

# CLIMATE RISK COUNTRY PROFILE

## NIGERIA



WORLD BANK GROUP

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## ACKNOWLEDGEMENTS

This profile is part of a series of Climate Risk Country Profiles developed by the World Bank Group (WBG). The country profile synthesizes most relevant data and information on climate change, disaster risk reduction, and adaptation actions and policies at the country level. The country profile series are designed as a quick reference source for development practitioners to better integrate climate resilience in development planning and policy making. This effort is managed and led by Veronique Morin (Senior Climate Change Specialist, WBG) and Ana E. Bucher (Senior Climate Change Specialist, WBG).

This profile was written by MacKenzie Dove (Senior Climate Change Consultant, WBG). Additional support was provided by Jason Johnston (Operations Analyst, WBG) and Yunziyi Lang (Climate Change Analyst, WBG).

Climate and climate-related information is largely drawn from the [Climate Change Knowledge Portal \(CCKP\)](#), a WBG online platform with available global climate data and analysis based on the latest [Intergovernmental Panel on Climate Change \(IPCC\)](#) reports and datasets. The team is grateful for all comments and suggestions received from the sector, regional, and country development specialists, as well as climate research scientists and institutions for their advice and guidance on use of climate related datasets.

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# FOREWORD

Climate change is a major risk to good development outcomes, and the World Bank Group is committed to playing an important role in helping countries integrate climate action into their core development agendas. The World Bank Group is committed to supporting client countries to invest in and build a low-carbon, climate-resilient future, helping them to be better prepared to adapt to current and future climate impacts.

The World Bank Group is investing in incorporating and systematically managing climate risks in development operations through its individual corporate commitments.

A key aspect of the World Bank Group's Action Plan on Adaptation and Resilience (2019) is to help countries shift from addressing adaptation as an incremental cost and isolated investment to systematically incorporating climate risks and opportunities at every phase of policy planning, investment design, implementation and evaluation of development outcomes. For all IDA and IBRD operations, climate and disaster risk screening is one of the mandatory corporate climate commitments. This is supported by the Bank Group's Climate and Disaster Risk Screening Tool which enables all Bank staff to assess short- and long-term climate and disaster risks in operations and national or sectoral planning processes. This screening tool draws up-to-date and relevant information from the World Bank's Climate Change Knowledge Portal, a comprehensive online 'one-stop shop' for global, regional, and country data related to climate change and development.

Recognizing the value of consistent, easy-to-use technical resources for client countries as well as to support respective internal climate risk assessment and adaptation planning processes, the World Bank Group's Climate Change Group has developed this content. Standardizing and pooling expertise facilitates the World Bank Group in conducting initial assessments of climate risks and opportunities across sectors within a country, within institutional portfolios across regions, and acts as a global resource for development practitioners.

For developing countries, the climate risk profiles are intended to serve as public goods to facilitate upstream country diagnostics, policy dialogue, and strategic planning by providing comprehensive overviews of trends and projected changes in key climate parameters, sector-specific implications, relevant policies and programs, adaptation priorities and opportunities for further actions.

It is my hope that these efforts will spur deepening of long-term risk management in developing countries and our engagement in supporting climate change adaptation planning at operational levels.



**Bernice Van Bronkhorst**

Global Director

Climate Change Group (CCG)

The World Bank Group (WBG)

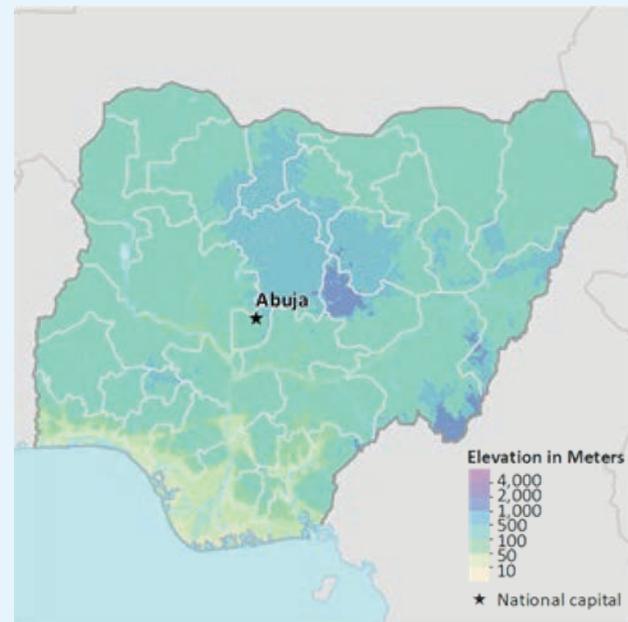
## COUNTRY OVERVIEW

The Federal Republic of Nigeria, herein Nigeria, is located along the inner corner of the Gulf of Guinea on the west coast of Africa. The country shares borders with Benin to the west, Niger to the north, and Chad and Cameroon to the east; its southern coast is along the Gulf of Guinea in the Atlantic Ocean. Nigeria has a land area of 923,768 square kilometers (km<sup>2</sup>) and includes 853 km of coastline. Nigeria is located primarily within the lowland, humid tropics and is generally characterized by high temperatures throughout the year, it has a relatively wet coastland and highly arid northern zones. Nigeria has two main relief regions: the high plateau ranging between 300 meters (m) to 900 m above sea level, and the lowlands, which are generally less than 300 m (**Figure 1**). The high plateaus include the North Central Plateau, the Eastern and North Eastern Highlands and the Western Uplands. The lowlands comprise the

Sokoto Plains, the Niger-Benue Trough, the Chad Basin, the interior coastal lowlands of western Nigeria, the lowlands and scarp lands of south eastern Nigeria and coastlands. The Niger Delta is a low-lying region, defined by a complicated system of natural and man-made channels through which the River Niger eventually empties into the sea.<sup>1</sup> The distribution of vegetation in Nigeria largely follows rainfall and are broadly categorized as tropical rainforest or savannah. The forest subtypes include salt-water swamps (Mangrove), fresh-water swamps and the high forest. The Savannah subtypes are Guinea, Sudan and Sahel. The Guinea savannah is the largest vegetation belt in the country, covering across half the country. The mangrove vegetation is found along the coastal strip where brackish water inundates the land diurnally.<sup>2</sup>

Nigeria is a lower middle-income country, has been the largest economy in Africa since 2012.<sup>4</sup> Nigeria has an estimated population of 206.14 million people (2020) with an annual population growth rate of 2.5% (**Table 1**).<sup>5</sup> Nigeria's population is projected to reach 262.9 and 401.3 million people in 2030 and 2050, respectively.

**FIGURE 1.** Elevation of Nigeria<sup>3</sup>



<sup>1</sup> Nigeria (2018). First Biennial Update Report of the Federal Republic of Nigeria under the UNFCCC. URL: [https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/218354\\_Nigeria-BUR1-1-Nigeria%20BUR1\\_Final%20\(2\).pdf](https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/218354_Nigeria-BUR1-1-Nigeria%20BUR1_Final%20(2).pdf)

<sup>2</sup> Nigeria (2020). Nigeria's Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

<sup>3</sup> World Bank (2019). Internal Climate Migration Profile - Nigeria

<sup>4</sup> Nigeria (2018). First Biennial Update Report of the Federal Republic of Nigeria under the UNFCCC. URL: [https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/218354\\_Nigeria-BUR1-1-Nigeria%20BUR1\\_Final%20\(2\).pdf](https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/218354_Nigeria-BUR1-1-Nigeria%20BUR1_Final%20(2).pdf)

<sup>5</sup> World Bank Data Bank (2021). World Development Indicators, Nigeria. URL: <https://databank.worldbank.org/source/world-development-indicators>

Approximately 50% of the population currently lives in urban areas and this is projected to increase to 60% and 70% of the population by 2030 and 2050, respectively.<sup>6</sup> The country has a Gross Domestic Product (GDP) of \$432.29 billion (2020) and a current annual growth rate of 2.2% in 2019 and 0.18% in 2020.<sup>7</sup> Between 2006 and 2016, (GDP) grew at an average rate of 5.7% per year, as volatile oil prices drove growth to a high of 8% in 2006 and to a low of -1.5% in 2016. While Nigeria's economy has performed much better in recent years than it did during previous boom-bust oil price cycles, such as in the late 1970s or mid-1980s, oil prices continue to dominate the country's growth pattern. Furthermore, the volatility of Nigeria's growth continues to impose substantial welfare costs on Nigerian households.

While Nigeria has made some socio-economic progress in recent years, its human capital development remains weak, largely due to under-investment; the country ranked 158 of 189 countries in the World Bank's 2019 Human Capital Index.<sup>8</sup> Furthermore, Nigeria continues to face massive developmental challenges, which include the need to reduce the dependency on oil and diversify the economy, address insufficient infrastructure, and build strong and effective institutions, as well as address its governance issues and public financial management systems. Inequality in terms of income and opportunities has been growing rapidly and has adversely affected poverty reduction. The country's North-South divide has widened in recent years due to the Boko Haram insurgency, farmer-herder conflict, banditry, and a lack of economic development in the northern part of the country. In southern Nigeria, violent crimes have also been on the rise, including militancy, piracy, kidnapping, and oil and gas infrastructure vandalism that has negative economic consequences for Nigeria. Large pockets of Nigeria's population still live in poverty, without adequate access to basic services, and could benefit from more inclusive development policies. The lack of job opportunities is at the core of the high poverty levels, of regional inequality, and of social and political unrest in the country.<sup>9</sup> In Nigeria, the high levels of poverty and low-degree of development and dependence on rainfed agriculture limits the capacity of poor households and communities to manage climate risk, increasing their vulnerability to climate-related shocks.<sup>10</sup>

**TABLE 1.** Data Snapshot: Key Development Indicators<sup>11</sup>

Indicator	
<b>Life Expectancy at Birth, Total (Years)</b> (2019)	54.7
<b>Population Density (People per sq. km Land Area)</b> (2018)	215.1
<b>% of Population with Access to Electricity</b> (2019)	55.4%
<b>GDP per Capita (Current US\$)</b> (2020)	\$2,097.10

<sup>6</sup> World Bank Data Bank (2021). Population estimates and projections, Nigeria. URL: <https://databank.worldbank.org/source/population-estimates-and-projections>

<sup>7</sup> World Bank Data Bank (2021). World Development Indicators, Nigeria. URL: <https://databank.worldbank.org/source/world-development-indicators>

<sup>8</sup> UNDP (2020). Human Development Reports, Nigeria. 2019 Human Development Index. URL: <http://hdr.undp.org/en/content/2019-human-development-index-ranking>

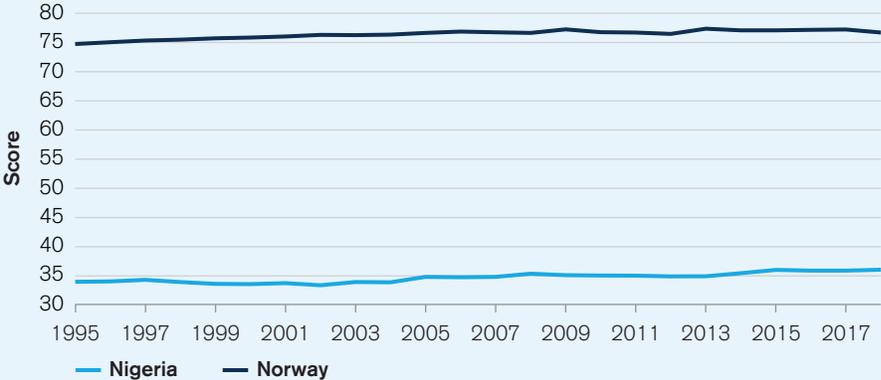
<sup>9</sup> World Bank (2021). Nigeria – Overview. URL: <https://www.worldbank.org/en/country/nigeria/overview>

<sup>10</sup> Nigeria (2016). Nationally-Determined Contributions. URL: [https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nigeria%20First/Approved%20Nigeria's%20INDC\\_271115.pdf](https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nigeria%20First/Approved%20Nigeria's%20INDC_271115.pdf)

<sup>11</sup> World Bank (2021). DataBank – World Development Indicators. URL: <https://databank.worldbank.org/source/world-development-indicators>

The ND-GAIN Index<sup>12</sup> ranks 181 countries using a score which calculates a country's vulnerability to climate change and other global challenges as well as their readiness to improve resilience. This Index aims to help businesses and the public sector better identify vulnerability and readiness in order to better prioritize investment for more efficient responses to global challenges. Due to a combination of political, geographic, and social factors, Nigeria is recognized as vulnerable to climate change impacts, ranked 160 out of 181 countries in the 2020 ND-GAIN Index. The more vulnerable a country is the lower their score, while the more ready a country is to improve its resilience the higher it will be. Norway has the highest score and is ranked 1st. **Figure 2** is a time-series plot of the ND-GAIN Index showing Nigeria progress in relation to Norway.

