

The Prevalence of Climate Change in Nigeria:  
An Empirical Study of the Effects and Dependable Remedies

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**ABSTRACT**

*The study sought to investigate the prevalence of climate change in Nigeria as science has it that climate is the long-term pattern of weather in an area, typically averaged over a period of 30 years. A descriptive survey design was adopted for the study. The study was conducted in Nigeria. The population of the study consisted of all environmental scientists in Nigeria. A stratified sampling technique was used to select 50 environmental scientists from each of the six geographical zones, giving a total of 300 environmental scientists that constituted the sample size used for the study. The instrument titled "Climate Change Questionnaire (CCQ)" was used for data collection. Face and content validation of the instrument was carried out by one expert in test, measurement, and evaluation to ensure that the instrument was accurate for the study. The Cronbach Alpha technique was used to determine the level of reliability of the instrument. In this case, the average reliability coefficient obtained was 0.84, and this was high enough to justify the use of the instrument. The researcher subjected the data generated for this study to appropriate statistical techniques such as descriptive statistics for answering the research questions. The test for significance was done at a 0.05 alpha level. The study concluded that carbon dioxide is the main cause of human-induced climate change. It stays in the atmosphere for a very long time. Other greenhouse gases, such as nitrous oxide, stay in the atmosphere for a long time. Other substances only produce short-term effects. One of the recommendations made in this study was that the emissions of other substances that warm the climate must also be substantially reduced as the resultant effect of climate change can only be stopped by reducing global emissions of carbon dioxide from human fossil fuel combustion and industrial processes to zero.*

**KEYWORDS:** Climate change, Causes, Effects, Remedies and Nigeria

**Introduction**

Climate change is increasingly becoming a serious challenge to Nigeria's socioeconomic development. Various manifestations of its impact are evident in Nigeria, which include an increase in drought, scarcity of food instigated somewhat by irregularities in rainfall and over-flooded roads. The implications of these challenges range from hunger and ill-health to migration. The paper draws attention to the increasing degree of the impacts and suggests adaptation strategies for Nigeria. Climate

change in Nigeria is evident from temperature increases, rainfall variability (increasing rainfall in coastal areas and a decline in rainfall in the continental areas), drought, desertification, rising sea levels, erosions, floods, thunderstorms, bush fires, landslides, radiation, and loss of biodiversity (Olaniyi et al. 2019). All of these will continue to negatively affect human life and the ecosystems in Nigeria. According to Dada et al. (2014), although depending on location, regions experience climate change with significantly higher temperatures during the dry seasons while rainfall during the rainy seasons helps keep the temperature at milder levels.

There are a few comprehensive reports and papers that provide useful evidence and discussion of the various impacts of climate change throughout Nigeria. The vast majority of the literature that provides evidence of climate change impacts and responses, however, focuses on the agricultural sector and on individual farming communities in particular regions of the country. Discussion of other mitigation and adaptation measures in the literature often takes the form of recommendations, rather than examples of what has already been achieved (Haider 2021). This is likely due to the need for much greater implementation of mitigation and adaptation measures in Nigeria. In addition, while there is some discussion about necessary capacity building at the individual, group, and community level to engage in climate change responses, there is much less attention given to higher levels of capacity at the state and national level (Haider, 2021). The associated challenges of climate change are not the same across the country because of the two precipitation regimes: high precipitation in parts of the Southeast and Southwest and low precipitation in the North. These regimes can cause aridity, desertification, and drought in the north, erosion and flooding in the south, or both (Akande, 2017; Onah, 2016).

### **Statement of Problem**

Too much heat can damage crops and vegetation, and too much rainfall can cause widespread flooding and forced relocation. Climate change is happening now, and it's the most serious threat to life on our planet. Nigeria has experienced climatic extremes in recent years. Yet progress by governments has been achingly slow. Nigerian insurers have not, however, paid sufficient attention to the impact of climate change. Many commitments to reduce carbon emissions have been set, but few are binding, and targets are often missed. The duration and intensity of rainfall have increased in the last three decades, producing large runoffs and flooding in many places. Despite the effects of climate change becoming more and more obvious, big polluting corporations—the ones responsible for the majority of carbon emissions—continue to carry on drilling for and burning fossil fuels. Nigerian children and youth are not yet properly educated on these issues, and thus lack sufficient knowledge on how to deal with climate change-related situations.

