ecology; “Combines the concerns of ecology and a broadly defined political economy, Together this encompasses the constantly shifting dialectic between society and land-based resources, and also within classes and groups within society itself”. In the context of this study, Escobar (1996, p.325) define “Political Ecology is the study of a relationship between Society and nature in contexts of power.” However, the natural resource that interacts with people, the ecosystem which also influences the environment and the social factors as a whole. For instance, other related issues such as land degradation, air pollution and environmental degradation also lead to the impact of climate change which is also a sign of implication on food crops specifically maize in the Nyankpala community in the Northern part of Ghana in which my research is based on (Escobar,1996).

In other words, Political Ecology is the relationship between the earth, the environment and nature which has been destroyed by human activities such as bush burning, cutting down of trees, soil erosion and so on, Land degradation, changes in rainfall and temperature patterns, and decline of biodiversity which brings changes to societies (Robbins, 2012) therefore the farmers in Nyankpala community have been facing all these challenges with their farming activities. I examine how these farmers cope with the change of weather and Temperature during their farming activities in the Nyankpala district which my case is based on through my research.

### **2.1.3 Chapter conclusion**

The chapter focused on the review of concepts relating to the impacts of climate change and the effects on food security, it reviewed data in detail on the issues of climate change, its mitigation and other relevant topics to the research study in relation to this, the theoretical review of the concepts was from a political ecology perspective or Approach.

## **CHAPTER THREE (3) RESEARCH METHODOLOGY**

### **3.0.0 Chapter Introduction**

The focus of this chapter is to outline the research design used in this study with further aspects including; Sample population, sample size, procedures used in sampling as well and methods employed in collecting data. This chapter also focused on the methods that I will use in conducting this research. It showed the various steps taken to conduct this research in order. The primary methods I used in this data collection are basically and purely qualitative and they include; observation, and interviews. The secondary methods employed in this research work were related literature review from journals, articles, and data from institutions, books and internet sources. This chapter also explained the methodology in detail for this research.

### **3.1.1 Research Methodology.**

The research adopted qualitative research techniques to dissolve and research thoroughly to understand the nature of the problem and propose lasting solutions to the issue of climate change impacts on peasant farmers in Nyankpala and the Northern region of Ghana. Both primary and secondary data were used for the purpose of this study. Strategic methods were put in place, with all efforts aimed at achieving quality results. The researcher intends to use two weeks for the fieldwork and intends to interview 10 farmers. Interviews were to be conducted at the Savanna Agricultural Research Institute to gather relevant information on climate change and maize production in Nyankpala and the Northern region at large, however, only one field and research officer was interviewed due to the activity schedule of the staff at CSIR-SARI. The secondary data will be relied upon as well. Data from the meteorological department and Ghana Statistical Service will be sought to support the data obtained from the field. Analysis of data was done using content and thematic analysis by subjecting the data from the farmers and the official at SARI to analyse and discuss the thematic areas relevant to the research.

### **3.2.0 Research Design**

A research design is usually the main work the researcher follows to come up with solutions to issues and guides of the research. The design of this research employed the use of techniques in all aspects of the research process, from data collection to data analyses and interpretation (Nachamias et al, 2004) qualitative data procedures were used in this research work.

### **3.3.0 Target Population**

Mugenda & Mugenda (1999, p. 3) define a population in “terms of a complete set of cases, individuals, or objects with some similar identifiable features and draws a population frame as an objective list of the population from which the researcher can make his or her selection.” In this regard, the population of this study consisted mainly of the maize farmers in Nyankpala in the Northern region and researchers at the CSIR-SARI. The study population was selected using a purposive sampling technique. “A purposive sampling technique usually involves the hand-picking of subjects based on certain required features that cannot be obtained from other sources” (Taherdoost, 2016 p. 18). In order to get the accurate result of the work the researcher intended to interview maize farmers only.

### **3.4.0 Sample size**

A sample size of 11 respondents was selected for the purpose of this study. According to Walliman (2005 p .5), “Sample sizes larger than 30 and less than 500 are appropriate for most research” in quantitative research, however even less sample sizes can be used for qualitative research works. A minimum of 5 research staff was targeted however only one (1) was actually involved in the research. Luckily the researcher identified an experienced field officer was interviewed to obtain the view/standpoints of the research institute on climate change with my research assistance. This will help balance the data intended to be obtained from the maize farmers in the area.

### **3.5.0 Determining the Sample Size**

According to the findings of Walliman (2005 p. 5), “the appropriate sample size is usually based on a number of accuracy factors dependent on a five-step process”. The first is to determine the attributes and goals to be studied and estimate the size of the entire study population. Another determining factor is the confidence level of 95 per cent confidence level is the standard. The relevant factor is to estimate the degree of variability in relation to how the concept being measured is distributed in the population. Also, another determiner is to estimate the response rate. The response rate in this sense would be informed by previous research conducted within Nyankpala and the Northern region of Ghana.

### **3.6.0 Instruments of Data Collection**

Chaleunvong, (2009) state that, the view of a techniques in data collection allow us together data reasonably on the study subjects; thus, people, objects and on the settings in which they occur. Instruments used for data collection to be used are mainly interviews. Interviews were used to gather data on maize production in Nyankpala from 10 farmers in the area. Interview guides were developed separately to be used to interview researchers from the Savanah Agricultural Research Institute.

### **3.7.0 Data Analysis Techniques**

Data analysis and processing involve studying the acquired information and making a conclusion. Data generated from the field will be qualitatively analyzed by organizing it according to the objectives of this study (Baxter & Babbie, 2003). Data generated from the interviews for farmers and the officials at the research institute will be subject to analysis and subject the data generated to critical content analysis to aid the interpretation and discussions of the data generated and analyzed.