**FIGURE 2.** ND-GAIN Index for Nigeria



Nigeria is currently dealing with a wide range of environmental challenges, some of which are exacerbated by climate change, and negatively affects every sector, particularly agriculture, water resources and infrastructure. Other challenges facing the country are deforestation and de-vegetation, causing biodiversity loss and land degradation; floods, erosion, drought and desertification which are degrading the environment especially in the semi-arid areas of the country resulting in conflicts; environmental pollution – namely air, water, land and noise; waste generation; mineral exploration and exploitation and the accompanying environmental degradation as well as limited access to safe water and poor sanitation. Climate change impacts in Nigeria is expected to have significant impacts on livelihoods and the broader economy.<sup>13</sup> Rising temperatures, extreme heat, and changing precipitation patterns will induce new challenges and exacerbate existing ones.

Nigeria submitted its [Third National Communication](#) in 2020 its [Nationally-Determined Contribution \(NDC\)](#) to the UNFCCC in 2016 and its [Updated NDC](#) in 2021. These outline the country's efforts to promote its sustainable development goals. Efforts include adaptation and mitigation actions which are economically efficient and socially desirable and which achieves climate change benefits. Policies are also aimed at alleviating poverty, increasing social welfare and inclusion, as well as improving individual well-being, and ensuring a healthy environment. Nigeria has identified its adaptation priorities, which include sustainable land use and water resource management that results

<sup>12</sup> University of Notre Dame (2020). Notre Dame Global Adaptation Initiative. URL: <https://gain.nd.edu/our-work/country-index/>  
<sup>13</sup> Nigeria (2020). Nigeria's Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

in food security, appropriate urban development, preservation of its biodiversity and ecosystem services, social protection mechanisms, infrastructure resilience, improved health and disaster risk reduction for reduced vulnerability across the country.<sup>14</sup>

## Green, Inclusive and Resilient Recovery

The coronavirus disease (COVID-19) pandemic has led to unprecedented adverse social and economic impacts. Further, the pandemic has demonstrated the compounding impacts of adding yet another shock on top of the multiple challenges that vulnerable populations already face in day-to-day life, with the potential to create devastating health, social, economic and environmental crises that can leave a deep, long-lasting mark. However, as governments take urgent action and lay the foundations for their financial, economic, and social recovery, they have a unique opportunity to create economies that are more sustainable, inclusive and resilient. Short and long-term recovery efforts outlined in the Nigeria Economic Sustainability Plan,<sup>15</sup> prioritizes investments that boost jobs and economic activity; have positive impacts on human, social and natural capital; protect biodiversity and ecosystems services; boost resilience; and advance the decarbonization of economies.

## CLIMATOLOGY

### Climate Baseline

#### Overview

Nigeria is characterized by three distinct climate zones, a tropical wet climate in the south, a tropical savannah climate for most of the central regions, and a Sahelian hot and semi-arid climate in the north of the country. This leads to a gradient of declining precipitation amounts from south to north. The southern regions experience strong rainfall events during the rainy season from March to October with annual rainfall amounts, usually above 2,000 millimeters (mm), and can reach 4,000 mm and more in the Niger Delta. The central regions are governed by a well-defined single rainy season (April to September) and dry season (December to March). The dry season is influenced by the Harmattan wind from the Sahara. Coastal areas experience a short drier season with most rain occurring over March to October. Annual rainfall can reach up to about 1200 mm. In the north, rain falls from June to September in the range of 500 mm to 750 mm. The rest of the year is hot and dry. Northern areas have a high degree of annual variation in its rainfall regime, which results in flooding and droughts.<sup>16</sup>

<sup>14</sup> Nigeria (2021). Updated Nationally-Determined Contributions. URL: <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nigeria%20First/NDC%20INTERIM%20REPORT%20SUBMISSION%20-%20NIGERIA.pdf>

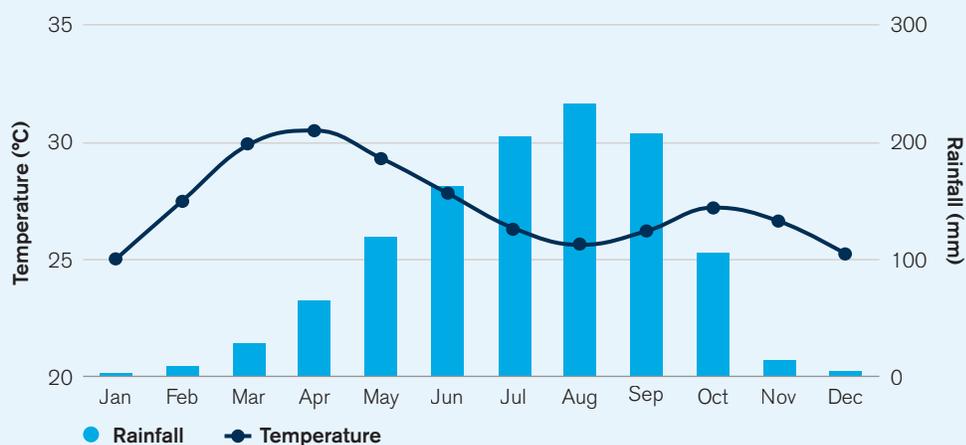
<sup>15</sup> Nigeria (2020). The Nigeria Economic Sustainability Plan. Budget Office of the Federation. URL: <https://www.budgetoffice.gov.ng/index.php/nigeria-economic-sustainability-plan>

<sup>16</sup> Nigeria (2020). Nigeria's Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

The most significant temperature difference in Nigeria is between the coastal areas and its interior as well as between the plateau and the lowlands. On the plateau, the mean annual temperature varies between 21°C and 27°C whereas in the interior lowlands, temperatures are generally over 27°C. The coastal fringes have lower means than the interior lowlands. Seasonal mean temperatures are consistently over 20°C throughout the country and diurnal variations are more pronounced than seasonal ones. Highest temperatures occur during the dry season, and vary little from the coast to inland areas.<sup>17</sup> Similar to rainfall, the relative humidity in Nigeria decreases from the south to the north, with an annual mean of 88% around Lagos.<sup>18</sup>

Analysis of data from the World Bank Group's [Climate Change Knowledge Portal \(CCKP\)](#) (**Table 2**) shows information for the latest climatology, 1991–2020. Mean annual temperature for Nigeria is 27.2°C, with average monthly temperatures ranging between 24°C (December, January) and 30°C (April). Mean annual precipitation is 1,162.8 mm. Rainfall is experienced throughout the year in Nigeria, with most significant rainfall occurring from April to October and with minimal rainfall occurring November to March, as shown for the latest climatology, 1991–2020 (**Figure 3**).<sup>19</sup> **Figure 4** shows the spatial variation of observed average annual precipitation and temperature across Nigeria.

**FIGURE 3.** Average Monthly Temperature and Rainfall for Nigeria, 1991–2020<sup>20</sup>



**TABLE 2.** Data Snapshot: Key Development Indicators<sup>21</sup>

Climate Variables	1991–2020
Mean Annual Temperature (°C)	27.2°C
Mean Annual Precipitation (mm)	1,162.8 mm
Mean Maximum Annual Temperature (°C)	33.2°C
Mean Minimum Annual Temperature (°C)	21.3°C

<sup>17</sup> GERICS (2015). Climate-Fact-Sheet, Nigeria. URL: [https://www.climate-service-center.de/products\\_and\\_publications/fact\\_sheets/index.php.de](https://www.climate-service-center.de/products_and_publications/fact_sheets/index.php.de)

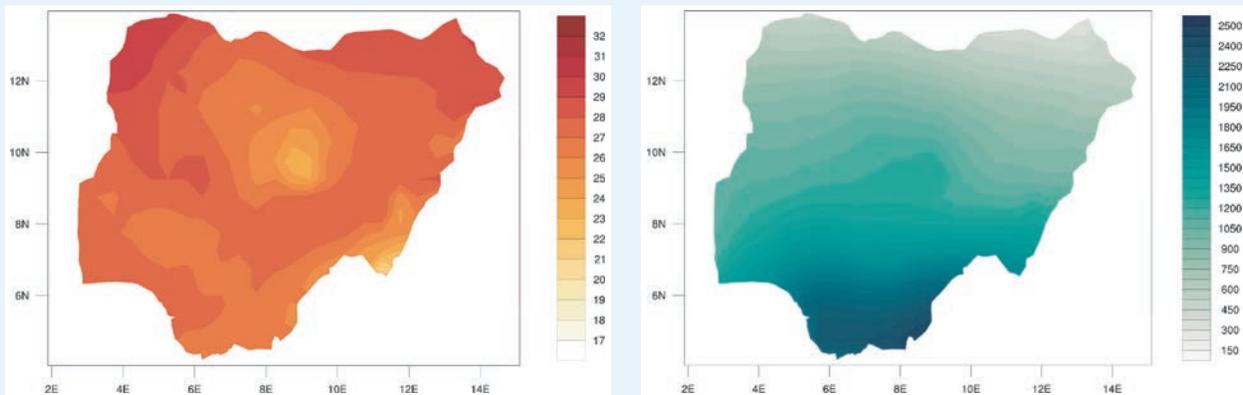
<sup>18</sup> Nigeria (2020). Nigeria's Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

<sup>19</sup> WBG Climate Change Knowledge Portal (CCKP, 2021). Nigeria. URL: <https://climateknowledgeportal.worldbank.org/country/nigeria>

<sup>20</sup> WBG Climate Change Knowledge Portal (CCKP, 2021). Nigeria. URL: <https://climateknowledgeportal.worldbank.org/country/nigeria>

<sup>21</sup> World Bank (2021). DataBank – World Development Indicators. URL: <https://databank.worldbank.org/source/world-development-indicators>

**FIGURE 4.** Average Annual Temperature (°C) (left); Annual Precipitation (mm) (right) of Nigeria, 1991–2020<sup>22</sup>

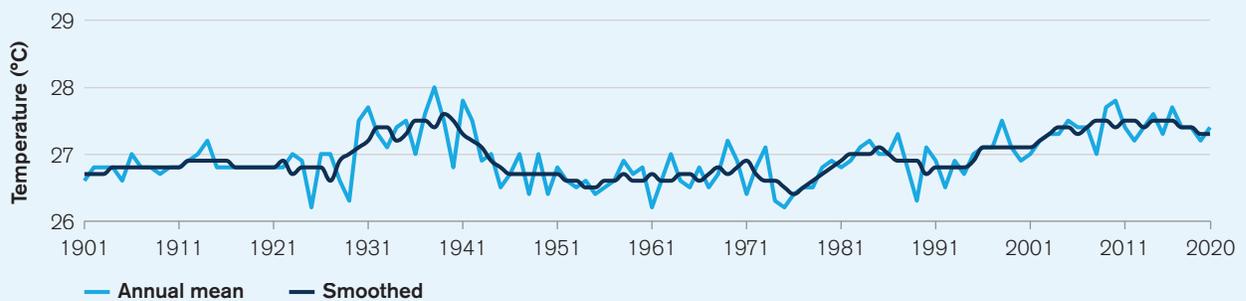


## Key Trends

### Temperature

Nigeria's mean annual temperature ranges between 17°C to 37°C in the south to 12°C to 45°C in the north. For the country, temperature increases of 0.03°C per decade were observed between 1901–2016, with stronger increases occurring over the last 30 years of 0.19°C per decade (**Figure 5**). The highest temperatures in Nigeria occur during the dry season, and vary little from the coast to inland the country's areas.<sup>23</sup> Nigeria has observed the gradual drying of Lake Chad over the last 40 years, from a land area of over 40,000 km<sup>2</sup> to currently just 1,300 km<sup>2</sup> as well as the encroachment by the Sahara Desert, which has been attributed largely to the country's increasing temperatures.<sup>24</sup>

**FIGURE 5.** Observed Temperature for Nigeria, 1901–2020<sup>25</sup>



<sup>22</sup> WBG Climate Change Knowledge Portal (CCKP, 2021). Nigeria, Historical Climate. URL: <https://climateknowledgeportal.worldbank.org/country/nigeria/climate-data-historical>

<sup>23</sup> GERICS (2015). Climate-Fact-Sheet, Nigeria. URL: [https://www.climate-service-center.de/products\\_and\\_publications/fact\\_sheets/index.php.de](https://www.climate-service-center.de/products_and_publications/fact_sheets/index.php.de)

<sup>24</sup> Nigeria (2020). Nigeria's Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

<sup>25</sup> WB Climate Change Knowledge Portal (CCKP, 2021). Nigeria URL: <https://climateknowledgeportal.worldbank.org/country/nigeria/climate-data-historical>

## Precipitation

In Nigeria, precipitation trends have a high degree of variability and the last several decades have observed a decrease in the predictability for seasonal rains across the country. Overall, rainfall has decreased incrementally across the country since the 1960s. Rainfall for the country varies from a very wet coastal area with annual rainfall greater than 3,500 mm to the Sahel region in the northwest and north-eastern parts, which receive an annual rainfall less than 600 mm. The annual variation of rainfall, particularly in the northern parts, is large. This has resulted in climatic hazards, especially floods and droughts.<sup>26</sup> Observed rainfall patterns indicate that rainfall for the country over the past century declined by approximately 80 centimeters (cm).<sup>27</sup>

# Climate Future

## Summary Statistics

The main data source for the World Bank Group's CCKP is the CMIP5 (Coupled Model Inter-comparison Project Phase 5) data ensemble, which builds the database for the global climate change projections presented in the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC). Four Representative Concentration Pathways (i.e. RCP2.6, RCP4.5, RCP6.0, and RCP8.5) were selected and defined by their total radiative forcing (cumulative measure of GHG emissions from all sources) pathway and level by 2100. The RCP2.6, for example, represents a very strong mitigation scenario, whereas the RCP8.5 assumes business-as-usual scenario. For more information, please refer to the [RCP Database](#). For simplification, these scenarios are referred to as a low (RCP2.6); a medium (RCP4.5) and a high (RCP8.5) emission scenario in this profile. **Table 3** provides CMIP5 projections for essential climate variables under high emission scenario (RCP 8.5) over 4 different time horizons. **Figure 6** presents the multi-model (CMIP5) ensemble of 32 Global Circulation Models (GCMs) showing the projected changes in annual precipitation and temperature for the periods 2040–2059 and 2080–2099.