### **Objectives of the Study**

Specifically, the study seeks:

1. To find out the causes of climate change in Nigeria
2. To examine the effects of climate change in Nigeria
3. To determine the dependable remedies of climate change in Nigeria

## Research Questions

1. What are the causes of climate change in Nigeria?
2. What are the effects of climate change in Nigeria?
3. What are the dependable remedies to climate change in Nigeria?

## Conceptual Review

### Concept of Climate

According to Riedy (2016), "climate" is the average of the weather conditions at a particular point on the Earth. Climate is the long-term pattern of weather in an area, typically averaged over a period of 30 years. Climate is defined as the "average weather," or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period ranging from months to thousands or millions of years. The classical period is 30 years, as defined by the World Meteorological Organization (WMO). These quantities are most often surface variables such as temperature, precipitation, humidity, atmospheric pressure, and wind. Climate, in a wider sense, is the state, including a statistical description, of the climate system (IPCC, 2001). Likely, Planton (2013) noted that climate is the state of the components of the climate system, which includes the ocean, land, and ice on Earth. The climate of a location is affected by its latitude and longitude, terrain, and altitude, as well as nearby water bodies and their currents. Typically, climate is expressed in terms of expected temperature, rainfall, and wind conditions based on historical observations. Climates can be classified according to the average and the typical ranges of different variables, most commonly temperature and precipitation (Ledley, Sundquist, Schwartz, Hall, Fellows, & Killeen, 1999). The most commonly used classification scheme was the Köppen climate classification.

### Concept of Climate Change

According to Sharifi (2020), climate change is a change in either the average climate or climate variability that persists over an extended period. The Earth's climate has always changed. Changes in the Earth's orbit, the energy output of the sun, volcanic activity, the geographic distribution of the Earth's land masses, and other internal or external processes can influence the climate. Scientists refer to this type of long-term climate change as "natural climate change". As a result of natural climate change, the Earth has experienced regular cold periods (or ice ages) in the past, when glaciers covered large parts of the Earth's surface. The Earth has also experienced warmer periods when sea levels were much higher than they are now. In the Earth's long-term history, the current period is characterised by a relatively warm, stable climate that has lasted since the end of the last ice age about 11,700 years ago. This period is known to geologists as the Holocene and is the period during which human civilisation has flourished. If this were the only type of climate change, then the interest among sociologists would be minimal. However, scientific observations and models indicate that the Earth's climate is now changing due to human activity. This is termed "anthropogenic climate change."

Based on Anthony (2011), over time, the enhanced greenhouse effect results in "global warming"—an increase in the Earth's average temperature. Global warming is one type of climate change, and it drives other changes in the climate, such as changes in rainfall

patterns and the frequency and distribution of weather events such as droughts, storms, floods, and heat waves. Although the terms "climate change" and "global warming" are often used interchangeably, "climate change" is a broader term that incorporates both global warming and other observed changes in the climate. Many scientists argue that the impacts of climate change will be devastating for natural and human systems, and that climate change poses an existential threat to human civilisation.

There have been previous periods of climate change, but the current changes are more rapid than any known event in Earth's history. Based on Berry et al. (2015), the main cause is the emission of greenhouse gases, mostly carbon dioxide (CO<sub>2</sub>) and methane. Burning fossil fuels for energy use creates most of these emissions. Agriculture, steelmaking, cement production, and forest loss are additional sources. Climate feedbacks, such as the loss of sunlight-reflecting snow cover and the release of carbon dioxide from drought-stricken forests, also affect temperature rise (Shaftel, 2016).

### Causes of Climate Change

Human activity is the main cause of climate change. People burn fossil fuels and convert land from forests to agriculture. Since the beginning of the Industrial Revolution, people have burned more and more fossil fuels and converted vast areas of land from forests to farmland. Burning fossil fuels produces carbon dioxide, a greenhouse gas. It is called a greenhouse gas because it produces a "greenhouse effect". The greenhouse effect makes the earth warmer, just as a greenhouse makes the earth warmer than its surroundings. Carbon dioxide is the main cause of human-induced climate change. It stays in the atmosphere for a very long time. Other greenhouse gases, such as nitrous oxide, stay in the atmosphere for a long time. Other substances only produce short-term effects.

