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Climate Change and Food Security in Borno State North Eastern Nigeria

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ABSTRACT

Climate change poses a significant threat to global food security affecting food availability, access and utilization. This study explores the impacts of climate change on food security focusing on two key objectives: Assess the effects of climate change on food availability, Identify strategies for enhancing climate resilience in food system. Though a comprehensive analysis of climate impacts on crop yield, food production, and distribution. This research reveals the complex relationship between climate variables and food access and food security. The study also identifies promising strategies for promoting climate resilience agriculture, improving food access. And supporting vulnerable communities and ecosystem. The findings of this research can form policy development aimed at addressing the pressing of climate change and food security.

Keywords; Climate change, Food security, Food availability, Food access, Crop yield and Food production

INTRODUCTION

Climate change has emerged as a critical global issue, sparking widespread concern due to its far-reaching implications [1]. Since the pre-industrial period, human activities especially those driven by economic development and population growth have significantly increased the emission of greenhouse gases. As a result, the levels of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) in the atmosphere have reached unprecedented levels not seen in over 800,000 years. These gases, alongside other human-induced factors, have been consistently linked to changes across the climate system and are considered the primary cause of the global warming observed since the mid-20th century [2]. Among environmental scholars, climate change remains one of the most intensely debated and researched topics. Growing concern over the shifting patterns of global climate has captured international attention. In simple terms, climate refers to the long-term weather conditions of a specific region, characterized by atmospheric elements such as solar radiation, temperature, humidity, and rainfall over extended periods. When these long-term averages or their natural variability shift significantly, the phenomenon is referred to as climate change. The present-day climate crisis is largely attributed to the intensified greenhouse effect, primarily caused by human-induced increases in greenhouse gases and aerosols that directly impact atmospheric conditions [3]. Greenhouse gases are responsible for trapping heat in the Earth's atmosphere a process that maintains temperatures suitable for life. However, human activities such as industrialization and large-scale agriculture have increased the concentration of these gases beyond natural levels, intensifying the greenhouse effect. This escalation has led to a noticeable rise in average global temperatures, commonly referred to as global warming. Activities like burning fossil fuels (coal and oil), deforestation, and industrial emissions have all contributed to the heightened levels of CO_2 in the atmosphere. Additionally, man-made compounds such as chlorofluorocarbons (CFCs), used in various industrial applications, have further damaged the ozone layer, thereby exacerbating global warming [4]. Agriculture plays a vital role in food security in two key ways: it directly produces the food people consume and, importantly, it provides the primary livelihood for 36% of the global workforce. In regions like Asia and the Pacific, the proportion can range from 40-50%, and in sub-Saharan Africa, about two-thirds of the working population rely on agriculture. If climate change negatively impacts agricultural production in low-income developing nations in Asia and Africa, the livelihoods of rural populations will be at risk, and their vulnerability to food insecurity will increase. Agriculture, forestry, and fisheries are sensitive to climate, and their production processes are expected to be impacted by climate

change. While temperate regions may benefit from higher agricultural yields, tropical regions are likely to face adverse effects. However, the precise impact at the local level remains uncertain and could be influenced by the adoption of risk management measures and adaptation strategies that enhance resilience and preparedness. Changes in agricultural production patterns will have two major effects on food security: Impacts on food production will affect food supply at both global and local levels. Higher yields in temperate regions could offset lower yields in tropical regions, but for many low-income nations with limited financial resources, these declines in local food production may result in increased reliance on food aid. Changes in agricultural production will also affect livelihoods and access to food. Rural poor communities, particularly in developing countries, may struggle to adapt to climate change, compromising their safety and well-being. Furthermore, the entire food system, including food processing, distribution, acquisition, preparation, and consumption, is just as crucial to food security as agricultural production. Technological advancements and global food distribution systems have made food security less dependent on climate than it was centuries ago. However, increasing severe weather events could disrupt food supply chains due to damage to transport and infrastructure. Additionally, the rising cost of energy and the need to reduce fossil fuel consumption are leading to a reevaluation of "food miles" the distance food travels from production to consumption minimizing emissions. As a result, local responsibility for food security may become more important, especially for vulnerable populations, which must be considered when developing adaptation strategies. The projected increases in temperature and precipitation will not occur gradually but rather through more intense and frequent hot spells and rainfall events. While the global average temperature is expected to rise, the distribution of precipitation will be uneven, with wet regions becoming wetter and dry areas experiencing more droughts [5]. The most recent report by the Intergovernmental Panel on Climate Change (IPCC) reaffirms previous conclusions regarding the progression of climate change and its primary physical effects such as rising land and ocean temperatures, sea-level rise, and increased ocean acidification. Additionally, the report enhances our understanding of potential regional shifts in precipitation patterns, including changes in intensity and seasonal timing. Advances in climate modeling, as well as improvements in data collection and utilization, now allow for more accurate medium-term projections at localized levels. These advancements are essential for assessing the potential impacts of climate change on agricultural systems with greater precision. As emphasized in the latest IPCC synthesis, the interconnected impacts of climate change can now be traced through evidence chains from physical climate phenomena to ecological systems and ultimately to human populations [6]. The study therefore, seeks to assess the effects of climate change on food availability in Borno, State, Northeastern Nigeria.