**TABLE 3.** Data Snapshot: CMIP5 Ensemble Projection

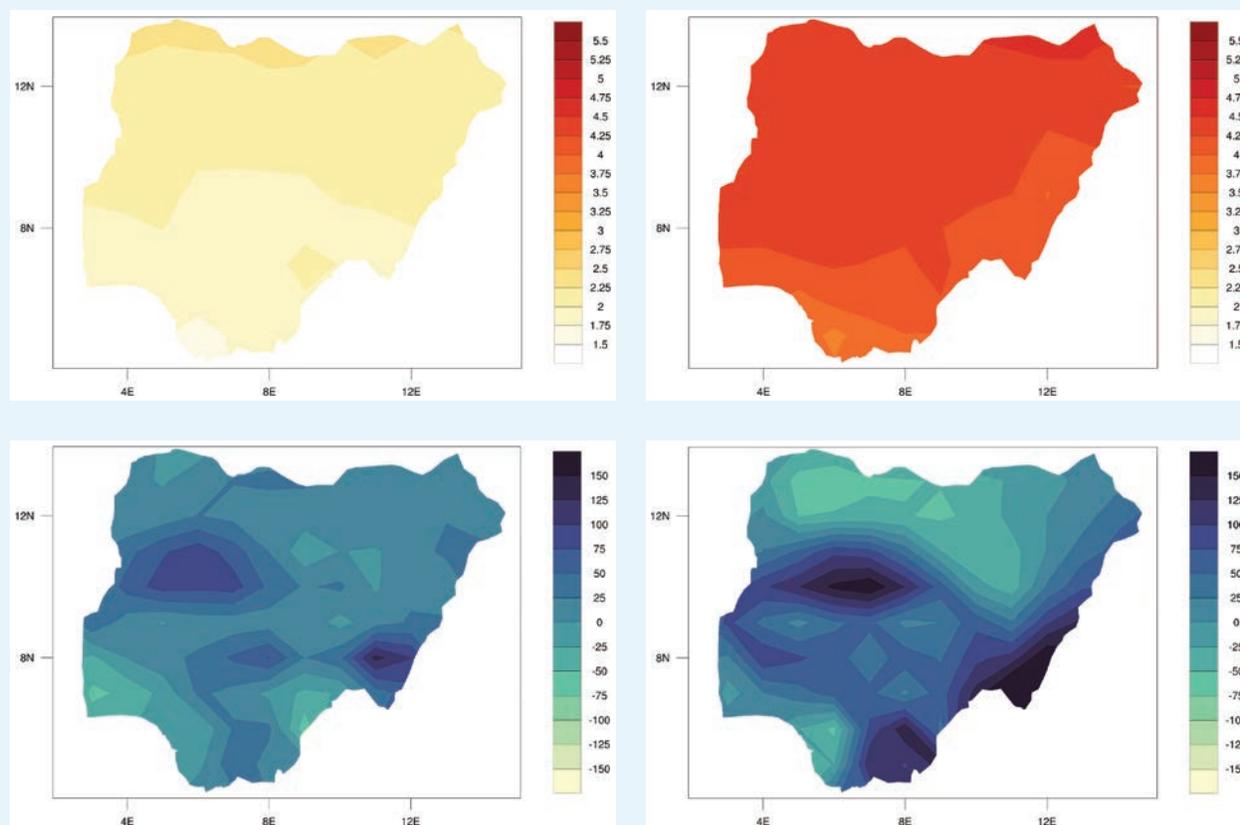
Cmip5 Ensemble Projection	2020–2039	2040–2059	2060–2079	2080–2099
<b>Annual Temperature Anomaly (°C)</b>	<b>+0. to +1.5</b> (+1.0°C)	<b>+1.3 to +2.8</b> (+1.8°C)	<b>+2.0 to +4.2</b> (+2.7°C)	<b>+2.9 to +5.7</b> (+3.7°C)
<b>Annual Precipitation Anomaly (mm)</b>	<b>–18.6 to +21.5</b> (+0.4 mm)	<b>–25.6 to +29.6</b> (–0.3 mm)	<b>–28.0 to +39.4</b> (+2.3 mm)	<b>–36.0 to +47.0</b> (+1.6 mm)

Note: The table shows CMIP5 ensemble projection under RCP8.5. Bold value is the range (10th–90th Percentile) and values in parentheses show the median (or 50th Percentile).

<sup>26</sup> GERICS (2015). Climate-Fact-Sheet, Nigeria. URL: [https://www.climate-service-center.de/products\\_and\\_publications/fact\\_sheets/index.php.de](https://www.climate-service-center.de/products_and_publications/fact_sheets/index.php.de)

<sup>27</sup> Nigeria (2020). Nigeria's Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

**FIGURE 6.** Multi-model (CMIP5) Ensemble Projected Changes (32 GCMs) in Annual Temperature (top) and Precipitation (bottom) by 2040–2059 (left) and by 2080–2099 (right), Relative to 1986–2005 Baseline Under RCP8.5<sup>28</sup>



## Key Trends

### Temperature

According to analysis from the German Climate Service Center (GERICS) of 32 Global Climate Models (GCMs), temperatures across Nigeria are expected to increase by 2.9°C to as much as 5.7°C by end of the century.<sup>29</sup> Nighttime temperatures are expected to increase by as much as 4.7°C. An increase in the duration of heat waves by a range of an additional 8 to 55 days are expected by the end of the century.<sup>30</sup> Temperature increases are expected to be lower in the southern areas of the country, but will increase much more rapidly in the interior and northern areas in comparison. Low temperatures are also expected to increase.<sup>31</sup>

<sup>28</sup> WBG Climate Change Knowledge Portal (CCKP, 2021). Nigeria Projected Future Climate. URL: <https://climateknowledgeportal.worldbank.org/country/nigeria/climate-data-projections>

<sup>29</sup> WBG Climate Change Knowledge Portal (CCKP, 2021). Nigeria Projected Future Climate. URL: <https://climateknowledgeportal.worldbank.org/country/nigeria/climate-data-projections>

<sup>30</sup> GERICS (2015). Climate-Fact-Sheet, Nigeria. URL: [https://www.climate-service-center.de/products\\_and\\_publications/fact\\_sheets/index.php.de](https://www.climate-service-center.de/products_and_publications/fact_sheets/index.php.de)

<sup>31</sup> Nigeria (2020). Nigeria's Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

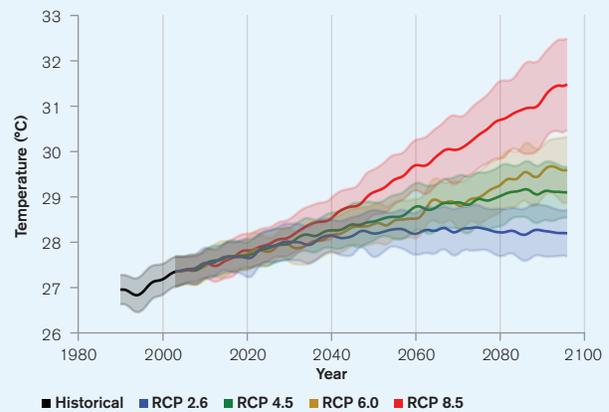
Across all emission scenarios, temperature increase for Nigeria are projected throughout the end of the century. As seen in **Figure 7**, under a high-emission scenario, average temperatures are expected to increase rapidly by mid-century. Average temperatures are expected to increase throughout the end of the century. Temperature increase is expected throughout the year. Increased heat and extreme heat conditions will result in significant implications for human and animal health, agriculture, and ecosystems.

### Precipitation

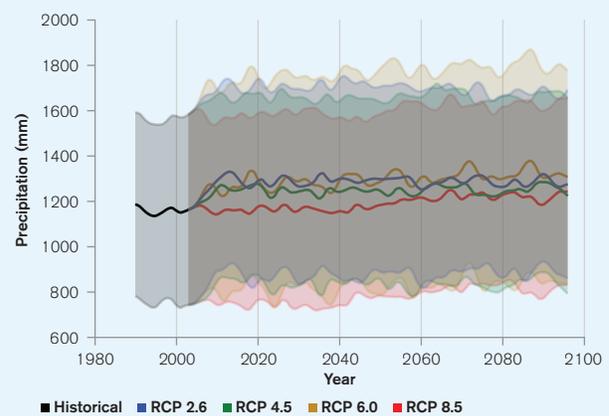
Rainfall for the country is highly variable and analysis indicates no clear trend in precipitation. There is an expectation for an increase in precipitation amounts towards the end of the rainy season into the beginning of the dry season (September to December). Heavy rainfall is projected to intensify, with precipitation events and extreme rainfall and extreme events are likely to result in flooding events expected to impact rivers and surface water runoff during the summer rainy seasons. Natural disasters due to the increase in the frequency and intensity of floods and droughts are also expected to increase.<sup>33</sup>

**Figure 8** shows the change in projected annual average precipitation for Nigeria. At a nationally aggregated scale, annual average precipitation is expected to remain similar to historical observations, but under the highest emissions scenario, RCP8.5, will decrease the most drastically. Water routing, storage and other management options can be highly varied depending if the precipitation input comes frequently or with long periods of aridity in between rainfall.<sup>34</sup> Under a high emissions scenario of RCP8.5, at a nationally aggregated level, rainfall is expected to stay largely similar to current conditions. However, across the country, rainfall is expected to decrease significantly in the northern areas and increase in the south and along the coast.