The Earth's climate can be affected by natural factors that are external to the climate system, such as changes in volcanic activity, solar output, and the Earth's orbit around the Sun. Of these, the two factors relevant on the timescales of contemporary climate change are changes in volcanic activity and changes in solar radiation. In terms of the Earth's energy balance, these factors primarily influence the amount of incoming energy. Volcanic eruptions are episodic and have relatively short-term effects on the climate. Changes in solar irradiance have contributed to climate trends over the past century, but since the Industrial Revolution, the effect of additions of greenhouse gases to the atmosphere has been over 50 times greater than that of changes in the sun's output.

Climate change can also be caused by human activities such as the burning of fossil fuels and the conversion of land for forestry and agriculture. Since the beginning of the Industrial Revolution, human influences on the climate system have increased substantially. In addition to other environmental impacts, these activities change the land surface and emit various substances into the atmosphere. These, in turn, can influence both the amount of incoming energy and the amount of outgoing energy and can have both warming and cooling effects on the climate.

### Top Six Causes of Climate Change

- **Burning fossil fuels:** Oil and gas are used all the time in almost every industry. It is used the most in vehicles, buildings, production, and to produce electricity. When we burn coal, oil, and gases, it largely adds to the climate problem. The use

of fossil fuels is also a threat to wildlife and the surrounding environment because of the toxicity that kills off plant life and leaves areas uninhabitable.

- **Deforestation:** Deforestation is the clearance of woodland and forest. This is either done for the wood or to create space for farms or ranches. Trees and forests turn carbon dioxide into oxygen, so when they are cleared, the stored carbon is then released into the environment. Deforestation can also occur naturally, which has a greater effect because of the fumes released from the fire.
- **Oil Drilling:** Oil drilling is responsible for 30% of the methane population and around 8% of the carbon dioxide pollution. Oil drilling is used to collect petroleum oil hydrocarbons. In this process, other gases are released into the atmosphere, which contribute to climate change. It is also toxic to the wildlife and environment it surrounds.
- **Waste:** Humans create more waste now than ever before because of the amount of packaging used and the short life cycle of products. A lot of items, waste, and packaging aren't recyclable, which means they end up in landfills. When the waste in landfills begins to decompose or break down, it releases harmful gases into the atmosphere that contribute to global warming.
- **Farming:** Farming takes up a lot of green space, meaning local environments can be destroyed to create space for farming. These animals produce a lot of greenhouse gases, for example methane. As well as this, they also produce an extreme amount of waste. Factory farming is responsible for even more climate issues because of the extra pollution it produces and the number of animals it can hold.
- **Overfishing:** Fish is one of humanity's main sources of protein, and a lot of the world now relies on this industry. Due to the number of people buying and consuming fish, there is now a reduced amount of marine life. Overfishing has also caused a lack of diversity within the ocean.

### Prevalence of Climate Change in Nigeria

The climate in Nigeria has been changing. Temperature increases, variable rainfall, rising sea levels and flooding, drought and desertification, land degradation, more frequent extreme weather events, impacted fresh water resources, and biodiversity loss are all visible, according to Elisha et al., (2017); Ebele and Emodi, (2016); and Olaniyiet al., (2013). Rainfall duration and intensity have increased, resulting in large runoffs and flooding in many parts of Nigeria (Enete, 2014). Rainfall variation is projected to continue to increase. Precipitation in southern areas is expected to rise, and rising sea levels are expected to exacerbate flooding and submersion of coastal lands (Akande et al., 2017; Ebele and Emodi, 2016). Amanchukwu et al., (2015) stated that droughts have also become a constant problem in Nigeria and are expected to continue in Northern Nigeria due to a decline in precipitation and a rise in temperature. The Northeast and the Northwest are the most vulnerable. The combination of rising heat and less rain has hastened desert encroachment, with the loss of the wetlands and a fast reduction in the amount of surface water, flora, and fauna resources on land (Abdulkadir et al., 2017; Akande et al., 2017; Ebele and Emodi, 2016; Federal Ministry of Environment, 2014). The Southwest and Southeast are relatively less vulnerable than other parts of the country. Within Southern Nigeria, the South-south (Niger Delta region) is the most

vulnerable due to sea level rise, increased precipitation, coastal erosion, and flooding, which has resulted in the displacement of many settlements (Matemilola, 2019; Federal Ministry of Environment, 2014).

