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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 obtained from the NPC census 2006, which was estimated as 140,003,542. A sample size of 400 was achieved by using Taro Yamane's formula. It was distributed among farmers, traders, economists, etc., who 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 SPSS and Cronbach alpha reliability index of 0.80, confirming the research instrument's suitability for the study. 5 Likert scale was 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 the government of Nigeria should increase investment in climate change adaptation measures, promote climate-resilient agriculture practices, improve disaster Risk Reduction and Management and also develop and implement a comprehensive climate change policy that will mitigate climate change effects in Nigeria.

Keywords: Climate change, Economy, Ecosystem, Nigeria

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 also has significant economic implications for Nigeria. The country's economy is heavily reliant on oil exports, which are vulnerable to climate-related disruptions (IEA, 2019).

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).

Thus, 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). 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 respond to the impacts of climate change effectively, 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, and biodiversity and identify strategies for reducing the country's vulnerability to climate-related shocks.

Theoretical Literature

Many theories have been developed that are related to climate change, but for this study, the following theories are considered relevant:

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.

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.

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.

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 that climate change brings about microbiological contamination like groundwater pollution and reduction in the quality of water, which affect the environment.

Abbass et al. (2022) examine a review of the impacts of global climate change, as well as 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 the 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, the information in this report was gathered 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 the Nigerian government should implement policies to support climate-resilient water management.

Ikejemba 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. They concluded that the Nigerian government should implement policies to support climate-resilient healthcare.

Egbon et al. (2018) 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 the Nigerian government should implement policies to support climate-resilient conservation.

Nwankwo et al. (2018) 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 the 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.

Methodology

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 the 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 to obtain 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) was 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 analyses 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 clarity, two (2) states were selected from each of the four (4) regions in Nigeria. The selected states and institutions are as follows: 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.

Data presentation

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

Table 1. Regional and State Distributions of the Questionnaires

Region	No. of States 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 regions. Among the 306 respondents, the majority were not married, accounting 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 41-50 years 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 leads 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 an increase in sea levels, thereby causing coastal erosion, flooding, and saltwater intrusion into freshwater sources.	**3.50**	**3.27**	**True**
4	Climate change has altered the ecosystems, leading to the loss of biodiversity and the 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, this affect forests and wildlife in Nigeria.	**4.22**	**3.81**	**True**
7	Climate change reduces 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 the 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 hinders economic growth.	**3.98**	**3.58**	**True**
12	Climate change reduces agricultural productivity that affects 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 increases 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**
	Climate change increases the risk of human trafficking affecting human well-being and economic growth in Nigeria.	**3.86**	**3.92**	**True**

25	Climate change increases 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, items 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 responses of all the respondents, the average total standard deviation is 3.54, and the average total mean is 3.46. Based on the findings, the anonymous respondents agreed that climate change has a significant negative 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 leads to heat-related illnesses and mortality in Nigeria, alterations in rainfall patterns lead to droughts and floods, increase in sea levels causes coastal erosion, flooding, and saltwater intrusion, loss of biodiversity and extinction of endemic species, disruption of food chains, reduction in water quality leads to water-borne diseases, loss of mangrove forests, disruption of migration patterns of animals, desertification, damage to infrastructure, reduction of 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 literature 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.

Conclusion

Climate change is having far-reaching impacts on Nigeria's ecosystem and economy. Rising temperatures, changing precipitation patterns, and increased frequency of extreme weather events are affecting agriculture, water resources, infrastructure, and human well-being. The economic costs of climate change are estimated to be significant, with annual losses of over $10 billion and a reduction in GDP of over 10% by 2050.

Recommendations

Based on the findings of the study, the following are recommended for Policy Makers and the Government of Nigeria:

1. Develop and implement a comprehensive climate change policy that addresses mitigation, adaptation, and resilience.
2. Increase investment in climate change adaptation measures, including infrastructure, agriculture, and water resources.
3. Promote climate-resilient agriculture practices, including conservation agriculture, agroforestry, and climate-smart agriculture.
4. Improve Disaster Risk Reduction and Management.

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