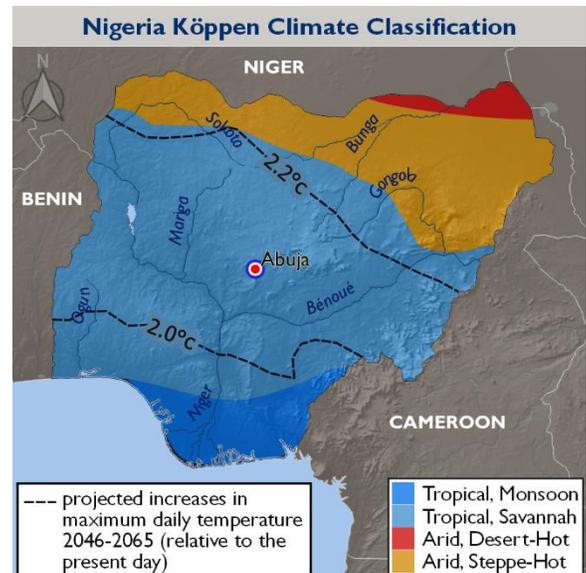




# CLIMATE RISK PROFILE NIGERIA

## COUNTRY OVERVIEW

Nigeria is Africa’s largest economy, most populous country, and home to a wealth of natural resources (particularly oil and natural gas). Unfortunately, these assets have not translated into inclusive growth for the country due to a lack of infrastructure, inadequate power supply, and overall state fragility. Nigeria generates one of the lowest per capita quantities of electricity in the world: 144 kWh per capita in 2014. The poverty rate is over 50 percent, inequality is on the rise, and the economy is subject to volatile oil prices. Intermittent violence, including Boko Haram insurgency in the North East Zone and agitation for resource control in the Niger Delta, combined with weak governance contribute to the country’s vulnerability. Sectors key to diversified and broader growth, such as agriculture and hydropower, are likely to be negatively impacted as rising temperatures and more variable rainfall disrupt crop and livestock production and reduce the predictability of water flow volumes. Increased flooding from more variable rainfall frequently leads to displacement of households and outbreaks of waterborne diseases such as cholera. Much of Nigeria’s growth has occurred along the coast, home to 25 percent of the population as well as the country’s oil and gas industry, exposing it to rising sea levels, flooding, and erosion. (1, 5, 15, 21, 22, 23)



## CLIMATE PROJECTIONS



1.1–2.5° C increase in temperatures by 2060



Increase in extreme precipitation events and number of hot days



0.4–1.0 m rise in sea level by 2100

## KEY CLIMATE IMPACTS

### Agriculture

Desertification of arable land  
Crop failure and reduced yield  
Saltwater intrusion of coastal production



### Water

Reduced water quality  
Increased flood risk  
Saline intrusion into coastal aquifers



### Human Health

Increase in heat-related mortality  
Diminished food security  
Increase in morbidity from air pollution



### Energy

Damage to infrastructure  
Reduced hydropower production  
Increased demand



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## CLIMATE SUMMARY

Nigeria has a diverse climate with nine distinct ecological zones, ranging from an arid north (with both lowlands and a plateau region) to a tropical south. In the south, annual average temperatures range from 17–37°C and in the north from 12–45°C. Annual rainfall amounts decrease in a gradient moving south to north – the south receives an average of 3,000 mm of rainfall per year versus 500 mm in the northeast. The timing of rainfall is seasonal and varies by region: the south experiences rainfall throughout much of the year (although less in November–March), while the north has a long dry season that can last up to seven months (October–April). Harmattan winds bring hot dry air from the Sahara Desert to Nigeria during the dry season and moist air from the Atlantic Ocean during the rainy season. (8, 6, 12, 14, 23)

### HISTORICAL CLIMATE

Historical climate trends include:

- Increase in temperatures of an average 0.8°C between 1960–2006, with a steep increase since 1980; larger increases in the northern region.
- Significant variability of precipitation between years and climate zones; a decrease in predictability for seasonal rains. Conflicting information exists on annual precipitation across the country, but some analyses show a decrease of 3.5 mm per month per decade between 1960–2006.
- Historical sea level rise cannot be confirmed in Nigeria, but significant inundation of coastal towns has already occurred.

### FUTURE CLIMATE

Projections indicate:

- Rise in temperatures of 1.1–2.5°C by 2060; more extreme increase expected in the north.
- Increase in the number of extreme heat days to 260 days by 2100 (versus only 10 days in 1990).
- Substantial decrease in number of cold nights, projected to be near zero by 2090.
- High uncertainty around future rainfall amount and frequency; variability likely to increase.
- Increased variability in rainfall and extreme rainfall events across most of the country.
- Rise in sea levels of 0.4–1.0 m by 2100.