### **Effect of Climate Change in our Society**

The build-up of greenhouse gases in the atmosphere has led to an enhancement of the natural greenhouse effect. It is this human-induced enhancement of the greenhouse effect that is of concern because ongoing emissions of greenhouse gases have the potential to warm the planet to levels that have never been experienced in the history of human civilization. Such climate change could have far-reaching and/or unpredictable environmental, social, and economic consequences. The challenges associated with climate change are not the same across the country. Nigeria has a tropical climate with two precipitation regimes: low precipitation in the north and high precipitation in parts of the southwest and southeast. This can lead to aridity, drought, and desertification in the north and flooding and erosion in the south (Akande et al., 2017; Nkechi et al., 2016). Vulnerability analysis demonstrates that states in the north experience higher degrees of vulnerability to climate change than those in the south (Madu, 2016; Federal Ministry of Environment, 2014).

Climate change destabilises the Earth's temperature equilibrium and has far-reaching effects on human beings and the environment. Because of the increased concentration of greenhouse gases, the energy balance and thus the temperature of the Earth change during the course of global warming, which has a significant impact on humans and the environment. Climate change affects the nature and characteristics of freshwater resources on which many Nigerians depend. Sea level rise and extreme weather will affect the ability to fish. The viability of inland fisheries is also threatened by increased salinity and shrinking rivers and lakes (Ebele and Emodi, 2016; BNRCC, 2011). Unpredictable rainfall variation, heat stress, and drought can adversely affect food production and result in food shortages (Abdulkadir et al., 2017; Elum et al., 2017; Ebele and Emodi, 2016; Enete IC, 2014). The high vulnerability of states in the north to climate change poses a serious threat to food security throughout the country (Madu, 2012). Drought conditions in parts of Northern Nigeria have also resulted in less drinking water. Also, climate change has serious implications for human health in Nigeria. Direct health impacts stem from extreme weather events such as heat waves (BNRCC, 2011). Indirect effects of climate change can arise from malnutrition due to food shortages; the spread of infectious diseases and food-and water-borne illnesses (e.g. typhoid fever, cholera); increased air pollution; and from higher temperatures correlated with increased cases of meningitis (Abdulkadir et al., 2017; Osuafor and Nnorom, 2014; BNRCC, 2011).

#### ***The direct consequences of man-made climate change include:***

- Rising maximum temperatures
- Rising minimum temperatures
- Rising sea levels
- Higher ocean temperatures
- An increase in heavy precipitation (heavy rain and hail)
- Shrinking glaciers
- Thawing permafrost

## Remedies of Climate Change

The energy sector is the most important sector for climate change mitigation. It is important to control greenhouse gases by moving towards renewable energy development. Despite movement in Nigeria toward the development of policy and legislation in support of renewable energy, there are few existing renewable energy projects (Dioha and Emodi, 2018; Elum and Momodu, 2017). The vast majority of renewable energy consumption that does exist is derived from hydropower (Achike et al., 2019; Dioha and Emodi, 2018; Elum and Momodu, 2017; Yahaya and Nwabuogo, 2016). The development of solar energy is new to the country, with growing interest from investors. The bioenergy industry could receive a boost from a persistent increase in the production of sugarcane, maize, and cassava (Elum et al., 2017). It is necessary to develop innovative financing schemes that will reduce the cost of low carbon technologies for consumers, in addition to making them a profitable project for investors (Dioha and Emodi, 2018). Again, there is a need to encourage sustainable lifestyle choices among Nigerians. These include less meat consumption, phasing out inefficient appliances, and greater access to and use of public transportation. Public infrastructure and services for effective waste reduction also need to be encouraged (Dioha and Emodi, 2018; Nkechi et al., 2016; Elias and Omojola, 2015).