### **3.8.0 Study Location**

Located about 10 miles southwest of Tamale, the capital of the Northern Region in north Ghana, Nyankpala is a town in the Tolon District. There is a campus of the University for Development Studies (UDS) in Nyankpala. The institution had four campuses, with this one being the first to open in northern Ghana until recently the WA and Navrongo campuses were made autonomous. The Savanna Agricultural Research Institute (SARI) of the Council for Scientific and Industrial Research (CSIR), an on-farm station of the Animal Research Institute (ARI), and an on-farm station of the Soil Research Institute are among the significant government institutions based in Nyankpala. , the agricultural sector contributed 18.3 per cent to GDP as against 25.5 per cent industry sector and 56.2 per cent service sector (Ghana Statistical Service (GSS), Citation 2018). However, the agricultural sector’s GDP of the country is low, which affects the sector and the livelihood of farmers with regard to food security and other gains. Tolon District in the Northern Region of Ghana. The district covers a total land area of 2,741 km<sup>2</sup> with a population of 72,990, with 36,360 males and 36,630 females. 75 per cent are farmers who grow crops such as rice, maize, beans millet etc. (GSS, 2012). The area remains the largest (14.2 per cent) which accounts for to agricultural sector to GDP (GSS, Citation2018).

Despite all the major roles, crop productivity in Ghana has remained low. The town is home to a plant for the Avnash rice industry. Students and academics on educational tours have occasionally visited this research institute. Nyankpala is home to a few public Junior High Schools. The Nyankpala District Assembly (D/A) Junior High School was the first to open its doors. Others include Nizamia English and Arabic (E/A) Junior High School, St. Monicas Roman Catholic (R/C) Junior High School, Islamic E/A Junior High School, the Nyankpala Model Schools, and various Primary Schools and Kindergarten. The community has six market days, during market days, traders, students, farmers and government workers troop to the market to purchase groceries and other items. The primary occupation in Nyankpala is mostly into farming where the indigenes farm mostly maize and rice.

### **3.9.0 Validity and Reliability**

A researcher utilizing all approaches during research attempts to establish a good and verifiable type that can be applied to all applicable to the study subjects in the wider population (Winter, 2000). Again, Patton (2001, p. 2) suggests that the methods of a researcher usually involve the “use of standardized measures so that the varying perspectives and experiences of people can be fit into a limited number of predetermined response categories to which numbers are assigned”.

#### **3.9.1 Validity of the instruments**

The validity of data collection instruments refers to the extent to which the data collection methodologies accurately measure what is set out to be measured in the research (Saunders et al., 2003). There are however a number of steps that are taken in the course of the research to ensure the validity of the study. Data was collected from reliable sources, such as farmers who are into maize production in Nyankpala district, and the experienced officials working in the research institute.

#### **3.9.2 Reliability of the Instruments**

The content validity of the instruments will be determined by good results, by ensuring that the extent to which the interview guide captured all aspects of the research questions and objectives (Gatara, 2010). Interview guide was used examined by my research supervisor to get the appropriate forms of questions for farmers, and also determine all the possible areas that needed so as to achieve the desired objectives of the study of my research.

#### **3.9.3 Data Collection Procedure**

The data collection instrument used in this study is the interview guide which was based on the objectives outlined in the research. For the purpose of this research, 10 farmers were targeted and 5 officials from the research institute, however the 10 farmers were met but only one official from the research institute was met during the course of conducting this research. The questions were to be used and in most cases read out by the research assistant and translated to the understanding of the farmer in Dagbanli to facilitate ease and accuracy of data and response.

The interview guides were to be shared and the interview dates with the persons intended to be interviewed, and however, it was to be conducted face to face with the respondent to ensure in any case if available additional data can be obtained which will be done by the research assistant. After the interview, the research assistant translate it into English for the researcher to analyze it as said in my limitations about language barrier in chapter one of the work.

#### **3.9.4 Ethical consideration**

These are methods that are mandatory to be followed by the researcher to bind her in carrying out the research before collecting data (Macmillan & Schumacher, 1993). In this study, lots of ethical considerations were observed, thus, first of all, approval will be obtained from the select respondent before the interviews are conducted. The respondents were assured in the course of data collection that whatever information given out was solely going to be used for the purpose of this research only and as such would be treated with confidentiality.

The researcher doesn't suggest responses for the respondent. This is to ensure that the responses generated were solely of the respondents' choosing and are accurate representations to the best of the respondents' knowledge and ability.

#### **3.9.5 Chapter conclusion**

This chapter has discussed the methods and procedures used in carrying out this research work. It is a study because it examines the method used by the researcher in this case. Other parts of the methodology covered in this chapter were the study population, sample size, sampling procedures, and research instruments. The data generated using these methods detailed above informed the analysis of data, data interpretation, and the presentation of the data as outlined in the next chapter which is chapter four of my research work.



## **CHAPTER FOUR (4) FINDINGS AND DISCUSSIONS**

### **4.0 Chapter introduction**

This chapter presents the findings of the research and presents detailed discussions on the data obtained from the field in the course of carrying out this research. As it was stated in the research methodology, the findings and field data will be analyzed using a particular content to analyse the work. The data obtained from the field were purely qualitative and as such qualitative instruments or techniques were used for the presentation and discussions of the research findings. It was initially stated that this research used the qualitative research design (Bryman, 2004) to explore the issues in question since this approach is most suited to questioning the “how” and “why” questions of research. The issues of how and why climate change is affecting the productivity of maize farmers in Nyankpala in Northern Ghana and sub-Saharan Africa. It is important to highlight the data collection and critical analysis of the study’s literature and other available online data. For the purpose of this particular content analysis used in the data presentation of the findings and for purposes of discussions the work is put into two parts, each part capturing the major themes of the study. Part I of the analysis presents the discussions of the field data from the maize farmers in Nyankpala, Part II also focuses on an in-depth analysis of the field data from the workers, some extension officers and fields at the CSIR-SARI. Each part however presented the data in three themes which are related to the research objectives, thus specific and overall research objectives. The researcher interviewed both Males and Females, old and young and Farmers who are maize farms only in Nyankpala community.