**FIGURE 7.** Projected Average Temperature for Nigeria (Reference Period, 1986–2005)<sup>32</sup>



**FIGURE 8.** Projected Average Precipitation in Nigeria (Reference Period, 1986–2005)<sup>35</sup>



<sup>32</sup> WBG Climate Change Knowledge Portal (CCKP, 2021). Nigeria Climate Data – Projections. URL: <https://climatedata.worldbank.org/CRMePortal/web/agriculture/crops-and-land-management?country=NGA&period=2080-2099>

<sup>33</sup> GERICS (2015). Climate-Fact-Sheet, Nigeria. URL: [https://www.climate-service-center.de/products\\_and\\_publications/fact\\_sheets/index.php.de](https://www.climate-service-center.de/products_and_publications/fact_sheets/index.php.de)

<sup>34</sup> WBG Climate Change Knowledge Portal (CCKP, 2021). Nigeria Water Dashboard. Data Description. URL: <https://climateknowledgeportal.worldbank.org/country/nigeria/climate-sector-water>

<sup>35</sup> WBG Climate Change Knowledge Portal (CCKP, 2021). Nigeria Water Dashboard. URL: <https://climateknowledgeportal.worldbank.org/country/nigeria/climate-sector-water>

## Overview

Nigeria is at risk to numerous natural hazards and prone to floods, storms, ocean surges, droughts and wildfires. Nigeria's coastal states face extensive risks from storm surge along the entire coast, and inland flooding and wildfires in the Niger Delta region, and negative rainfall anomalies in the southeast. The northern areas of the country face chronic aridity and riverine flooding along the Sokoto River in the northwest and the Komadugu River system in the northeast,<sup>36</sup> as well as transboundary flooding along Niger and Benue rivers. The middle areas of the country are at risk to high exposure from aridity, which is compounded by high-tensions between farmers and pastoralists concerning land rights as well as water access.<sup>37</sup>

Nigeria is classified as one of the ten most vulnerable countries to the impacts of climate change and natural hazards.<sup>38</sup> Most recently, Nigeria experienced a double shock of severe drought in the northeast and widespread flooding that affected nearly the entire country in 2012. The floods caused nearly \$17 billion in damages and losses in the 12 most-affected states. Nigeria is regularly affected by multiple hazards such as floods and droughts. Furthermore, low-income households are the most vulnerable to weather-related natural disasters.<sup>39</sup> Agriculture, which is heavily impacted by flooding and drought, serves as the main source of income for 80% of the rural poor. The rapid rise of urbanization and urban poverty also increases potential flood risk.<sup>40</sup> An estimated 24% of Nigeria's population (approximately 41 million people) are living in high climate exposure areas. Some of the highest overall exposure is concentrated in the coastal states, including the coastal areas of Lagos, Delta and Rivers states, where large population concentrations live in the cities of Lagos, Warri and Port Harcourt, where poorer households and slum areas are at risk from flooding and storm surges.<sup>41</sup> An estimated 27 to 53 million people may need to be relocated due to a 0.5 meter increase in sea level, which is projected for Nigeria by end of the century.<sup>42</sup> In addition, ongoing coastal erosion, rising seas and oil pollution are destroying the Delta's mangrove forest – a major buffer against storm surge from the sea.<sup>43</sup> Increased food insecurity is also of specific concern following disasters which result in land and infrastructure degradation due to erosion, direct crop failure due to floods and heavy rains, and possible nutrient leaching, and fungal growth due to increased humidity. Water availability will be affected by possible periods of drought.<sup>44</sup> Given the dependency of Nigeria's economy on climate-sensitive industries (agriculture, forestry, oil, and gas extraction), climate change inaction could cost Nigeria between 6%–30% by 2050, equivalent to a loss of US\$100–460 billion.<sup>45</sup>

<sup>36</sup> Echendu, A (2020). The impact of flooding in Nigeria's sustainable development goals. *J. or Ecosystem Health and Sustainability*. 6(1). DOI: <https://doi.org/10.1080/20964129.2020.1791735>

<sup>37</sup> USAID (2018). Fragility and Climate Risks in Nigeria. URL: [https://pdf.usaid.gov/pdf\\_docs/PA00TBFK.pdf](https://pdf.usaid.gov/pdf_docs/PA00TBFK.pdf)

<sup>38</sup> Climate Scorecard (2019). Nigeria Listed as One of the 10 Most Climate Vulnerable Countries. URL: <https://www.climatescorecard.org/2018/11/nigeria-listed-as-one-of-the-10-most-climate-vulnerable-countries/>

<sup>39</sup> Echendu, A (2020). The impact of flooding in Nigeria's sustainable development goals. *J. or Ecosystem Health and Sustainability*. 6(1). DOI: <https://doi.org/10.1080/20964129.2020.1791735>

<sup>40</sup> GFDRR (2019). Nigeria. URL: <https://www.gfdrr.org/en/nigeria>

<sup>41</sup> World Bank (2020). The Cost of Coastal Zone Degradation in Nigeria: Cross River, Delta, and Lagos States. URL: <https://openknowledge.worldbank.org/handle/10986/34758>

<sup>42</sup> USAID (2018). Fragility and Climate Risks in Nigeria. URL: [https://pdf.usaid.gov/pdf\\_docs/PA00TBFK.pdf](https://pdf.usaid.gov/pdf_docs/PA00TBFK.pdf)

<sup>43</sup> Merem et al (2019). Regional Assessment of Climate Change Hazards in Southern Nigeria with GIS. *Journal of Safety Engineering* 2019, 8(1): 9–27 DOI: <https://doi.org/10.5923/j.safety.20190801.02>

<sup>44</sup> Ayanlade A, Radeny M, Morton JF, Muchaba T. (2018). Rainfall variability and drought characteristics in two agro-climatic zones: An assessment of climate change challenges in Africa. *Science of The Total Environment* 630:728–737. URL: <https://ccafs.cgiar.org/news/understanding-rainfall-variability-drought-and-farmers%E2%80%99-coping-strategies-nigeria#.XYEZBZNR4>

<sup>45</sup> World Bank Group (2020). Country Partnership Framework for the Federal Republic of Nigeria for the Period FY21-FY25. November 16, 2020. URL: <https://openknowledge.worldbank.org/handle/10986/35098>

Climate change, deforestation, watershed degradation, land use, urbanization and widespread settlements into flood-prone areas have exacerbated issues and impacts from flooding and droughts and have also increased the risk of wildfires. Fires in Nigeria generally emanate from human activities and serve as a land clearing approach for agricultural purposes, disposal of waste, pasture management, animal tracking and hunting. The majority of damaging fires are observed from January onwards, due to high temperature (above 35°C) and also influenced by the hot and dry harmattan winds flowing from North to South between December and March.<sup>46</sup> Heavy rainfall can also trigger riverine and flash floods; these are common in the country's hill areas and can also trigger landslides and mudslides and consequently gully erosion in sedimentary terrains. Additionally, water stress during dry periods is likely to be further exacerbated with competing demands from household, industrial consumption and agriculture. Increased heat will further strain existing water resources and impacts from changing rainfall patterns.<sup>47</sup>

Data from the EM-Dat database,<sup>48</sup> presented in **Table 4**, shows the country has endured various natural hazards, including droughts, floods, landslides, epidemics, and storms.

**TABLE 4.** Natural Disasters in Nigeria, 1900–2020

Natural Hazard 1900–2020	Subtype	Events Count	Total Deaths	Total Affected	Total Damage ('000 USD)
<b>Drought</b>	Drought	1	0	3,000,000	71,103
<b>Epidemic</b>	Bacterial Disease	27	17,278	163,378	0
	Viral Disease	24	8,233	182,474	0
<b>Extreme Temperature</b>	Cold Wave	1	18	Data not available	0
	Heat Wave	1	60	Data not available	0
<b>Flood</b>	Flash Flood	6	330	109,165	7,805
	Riverine Flood	28	1,110	10,275,064	636,717
<b>Insect Infestation</b>	Grasshopper	1	Data not available	Data not available	0
	Locust	1	Data not available	Data not available	0
<b>Storm</b>	Convective Storm	3	54	16,012	1,000
<b>Landslide</b>	Landslide	3	32	1,800	0

<sup>46</sup> IFFN (2006). Fire Situation in Nigeria. URL: [https://www2.fire.uni-freiburg.de/iffn/iffn\\_34/12-IFFN-34-Nigeria.pdf](https://www2.fire.uni-freiburg.de/iffn/iffn_34/12-IFFN-34-Nigeria.pdf)

<sup>47</sup> Nigeria (2020). Nigeria's Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

<sup>48</sup> EM-DAT: The Emergency Events Database - Universite catholique de Louvain (UCL) - CRED, D. Guha-Sapir, Brussels, Belgium. URL: [http://emdat.be/emdat\\_db/](http://emdat.be/emdat_db/)

## Key Trends

Climate change trends in Nigeria are expected to increase the risk and intensity of flooding through increased frequency and intensity of heavy rainfall events. Additionally, the country's eastern and central areas are expected to experience increased aridity and drought, with significant impact on livelihoods. Droughts have already resulted in famine, population displacement, conflicts, and biodiversity loss. Seasonal droughts are expected to be prolonged, which will cause problems especially in the central and eastern areas of the country.<sup>49</sup> Nigeria has experienced major flooding events, with the most recent and most significant occurring in 2012. Severe flooding in 2012 affected seven million people and caused economic damages estimated at \$500 million. Severe flooding in 2015 affected one million people and resulted in damages of approximately \$25 million.<sup>50</sup> According to a 2009 DFID study, if no adaptation action is taken, between 2–11% of Nigeria's GDP could be lost by 2020. The Post Disaster Need Assessment (PDNA) Report following 2012 flood revealed that the total damage caused by the disaster amounted to \$16.9 billion, representing 1.4% of real GDP growth in that year.<sup>51</sup>

Changes in rainfall with increased temperature and increases in floods and droughts will impact food security and water availability. Increased incidence of extreme rainfall may also result in soil erosion and water logging of crops, thus decreasing yields and increasing food insecurity. Given projected climate change trends, Nigeria and the surrounding West African region is expected to be a hotspot of food insecurity in the future. This may result in significant economic losses, damage to agricultural lands and infrastructure as well as human casualties. Land degradation and soil erosion, exacerbated by recurrent flood adversely impacts agricultural production, disproportionately affecting the livelihoods of the rural poor. Food security will be influenced because of the vulnerability of some crops to increasing temperatures and/or water stress.<sup>52</sup> Despite improvements in the country's 2018 food security situation due to sustained humanitarian assistance, policy actions, and government interventions in the agricultural sector, the food security and nutrition situation remains fragile in northeastern Nigeria where food is still the biggest unmet need of Internally Displaced People (IDPs) in camps and camp-like settings. Vulnerable households are not able to cultivate enough land nor do they own sufficient livestock to cover their food needs. The country's ongoing conflict also continues to have a direct impact on people's nutrition status that is further exacerbated by weak health infrastructures and food insecurity.<sup>53</sup> **Figure 9** presents different risks for Nigeria in terms of urban flooding, water scarcity, extreme heat, and wildfires.

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<sup>49</sup> Nigeria (2020). Nigeria's Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

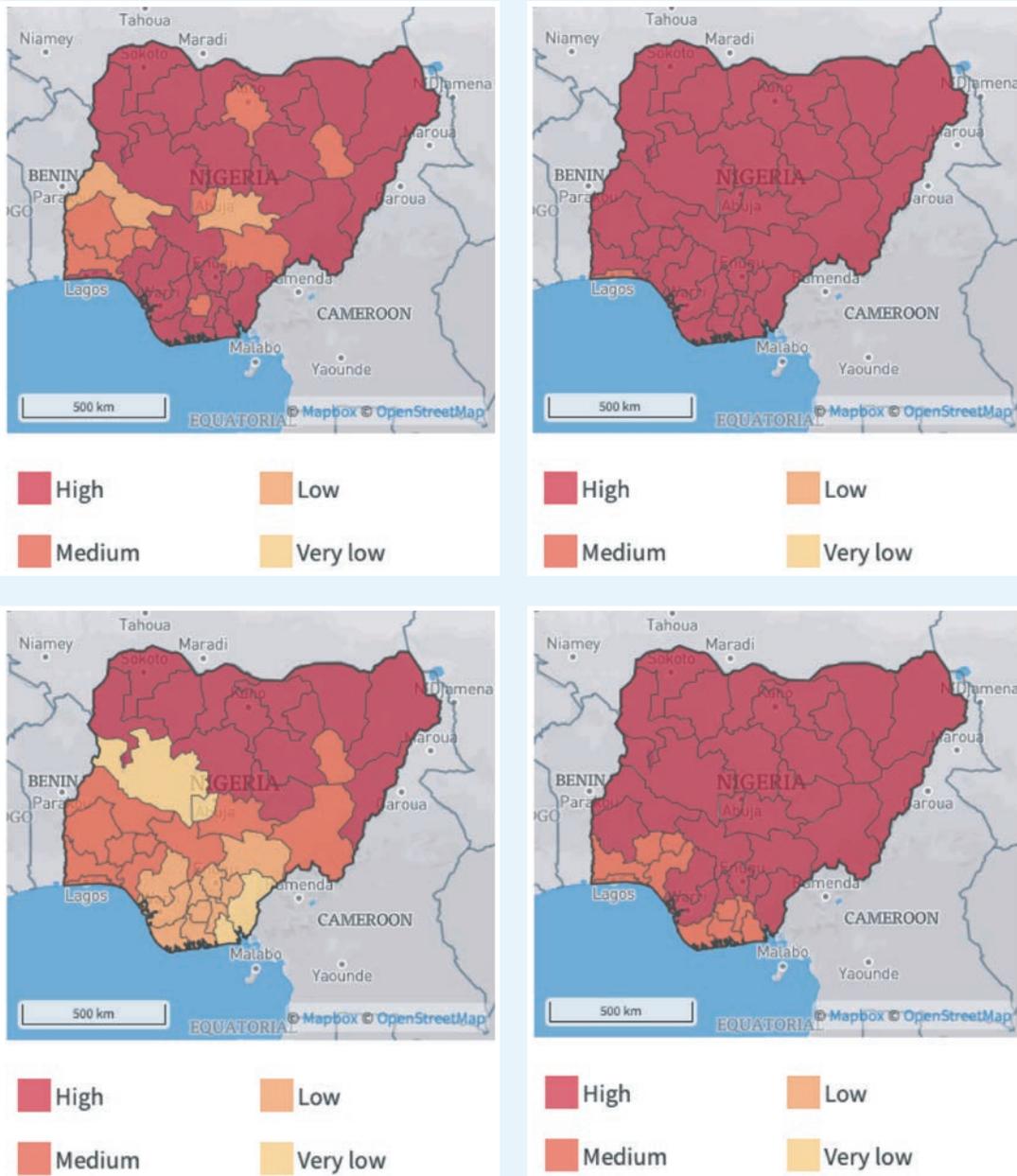
<sup>50</sup> GERICS (2015). Climate-Fact-Sheet, Nigeria. URL: [https://www.climate-service-center.de/products\\_and\\_publications/fact\\_sheets/index.php.de](https://www.climate-service-center.de/products_and_publications/fact_sheets/index.php.de)