## SECTOR IMPACTS AND VULNERABILITIES

### AGRICULTURE

Agriculture is key to Nigeria’s economy; it is the main source of income for 80 percent of rural poor and contributes more than 20 percent to national gross domestic product (GDP). Despite growing a wide range of crops, Nigeria is a major importer of food and struggles with malnutrition and food insecurity due to low productivity. Nigeria is 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 atmospheric CO<sub>2</sub> will lead to nutrient declines in rice of up to 17 percent, and higher temperatures and variability in rainfall will reduce rice yields. Cassava, while adapted to hot, dry conditions compared with other crops, is susceptible to waterlogging and may be sensitive to increased levels of CO<sub>2</sub> which could increase cyanide concentrations. The majority of agricultural production is rainfed (less than 1 percent is irrigated) and done by smallholder farmers using traditional methods. Floods, erosion, and soil loss are key concerns in the south. These same hazards, in

addition to declines in precipitation and increased temperatures, threaten crops and livestock in the north. Crop failures are already occurring due to intense rain storms, flooding, and a shifting exposure to pests – all issues that will intensify with climate change.

Climate Stressors and Climate Risks AGRICULTURE	
Stressors	Risks
Rising temperatures	Reduced yields from increased temperatures, particularly for rice
	Reduced livestock productivity, particularly in arid and semi-arid regions, due to stressed grazing lands and direct impacts of heat on livestock health
Increased frequency of heavy rainfall events	Crop failure or reduced growing season due to unpredictable rain patterns, intense storms, and floods
Unpredictable rainfall patterns	Increased damage to crops and livestock from pests and diseases

A shortened growing season due to higher temperatures will negatively impact rice yields on average across Africa by 24 percent by 2070, especially in rainfed rice areas. Agricultural losses by 2100 could reach 2–4 percent of GDP in West Africa. Livestock production, mainly cattle, sheep,

and goats, is a significant contributor to Nigeria’s agriculture; 60 percent is managed on semi-arid lands. Yields are low in part due to lack of feed and grazing lands, which are under pressure from climate change-related desertification in the semi-arid region. (1, 2, 7, 8, 9, 19)

## WATER RESOURCES

Nigeria has substantial surface and groundwater resources (surface waters total upwards of 20 million hectares). The Niger River is the largest river in the country, starting in the northwest corner and traveling to the coast. Other significant river tributaries and numerous lakes exist throughout the country – Lake Chad and Kainji Lake are the largest. Most populated areas of the country are close to freshwater resources, but only 30 percent of the population has access to safe drinking water in the north – the region most at risk of extreme temperatures and reduced rainfall. Changes in hydrology, mainly a reduction in river flows and other surface water, are expected across West Africa, and were observed already in the last half century. However, the complex system of land and vegetation changes, water demand, and socioeconomic factors means that climate is not the single most important factor in determining future changes: due to these pressures, hydrological models suggest reductions in West African river flows of 15–20 percent by 2020 and 20–40 percent by 2050. The Niger Basin is highly exposed to these pressures and will face reductions of water

availability in some areas, but increased flooding and declining water quality in others. Rising sea levels are causing saltwater intrusion, damaging coastal aquifers and coastal industry. Changing water availability, combined with increasing demand, has the potential to increase political tension around water ownership and use. (8, 15, 16)

Climate Stressors and Climate Risks WATER RESOURCES	
Stressors	Risks
Rising temperatures and evaporation rates	Possible reduced river flows (especially east and central Niger Basin), impacting water supply
More severe dry season	Increased flooding and associated impacts on water quality and water infrastructure
Increased frequency of heavy rainfall events	Increased demand on water resources to irrigate crops (addressing higher temperatures and variable rainfall)
Rising sea levels	Salinization of existing surface and groundwater resources in coastal areas

## HUMAN HEALTH

Since 2005 Nigeria’s human health indicators have been improving (its Human Development Index value increased 13.1 percent), but challenges remain, and a changing climate could reverse recent gains. By 2070, projections suggest that approximately 550,000 people could be affected by flooding each year due to sea level rise. Inland river floods are also likely to increase, placing an additional 800,000 people at risk each year by 2030. Flooding has both direct and indirect effects on health, ranging from loss of life resulting from extreme weather events, to disruptions to food production, water contamination, and increased risk of vector- and/or waterborne diseases. In 2017 a cholera outbreak in Lagos was linked to floodwaters contaminated by septic overflows entering water

supplies. Nigeria’s water and sanitation infrastructure is not well prepared to handle the projected increase in intense precipitation; in rural areas only 44 percent have good sanitation and 39 percent access to potable water. The proportion of diarrheal deaths attributable to climate change is projected to rise to 14 percent by 2050.