METHODS AND MATERIALS

The study used mixed method research design, incorporating both qualitative and quantitative approaches to gain a comprehensive understanding of the topic.

Study Area: the research focus on Mungono local govern area of Borno state north eastern Nigeria.

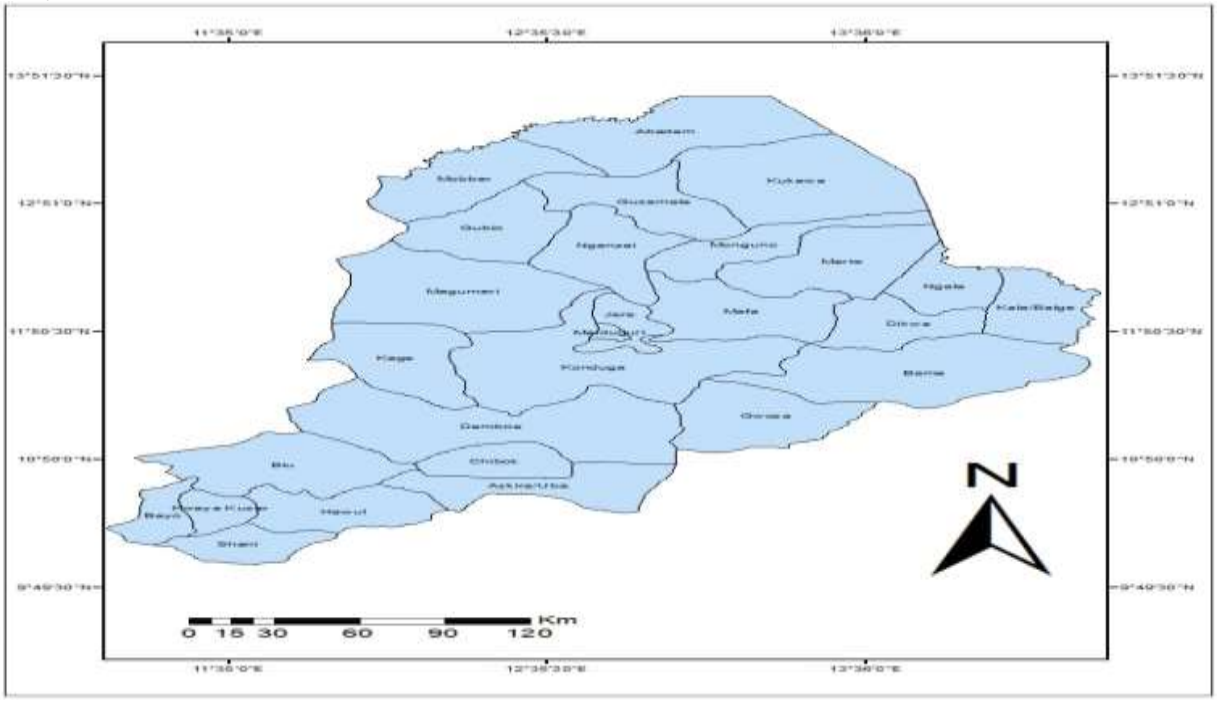


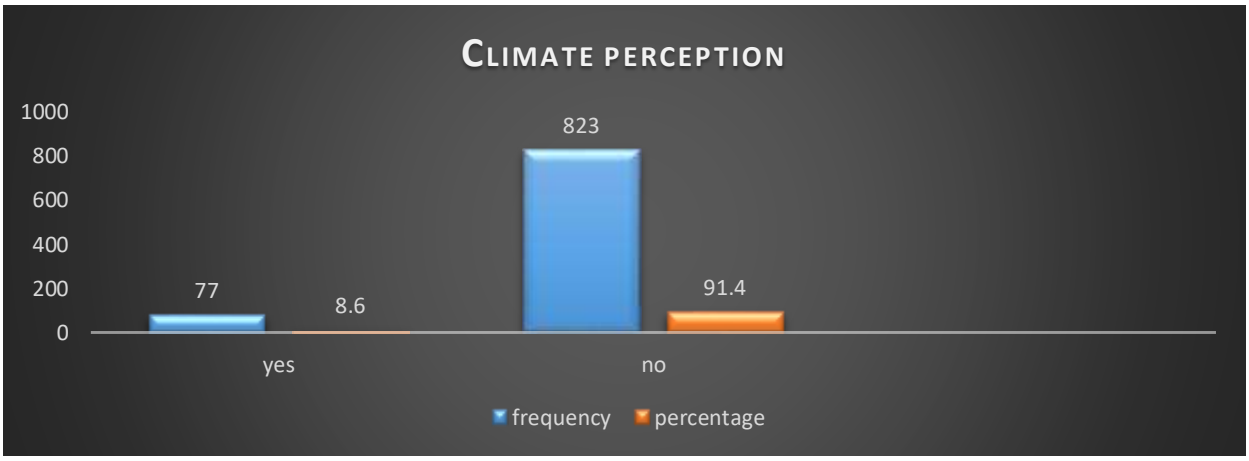
Figure 1: Study Area

The study used stratified sampling to select respondents, dividing population, into two groups: farmers, fishermen and vulnerable groups (women, children and elderly person) living in internally displaced camps in Borno. A total of 427 participants were selected with 85 farmers and 102 for fishermen and 342 from vulnerable groups. Tools such as structured questionnaire and anthropometric measurements and climatic data analysis, focus group discussion and key information interviews were also use for data collection from the respondents.

Food Security Indicator: household hunger scale (HHS) food consumption score (FCS), and coping strategies index (CSI) were calculated to access food security. Descriptive statistic, frequency, percentage, and mean were used to analyze demographic characteristics in the study area.

RESULTS AND DISCUSSION

The data offers important insights into how respondents perceive the future effects of climate change. The responses show a clear concern about the worsening state of the environment in the coming years. A small group (8.6%) of respondents believe that climate change will improve in the near future, indicating that only a limited number of individuals hold an optimistic view regarding future climate conditions. Just 1% of respondents anticipate that climate conditions will remain the same, suggesting that nearly all participants expect some form of change, either positive or negative, in the future. A substantial portion (38.8%) of respondents foresee a significant worsening of climate conditions, reflecting heightened concerns about severe environmental effects such as extreme weather events, rising temperatures, and biodiversity loss. Nearly half (46.6%) of the participants predict that climate change will gradually worsen, signaling a general sense of ongoing, albeit less dramatic, environmental decline in the coming years. These findings are consistent with global studies emphasizing public concern about climate change. [7], found that public perceptions of climate change are strongly shaped by media coverage of extreme weather and environmental degradation, influencing societal expectations about the future. Similarly, [8], noted that most respondents across various demographics expect climate change to worsen, highlighting global concerns regarding ecological sustainability and socio-economic effects. Overall, 85.4% of respondents anticipate that climate change will either worsen significantly or somewhat, underscoring widespread anxiety about the future of the environment. This mirrors findings from [7] and [8], which suggest that public awareness plays a crucial role in shaping attitudes toward climate change and its anticipated impact.