<sup>51</sup> Nigeria (2021). Updated Nationally-Determined Contributions. URL: <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nigeria%20First/NDC%20INTERIM%20REPORT%20SUBMISSION%20-%20NIGERIA.pdf>

<sup>52</sup> USAID (2018). Fragility and Climate Risks in Nigeria. URL: [https://pdf.usaid.gov/pdf\\_docs/PA00TBFK.pdf](https://pdf.usaid.gov/pdf_docs/PA00TBFK.pdf)

<sup>53</sup> FAO (2019). Nigeria Humanitarian Response Plan 2019–2021. URL: <http://www.fao.org/3/CA3037EN/ca3037en.pdf>

**FIGURE 9.** Risk of Urban Flood (top left); Risk of Wildfire (top right); Risk of Water Scarcity (bottom left); Risk of Extreme Heat (bottom right).<sup>54</sup>



<sup>54</sup> ThinkHazard! (2021). Nigeria Wildfire. URL: <http://thinkhazard.org/en/report/205-nigeria/WF>

## Implications for DRM

Nigeria is working to advance its disaster risk management (DRM) agenda. In 2011, the country passed the National Disaster Management Framework (NDMF), which is focused on improving national capacity for risk management, as opposed to post-disaster response and recovery.<sup>55</sup> The 2012 flood was a key turning point in national strategy to invest and support long-term disaster resilience efforts. This was supported through Nigeria's post-disaster needs assessment of the 2012 floods.<sup>56</sup> In order to further reduce risks and advance its DRM agenda, national efforts include the establishment of functional DRM institutions across all levels of government, encouraging the coordination between government agencies to share data and develop plans for disaster preparedness, which will also include conflict and epidemics. Increased investment in flood mitigation infrastructure is expected to reduce exposure. Efforts are also ongoing to enhance awareness, coping capacity and resilience efforts at community levels.<sup>57</sup> These include the annual releases of the Seasonal Climate Prediction by Nigeria Meteorological Agency (NiMET) and the Annual Flood Outlook the Nigeria Hydrological Services Agency (NIHSA), to enhance preparedness and planning the Agricultural and allied sectors. Nigeria's National Emergency Management Agency (NEMA) is the federal body responsible for overseeing disaster response and management.<sup>58</sup>

## CLIMATE CHANGE IMPACTS TO KEY SECTORS

Nigeria is highly vulnerable to seasonal variability and long-term climate change. Increasing vulnerability is expected to result in cumulative impacts across the country's social, economic, and environmental structures. Heavy rainfall and floods in particular are likely to have significant consequences on the environment, society, food security situation, as well as the wider economy. Significant impacts are also expected for the country's water resources, agriculture, wetland areas, and health sectors. Increased temperatures, flooding, increased aridity, and soil erosion puts both urban and rural communities at risk, particularly for poor and vulnerable groups. Environmental degradation, impacted water resources, and loss of biodiversity and ecosystem services constitute serious obstacles to the country's continued development and responsible management of its natural resources, which is also likely to impact the country's tourism sector. Environmental pollution is a serious challenge, especially for major urban areas.<sup>59</sup> Projected trends of climate variability and longer-term change are likely to exacerbate these concerns, as the majority of agricultural and livestock production is rainfed, and provides livelihoods for the majority of the population and may trigger increased internal migration and urbanization. More extreme weather events such as intense rainfall after prolonged dry spells can lead to erosion and flash flooding, damaging roads and infrastructure, wiping out crops and put additional lives at risk.<sup>60</sup>

<sup>55</sup> Echendu, A (2020). The impact of flooding in Nigeria's sustainable development goals. *J. or Ecosystem Health and Sustainability*. 6(1). DOI: <https://doi.org/10.1080/20964129.2020.1791735>

<sup>56</sup> Nigeria (2013). Nigeria Post-Disaster Needs Assessment 2012 Floods. URL: [http://www.gfdrr.org/sites/gfdrr/files/NIGERIA\\_PDNA\\_PRINT\\_05\\_29\\_2013\\_WEB.pdf](http://www.gfdrr.org/sites/gfdrr/files/NIGERIA_PDNA_PRINT_05_29_2013_WEB.pdf)

<sup>57</sup> GFDRR (2019). Nigeria. URL: <https://www.gfdrr.org/en/nigeria>

<sup>58</sup> Mashi, S. Oghenejabor, O. and Inkani, A. (2019). Disaster risks and management policies and practices in Nigeria: A critical appraisal of the National Emergency Management Agency Act. *International Journal of Disaster Risk Reduction*. 33. pp. 253-265. DOI: <https://doi.org/10.1016/j.ijdr.2018.10.011>

<sup>59</sup> Nigeria (2018). First Biennial Update Report of the Federal Republic of Nigeria under the UNFCCC. URL: [https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/218354\\_Nigeria-BUR1-1-Nigeria%20BUR1\\_Final%20\(2\).pdf](https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/218354_Nigeria-BUR1-1-Nigeria%20BUR1_Final%20(2).pdf)

<sup>60</sup> USAID (2018). Fragility and Climate Risks in Nigeria. URL: [https://pdf.usaid.gov/pdf\\_docs/PA00TBFK.pdf](https://pdf.usaid.gov/pdf_docs/PA00TBFK.pdf)

## Gender

An increasing body of research has shown that climate-related disasters have impacted human populations in many areas including agricultural production, food security, water management and public health. The level of impacts and coping strategies of populations depends heavily on their socio-economic status, socio-cultural norms, access to resources, poverty as well as gender. Research has also provided more evidence that the effects are not gender neutral, as women and children are among the highest risk groups. Key factors that account for the differences between women's and men's vulnerability to climate change risks include: gender-based differences in time use; access to assets and credit, treatment by formal institutions, which can constrain women's opportunities, limited access to policy discussions and decision making, and a lack of sex-disaggregated data for policy change.<sup>61</sup>

# Agriculture

## Overview

The agricultural sector is critical to Nigeria's economy and the overall food security situation for the country. Nearly 78% of the total land mass of the country, representing 708,000 km<sup>2</sup>, are under agriculture cultivation. Of these, 48.0% constitute arable lands, 42.8% are under permanent meadows and pastures and the remaining 9.2% are under permanent crop production. The agriculture sector is also the largest employer of the country and accounts for 24.4% of GDP (2016).<sup>62</sup> Nigeria's agriculture is dominated by small-holder farmers and characterized by limited mechanization. Additionally, the relatively low soil fertility, climate, land tenure and inefficient land management practices are responsible for low productivity for the sector. This low productivity has in part, resulted in the heavy dependency on import to meet food demand. Some of the most significant food imports include wheat, fish, rice and sugar. Nigeria is currently the second largest importer of rice in the world. Recently, there have been increasing efforts directed at reducing food imports, which include programs to attract the youth to agriculture; improvement of local rice and cassava production initiatives, which have contributed to making Nigeria a leading producer of cassava in the world,<sup>63</sup> and border closure interventions to reduce smuggling and drive local food (rice and poultry) production.<sup>64</sup>

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<sup>61</sup> World Bank Group (2016). Gender Equality, Poverty Reduction, and Inclusive Growth. URL: <http://documents1.worldbank.org/curated/en/820851467992505410/pdf/102114-REVISED-PUBLIC-WBG-Gender-Strategy.pdf>

<sup>62</sup> Nigeria (2018). First Biennial Update Report of the Federal Republic of Nigeria under the UNFCCC. URL: [https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/218354\\_Nigeria-BUR1-1-Nigeria%20BUR1\\_Final%20\(2\).pdf](https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/218354_Nigeria-BUR1-1-Nigeria%20BUR1_Final%20(2).pdf)

<sup>63</sup> Nigeria (2020). Nigeria's Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

<sup>64</sup> Golub, S., Mbaye, A. and Golubski, C. (2019). The effects of Nigeria's closed borders on informal trade with Benin. Brookings. [29 October, 2019]. URL: <https://www.brookings.edu/blog/africa-in-focus/2019/10/29/the-effects-of-nigerias-closed-borders-on-informal-trade-with-benin/>

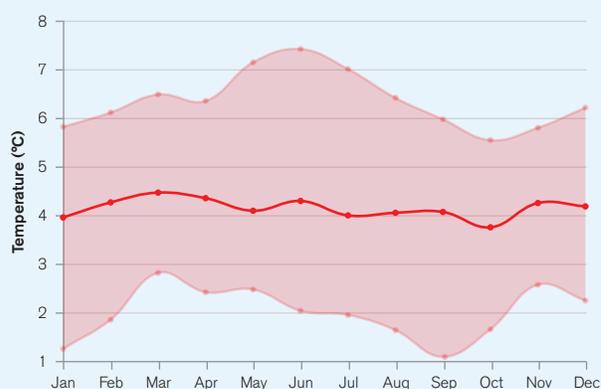
## Climate Change Impacts

Projected climate variability and change trends for Nigeria such as rising temperatures, an increase in frequency and intensity of heavy rain events and increased duration of dry spells, increased aridity and drought threaten the country's agricultural sector. The sector is already challenged by seasonal changes and increasingly variable rainfall, limited infrastructure, substantial post-harvest losses, and lack of access to inputs and finance. Despite being the second largest importer of rice in the world, Nigeria is also one of the largest consumers and producers of rice in Africa and the largest producer of cassava in the world. Studies show that increased levels of CO<sub>2</sub> will lead to nutrient declines in rice of up to 17%, with increased rainfall variability and higher temperatures likely to also further reduce rice yields. Cassava is relatively well adapted to hot and dry conditions; however, it is susceptible to water logging and production yields could be impacted from heavy rainfall events.<sup>65</sup>

It is estimated that just 1% of Nigerian agriculture is irrigated, with the vast majority of the country's agriculture reliant upon rainfed agriculture and smallholder farmers using traditional methods. In southern production zones, flooding, erosion and soil loss are of concern for the sector. In the north, a traditional livestock production zone, decreasing precipitation and increased temperatures are of significant concern. Trends are likely to adversely impact livestock productivity in arid and semi-arid regions, affect ecosystems due to over-stressed grazing lands and the direct impacts of heat on livestock. Due to changes in seasonal rainfall patterns, shortened growing seasons are also likely due to higher temperatures, which are also expected to further impact rice production in Nigeria and across West Africa. Livestock, mainly sheep, cattle and goats are significant contributors to Nigeria's agriculture, with 60% being managed on semi-arid land. Livestock production is under pressure from climate change-related desertification in these semi-arid and arid zones.<sup>66</sup>

**Figure 10** shows the projected change in average daily max-temperature across the seasonal cycle. Temperature thresholds for agriculture and livestock are important as temperature changes, and in particular extreme heat, it can cause damage to plants and affect the health of livestock as well as farm workers. Crops are known to have specific temperature windows for optimal growth and yield. While cold temperatures and frost can affect the early growth, but high temperatures above crop-specific thresholds rapidly reduce the yield. **Figure 11** shows the change in the number of days over 35°C, under a high emission scenario, RCP8.5 across the country for the periods 2040–2059 and 2080–2099.

