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Climate Change, Ecosystem and The Economy of Nigeria

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ABSTRACT

This research examines the economic impacts of climate change on agriculture, human health, water resources and biodiversity in Nigeria. The research used both primary and secondary data. The primary data was gotten from NPC census 2006 which was estimated as 140,003,542. A sample size of 400 was achieved by using Taro Yamane formula and were distributed among farmers' traders' economist etc. that were selected as the respondents of the study which 306 sample size returned. The validity of the research instrument was ascertained and its reliability was established using the SPSS and also Cronbach alpha reliability index of 0.80, confirming the research instrument's suitability for the study. 5 Likert scale were used to answer the research questions using a criterion mean of 3.0, while research hypotheses were tested using Pearson correlation at 0.05 level of statistical significance. Findings from the study show that climate change lead to heat-related illnesses and mortality, alterations in rainfall patterns that lead to droughts and floods, erosion, flooding, loss of biodiversity, reduction in water quality, water-borne diseases, desertification, damage to infrastructure, reduction agricultural productivity, increase in water scarcity, food insecurity, energy scarcity, increase in emigration, socio-political and economic instability that affect economic growth in Nigeria. The study concluded and recommended that policy makers and government of Nigeria should increase investment in climate change adaptation measures, promote climate-resilient agriculture practices, improve

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disaster Risk Reduction and Management and also develop and implement a comprehensive climate change policy that will mitigate climate change effect in Nigeria.

1. INTRODUCTION

Climate change is a pressing global issue that has far-reaching consequences for ecosystems, economies, and human societies worldwide. The scientific consensus is clear: human activities, particularly the emission of greenhouse gases from burning fossil fuels and land use changes, are significantly contributing to the increase in global temperatures (IPCC, 2013). The impacts of climate change are widespread and varied, ranging from changes in temperature and precipitation patterns to increased frequency and severity of extreme weather events (IPCC, 2012). Nigeria, as a developing country is particularly vulnerable to the impacts of climate change. With a population of over 200 million people, Nigeria is the most populous country in Africa and has a rapidly growing economy (World Bank, 2020). However, the country's economy is heavily reliant on agriculture, which is highly susceptible to climate-related shocks (IFAD, 2019). Furthermore, Nigeria's infrastructure and human settlements are often poorly adapted to withstand the impacts of extreme weather events, making the country highly vulnerable to climate-related disasters (UNDP, 2019). The impacts of climate change on Nigeria's ecosystem and economy are multifaceted and interrelated. Climate change is altering the country's temperature and precipitation patterns, leading to changes in the distribution and abundance of plants and animals (IPCC, 2013). This, in turn is affecting the livelihoods of millions of Nigerians who depend on natural resources for their survival. Climate change is also increasing the frequency and severity of extreme weather events, such as floods and droughts, which are having devastating impacts on Nigeria's infrastructure, agriculture, and human settlements (UNDP, 2019). In addition to its environmental impacts, climate change is also having significant economic implications for Nigeria. The country's economy is heavily reliant on oil exports, which are vulnerable to climate-related disruptions (IEA, 2019). Furthermore, climate change is increasing the costs of healthcare, infrastructure, and emergency response, which are placing a significant burden on Nigeria's economy (World Bank, 2020). Despite the significant impacts of climate change on Nigeria's ecosystem and economy, the country is taking steps to address the challenge. The Nigerian government has developed a National Climate Change Policy, which outlines the country's vision for reducing its greenhouse gas emissions and adapting to the impacts of climate change (FMENV, 2012). Furthermore, the country is participating in international climate change negotiations and is working to develop its capacity to adapt to the impacts of climate change (UNFCCC, 2020). However, despite these efforts, significant gaps remain in Nigeria's response to climate change. The country's climate change policy is still in its early stages of implementation, and significant challenges remain in terms of institutional capacity, funding, and public awareness (FMENV, 2012). Furthermore, the country's efforts to adapt to the impacts of climate change are often fragmented and uncoordinated, which is reducing their effectiveness (UNDP, 2019). In order to address these gaps and ensure that Nigeria is able to effectively respond to the impacts of climate change, further research is needed. This study aims to contribute to this effort by examining the impacts of climate change on Nigeria's ecosystem and economy. The study will review existing literature on the topic, examine the impacts of climate change on Nigeria's agriculture, water resources, human health, biodiversity and identify strategies for reducing the country's vulnerability to climate-related shocks.