### **4.1 Background information of my Research Assistant**

The research Assistant was contracted to support me in the course of the data collection. He is called Mohammed Nasir-Deen Abdul-Razak. He holds a degree in Social Change Communication from the University for Development Studies and a Masters’ degree in Information Technology. He is experienced and well-versed in interpersonal and intercultural communication, qualitative data collection and research having worked on different projects in different parts of the country (Northern region, Upper East, Upper West, Savannah, North East and Ashanti region). He has worked as a field officer, a project officer, a field facilitator and a programs officer for different organizations including USAID and on different subject matter. He has over the years’ accumulated experience in development work as he knows how to relate to people at all levels of society. He understands and speaks the local language very fluently and as such understood and was able to translate the interview guides in Dagbani to the farmers as well as translate their responding which was later transcribed in English. He was in contact with me from every aspect of the data collection, reporting and giving details as well as taking directives from me. He did a good job in reaching the farmers since the work was conducted at a time when the majority of the farmers were still on their fields. Most of the time, he stayed in the community till late evening to get the farmers to interview them. He did the interviews on my behalf and also reported via “WhatsApp call” and chats on the nature of and patterns of the responses to inform me on what the data analysis trend will look like. He interviewed the farmers in Dagbani, and interpreted the data in English and forwarded to me to analyze and discuss. Because he always engaged me in the course of the data collection, I was able to verify every data he collected during the period. He also gave suggestions and explanations of some patterns which all helped me in the discussions in this chapter.

### **4.2 PART I- Analysis and discussions of field data from farmers in Nyankpala**

To understand the data type used for this research, it is important to note how the data was collected in the field. The researcher conducted field surveys and used a purposive sampling method in identifying the houses and households of some select maize farmers in Nyankpala. The purposive sample was used as per the research aim, objectives and research questions and the key

areas the research sought to examine. The findings of this section can be discussed under various themes.

#### **4.2.1 Decline in Maize and crop production in Nyankpala over the past five years.**

In attempts to examine the decline in crop yield of farmers in the Nyankpala community, there was real evidence submitted by numerous research participants indicating that there has been a significant decline in their crop yields. For example, data from one respondent has it;

“Yes there are a lot of changes and even though the value of money keeps changing, we usually could harvest up to 40bags from 3-acre farms, now to harvest 20 bags on a 4-acre farm is something near impossible, especially for maize” (Field data, R1, 1st September, 2023).

From the data indicated above, there is a significant decline in the productivity and production of the farmers in the area. If farmers in this locality could harvest about 40bags of maize from their 3-acre of land and now cannot get close to 20 bags on even 4-acre plots, it means there is a significant decline of more than 50 per cent in the maize production as per the data given from this research participant in the field survey. According to Jones and Thornton (2003) discuss in their research works a decline in maize yield in Africa and Latin America by about or over 10 per cent. As per the data presented earlier, a research participant demonstrated that the local farmers in Nyankpala run through the old and traditional methods of farming are already currently experiencing close to and about a 50 per cent decline in the year 2023 which is very bad and alarming and also calls for the necessary interventions to sustain their livelihoods as well as lead to sustained increased agricultural outcomes leading to food security in the area. According to the work of Jakpa et al. (2019), climate change in the Tolon district where Nyankpala is located has affected the crop yield of farmers and has led to increased atmospheric temperatures, and decreased rainfalls which consequently accounts for the rapid and rampant decline and decrease in crop yield and productivity in Nyankpala, in Tolon district, the Northern region, Ghana and sub-Saharan Africa at large.

Again, data from another respondent indicated;

“Economically, it affects us, since we do not get much revenue from the same activity that consumes much of our time, it is worrisome” (Field data, R2, 1st September 2023).

Indications, from the data presented above, it is also important to read a deeper meaning into the words of the respondent to generate the literal meaning from the data. The research participant indicated that there has been an economic effect on the maize farmers which makes the income from their farming activities not good for them. This means the amount of money they previously made from farming, they do not make close to what they initially made in the subsequent and previous years. From the data above, it is also relevant and worth noting that, the research participant indicated that the farmers in Nyankpala are worried about the severe effects of climate change which has led to a major decrease in their maize production.

Other data in relation to the theme of the decline in maize production in Nyakpala is that;

“The crops don’t grow well, hence the yields are very terrible” (Field data, 2023, R3, 1st September 2023)

Indications, on the same subject matter, other data from the research participants indicated that;

“Yes, it has reduced our crop yields” (Field data, 2023, R4, 1st September, 2023)

Also, another farmer in the area, when asked about crop yield and whether there has been a decline in their production due to the weather changes, the respondent presented that;

“It’s just that there are no rains at some point when it is supposed to rain which makes the maize not to grow well that is our major challenge now” (Field data, 2023, R5, 1st September, 2023)

From the data presented above, and others in the research, it is an indication that substantial evidence is required to understand the current rainfall trends and patterns, that have declined crop yield in the research or study area. R3 indicated that the weather change has made the crops unable to grow well, which translates to poor fruiting and terrible yields for the farmers

in Nyankpala. Also, R5 stated briefly that rainfall is the major challenge faced by (them) farmers in the area is inadequate rains which leads to the decline and poor maize yields.