**FIGURE 10.** Projected Average Daily Max Temperature for Nigeria for the period 2080–2099 (RCP8.5, Reference Period, 1986–2005)<sup>67</sup>

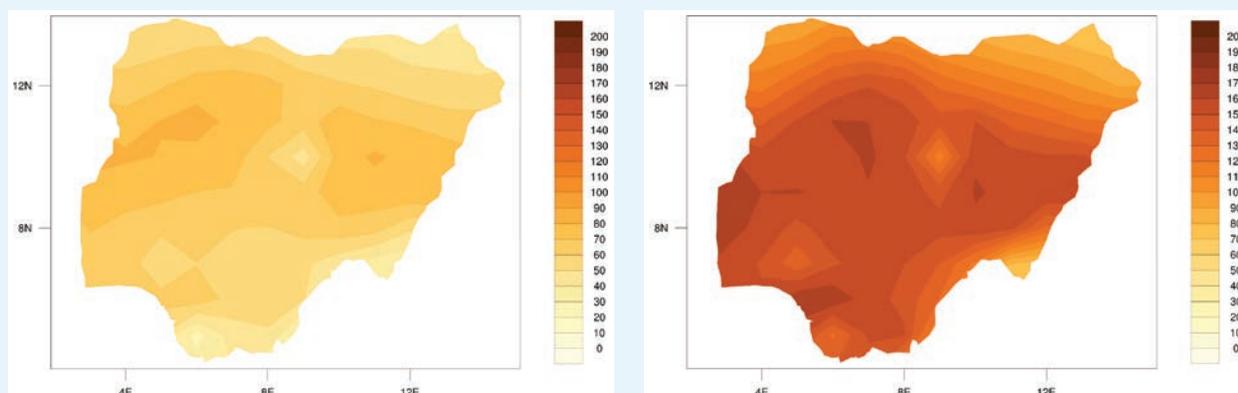


<sup>65</sup> Nigeria (2018). First Biennial Update Report of the Federal Republic of Nigeria under the UNFCCC. URL: [https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/218354\\_Nigeria-BUR1-1-Nigeria%20BUR1\\_Final%20\(2\).pdf](https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/218354_Nigeria-BUR1-1-Nigeria%20BUR1_Final%20(2).pdf)

<sup>66</sup> USAID (2019). Climate Risk Profile – Nigeria. URL: [https://www.climatelinks.org/sites/default/files/asset/document/2019\\_USAID-ATLAS-Nigeria-Climate-Risk-Profile.pdf](https://www.climatelinks.org/sites/default/files/asset/document/2019_USAID-ATLAS-Nigeria-Climate-Risk-Profile.pdf)

<sup>67</sup> WBG Climate Change Knowledge Portal (CCKP, 2021). Nigeria Agriculture Dashboard. URL: <https://climatedata.worldbank.org/CRMePortal/web/agriculture/crops-and-land-management?country=NGA&period=2080-2099>

**FIGURE 11.** Projected Change in the Number of Hot Days (35°C) for the Periods 2040–2059 (left) and 2080–2099 (right) (Reference Period, 1986–2005)<sup>68</sup>



## Adaptation Options

Both the sensitivity of the agricultural sector to the climate and the high reliance of this sector on rainfall and water resources have important implications for Nigeria's farmers and economy.<sup>69</sup> Key adaptation strategies have been identified to increase sectoral productivity, which include expanding and optimizing irrigation infrastructure, with national investment schemes and private sector companies taking a lead on procurement opportunities. Introducing drought-tolerant and early maturing crop varieties. Increasing and upgrading the country's storage facilities to reduce loss and increase the country's food security. Providing agricultural insurance and enhancing the country's agricultural extension services and promoting alternatives to livestock production.<sup>70</sup> In support of its national adaptation strategies and efforts, Nigeria has committed to adopt improved agricultural systems for both crops and livestock, this includes: diversify livestock and improve range management; increase access to drought resistant crops and livestock feeds; adopt better soil management practices; and provide early warning/meteorological forecasts and related information. Furthermore, Nigeria through its partnership with the African Risk Capacity (ARC) has adopted an innovative insurance risk pooling approach towards climate risk financing and disaster risk management in the agricultural sector.<sup>71</sup> Commitments have also been made for the implementation of strategies for improved resource management, including the increased use of irrigation systems that use low amounts of water; increase rainwater and sustainable ground water harvesting for use in agriculture; increase planting of native vegetation cover and promotion of re-greening efforts; and intensify crop and livestock production in place of slash and burn practices. Finally, the government has committed to focus on agricultural impacts in the savanna zones, particularly the Sahel; areas that are likely to be most affected by the impacts of climate change.<sup>72</sup>

<sup>68</sup> WBG Climate Change Knowledge Portal (CCKP, 2021). Nigeria Agriculture Dashboard. URL: <https://climatedata.worldbank.org/CRMePortal/web/agriculture/crops-and-land-management?country=NGA&period=2080-2099>

<sup>69</sup> Nigeria (2020). Nigeria's Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

<sup>70</sup> Downie. R. (2017). Growing the agriculture sector in Nigeria. CSIS Global Food Security Project. URL: [https://fscluster.org/sites/default/files/documents/170317\\_downie\\_agriculturesectornigeria\\_web1.pdf](https://fscluster.org/sites/default/files/documents/170317_downie_agriculturesectornigeria_web1.pdf)

<sup>71</sup> African Risk Capacity (2018). Nigerian Government signs MoU with African Risk Capacity to address impact of extreme weather events. Press Release. [24 May, 2018]. URL: <https://www.africanriskcapacity.org/2018/05/24/press-release-nigerian-government-signs-mou-with-african-risk-capacity-to-address-impact-of-extreme-weather-events/>

<sup>72</sup> Nigeria (2021). Updated Nationally-Determined Contributions. URL: <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nigeria%20First/NDC%20INTERIM%20REPORT%20SUBMISSION%20-%20NIGERIA.pdf>

# Water

## Overview

Nigeria has a large amount of fresh water capable of yielding more than 214 km<sup>3</sup> of fresh water and covering a surface area of over 20 million hectares. The country's water resources include 200 dams storing more than 31 billion m<sup>3</sup>, however the country remains highly vulnerable as recent water supply is unable to meet demands for domestic, industrial and agricultural purposes. The vulnerability in the water sector is affected by declining trends in the in-flow of water into dams due to lengthening dry seasons, increase in flooding incidences especially along the Niger and Benue rivers and the country's limited rural water distribution infrastructure which is hampering efficient community level access to and use of its water resources for irrigation. In addition, fresh water sources are polluted through the disposal of domestic and chemicals wastes.<sup>73</sup> Most of the Nigeria's rivers are from four main hydrological basins: the North Central Plateau (Sokoto-Rima, Hadejia, Gongola, and Kaduna rivers etc.), the Western Uplands (Moshi, Awun, Ogun, Osun, Osse rivers etc.), the Eastern Highlands (Katsina-Ala, Donga rivers, etc.) and the Uri Plateau (Anambra, Imo and Cross rivers etc.). These drainage and relief features of the country have impacts on its water resources and land use potentials, particularly for agriculture and human consumption.<sup>74</sup> In rural areas, approximately 88% of all households use surface water, with 83% of those being among the poorest households in the country.<sup>75</sup>

## Climate Change Impacts

A considerable proportion of Nigeria's population is at risk of water stress, with less than 40% having direct access to potable water. Increased rainfall variability is likely to result in flooding in some humid areas in the south of the country while a reduction in precipitation in the savannah north may result in droughts and decrease in surface water resources. Changes in surface runoff and groundwater flows in shallow aquifers can possibly have long-term implications for both permanent and seasonal water bodies. The rapid shrinking of Lake Chad from approximately 45,000 km<sup>2</sup> in 1960 to less than 3,000 km<sup>2</sup> in 2007 has been primarily attributed to changes in the climatic conditions in the region. Hydro-electric power generation will also be negatively affected due to lower and irregular inflows in dams.<sup>76</sup>

Drought and desertification are resulting in the loss of biodiversity, loss of land cover and depletion of water resources and affects the socioeconomic development of these areas. Persistent droughts, in particular, may result in failure of crops and death of livestock, with likely increases in food insecurity and potential for famine in these areas. Drought and desertification-induced changes in population dynamics may include increased migration from rural areas into the urban centers, which leads to greater pressure on the existing urban infrastructure.<sup>77</sup> The northern region is most at risk of extreme temperatures and reduced rainfall. Changes in hydrology, primarily due to reduction in river flows

<sup>73</sup> Nigeria (2020). Nigeria's Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

<sup>74</sup> Nigeria (2018). First Biennial Update Report of the Federal Republic of Nigeria under the UNFCCC. URL: [https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/218354\\_Nigeria-BUR1-1-Nigeria%20BUR1\\_Final%20\(2\).pdf](https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/218354_Nigeria-BUR1-1-Nigeria%20BUR1_Final%20(2).pdf)

<sup>75</sup> Abubakar, I. (2019). Factors influencing household access to drinking water in Nigeria. *Utilities Policy*, 58, pp. 40–51. URL: <https://www.sciencedirect.com/science/article/abs/pii/S0957178718302856>

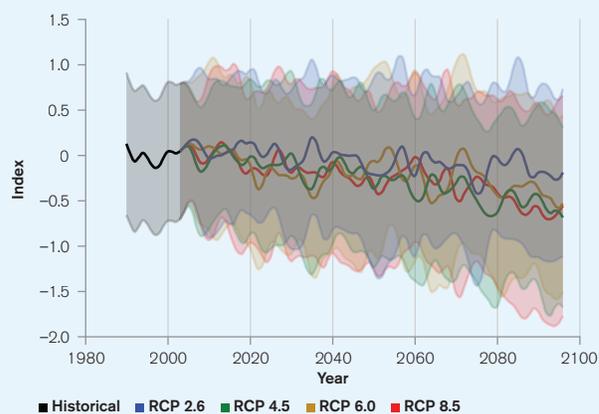
<sup>76</sup> Nigeria (2018). First Biennial Update Report of the Federal Republic of Nigeria under the UNFCCC. URL: [https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/218354\\_Nigeria-BUR1-1-Nigeria%20BUR1\\_Final%20\(2\).pdf](https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/218354_Nigeria-BUR1-1-Nigeria%20BUR1_Final%20(2).pdf)

<sup>77</sup> Nigeria (2020). Nigeria's Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

and other surface water such as lakes, ponds and reservoirs, are expected across West Africa. The Niger Basin is highly exposed to these pressures and will face reductions of water availability in some areas, but also increased flooding and declining water quality in others. Changing water availability, combined with increasing demand, has the potential to increase political tension around water ownership and use. Rising temperatures are expected to increase evaporation rates, particularly in the east and central Niger Basin, which will impact water supply. Increased severity of dry seasons with heavy rainfall events will increase likelihood of flooding and flash flood events, which will impact water quality and water infrastructure, and also place greater stress on crops and livestock. Water quality will be impacted by rising temperatures and increased duration of dry spells resulting in warmer surface temperatures, accelerating bacteria growth.<sup>78</sup>

Changes in precipitation patterns will impact river flow, irrigation, water management and flooding. This can be seen through both the supply as well as demand. Increases in heavy rainfall and flooding come with equally greater periods of enhanced drought, which are exacerbated by higher temperatures, and thus stronger evapotranspiration. Projected climate change trends for Nigeria are therefore expected to enhance the contrast between wet and dry and thus might change the dynamics around the balance between availability and use of water. Higher intensity rain and enhanced droughts pose significant challenges to water supply infrastructure and water quality. **Figure 12** shows the projected annual Standardized Precipitation Evapotranspiration Index (SPEI) the end of the century. SPEI is an index which represents the measure of the given water deficit in a specific location (−2 indicates severe drought); accounting for contributions of temperature-dependent evapotranspiration. As seen in the figure, Nigeria's aggregate national SPEI by end of the century is −0.7, however the northern and northeastern areas of the country (already very arid) will experience greater degrees of drought. This is an important understanding for the water sector (as well as energy) as it provides insight into increasing or decreasing pressure on water resources.

**FIGURE 12.** Projected Annual SPEI Drought Index, Nigeria (Reference Period, 1986–2005)<sup>79</sup>



<sup>78</sup> USAID (2019). Climate Risk Profile – Nigeria. URL: [https://www.climatelinks.org/sites/default/files/asset/document/2019\\_USAID-ATLAS-Nigeria-Climate-Risk-Profile.pdf](https://www.climatelinks.org/sites/default/files/asset/document/2019_USAID-ATLAS-Nigeria-Climate-Risk-Profile.pdf)

<sup>79</sup> WBG Climate Change Knowledge Portal (CCKP, 2021). Nigeria Water Dashboard. URL: <https://climatedata.worldbank.org/CRMePortal/web/water/land-use/-/watershed-management?country=NGA&period=2080-2099>

## Adaptation Options

To address the concerns of the country's water resources sector, Nigeria is empowering the National Institute for Water Resources and other agencies under the Ministry of Water Resources to focus on strategies to optimize use and access to the country's water resources. Several ongoing adaptation and conservation strategies include reducing water loss from dams such as Kainji, Challawa, Tiga and Bakolori. Efforts to control evaporation on parts of Lake Chad have included the use of biodegradable suppressants, and estimated to reduce evaporation by 40%, however more research is needed and the financial investment required is prohibitive.<sup>80</sup> Adopting and implementing more efficient irrigation systems across the country can greatly improve water management, losses and evaporation as well as improve agricultural yields. Enhanced storage of water in reservoirs can support vegetating the wetlands and increase water use efficiency. The recycling of wastewater can improve agriculture in peri-urban areas, especially in drier areas. Water transfers can also be helpful in re-distributing freshwater; this is, however, expensive and requires substantial political understanding especially when multiple communities are involved.<sup>81</sup> Nigeria has also committed to improving water management strategies, such as irrigation farming, water harvesting, soil fertility enhancement and erosion control, etc.<sup>82</sup> Improved domestic and industrial waste management practices, including investments in waste and water supply treatment plants, and environmental governance will also have substantial effects on water quality enhancement.