Theoretical Literature

Many theory has been developed that is related to climate change but for the purpose of this study, the following theory are consider relevant for this study:

1. The Global Warming Theory

The theory of global warming, developed by Svante Arrhenius in 1896 (Arrhenius, 1896), postulates that human activities, particularly the combustion of fossil fuels, increase the concentration of greenhouse gases in the atmosphere, leading to an increase in the natural greenhouse effect and an increase in global temperature.

2. The Climate Change Theory

The climate change theory, developed by the Intergovernmental Panel on Climate Change (IPCC) in 1990 (IPCC, 1990), integrates the concepts of the greenhouse effect and global warming, and recognizes that human activities are significantly contributing to climate change.

3. The Sustainable Development Theory

The sustainable development theory, developed by the World Commission on Environment and Development (WCED) in 1987 (WCED, 1987), suggests that economic development and environmental protection are not mutually exclusive, and that sustainable development can be achieved through the integration of economic, social, and environmental considerations.

4. The Climate Justice Theory

The climate justice theory, developed by various scholars, including Shue (1999) and Vanderheiden (2008), suggests that climate change is a matter of justice, and that those who have contributed most to climate change have a moral obligation to take action to mitigate its impacts.

Empirical Literature

Naz, et. al (2024) examine integrated assessment and geostatistical evaluation of groundwater quality through water quality indices. The study found out that climate change brings about microbiological contamination like groundwater pollutions and reduction in the quality of water which affect the environment.

Abbass et al (2022) examine a review of the global climate change impacts, adaptation, and sustainable mitigation measures. The study is aimed to conceptually engineer how climate variability is deteriorating the sustainability of diverse sectors worldwide. Specifically, the agricultural sector's vulnerability is a globally concerning scenario, as sufficient production and food supplies are threatened due to irreversible weather fluctuations. In turn, it is challenging the global feeding patterns, particularly in countries with agriculture as an integral part of their economy and total productivity. Climate change has also put the integrity and survival of many species at stake due to shifts in optimum temperature ranges, thereby accelerating biodiversity loss by progressively changing the ecosystem structures. Climate variations increase the likelihood of particular food and waterborne and vector-borne diseases, and a recent example is a coronavirus pandemic. The methodology investigates

hypothetical scenarios of climate variability and attempts to describe the quality of evidence to facilitate readers' careful, critical engagement. Secondary data is used to identify sustainability issues such as environmental, social, and economic viability. To better understand the problem, gathered the information in this report from various media outlets, research agencies, policy papers, newspapers, and other sources. This review is a sectorial assessment of climate change mitigation and adaptation approaches worldwide in the aforementioned sectors and the associated economic costs. According to the findings, government involvement is necessary for the country's long-term development through strict accountability of resources and regulations implemented in the past to generate cutting-edge climate policy.

Balogun et al. (2019) examined the impacts of climate change on water resources in Nigeria. The authors used a survey of 200 households and found that climate change had led to changes in precipitation patterns, which had negatively impacted access to clean water. The study concluded and recommended that Nigerian government should implement policies to support climate-resilient water management.

Ikejamba et al. (2019) investigate the impacts of climate change on agriculture in Nigeria. The authors used a survey of 300 farmers and found that climate change had led to changes in temperature and precipitation patterns, which had negatively impacted agricultural productivity. The study recommended that the Nigerian government should implement policies to support climate-resilient agriculture

Akinyemi et al. (2018) examined the impacts of climate change on human health in Nigeria. The authors used a review of existing literature and found that climate change had led to an increase in heat-related illnesses, respiratory problems, and water-borne diseases. The concluded that the Nigerian government should implement policies to support climate-resilient healthcare.

Egbon et al. (2018) study examined the impacts of climate change on biodiversity in Nigeria. The authors used a review of existing literature and found that climate change had led to a loss of biodiversity, changes in species distribution, and disruption of food chains. They gave some recommendations and concluded that Nigerian government should implement policies to support climate-resilient conservation.