From the data above, it is evident and from other data sources that the major causes of the declined crop yields are; inadequate rains affecting the planting season, inconsistent rainfall and also, and farmers sticking to or using the old or traditional farming methods. These are the factors accounting for the decreased crop yields in Nyankpala, one respondent explained in detail; “Yes, we have very short rainy seasons currently because at first, serious rains started early March to November or October ending but now there are no serious rains which come after April and ends earlier too” (Field data, 2023, R6, 1st September, 2023).

The data above indicates that the change in climate has made the planting seasons quite shorter since initially or years back the rains started earlier and extended over a period which gave the farmers the liberty to ensure their maize crops are watered enough and that the time period is just adequate to ensure enough and suitable water levels for the maize crops. Certainly, this decline could be one of the important measures affecting maize yield in the Nyankpala community. It is worth noting, that the data presented above explains and examines deeply into why and how climate change has led to decreased crop yields in the area. Also, farmers sticking to old farming practices, as is noted in;

“...because we are using the old methods, we don’t see any new things, except for the fact that the weather changes affects us a lot” (Field data, 2023, R6, 1st September, 2023).

“We are still using the old or traditional methods of growing maize and it is for this that the majority of us have very bad yield, I think the best thing to do is to adapt to the new farming technologies, adopt the new species they plant, I’m told that one can withstand fewer and more rains and also matures quickly but we don’t have any idea of how to do the new method for it to withstand the changes of rainfall and Temperature” (Field data, 2023, R6, 1st September 2023)

The method of farming, the reluctance of the government and the inability of farmers to advance their production and agricultural methods by adopting modified and modern farm inputs such as seeds, fertilizers and other inputs to boost their yield is another contributing factor to the decline in the production of the farmers in the area. Farmers are unable to adopt these new farming methods because of their low earnings against the high costs of these inputs and no government support or intervention to fix for the farmers with the recent removal of subsidies on agricultural inputs and fertilizer could account for this significant and persistent decline in maize production in Nyankpala.

#### **4.2.2 The effects of climate change on the quality of life of peasant farmers**

This section examined critically the data of the research participants on the effects of climate change on their lives. This was to examine whether the change in climate had led to a negative or positive impact on the lives of the maize farmers in the area. In attempts to examine this, it is quite important to present the responses of the maize farmers and how they interpreted the effects of climate change on the quality of their lives. This is looked at from two perspectives, whether climate change had a positive impact on the quality of their lives or whether it had impacted on them negatively. To discuss further, relations are made to the data. Data from one respondent showed that;

“It has affected the yield of our farms and as such has reduced the income that we previously earned together with the decreased value of our currency, what we earn now is just nothing to sustain us and our families” (Field data, 2023, R8, 1st September 2023).

From the data presented above, climate change has greatly impacted on the lives of farmers living in Nyankpala. In trying to understand “how” climate change has impacted on the lives of these farmers, it is quite clear and evidently stated that farmer's earnings are seriously on a decline in their maize production which comes together with a depreciating of the country’s currency, it makes their earnings insufficient and inadequate to take care of their families. Also, another respondent showed that;

“... the armyworms that attack our maize crops, initially they were not there, they just came into existence recently and have caused so much damage to our crops, because, in seasons where your maize yields are very well, they attack and spoil all the crops due to a lot of heat when it hasn't rain in this side of the region” (Field data, 2023 R1, 1st Sept 2023).

Climate change (weather changing) according to R1 has affected the activities of farmers very much including bringing about new pests and diseases that were initially not known to them. A typical example given was the army worms that attacks the maize crops and has also led to the possible decline in production by these farmers. Additionally, another data has it this way, indicating;

“Yes. It has reduced the amount of money that previously came into our pockets” (Field data, 2023, R8, 1st September, 2023).

Due to climate change, the maize farmers in Nyankpala have a reduced earnings which as a result of the reduced yields and their inability to cope or adopt modern agricultural and farming inputs to boost their yield, it has translated and further exacerbated, widened and increased the poverty levels faced by the farmers in Nyankpala.

Another data from the research participants, has it that

“Its just monetary, since we do not have other sources that gives us much money, our reliance is on our farms” (Field data, 2023 R9, 1st September, 2023).

The data presented above, reiterates the fact that the major problem climate has brought upon farmers in Nyankpala is monetary problems. This means it has created financial difficulties and challenges to the farmers which in reference to the above, is from the inconsistent and short rainfall patterns which has further led to decline in maize yield making farming unattractive and unsustainable since the produce the farmers harvest are inadequate to cater for their basic financial and other needs. To add to this, another research participants' data, has it this way;

“As a farmer, without enough rains, it means you wouldn't get good yield and that means you will not generate enough revenue and might even run at lost because these days looking at farm inputs alone, the cost is scary, you invest so much in a farm only to not get a good yield, that is very worrisome and frustrating, we have other things we do to support ourselves but some people are just unable to cope with it” (Field data, 2023, R10, 1st September, 2023)

In examining the data above, it is relevant and worth noting the sequential arrangements of the effect of climate change on the livelihood and quality of life of farmers in Nyankpala. The research participant highlighted that without adequate rains, their yields are declining, this then means a decreased revenue level and also comparatively considering the prices of farm inputs and other cost of farming maize the situation is depressing since majority of the farmers in this brackets are in able to cope with the rising stress, cost and prices of implements as against decreased and declined maize yields. This affects their purchasing power hence reducing the quality of life of the farmers in Nyankpala.