## Energy

### Overview

Oil and natural gas, and biomass constitute the main sources of energy for Nigeria; however, there are significant efforts to harness the high potentials available from solar and wind. Currently, the majority of rural communities remain off the grid, and approximately 60% of the population lack access to electricity. At the current rate of grid expansion, they will largely remain under-served.<sup>83</sup> Nigeria has the second largest proven crude oil reserves in Africa with oil fields located in the south, specifically in the Niger Delta and offshore in the Gulf of Guinea. Current exploration activities are mostly focused in the deep and ultra-deep offshore, with some activities in the Chad Basin in the northeast of the country. Nigeria's oil production is expected to double between 2018 and 2030, increasing to about 400 billion m<sup>3</sup> per annum. Additionally, a significant amount of Nigeria's gross natural gas production is flared (burned off) as some of Nigeria's oil fields lack the infrastructure needed to capture the natural gas produced with oil, known as associated gas. Apart from oil production, Nigeria is the third largest producer of bioenergy in the world, after China and India. Nigeria is also one of the largest fuel wood producers, and biomass resources of Nigeria can be identified as crop residues, forage (grasses and shrubs), animal wastes and waste arising from forestry, municipal and industrial activities, as well as, aquatic biomass. Crops such as sweet sorghum, maize and sugarcane are the most promising feedstock for biofuel production, although biofuels are not current commonly used.<sup>84</sup>

<sup>80</sup> Nigeria (2020). Nigeria's Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

<sup>81</sup> Abubakar, I. (2019). Factors influencing household access to drinking water in Nigeria. *Utilities Policy*, 58, pp. 40–51. URL: <https://www.sciencedirect.com/science/article/abs/pii/S0957178718302856>

<sup>82</sup> Nigeria (2021). Updated Nationally-Determined Contributions. URL: <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nigeria%20First/NDC%20INTERIM%20REPORT%20SUBMISSION%20-%20NIGERIA.pdf>

<sup>83</sup> Nigeria (2021). Updated Nationally-Determined Contributions. URL: <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nigeria%20First/NDC%20INTERIM%20REPORT%20SUBMISSION%20-%20NIGERIA.pdf>

<sup>84</sup> Nigeria (2018). First Biennial Update Report of the Federal Republic of Nigeria under the UNFCCC. URL: [https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/218354\\_Nigeria-BUR1-1-Nigeria%20BUR1\\_Final%20\(2\).pdf](https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/218354_Nigeria-BUR1-1-Nigeria%20BUR1_Final%20(2).pdf)

Production of energy in Nigeria is characterized by inefficiency and inadequacy and the country has one of the least energy-efficient economies in the world. Daily production remains at only 30% of installed megawatt capacity, leading to insufficient supply (resulting in load shedding, blackouts, and a reliance on private generators) and leaving approximately 93 million people without access to electricity. Growing population and expanding economic challenges are making the sector less and less adequate. Low energy consumption is caused by the recurrent scarcity of petroleum products and the persistent electricity black outs, which have resulted in a high reliance on self-generated electricity.<sup>85</sup>

## Climate Change Impacts

In Nigeria, the largest proportion of produced and exported energy is derived from oil and gas, whose coastal production is vulnerable to sea level rise, storm surges, and coastal flooding. In 2012, the oil production sector incurred over \$630 million in losses from the 2012 flood event due to lost production and infrastructure damages. Renewable energy, namely hydropower, is an important and growing energy source, and is critical to the country's development goals. Nigeria plans to expand renewables to 36% of electricity production by 2030 (from 17% in 2014) by investing in projects such as the anticipated 3,050-megawatt Mambila hydroelectric power plant in Taraba State. Increased evaporation, more extreme heavy rainfall events, and increased river flows in some areas, are projected to increase flood damage to dams and turbines, while reservoir evaporation, siltation, and increased rainfall and river flow variability will pose a challenge for hydropower development due to the drying up of water resources. In addition, reduced rainfall and higher temperatures in the north could reduce the availability of biomass, an important energy source for rural households. Energy demand in Nigeria will increase due to rising temperatures and due to evaporation rates a reduced supply of biomass may be available for fuel. An increased frequency of heavy rainfall events may increase the frequency and intensity of flooding and storm surges, consequently damaging and disrupting energy production infrastructures, including generation transmission.<sup>86</sup>

Hydropower facilities present promising opportunities for needed electricity generation across the region and given the abundance of surface water resources and the likely increase in precipitation. However, the changing characteristics of annual and seasonal precipitation as well as the increase in heavy rainfall events is increasingly likely to disrupt river flow regimes, increase investment and construction costs to accommodate resilient designs, and increase challenges to sustained energy generation, e.g. operation and maintenance. Extreme weather events such as heavy rains can damage infrastructure, roads, communication networks and disrupt supply lines. An increase in the frequency and intensity of heavy rains and flooding is also likely to impact fragile infrastructure systems which can also impact hydro-power generation.

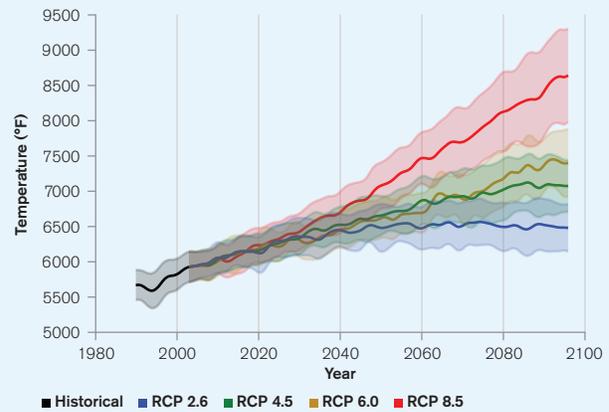
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<sup>85</sup> Nigeria (2020). Nigeria's Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

<sup>86</sup> USAID (2019). Climate Risk Profile – Nigeria. URL: [https://www.climatelinks.org/sites/default/files/asset/document/2019\\_USAID-ATLAS-Nigeria-Climate-Risk-Profile.pdf](https://www.climatelinks.org/sites/default/files/asset/document/2019_USAID-ATLAS-Nigeria-Climate-Risk-Profile.pdf)

Increased temperatures are likely to increase energy demand, especially during peak heat periods. The relationship of daily heat with the demand for electricity can be estimated through a quantity called the Cooling Degree Days (Figure 13). This quantity accumulates the temperatures above 18°C threshold which broadly represents a comfortable living environment. The cooling degree days capture the amount of heat that society would like to get rid of by period through some form of active cooling, be it through air conditioning or through evaporative processes that generally require pumps for water. The monthly changes provide insight into potentially extended seasons of power demand for cooling, or highlighting when during the year likely power demand increases might occur. The increase in cooling days across the seasonal cycle. Sharp increases in temperature are expected during the country's typical hot-seasons across all RCP scenarios.

**FIGURE 13.** Projected Change in Cooling Degree Days (65°F) in Nigeria (Reference Period, 1986–2005)<sup>87</sup>



## Adaptation Options

The Nigerian government has made addressing the need to provide access to energy for all Nigerians a significant priority. While a significant share of current energy demand remains unmet. The current grid is unable to reliably serve the existing industrial and urban customer base. Nigeria has committed to increasing energy supply through gas-powered generation, using the associated gas currently flared for oil and gas exploration operations, which can replace small generators. Nigeria is also looking to expand off-grid electrification through solar energy usage, expand fuel-efficient cookstoves and improve its transit system through CNG (Compressed Natural Gas) retrofitting, currently being tested in Lagos State. Improved energy efficiency building regulations are being developed and implemented, e.g. the [National Building Energy Efficiency Code \(BEEC\)](#). The government is also looking to diversify its secure energy backup systems and has committed to expanding sustainable energy sources and decentralize transmission in order to reduce vulnerability of energy infrastructure to expected climate impacts.<sup>88</sup>

<sup>87</sup> WBG Climate Change Knowledge Portal (CCKP, 2021). Nigeria Water Sector. URL: <https://climateknowledgeportal.worldbank.org/country/nigeria/climate-sector-energy>

<sup>88</sup> Nigeria (2021). Updated Nationally-Determined Contributions. URL: <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nigeria%20First/NDC%20INTERIM%20REPORT%20SUBMISSION%20-%20NIGERIA.pdf>

# Health

## Overview

While Nigeria is making progress towards the achievement of the health-related Sustainable Development Goals, the country still has significant challenges for public health regarding access to and availability of quality health care services and continues to have one of the highest burdens of disease globally. The prevalence of infectious and parasitic diseases such as, malaria (141 in 100,000), tuberculosis (282 in 100,000), HIV/AIDS (3.9% of the population) and Schistosomiasis remains high. Additionally, diabetes and cardio-vascular diseases are becoming significant health problems. Only 48% of the population has “sustainable” access to clean water, with 44% having access to good sanitation.<sup>89</sup> Key challenges for the health sector include a weak healthcare system characterized by constrained governance systems, low levels of health care financing and inadequate financial protection for the poor, low levels of research for health and poor community participation and utilization of health services – particularly child and maternal services. These challenges significantly increase the sector’s vulnerability to anticipated climate change impacts.<sup>90</sup>

## Climate Change Impacts

Nigeria is highly vulnerable to the adverse health implications from projected future climates for the country, including increased temperatures, more intense and frequent extreme weather events and heavy rainfall, and increased duration and severity of aridity and drought. These trends are likely to result in increased water and food insecurity, higher exposure to heat stress and ultraviolet radiation, changes in infectious and vector borne disease transmission patterns. Under a high emissions scenario, diarrheal deaths attributable to climate change in children under 15 years old are projected to be about 9.8% of the over 76,000 diarrheal deaths projected in 2030. Additionally, heat-related deaths in the elderly (65+ years) are projected to increase to almost 80 deaths per 100,000 by 2080 compared to the estimated baseline of about 3 deaths per 100,000 annually between 1961 and 1990. Higher temperatures, land and water scarcity, flooding, drought, and displacement will negatively impact agricultural production and cause further breakdown in food systems. These disproportionately affect those most vulnerable and can lead to food insecurity. Vulnerable groups risk further deterioration into food and nutrition crises if exposed to extreme weather events. Without considerable efforts made to improve climate resilience, it has been estimated that the risk of hunger and malnutrition globally could increase by up to 20% by 2050.<sup>91</sup>

Additionally, flooding due to sea level rise is estimated to affect approximately 550,000 people by 2070. This could also result in food and water contamination and the increased risk of water and vector borne diseases. Nigeria’s water and sanitation infrastructure is not well prepared to handle the projected increase in intense precipitation. Climate change will also likely exacerbate health issues related to respiratory infections (already responsible for 19% of deaths in Nigeria) as air pollution is expected to worsen with rising temperatures.<sup>92</sup> Almost 130,000 deaths per year are attributed to household air pollution from indoor burning of cooking fuel. Extreme heat intensifies ground-level ozone, which combines with fine particulate pollutants (soot and dirt from coal combustion, diesel engines, or fires)

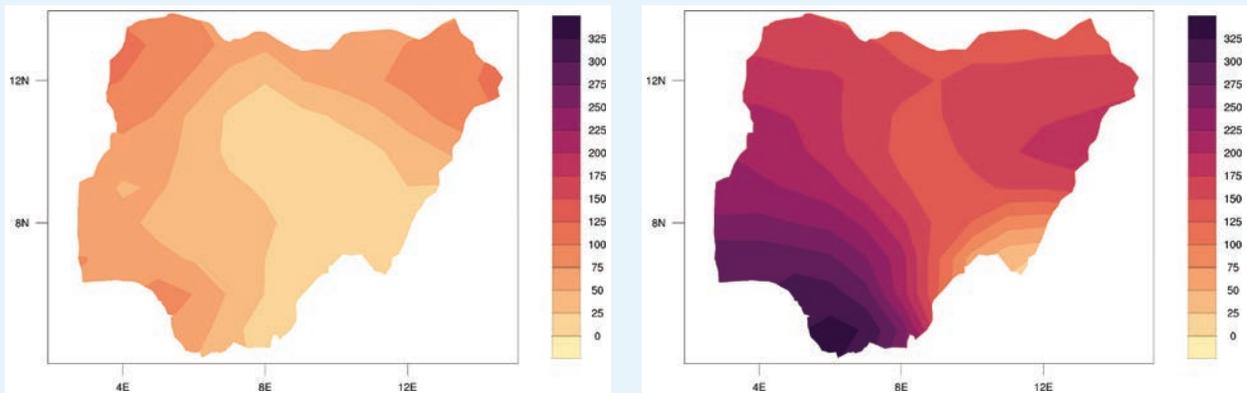
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<sup>89</sup> Nigeria (2020). Nigeria’s Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