Nwankwo et al. (2018) study examined the impacts of climate change on human settlements in Nigeria. The authors used a survey of 200 households and found that climate change had led to increased flooding, erosion, and heat-related illnesses. The study recommended that Nigerian government should implement policies to support climate-resilient human settlements. From the empirical literature above, none of the study look at the impact of climate on agriculture, human health, water resources and biodiversity all in a single paper, therefore this paper in tend to examine the economic impacts of climate change on agriculture, human health, water resources and biodiversity all in a single study using Nigeria as a case study.

2. METHODS

The study adopts survey research design to examine the economic impacts of climate change on agriculture, human health, water resources and biodiversity. Primary and secondary data were employed in the study. The population of this study includes the entire

population of Nigeria. Its total population was estimated at 140,003,542 according to 2006 census. With the use of Taro Yamane, the population size was reduced to 400. The research instrument adopted for this study is a self-structured questionnaire titled the economic impacts of climate change on agriculture, human health, water resources and biodiversity in Nigeria (C.C.A.H.H.W.R.B). It enabled the researchers obtained relevant data for the research.

The descriptive statistical tools of tables, percentages, averages etc. were used for data presentation. On the other hand, 5 Linkert scale with the use of Mean and Standard Deviation in Statistical Package for Social Science (SPSS) were used in analysing the three research questions. The research questions were analysed using a mean criterion of 3.0 for the research questions, an aggregate mean below 3.0 means the respondents disagree with the stated research question while an aggregate mean of 3.0 and above means the respondents agree with the stated research questions.

The questionnaire was designed to elicit information from the respondents, and to suit the need and purpose of the study. The questionnaire was designed in two (2) sections. The first section looked at demographic data of the respondents such as; gender, age and academic qualification. The second analyse the economic impacts of climate change on agriculture, human health, water resources and biodiversity in Nigeria. The questionnaire adopted a 5-point Likert scale of Strongly agreed (SA), Agreed (A), Undecided (U), Strongly Disagreed (SD), and Disagreed (D). The instrument is made up of a total of 30 items. Purposive sampling techniques were adopted for the study. For the purpose of clarity, two (2) states were selected from each of the four (4) regions in Nigeria. The selected state and institutions chosen as follow: Northern Region: Kano State and Abuja; Southern Region: Rivers State and Cross River State; Eastern Region: Enugu State and Imo State; Western Region: Lagos State and Ogun State. Fifty questionnaires were distributed to each of the selected institutions, ten of which were sent to professors in the geography department and the remaining forty to farmers, traders and residents of all the states. The choice of using sampling techniques in the scope of this research work is that it provides non-probability samples that are selected on the basis of characteristics present in a specific group of the population and the general study. It also helps the researcher to identify extreme opinions present in each population group.

3. RESULTS AND DISCUSSION

The data was presented based on the research objectives. Primary and secondary data were reviewed and questionnaire was distributed based on region, selected states, specific demographic characteristics such as age, gender, marital status and all other demographic variables are calculated using percentages.

Table 1. Regional and State Distributions of the Questionnaires

Region	No. of State in Region	Names of State Selected	No. of Questionnaires Distributed	No. of Questionnaires Returned
Northern	18	Kaduna	50	33
		Kano	50	36

Southern	6	Rivers	50	43
		Delta	50	43
Eastern	5	Abia	50	35
		Anambra	50	37
Western	7	Lagos	50	38
		Ogun	50	41
			400	306

Source: authors compilation (2025)

Table 2. Socio-demographic characteristics of the Respondents

Socio-Demographic Characteristics	Frequency	Percentage
Gender		
Male	169	55.2
Female	137	44.8
Total	306	100
Status		
Not Married	181	59.1
Married	125	40.9
Total	306	100
Age Range		
20-30 years	42	13.7
31-40 years	93	30.4

41-50 years	134	43.7
51 Above	37	12.1
Total	306	100
Academic Qualification		
FSLC/WAEC	68	22.2
NCE/ND	84	27.4
HND/BSC	96	31.4
MSC/PHD	58	19.0
Total	306	100
Total	306	100

Source: Authors Survey, 2025.