Also, on this thematic area of the effects of climate change on the quality of life of farmers in Nyankpala, it is worth noting this, from one of the research participants;

“With regards to our farming, I can assure you it has affected every farmer, especially those of us who are uneducated and without any special skills in agriculture who are just sticking to the traditional farming practices, it has affected us so much. Our income levels have dwindled so much over time” (Field data, 2023, R10, 1st September, 2023).

From the inputs of this research participant, it is clear that there is a direct impact of climate change on the quality of life of the maize farmers. The data showed that climate change has effected every farmer but has immense effect on the uneducated farmer who are still utilizing and sticking to the old and traditional methods of farming maize. They sow using grains stored from the previous harvest years, without treating or adding value to these grains they tend to germinate poorly, grow over longer periods and do not fruit and mature well. In spite of this, the farmer is affected to core with even the gravest and severest of effect being felt by the uneducated and

unskilled farmers who are unable to adopt new farming practices, this makes their yields very poor and also their earnings from their produce reduced drastically. This has a symbiotic and very direct relationship with the farmers' quality of life, since their earnings determine their purchase power and ability to survive over time. So, where these earnings are and keep decreasing and falling over time, the effect of it is the increased poverty levels and low quality of life of the maize and subsistence farmers in Nyankpala.

Having explored the theme of the effects of climate change on the quality of life of the farmers in Nyankpala, it is quite important to understudy the interventions of the government and the knowledge levels of maize farmers on the issue and subject of climate change. This will help in the assessment of the overall knowledge and information as well as support and policy interventions of the government of Ghana and how this is affecting the productivity of farmers in Nyankpala. Are there any policy interventions by the government of Ghana on the issues of climate change mitigation and adaptation whether the maize farmers in Nyankpala are aware of these policy interventions and how the interventions has affected the productivity of the maize farmers in Nyankpala are pertinent and important issues to resolve.

#### **4.2.3 Policy interventions by the government of Ghana on climate change mitigation and adaptation issues.**

This research work is premised in the context of political ecology. Political ecology as explained in the earlier chapter combines the concerns of ecology and the broad definitions and issues in Political economy (Blaikie and Brookfield, 1987). In spite of this, it is pertinent to assess the issue of climate change which is a concern of ecology and the broad issues of political economy focusing on the power structure, relations and dynamics of the production, reproduction and distribution in the country. It is because of this, the study examined the policy changes/interventions by the current and past governments on climate change adaptation, and mitigation strategies. From the data generated from the research participants in the course of the research, it is worth noting key information given on the issues of government interventions. For instance, one research participant stated briefly and concisely that; "There is a government policy like that? Well, we do not care much about the government because whatever they do is not for our common good but for their own benefit" (Field data, 2023, R10, 1st Sept 2023).

This response from one of the farmers speaks volumes about the general plight of the marginalized population as they have developed apathy and do not even care about government policies, initiatives and interventions. The above showed the participant was not even aware of any government policy intervention on mitigating and reducing the impacts of climate change on the agricultural productivity of farmers in Ghana at large and not just limited to maize farmers in Nyankpala. This statement and several others postulate the inability of the Ghanaian government to protect the interest of the general population and the interest of farmers and growers who are actually feeders of the nation. Despite the fact that, agriculture has been and still remains the backbone of the Ghanaian economy, previous, past and present governments have shown no interest in the sector. Thus, they have shown no interest to protect the interest and livelihood sources of farmers, and this has as well led to the regression of farming in the rural communities, making sustainability and sustenance a major problem faced by the average farmer in the region. Is this applicable to other rural areas and countries? A question that can be explored in other research works.

Consequentially, another research participant has it this way;

"Yes, the government has very good policies on paper but in reality they do not consider we the farmers when implementing any policy, they do what will benefit them" (Field data, 2023, R9, 1st September, 2023)

The data showed that the Ghanaian government has very good policies drafted or written and approved but the reality is they are not applicable and practical. This farmer demonstrated

knowledge on the awareness of some government policies meant to protect farmers against the vagaries of the weather and of climate change, however the data suggested the research participant is only aware but not reaping any real benefits from the government interventions or policies. Indicating that, the government doesn't consider the farmers or people at the grassroots when drafting or implementing policies but are only concerned about what they will harvest into their pockets. This equally accounts for the apathy these farmers and people living in the rural communities have developed towards the government. To understand these issues itemized clearly, it is important to cross reference and examine other responses given by the field participants and what they are pin pointing to.

Additionally, the data from another research participant shows;

“Yes, we are aware of the government policies but they're just “white elephants” since they mean nothing to us” (Field data, 2023 R8, 1st September, 2023).

This data as well sides with the other data previously extracted and discussed under R9 and R8. This shows the farmer is unequivocally aware of the policies and government interventions, however, it doesn't mean anything to the farmer since in the statement, the farmer referred these government policies as “white elephants” meaning useless or wasted interventions. The reasons for using this term could be enormous, ranging from the issue of the policies being centralized, possibly the policies are passed to only reap the benefits on areas or international grants available to the government. Or even erstwhile the policies could be good policies rolled out to support the farmers but probable the benefits are not even, widely or adequately spread across the country.

Also, another data indicated that;

“Yes, modern interventions and others but they are favoring some farmers and not all of us, so in most cases you will ask someone and the fellow might say they are not aware of what that is” (Field data, 2023, R7, 1st September, 2023).

From this extract, the participant indicated his awareness of government policies available to support farmers and prevent them from the tremendous and harsh effects of climate change. The participant noted the government policies and interventions were however favoring some farmers and not all farmers. This was because in most cases, just as represented in the data, most farmers are not even aware of the existence of such a policy by the government. In any case where they are unaware of the policies of the government whenever and wherever they are asked about these interventions they will most definitely deny knowing there are such policies, since in most cases the interventions are centralized and the benefits are not evenly spread across and felt by the farmers in the rural areas such as Nyankpala and other typical farming communities.