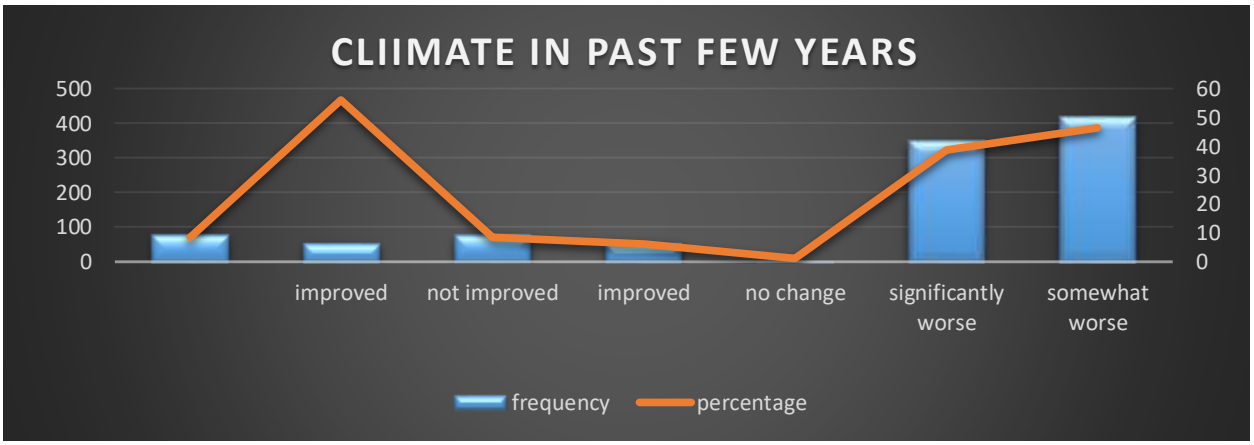


Figure 2: G. climate change perception, and H. climate in the past few year

Impacts of Climate Change on Food Scarcity

The data on food scarcity perceptions reveals a near-even split among respondents, with 468 respondents (52%) believing that climate change increases food scarcity, while 432 respondents (48%) report no impact. This slight majority supports the understanding that climate change exacerbates food scarcity, particularly through disruptions to agricultural systems and food distribution networks. Extreme weather events like droughts, floods, and heat waves disrupt crop yields and affect the reliability of food supplies, making food less accessible in certain regions. Research by [9], in *Food Security* shows that such disruptions are key drivers of increased food scarcity, particularly in regions already experiencing economic instability and inadequate infrastructure. [10], in *Nature Food* similarly highlights how climate-induced reductions in crop yields, driven by extreme heat or unpredictable rainfall, significantly contribute to food scarcity. While some regions may experience resilience or adaptation, others remain highly vulnerable to these adverse effects. The findings underscore the need for resilient food systems and proactive policies to address the growing risk of food scarcity due to climate change. These findings reflect the complex and multifaceted nature of climate change's impact on food systems, highlighting the need for comprehensive strategies to address both the direct and indirect effects on food security, income, and scarcity.

CONCLUSION

The study on the impacts of climate change in North Eastern Nigeria presents a crucial exploration of the multifaceted consequences of environmental shifts on agriculture, food security, human security, and health. The study extends the discourse on food security by exploring how climate change exacerbates food insecurity in the region. By linking climate-induced agricultural losses to food availability, accessibility, and utilization, this research addresses gaps in understanding the unique food security challenges faced by communities in North Eastern Nigeria. The following recommendations are made:

Enhance Agricultural Resilience: - It is vital to adopt climate-smart agricultural practices to improve the region's agricultural productivity and resilience to climate change. Remote sensing and GIS tools can assist in monitoring crop health, predicting weather patterns, and optimizing land use for more sustainable farming. Encouraging the use of drought-resistant crops, efficient irrigation systems, and sustainable livestock management techniques will be essential in mitigating the adverse effects of climate change on agriculture.

Strengthen Food Security Frameworks: - Strengthening local food production systems and improving food distribution networks are fundamental to securing food availability. GIS can be used to identify areas with critical food shortages, helping to prioritize interventions. Integrating climate risk assessments into food security planning will enable more robust responses to future climatic disruptions.

Protect Human Security: - Climate change's socio-economic consequences require targeted interventions to protect human security. Policies aimed at conflict prevention, disaster preparedness, and strengthening social safety nets will help to reduce climate-induced displacement and alleviate socio-economic pressures. GIS tools can assist in mapping migration patterns, conflict hotspots, and vulnerable communities, which will guide the development of more effective interventions.

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