Climate change will likely exacerbate health issues related to respiratory infections (already responsible for 19 percent of deaths in Nigeria) as air pollution is expected to worsen with rising temperatures. 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) 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 spread by the *Anopheles* mosquito, which 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. (3, 13, 18, 24)

## ENERGY

Although Nigeria is endowed with large oil, gas, hydro, and solar resources, daily production remains at only 30 percent 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. 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. For example, 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 development goals. The country plans to expand renewables to 36 percent of electricity production by 2030 (from 17 percent 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 reduced

## POLICY CONTEXT

### INSTITUTIONAL FRAMEWORK

Nigeria established a Special Unit on Climate Change in 2003 and upgraded it to a full Department of Climate Change in 2011. The department sits within the Federal Ministry of Environment and coordinates all climate change-related activity. An Inter-Ministerial Committee on Climate Change facilitates cross-sector coordination between ministries and other stakeholders. Nigeria has been actively engaged in international climate policy negotiations since it became a Party to the UN Framework Convention on Climate Change (UNFCCC) in 1994. In 2012 the Federal Executive

Climate Stressors and Climate Risks HUMAN HEALTH	
Stressors	Risks
Rising temperatures and extreme heat events	Increase in heat stress and heat stroke, particularly in elderly and other vulnerable populations
	Increased outbreaks of waterborne diseases like cholera
Increased frequency of heavy rainfall events	Loss of life, disruption to food production, and contamination of water supplies due to storm surges and flooding
Rising sea levels	Reduced air quality; exacerbation of respiratory infections

river flows in some areas, however, are projected to increase flood damage to dams and turbines, reservoir evaporation and siltation, and river flow variability, challenging hydropower development. In addition, reduced rainfall and higher temperatures in the north could reduce the availability of biomass, an important energy source for rural households. (4, 7, 10, 11, 17)

Climate Stressors and Climate Risks ENERGY	
Stressors	Risks
Rising temperatures and evaporation rates	Increased energy demand
	Reduced supply of biomass used for fuel
Increased rainfall variability and frequency of heavy rainfall events	Evaporation and drying of water resources used for hydropower
	Damage to infrastructure and disruption to energy production from flooding and storm surges

Council adopted the Nigeria Climate Change Policy Response and Strategy. Several sector- or issue-specific policies and programs were created under this strategy. The country is currently preparing its Third National Communication with the support of UNDP.

### NATIONAL STRATEGIES AND PLANS

Priority areas for adaptation include agriculture, forests, energy, transportation, industry and commerce, and vulnerable groups.

- [First National Communication](#) (2003) and [Second National Communication](#) (2014) to the UNFCCC

- [The National Adaptation Strategy and Plan of Action for Climate Change](#) (2011)
- Nigeria Climate Change Policy Response and Strategy (2013)
- [Intended Nationally Determined Contribution](#) (2015)
- [National Agricultural Resilience Framework](#) (2015)
- Vision 2020 National Development Plan

## KEY RESOURCES

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Map resource – adapted from Peel, M.C., et al. 2007. [Updated world map of the Köppen-Geiger climate classification](#); data accessed from [SDAT](#).

## SELECTED ONGOING EXPERIENCES

Most aid is focused on the area of conflict in northern Nigeria. Other sector focuses include health, agriculture, and energy. Below are selected projects focused on climate change adaptation, or some aspect of it, in Nigeria.

Selected Program	Amount	Donor	Year	Implementer
<a href="#">Agro-Processing, Agricultural Productivity Enhancement and Livelihood Improvement Support Project</a>	\$200 million	World Bank	2017–2023	Federal Ministry of Agriculture and Rural Development (FMARD)
<a href="#">Sanitation, Hygiene and Water in Nigeria</a>	\$126 million	DFID	2013–2020	UNICEF
<a href="#">Enhancing Transboundary Cooperation and Integrated Water Resources Management in the Lake Chad Basin</a>	\$36.3 million	Global Environment Fund	2017–2022	African Development Bank (AfDB)
<a href="#">Green Innovation Centres for the Agriculture and Food Sector Programme</a>	\$19 million	German Development Agency (GIZ)	2015–2021	FMARD
<a href="#">The Acumen Resilient Agriculture Fund</a>	\$56 million	Green Climate Fund	2018–2030	Federal Ministry of Environment and FMARD
<a href="#">Nigeria Electrification Project for Rural Households</a>	\$2.1 million	AfDB	2018	Rural Electrification Agency