### **The main ways to stop climate change are to pressure government and business to:**

- Keep fossil fuels in the ground. Fossil fuels include coal, oil and gas—and the more that are extracted and burned, the worse climate change will get. All countries need to move their economies away from fossil fuels as soon as possible.
- Invest in renewable energy. Changing our main energy sources to clean and renewable energy is the best way to stop using fossil fuels. These include technologies like solar, wind, wave, tidal, and geothermal power.
- Switch to sustainable transport. Petrol and diesel vehicles, planes, and ships use fossil fuels. Reducing car use, switching to electric vehicles and minimizing plane travel will not only help stop climate change, it will reduce air pollution too.
- Help us keep our homes cosy. Homes shouldn't be draughty and cold – it's a waste of money and miserable in the winter. The government can help households heat our homes in a green way by insulating walls and roofs and switching away from oil or gas boilers to heat pumps.
- Improve farming and encourage vegan diets. One of the best ways for individuals to help stop climate change is by reducing their meat and dairy consumption, or by going fully vegan. Businesses and food retailers can improve farming practices and provide more plant-based products to help people make the shift.
- Restore nature to absorb more carbon. The natural world is very good at cleaning up our emissions, but we need to look after it. Planting trees in the right places or giving land back to nature through "rewilding" schemes is a

good place to start. This is because photosynthesising plants draw down carbon dioxide as they grow, locking it away in the soil.

- Protect forests like the Amazon. Forests are crucial in the fight against climate change, and protecting them is an important climate solution. Cutting down forests on an industrial scale destroys giant trees which could be sucking up huge amounts of carbon. Yet companies destroy forests to make way for animal farming, soya or palm oil plantations. Governments can stop them by making better laws.
- Protect the oceans. Oceans also absorb large amounts of carbon dioxide from the atmosphere, which helps to keep our climate stable. But many are overfished, used for oil and gas drilling or threatened by deep sea mining. Protecting oceans and the life in them is ultimately a way to protect ourselves from climate change.
- Reduce how much people consume. Our transport, fashion, food and other lifestyle choices all have different impacts on the climate. This is often by design – fashion and technology companies, for example, will release far more products than are realistically needed. But while reducing consumption of these products might be hard, it's most certainly worth it. Reducing overall consumption in more wealthy countries can help put less strain on the planet.
- Reduce plastic. Plastic is made from oil, and the process of extracting, refining and turning oil into plastic (or even polyester, for clothing) is surprisingly carbon-intense. It doesn't break down quickly in nature so a lot of plastic is burned, which contributes to emissions. Demand for plastic is rising so quickly that creating and disposing of plastics will account for 17% of the global carbon budget by 2050 (this is the emissions count we need to stay within according to the Paris agreement).

## Methods

A descriptive survey design was adopted for the study. The study was conducted in Nigeria. The population of the study consisted of all environmental scientists in Nigeria. A stratified sampling technique was used to select 50 environmental scientists from each of the six geographical zones, giving a total of 300 environmental scientists that constituted the sample size used for the study. The instrument titled "Effect of Climate Change Questionnaire (ECCQ)" was used for data collection. Face and content validation of the instrument was carried out by one expert in test, measurement, and evaluation to ensure that the instrument was accurate for the study. The Cronbach Alpha technique was used to determine the level of reliability of the instrument. In this case, the average reliability coefficient obtained was 0.84, and this was high enough to justify the use of the instrument. The researcher subjected the data generated for this study to appropriate statistical techniques such as descriptive statistics for answering the research questions. The test for significance was done at a 0.05 alpha level.



## Results/Discussion

### Research Questions One

The research question sought to find out the causes of climate change in Nigeria. To answer the research percentage analysis was performed on the data, (see table 1).

**Table 1: Percentage Analysis of the Causes of Climate Change in Nigeria**

CAUSES	FREQUENCY	PERCENTAGE
Waste	72	24**
Deforestation	58	19.33
Farming	50	16.67
Burning fossil fuels	43	14.33
Oil Drilling	41	13.67
Overfishing	36	12*
<b>TOTAL</b>	<b>300</b>	<b>100%</b>

\*\* The highest percentage frequency

\* The least percentage frequency

SOURCE: Field survey

The above table 1 presents the percentage analysis of the causes of climate change in Nigeria. From the result of the data analysis, it was observed that "waste" 72(24%) was rated the most prominent cause of climate change in Nigeria, while "overfishing" 36(12%) was rated the least cause of climate change in Nigeria. The result was also supported by other experts in environmental science.