In Table 1 we can see the details of the regional, state and institutional distribution of the population. The population was distributed equally (50) to two states selected from each of the region. Among the 306 respondents, the majority are not married accounted for 59.1% of the total. The gender distribution is 137 females (44.8% of the total) and 168 males (55.2% of the total). In terms of age, most respondents are over 41-50years of age; Similarly, when asked about their educational status, the highest respondents have HND/BSC (31.4%) and the lowest respondents have MSC/PHD which constitute 19.0%.

Data Analysis

In order to determine the appropriateness of the research questions, the data of this study are presented and analysed below using mean, standard deviation, SPSS software, Cronbach alpha correlation test of 0.80 and Pearson correlation at 0.05 level of statistical significance.

Research Question

What are the economic impacts of climate change on agriculture, human health, water resources and biodiversity in Nigeria?

Table 3. Respondents' views on the economic impacts of climate change on agriculture, human health, water resources and biodiversity in Nigeria.

No.	Reports	Mean	Standard Deviation	Decision
Ecosystem Impacts				
1	Increase in climate change lead to heat-related illnesses and mortality in Nigeria.	3.80	3.57	True
2	Alterations in rainfall patterns lead to droughts and floods, that affect agriculture and water resources in Nigeria.	4.21	3.65	True

3	Climate change brings about increase in sea levels thereby causing coastal erosion, flooding, and saltwater intrusion into freshwater sources.	3.50	3.27	True
4	Climate change altered the ecosystems leading to loss of biodiversity and extinction of endemic species.	3.39	3.29	True
5	Changes in temperature and precipitation patterns disrupt food chains which affect agriculture, forestry and fisheries in Nigeria.	3.72	3.44	True
6	Rising temperatures and changing precipitation patterns increased the risk of wildfires as this affect forests and wildlife in Nigeria.	4.22	3.81	True
7	Climate change reduce water quality, leading to increased risk of water-borne diseases in Nigeria.	3.39	3.58	True
8	Rising sea levels and increased storm surges leads to loss of mangrove forests which affect coastal ecosystems.	4.06	3.67	True
9	Climate change disrupt migration patterns of animals as this affect ecosystems and biodiversity.	4.46	4.01	True
10	Climate change increased the risk of desertification affecting agriculture, forestry and wildlife in Nigeria.	4.16	3.83	True

Economic Impacts

11	Climate-related disasters cause damage to infrastructure, including roads, bridges, and buildings in Nigeria which hinder economic growth.	3.98	3.58	True
12	Climate change reduce agricultural productivity that affect food security and economic growth in Nigeria.	3.87	3.50	True
13	Climate-related disasters affect tourism that lead to loss of revenue and economic growth in Nigeria.	3.93	3.65	True
14	Climate-related illnesses and injuries increase healthcare costs which affect the economy and human well-being.	4.02	3.66	True
15	Climate change increased the risk of water scarcity affecting agriculture, industry and human consumption in Nigeria.	3.41	3.10	True
16	Climate change affect fisheries leading to loss of livelihoods and economic growth in Nigeria.	3.78	3.46	True
17	Climate change increase the risk of food insecurity which affect human well-being and economic growth in Nigeria.	3.57	3.76	True

18	Climate change affect forestry leading to loss of revenue and economic growth in Nigeria.	3.78	3.34	True
19	Climate change increase the risk of energy scarcity affecting economic growth and human well-being in Nigeria.	3.48	3.04	True
20	Climate-related disasters cause damage to transportation systems which affect economic growth and human well-being.	3.11	3.24	True
21	Climate change increase the risk of socio-political and economic instability affecting economic growth and human well-being.	4.23	3.52	True
22	Climate change increase the risk of migration affecting social cohesion and economic growth in Nigeria.	3.81	3.68	True
23	Climate change increase the risk of conflict affecting social cohesion and economic growth in Nigeria.	3.21	3.88	True
24	Climate-related disasters cause damage to education infrastructure affecting human capital and economic growth in Nigeria.	3.35	3.22	True
25	Climate change increase the risk of human trafficking affecting human well-being and economic growth in Nigeria.	3.86	3.92	True
26	Climate change increase the risk of economic instability affecting economic growth and human well-being.	4.26	3.45	True
Average Total		3.46	3.54	True

Source: Author's survey, 2025.