“Yes, just that we don't benefit from any of those policies, they have increased the price of weedicides and fertilizers” (Field data, 2023, R6, 1st September, 2023)

As per the data given above by R6, a farmer and also a key research participant as the research is centered on the effects of climate change on the productivity of these maize farmers. The data postulates however that, the farmers in general do not benefit from the government interventions and policies of the government. How so? If the policies are supposed to be centered on the activities of these farmers to ensure they are protected and also have and yield the maximum benefits of maize farming as well as contribute their quota to feed the nation and also sustain their families, households and contribute to national food security in the country. Has the policy achieved its aim? Not according to the data provided by this research participant, and despite being aware there are government policies that are supposed to protect the farmers against the effects of climate change, this farmer as well is quite affirmative that the intervention has not in any way favored the maize farmer in Nyankpala.

The research participant indicatively talked about issues of increase in prices of weedicides and fertilizers which are as a result of the removal of government subsidies on these agricultural and farm inputs. Has this really helped or hurt the farmer? It is clear from data evidently that the removal of subsidies on farm inputs and fertilizers is a contributing factor to the decline in maize

yields and also the decline quality of life enjoyed by maize farmers in Nyankpala and the rural communities in the Northern region of Ghana.

“No, the government hasn’t done anything, and even the subsidies that were on fertilizers and weedicides have been scrubbed off, what at all have they done for farmers? It is only noise they are making” (Field data, 2023, R5, 1st September, 2023)

Another study participant showed the government has not done anything in regards to the effects of climate change on farmers and agriculture. This respondent as well reiterated the issue of removal of subsidies on fertilizers and weedicides indicating that the government has not brought any intervention or policy to protect the interest of farmers especially small holder farmers against the severing impacts and negative effects of climate change, environmental rise in temperatures and also decreased rainfalls as experienced in most parts of Ghana and sub-Saharan Africa.

“Yes, we are aware, this Genetically Modified Species like I said is helping some of us, others’ too find it too expensive” (Field data, 2023, R4, 1st Sept, 2023)

From this data above, the respondent affirmed awareness of the government policies and interventions to mitigate the severing impacts of climate change on farmers. Also indicated that it is helping some of them, this statements shows this farmer has adopted either fully or partially the new farming inputs and farm implements on his maize farm. The respondent however, indicated that the high cost of these inputs is still making it quite difficult for some maize farmers to adopt these new and modern implements in and on their farms.

“Yes, we hear there are policies on this and that but we do not feel the real impact in our lives, it seems everything is at the top there” (Field data, 2023 R3, 1st Sept, 2023)

This respondent indicated there are indeed government policies and interventions in the country supposed to protect farmers and their farming activities against the impacts of climate change. However, the farmers have only heard but do not feel the real impact in their lives, indicating the interventions might be centralized and only at the top level government, or either concentrated in the big towns and cities where agricultural and farming activities are even quite low.

“Is it the planting for food and jobs or which policy? Government is not doing anything to help farmers” (Field data, 2023, R1, 1st September, 2023).

Lastly, on the data about the interventions and policies of the government to protect the farmers against the effects of climate change, it is quite evident that the respondent showed apathy to this question, rhetorically asking if the policy meant is the “planting for food and jobs”. The research participant highlighted quite clearly that the government is not doing anything to help the rural farmers and that their focus is not on the farmers. Hence there are no government policies and interventions known to them that are indicatively to protect the interest of farmers as well as prevent them from the negative consequences and effects of climate change.

#### **4.2.4 Climate change adaptation strategies by governments and individuals**

The final thematic area under discussion in this section is the climate change adaptation strategies rolled out by governments or practiced by individual farmers’ on their respective farms. This indicatively is to understand what adaptation strategies or measures are put in place and utilized by either governments or farmers in the fight against climate change. In spite of this, respondents were asked the whether they are adapting to climate change either by adopting modern farming practices, farm inputs and implements and also whether there are other adaptive strategies adopted or implemented by the government which has helped combated or in combating the issues of climate change. For this purposes of this discussion, extracts from the data from research participants indicated;

“No, we are sticking to the regular farming practices, we have heard about these new seeds but they are quite expensive, though those maize crops mature within a very short period” (Field data, 2023, R1, 1st September, 2023).

The response generated herein this data, as indicated by the research participant or maize farmer in Nyankpala indicated that there were adaptive practices however that were the adoption of new and modern methods/farm practices. However, the farmers in Nyankpala, per the responses given have heard of and are aware of the adaptation methods to combat the effects of climate change. However, the farmers are sticking to their regular or traditional practices, why? Because the new farming practices are expensive though these crops mature within a shorter period as compared to the traditional seedlings/seeds used by the farmers in Nyankpala. A typical example is the genetically modified organisms or seeds which are proposed as resistant to short-term droughts, and inconsistencies in rainfall patterns and have the general ability to withstand any weather condition.

Additionally, the data from R2 indicates;

“No, we are just using the known/old methods” (Field data, 2023, R2, 1st Sept, 2023).

The data above indicated the knowledge gap of these farmers on the new or adaptive farming methods that are proposed as solutions and adaptive strategies to mitigate the problems of climate change. This is a general solution which has been tested and proven effective, in spite of this, it is recommended that the farmers in Nyankpala be trained on the modified species as well as the importance of modern best practices in agriculture.

“Yes, we are using new modified species, and it has even helped our farming activities because those of our neighbors sticking to the old farming still have very poor yield and though some of us use the modified species we still experience decline, those using the old methods don't get any better yield” (Field data, 2023, R4, 1st September, 2023).