### Research Questions Two

The research question sought to find out the effects of climate change in Nigeria. To answer the research percentage analysis was performed on the data, (see table 2).

**Table 2: Percentage Analysis of the Effect of Climate Change in Nigeria**

EFFECT	FREQUENCY	PERCENTAGE
Rising maximum temperatures	53	17.67**
Rising minimum temperatures	38	12.67
Rising sea levels	48	16
Higher ocean temperatures	45	15
An increase in heavy precipitation (heavy rain and hail)	42	14
Shrinking glaciers	39	13
Thawing permafrost	35	11.67*
<b>TOTAL</b>	<b>300</b>	<b>100%</b>

\*\* The highest percentage frequency

\* The least percentage frequency

SOURCE: Field survey

The above table 2 presents the percentage analysis of effect of climate change in Nigeria. From the result of the data analysis, it was observed that "Rising maximum temperatures" 53(17.67%) was rated the most prominent effect of climate change in Nigeria, while "Thawing permafrost" 35(11.67%) was rated the least. The result, therefore, means that there is remarkable effect of climate change in Nigeria. The result is cognate to the research findings of BNRCC (2011), who stated that climate change has serious implications for human health in Nigeria. Direct health impacts stem from extreme weather events such as heat waves. Indirect effects of climate change can arise from malnutrition due to food shortages; the spread of infectious diseases and food-and water-borne illnesses (e.g. typhoid fever, cholera); increased air pollution; and from higher temperatures correlated with increased cases of meningitis.

### Research Questions Three

The research question sought to find out the dependable remedies to climate change in Nigeria. To answer the research percentage analysis was performed on the data, (see table 3).

**Table 3: Percentage Analysis of the Dependable Remedies to Climate Change in Nigeria**

REMEDIES	FREQUENCY	PERCENTAGE
Keep fossil fuels in the ground	20	6.67*
Invest in renewable energy	25	8.33
Switch to sustainable transport	21	7
Help us keep our homes cosy	40	13.33**
Improve farming and encourage vegan diets	38	12.67
Restore nature to absorb more carbon	36	12
Protect forests like the Amazon	33	11
Protect the oceans	32	10.67
Reduce how much people consume	25	8.33
Reduce plastic	30	10
<b>TOTAL</b>	<b>300</b>	<b>100%</b>

\*\* The highest percentage frequency

\* The least percentage frequency

SOURCE: Field survey

The above table 3 presents the percentage analysis of the dependable remedies to climate change in Nigeria. From the result of the data analysis, it was observed that "Help us keep our homes cosy" 40(13.33%) was rated the most prominent dependable remedies to climate change in Nigeria, while "Keep fossil fuels in the ground" 20(6.67%) was rated the least. The result is cognate to the research findings of Dioha and Emodi (2018), who asserted that the energy sector is the most important sector for climate change mitigation. It is important to control greenhouse gases by moving towards renewable energy development. Despite movement in Nigeria toward the development of policy and legislation in support of renewable energy, there are few existing renewable energy projects.

## Conclusion

Climate change destabilizes the earth's temperature equilibrium and has far-reaching effects on human beings and the environment. And these effects have unpredictable environmental, social, and economic consequences. Carbon dioxide is the main cause of human-induced climate change. Nigeria has a tropical climate with two precipitation regimes: low precipitation in the north and high precipitation in parts of the southwest and southeast. The Northeast and the Northwest are the most vulnerable. The study concludes that carbon dioxide is the main cause of human-induced climate change. It stays in the atmosphere for a very long time. Other greenhouse gases, such as nitrous oxide, stay in the atmosphere for a long time. Other substances only produce short-term effects.

## Recommendations

1. Emissions of other substances that warm the climate must also be substantially reduced as the resultant effect of climate change can only be stopped by reducing global emissions of carbon dioxide from human fossil fuel combustion and industrial processes to zero.
2. There is a need to encourage sustainable lifestyle choices among Nigerians. These include less meat consumption, phasing out inefficient appliances, and greater access to and use of public transportation.

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