<sup>90</sup> Nigeria (2018). First Biennial Update Report of the Federal Republic of Nigeria under the UNFCCC. URL: [https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/218354\\_Nigeria-BUR1-1-Nigeria%20BUR1\\_Final%20\(2\).pdf](https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/218354_Nigeria-BUR1-1-Nigeria%20BUR1_Final%20(2).pdf)

<sup>91</sup> WHO (2015). Climate and Health Country Profile – Nigeria. URL: [https://apps.who.int/iris/bitstream/handle/10665/208865/WHO\\_FWC\\_PHE\\_EPE\\_15.11\\_eng.pdf?sequence=1](https://apps.who.int/iris/bitstream/handle/10665/208865/WHO_FWC_PHE_EPE_15.11_eng.pdf?sequence=1)

**FIGURE 14.** Projected Number of Days with a Heat Index (>35°C) in Nigeria for 2040–2059 (left) and 2080–2099 (right), Under RCP8.5 (Reference Period, 1986–2005)<sup>94</sup>

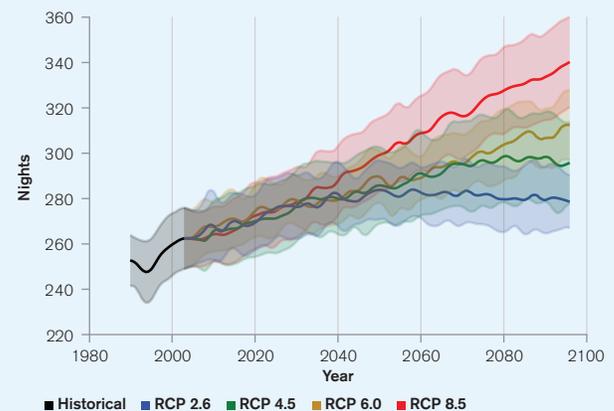


and chemicals like carbon monoxide or sulfur dioxide to reduce air quality, especially in urban areas. Malaria, the number one cause of death for children under 5 in Nigeria, is sensitive to changes in temperature and rainfall. As with much of West Africa, areas of endemic malaria are projected to contract as the disease-carrying mosquito is unable to survive in higher temperatures.<sup>93</sup>

In Nigeria, the annual distribution of days with a high-heat index provides insight into the health hazard of heat. High heat indices (>35°C) can raise the impact on the human body and lead to health issues in broad segments of the population. **Figure 14** shows the spatial variation of the number of days with Heat Index over 35°C across Nigeria for the period 2040–2059 and 2080–2099, against the baseline period 1986–2005, under RCP8.5.

Increased night temperatures can result in decreased opportunity for natural cooling. Increased health threats can be projected and monitored through the frequency of tropical nights (>20°C). Tropical Nights (**Figure 15**) represents the projected increase in tropical nights for different emission scenarios (CMIP5 ensemble) to demonstrate the difference in expected numbers of tropical nights. As seen in the figure below, tropical nights are projected to be minimally increased, except for the sharp increase expected under the high emission scenario.

**FIGURE 15.** Projected Number of Tropical Nights (Tmin >20°C) (Reference Period, 1986–2005)<sup>95</sup>



<sup>92</sup> Nigeria (2020). Nigeria's Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

<sup>93</sup> USAID (2019). Climate Risk Profile – Nigeria. URL: [https://www.climatelinks.org/sites/default/files/asset/document/2019\\_USAID-ATLAS-Nigeria-Climate-Risk-Profile.pdf](https://www.climatelinks.org/sites/default/files/asset/document/2019_USAID-ATLAS-Nigeria-Climate-Risk-Profile.pdf)

<sup>94</sup> WBG Climate Change Knowledge Portal (CCKP, 2021). Nigeria Health Sector. URL: <https://climateknowledgeportal.worldbank.org/country/nigeria/climate-sector-health>

<sup>95</sup> WBG Climate Change Knowledge Portal (CCKP, 2021). Nigeria Health Sector. URL: <https://climateknowledgeportal.worldbank.org/country/nigeria/climate-sector-health>

## Adaptation Options

Nigeria is committed to improving its healthcare system, service delivery and resilience to climate change. The government is committed to undertaking research to better understand the health impacts of climate change and to strengthen its disease prevention, early warning and treatment for those diseases expected to increase. The country is also improving its wastewater and solid waste management facilities as well as improve water resource management.<sup>96</sup> Efforts are needed to promote and facilitate the adoption of practices and technologies that reduce exposure and health impacts from extreme heat.<sup>97</sup> Additional adaptation strategies include improving information and forecasting on extreme weather events such as heat waves, extreme storms and dry spells. There is need to increase access to high quality health services and promote climate-health education in schools. Finally, health care system personnel may not be fully aware of the relationship between climate change, seasonal variability and health impacts. Increases in training and capacity can improve the level of knowledge and skills to prevent diseases connected with climatic factors, however this knowledge remains relatively limited among the general population.<sup>98</sup>

## ADAPTATION

### Institutional Framework for Adaptation

Nigeria's approaches to addressing climate change are focused on ensuring strategies are consistent with national development priorities and use the energy sector as a key driver for high economic growth. The country has made some progress on its climate change governance as the government recognizes climate change as a threat to its economic prosperity and future development. In order to improve policy formulation and co-ordination in this area, the Ministry of the Environment created a Special Climate Change Unit which recently has been transformed into the Department of Climate Change (DCC). This department sits within the Federal Ministry of Environment, which coordinates all climate change-related activity. The country's Inter-Ministerial Committee on Climate Change facilitates cross-sector coordination between ministries and other stakeholders.<sup>99</sup> In 2012, the Federal Executive Council adopted the Nigeria Climate Change Policy Response and Strategy. Several sector- or issue-specific policies and programs were created under this strategy. Efforts to improve the country's institutional capacity to deal with climate change, have included several policy initiatives with relevance to climate change. The country's climate change strategies focus on agriculture, freshwater resources, coastal water resources and fisheries, forests, biodiversity, health and sanitation, human settlements and housing, energy, transportation and communications, industry and commerce, disaster, migration and security, livelihoods, vulnerable groups, and education.<sup>100</sup>

<sup>96</sup> WHO (2015). Climate and Health Country Profile – Nigeria. URL: [https://apps.who.int/iris/bitstream/handle/10665/208865/WHO\\_FWC\\_PHE\\_EPE\\_15.11\\_eng.pdf?sequence=1](https://apps.who.int/iris/bitstream/handle/10665/208865/WHO_FWC_PHE_EPE_15.11_eng.pdf?sequence=1)

<sup>97</sup> Nigeria (2021). Updated Nationally-Determined Contributions. URL: <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nigeria%20First/NDC%20INTERIM%20REPORT%20SUBMISSION%20-%20NIGERIA.pdf>

<sup>98</sup> Nigeria (2020). Nigeria's Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

<sup>99</sup> Nigeria (2020). Nigeria's Third National Communication under the UNFCCC. URL: <https://unfccc.int/documents/226453>

<sup>100</sup> LSE (2019). Nigeria. URL: <http://www.lse.ac.uk/GranthamInstitute/country-profiles/nigeria/>

# Policy Framework for Adaptation

Nigeria submitted its Third National Communication to the UNFCCC in 2020, its First Biennial Update Report in 2018, and its Nationally-Determined Contributions in 2016. To reach its adaptation goals, Nigeria is working towards an integrated approach to support cross-cutting national policies and strategies in mainstreaming environmental sustainability and climate change adaptation efforts. Improvements to legislative and regulatory frameworks, and capacity development and transfer of technology in certain priority areas will further support these efforts. The country is also committed to implementing mitigation measures that will promote low carbon as well as sustainable and high economic growth and to increase climate change related science, technology and R&D to enable the country to better participate in international scientific and technological cooperation on climate change. Commitments are also focused on strengthening national institutions and mechanisms (policy, legislative and economic) to establish a suitable and functional framework for climate change governance.<sup>101</sup> Continued adaptation efforts are focused on the country's most vulnerable sectors: agriculture, forestry, water resources, and health, and on increasing the country's resilience capabilities, and strengthen the country's social and economic structures against vulnerability.<sup>102</sup>

## National Frameworks and Plans

- [Updated Nationally Determined Contribution \(2021\)](#)
- [Third National Communication \(2020\)](#)
- [First Biennial Update Report \(2018\)](#)
- [Nationally Determined Contribution \(2016\)](#)
- [National Agricultural Resilience Framework \(2015\)](#)
- [Second National Communication \(2014\)](#)
- [Post-Disaster Needs Assessment 2012 Floods \(2013\)](#)
- [National Adaptation Strategy and Plan of Action for Climate Change for Nigeria \(2011\)](#)
- [National Disaster Framework \(2010\)](#)
- [First National Communication \(2003\)](#)

## Recommendations

### Research Gaps

- Improve, support, and reinforce meteorology, climatology and hydrology scientific capabilities for the Nigerian Meteorological Agency (NiMET), (NIHSA) and (NEMA)
- Enhance capabilities for handling climate change data at the national, regional, and local levels through the Climate Change Department of Federal Ministry of Environment, including leveraging partnerships with the National Space Research and Development Agency and the National Bureau of Statistics to adopt disruptive technologies such as satellites, drones, geospatial and bigdata analytics (Artificial intelligence and Machine Learning)

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<sup>101</sup> Nigeria (2021). Updated Nationally-Determined Contributions. URL: <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nigeria%20First/NDC%20INTERIM%20REPORT%20SUBMISSION%20-%20NIGERIA.pdf>

<sup>102</sup> Nigeria (2021). Updated Nationally-Determined Contributions. URL: <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nigeria%20First/NDC%20INTERIM%20REPORT%20SUBMISSION%20-%20NIGERIA.pdf>

- Develop effective early warning system for monitoring, preventing and effectively responding to the human diseases associated with climate change<sup>103</sup>
- Evaluate needs and develop a national strategy for technology transfer to support the country's renewable energy goals

## Data and Information Gaps

- Undertake data-driven risk assessment and risk reduction measures to increase the resilience of the transportation and communication sectors<sup>104</sup>
- Establish institutional capacity for providing timely early warning systems to farmers for improved decision making and understanding seasonal variability for key agricultural zones
- Strengthen transboundary flood monitoring, forecasting and nation-wide probabilistic flood modeling to inform disaster risk planning and preparedness
- Increase understanding of water resource threats and groundwater risks to improve long term management and improve water use efficiency in agriculture and urban management
- Improve regulation and enforcement to protect forests, rainforests and protected areas
- Strengthen information exchange by enhancing technologies transfer and capacities necessary from national to local levels to promote environment and climate change mitigation and adaptation through education and public awareness development
- Build capacity of media, theatre groups, and entertainment and advertising industries to mobilize their experience in shaping public awareness and increase the active public participation in the climate change adaptation and mitigation debate<sup>105</sup>
- Initiate research to establish the linkages of climate change factors in poverty, insurgencies and conflict-induced migration<sup>106</sup>

## Institutional Gaps

- Establishment of National Environment and Climate Change Research Center with partnership with the Climate Change Department, Federal Ministry of Environment and existing government and academic institutions for climate data archived and available for research.
- Establish land-use plans by type of use (road infrastructure, oil and gas distribution, agriculture and animal husbandry, forests, coastal zones, urban spaces etc.)
- Finalize regulations to fund and implement impact studies regarding climate change impacts for the country and key sectors<sup>107</sup>
- Develop a Monitoring, Evaluation and Learning (MEL) framework to assess the efficiency of policies and measures to increase resilience, facilitate social inclusion, improve livelihood security, and reduce emissions<sup>108</sup>

<sup>103</sup> Nigeria (2021). Updated Nationally-Determined Contributions. URL: <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nigeria%20First/NDC%20INTERIM%20REPORT%20SUBMISSION%20-%20NIGERIA.pdf>

<sup>104</sup> Nigeria (2021). Updated Nationally-Determined Contributions. URL: <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nigeria%20First/NDC%20INTERIM%20REPORT%20SUBMISSION%20-%20NIGERIA.pdf>

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# CLIMATE RISK COUNTRY PROFILE

## NIGERIA



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