The responses of this farmer indicates they have adopted the new farming inputs and implements, and the modified species has helped their yield. The data indicated that the farmers who are stuck with the old methods of production are still having very poor yields. As per this response, the farmers where they adopt the news and best farming practices are equally adopting adaptive measures and strategies to combat the effects of climate change. The new methods could include, new ways of controlling weeds and pests, new ways of fertilizing their lands using the requisite inorganic fertilizer components which provides the crops with the nutrients needed in their right proportions to boost the crop growth, yield and most importantly increase the harvests of the farmers. Out of the 10 farmers interviewed, only one has adopted the new farming methods and another has partially adopted the new farming practices. The rest of the farmers are stuck with the traditional methods of farming, ploughing their fields, weeds and pest control, fertilizing their lands and all other farming processes from the planting to the harvest of their maize crops. This could probably account for the general overall decline in crop production and also the reasons why the impacts of climate change are felt severely by the rural area farmers and farmers in Nyankpala.

The farmers' data conclusively indicated that, there has been a consistent decrease in the yield of maize farmers in Nyankpala, and this can be attributed to factors such as inadequate government interventions and policy to protect farmers against the effects of climate change. The data demonstrated as well that the cost of modern agricultural practices, farm inputs and implements herein known as climate change adaptive practices has also been the reason for the slow adoption of new or modern farming methods. Another key note from the data is that; the yield of majority of the farmers is declining because they are stuck with old methods or farming practices. The data indicated that the farmers who have adopted fully (1) and the partially (1) are getting better yields and as per the data given, they agreed on the high cost of these inputs, but as well demonstrated their efficiencies as the have better yields.

#### **4.3 PART II- Analysis and discussions of field data from CSIR-SARI workers**

Another important component of the findings and discussions was the presentation and discussions of the data generated from the interviews conducted with the agricultural and research (extension) officers at SARI, due to time constraints, only one field officer was interviewed during



the process. The organization was selected because of their contributions to soil science research, crop, agronomy, plant breeding and investigating suitable crop genetic for the weather and climate conditions in Nyankpala, Northern region and the nation at large. The organization is very successful in coming up with new and adaptive crop varieties including maize varieties that are resilient and are able to withstand the current unfavorable climatic conditions. The thematic areas under discussions with the farmers at SARI include;

#### **4.3.1 Contributions of CSIR-SARI to maize production in Nyankpala.**

As per the data from the officer at SARI interviewed, the data has it that; “This is a very huge question, but I will say for instance the institute is researching on the most resilient crop species that can be planted and mature within a short period and can as well be used within the typical rural content. So our research is focused on seedlings with resilience and all that, but other times we engage some farmers on our fields to help in the farming activities, the smart ones among them pick up some of the practices we implement on our farms which are sure best practices and replicate them on their farms. So yes indeed we are contributing to mitigating the impacts of maize production, not just in Nyankpala but in the region and the country at large” (Field data, 2023 QR1, September 8th, 2023).

Per the data given by the field officer, the data showed that the CSIR-SARI is into a study to come up with a more resilient crop species that can stand all weather, and take shorter periods to mature to ensure the inconsistent and short rainfalls in the north does not affect the maize crops as much. And also crops that can withstand weather and temperature change as well as yield or fruit better than the current existent crop varieties. Additively, the data postulates;

“Like, I said we are still on course and whatever we come up with will be very operational in a variety of contexts because our research are across different soil types to ensure suitability for different localities. This will ensure a wide range of operationalization and adaptation of the new breeds by SARI” (Field data QR1, 8th September, 2023).

The data showed that the efforts of the research institute includes and is not only limited to development of new species but also on the operationalization of the new species in varied crops and soil types to ensure the varieties can be used across a wide range of soil type.

#### **4.4 Chapter conclusion**

This chapter succeeded in discussing the findings of the research study and also, listed and presented the data in two parts, data from the farmers in Nyankpala and also from the staff of the CSIR-SARI. The next chapter of this study concludes and proposes research recommendations based on the findings of the research, thus from the farmer's data and information sought from the research participants.

## CHAPTER FIVE (5) CONCLUSION

### 5.0 Chapter introduction

The research study set out to examine the effects of climate change on the productivity of farmers in Nyankpala. As part of this general objective, was to access the effects of climate change on the quality of life of farmers in Nyankpala and to access the knowledge gaps and also policy and government interventions to mitigate the impacts of climate change on the agricultural, crop or maize productivity of farmers in the area.

### 5.1 Conclusion

The major findings of the research included but is not limited to a consistent decrease in the yield of maize farmers in Nyankpala, and this can be attributed to factors such as inadequate government interventions and policy to protect farmers against the effects of climate change. The data demonstrated as well that the cost of modern agricultural practices, farm inputs and implements herein known as climate change adaptive practices has also been the reason for the slow adoption of new or modern farming methods. Another key note from the data is that the yield of majority of the farmers is declining because they are stuck with old methods or farming practices. The data indicated that the farmers who have adopted fully and the partially are getting better yields and as per the data given, they agreed on the high cost of these inputs, but as well demonstrated their efficiencies as they have better yields. The study also revealed however that, there was a growing insect and worm infestation of the maize crops among peasant farmers in Nyankpala. The data indicated and from the officer at the CSIR showed consistency indicating why there was a continuous decline in agricultural productivity among farmers in Nyankpala, indicating that their inability to cope or adapt new farming technologies, farm inputs, farm implements and other agricultural practices but heavy reliance on the traditional practices and outmoded farming methods has thus affected grossly their crop yields.