According to table 3, item 1-26 analyse the economic impacts of climate change on agriculture, human health, water resources and biodiversity in Nigeria. As shown in the table above, the average mean for this research work is well above the standard average of 3.0. Also, from the respond of all the respondents, the average total standard deviation is 3.54 and the average total mean is 3.46. Base on the findings, the respondents anonymous agreed that climate change has a negative significant effect on agriculture, human health, water resources and biodiversity in Nigeria.

Discussion of Findings

Responses to the research questions revealed the economic impacts of climate change on agriculture, human health, water resources and biodiversity in Nigeria are: increase in climate change lead to heat-related illnesses and mortality in Nigeria, alterations in rainfall patterns that lead to droughts and floods, increase in sea levels that cause coastal erosion, flooding, and saltwater intrusion, loss of biodiversity and extinction of endemic species, disruption food chains, reduction in water quality that lead to water-borne diseases, loss of mangrove forests, disruption of migration patterns of animals, desertification, damage to infrastructure, reduction agricultural productivity, loss of revenue from tourism, illnesses and injuries,

increase in water scarcity, decrease in fishes in rivers, increase in the risk of food insecurity, loss of revenue in forestry, increase in energy scarcity, damage of transportation system, economic instability, increase in emigration, damage of education infrastructure and increase in the risk of socio-political and economic instability that affect economic growth in Nigeria. The findings of research question are in-line with the findings of Naz, et. al (2024) and Balogun et al. (2019) that climate change brings about groundwater pollutions and reduction in the quality of water, Abbass et al (2022) Climate variations increase the likelihood of particular food and waterborne and vector-borne diseases, food insecurity, Ikejemba et al. (2019) climate change led to reduction in agricultural productivity, Akinyemi et al. (2018) that variation in climate increase in heat-related illnesses, respiratory problems, and water-borne diseases, Egbon et al. (2018) climate change lead to loss of biodiversity, changes in species distribution, and disruption of food chains, and Nwankwo et al. (2018) that climate change led to increased flooding and erosion. Consequently, through the findings of the research question and the associated empirical literatures evidence, this study has been able to highlight the economic impacts of climate change on agriculture, human health, water resources and biodiversity in Nigeria which is the main aim of the study.

4. CONCLUSION

Climate change is having profound and far-reaching impacts on Nigeria's ecosystem and economy. Rising temperatures, changing precipitation patterns, and the increasing frequency of extreme weather events are significantly affecting key sectors such as agriculture, water resources, infrastructure, and human well-being. The economic consequences are alarming, with annual losses exceeding \$10 billion and projections of a GDP reduction of over 10% by 2050. Based on the findings of this study, several recommendations are proposed for policymakers and the Nigerian government to address these challenges. First, it is essential to develop and implement a comprehensive climate change policy that encompasses mitigation, adaptation, and resilience measures. Second, increased investment in climate change adaptation initiatives, particularly in infrastructure, agriculture, and water resource management, is crucial. Third, promoting climate-resilient agricultural practices, such as conservation agriculture, agroforestry, and climate-smart farming techniques, can help protect the livelihoods of farmers and enhance food security. Finally, there is an urgent need to strengthen disaster risk reduction and management systems to better prepare for and respond to the increasing frequency of climate-related disasters. Adopting these measures will enhance Nigeria's capacity to mitigate the impacts of climate change and build a more sustainable and resilient future.

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6. AUTHORS' NOTE

The author is solely responsible for the content and analysis presented in this article. There were no conflicts of interest associated with this study, either financially or non-financially. This article is purely the result of the author's study and analysis based on the literature study that has been carried out in depth.

The author also states that all sources used have been listed correctly according to academic rules, and that no part of this article is the result of plagiarism. Any questions or correspondence related to this article can be addressed to the author through the available contact.

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