*“Yes there are a lot of changes and even though the value of money keeps changing, we usually could harvest up to 40bags from 3-acre farms, now to harvest 20 bags on a 4-acre farm is something near impossible, especially for maize” (Field data, R1, 1st September, 2023).*

Indicatively, on issues of the maize yield decline, according to the facts presented above, the area's farmers' productivity and output have declined significantly. According to the data provided by this research participant in the field survey, if farmers in this locality could harvest about 40 bags of maize from their 3-acre plots and now cannot get close to 20 bags on even 4-acre plots, there has been a significant decline of more than 50 percent in maize production. Furthermore, Jones and Thornton (2003) describe in their research works that 10percent or more loss in maize output in Africa and Latin America. According to the data presented earlier, a research participant demonstrated that local farmers in Nyankpala using old and traditional farming methods are already experiencing close to and around a 50 percent decline in the year 2023, which is very bad and alarming and also calls for the necessary interventions to sustain their livelihoods as well as lead to sustained increased agricultural outcomes leading to food security in the area.

Government interventions are weak, though existent have not met their true purpose of establishment. The interventions are not serving those Farmers, it should be serving the farmers, the poor, the marginalized and those unable to adapt to new farming methods. These people should be the center of government policy and intervention, as it will go a long way to increase their sustenance, improve their livelihood and also contribute to food security not only in their geographical areas but in the region, Ghana and the sub-Saharan African region at large. From the data, one of the research participants has it this way;

*“There is a government policy like that? Well, we do not care much about the government because whatever they do is not for our common good but for their own benefit” (Field data, 2023, R10, 1st Sept 2023).*

This indicates the level of empathy developed by the masses or the local people living in rural communities towards the government of the day and their policies. They intend to live without caring about the policies that are existent because they do not in any way benefit from the policy interventions that are targeted at mitigating the impacts of climate change as well as prevent the vulnerable farmer against the weather and rainfall patterns. Adding to that, another participant indicated that;

*“Yes, just that we don’t benefit from any of those policies, they have increased the price of weedicides and fertilizers” (Field data, 2023, R6, 1st September, 2023)*

The data presented showed that the people or farmers of Nyankpala do not get any benefits from the government and the policies the government forms. The data from R6 indicated clearly that the government does not protect the farmers of Nyankpala and they have increased the prices of weedicides and fertilizes. The high cost of goods is also another reason why the farmers have not been able to increase their production and scale up to produce more.

*“Like, I said we are still on course and whatever we come up with will be very operational in a variety of contexts because our research are across different soil types to ensure suitability for different localities. This will ensure a wide range of operationalization and adaptation of the new breeds by SARI” (Field data QR1, 8th September, 2023).*

The data above from QR1, indicated the research institute is researching and developing new varieties to mitigate the harsh weather and also be able to withstand drought and other harsh conditions. In as much as there are growing challenges, institutions, individuals and the government are making efforts to reduce the effects of climate change. However, are there any results? Where are we headed? This calls for serious efforts to be made towards the mitigation of climate change.

*In conclusion,*

There is the need for the government to scale up activities that are intended to protect the farmers. This will ensure that their livelihoods are sustained, their incomes are improved and stabilized. Additionally, development practitioners, NGOs and partners should complement the efforts of the government to ensure institutional strengthening and accountability of the various government departments in agriculture related sector to ensure that maize production is enhanced and the farmers are empowered to withstand and trained on mitigating methods to combat the effects of climate change. Some of the studies’ recommendation are enlisted in the next section.

### **5.3 RECOMMENDATIONS**

As per the data provided, there is a need;

- For the government of Ghana to increase and enhance interventions as well as strengthen institutions responsible for implementing these interventions to ensure that the purposes for which the interventions and policies were made meet their purpose.
- Additionally, more research should be conducted on the gender disparity examining the income levels and effects of climate change on the agricultural production, earnings, income levels, and quality of life of farmers comparing the quality of life between men and women living in the same locality or farming community.
- Extension officers should take their outreach duty seriously, since they reach out to the farmers in the local communities to educate them, inform and train them on best farming practices and new or modern farming methods.
- Development practitioners should focus on developing the capacities of local farmers who are still stuck with indigenous agricultural practices to ensure their livelihoods are improved and sustained.
- There should be a linkage of agricultural institutions to the local communities to educate, train and implement with the local farmers new agricultural and enhanced methods of production, soil fertilization, weedicides and pesticide control to maximize the productivity of these farmers.

### Appendix 1: Data of Participants

SN	Name	Code	Age	Identifies (SEX)	Occupation	Interview Date
1	Alhassan Awudu	R1	49	Male	Farmer	September 1 <sup>st</sup> , 2023
2	Pagnaa Sumaila	R2	43	Female	Farmer	September 1 <sup>st</sup> , 2023
3	Ahmed Ismail Tanko	R3	57	Male	Farmer	September 1 <sup>st</sup> , 2023
4	Radiatu Alhassan	R4	30	Female	Farmer	September 1 <sup>st</sup> , 2023
5	Anamzooya Kpabiya	R5	37	Male	Farmer	September 1 <sup>st</sup> , 2023
6	Wumbei Abdulai	R6	60	Male	Farmer	September 1 <sup>st</sup> , 2023
7	Ibrahim Tipagya	R7	45	Male	Farmer	September 1 <sup>st</sup> , 2023
8	Inusah Fatawu	R8	48	Male	Farmer	September 1 <sup>st</sup> , 2023
9	Salima Muktaru	R9	40	Female	Farmer	September 1 <sup>st</sup> , 2023
10	Mohammed Nyab' Biyoona	R10	55	Male	Farmer	September 1 <sup>st</sup> , 2023
11	Emmanuel Ampofo	QR1	48	Male	Field & Research Officer, SARI	September 8 <sup>th</sup> , 2023

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