

Disaster displacement risk in Nigeria

Overview of the risk of future displacement by
riverine floods, storm surges and droughts at the
national and sub-national levels



Acknowledgements

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Other contributing organizations include:

CIMA foundation

United Nations University

Institute for Environmental Decisions – ETH Zurich

Nanyang Technological University

Potsdam Institute for Climate Impact Research

IDMC's report was made possible thanks to the generous funding of the European Union and the German Federal Foreign Office.

Graphic design, cartography and layout: Stéphane Kluser (Komplo).



**Co-funded by
the European Union**



Federal Foreign Office

Cover photo: Women walk by stagnant water in Muna camp, Maiduguri, Nigeria. With 9.9 million movements between 2008 and 2024, Nigeria reported the highest number of disaster displacements in Africa. © UNOCHA/Damilola Onafuwa



A flooded road in a displacement camp in Maiduguri, Nigeria. Heavy rains and the overflow of the Alau dam in 2024 inundated parts of the city, cutting off camps and forcing thousands of people to flee again. © UNOCHA/Damilola Onafuwa

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Boats along the shoreline of a lake in Nigeria. Changing rainfall patterns and fluctuating water levels continue to affect livelihoods and contribute to displacement risk. © IOM/Great Ovie Taghwo

Introduction

Every year, floods, droughts, storms, earthquakes and other natural hazards force millions of people to leave their homes. Latest data from the Internal Displacement Monitoring Centre (IDMC) shows that 45.8 million of internal displacements, or movements, associated with disasters were reported in 2024, the highest figure on record and far above the decadal average of 26.5 million.

Fleeing can be the first of many further disruptions to people's lives, however. Not only their livelihoods are affected, but it can take weeks or even months before they are able to return. Those who do return often face unsafe conditions and the prospect of being displaced again by the next disaster.

While understanding historical trends is key, looking at the past is not enough. Producing information and analysis on the risk of future disaster displacement can help reducing risk and build resilience before hazards strike, thereby minimising the impacts of disasters, including displacement. In 2017, IDMC began a unique probabilistic modelling exercise for disaster displacement, assessing the likelihood of population movements in the future at a global level. The model used a state-of-the-art probabilistic approach, like that applied by catastrophe modellers and the insurance industry over the past few decades. It built on a risk analysis developed by the UN Office for Disaster Risk Reduction (UNDRR), which considered a wide range of hazard scenarios, their likelihood, and their potential to cause housing damage, which was used as a proxy to assess the likelihood of people getting displaced.

The model provided disaster displacement risk data at the national level (Admin 0), and defined vulnerability from a purely physical perspective -e.g structural vulnerability of buildings being severely damaged or destroyed by different hazard intensities-, without taking into account other socioeconomic factors including poverty, inequality and access to services, nor how global warming could affect the frequency and intensity of certain weather-related hazards.

Understanding physical impacts alone is not sufficient to fully capture displacement risk, however. Given that people's level of vulnerability and exposure to hazards does much to determine the severity of a hazard, it is important to assess how these aspects may change over space and time, and to unpack the economic, social and environmental factors that affect disaster risk, including optimistic and pessimistic climate change scenarios.

To refine further the granularity and comprehensiveness of its model, IDMC collaborated with several partners to develop an updated version that incorporates the latest hazard scenarios, both optimistic and pessimistic climate change projections affecting their frequency and intensity, new exposure layers, and an enhanced vulnerability component that goes beyond structural building fragility. The model assesses the risk of severe housing damage or destruction, as well as the loss of livelihoods for certain hazards, to estimate the probability of displacement. In essence, it focuses on the risk of medium- to long-term displacement and does not account for or model pre-emptive evacuations. Compared to the previous model, data is provided at Admin 1.

While still work in progress, the first results at a global level were obtained in early 2025, allowing to have a more detailed picture of global disaster displacement risk. As part of a series of papers on disaster displacement risk at a national level, the objective of this report is to advance our collective understanding of the current interlinkages between disasters, displacement and climate change, and better anticipate their future evolution. Given that "riskscapes" are constantly evolving, we need to better understand population and socioeconomic patterns, as well as fluctuations in the frequency and intensity of climate-related hazards in order to act more efficiently and ensure that no one is left behind



A woman stands in her small garden in her home in a displacement camp in Maiduguri, Nigeria. Recurrent flooding linked to the increasing impacts of climate change threatens food security of displaced families. © UNOCHA/Damilola Onafuwa

Disaster displacement in Nigeria: historical trends (2009-2024)

Nigeria is located in West Africa, along the Gulf of Guinea, between Benin and Cameroon, with a coastline stretching over 800 km. In the north, the country has a border with Niger and Chad. Nigeria has a diverse geography, including plains, plateaus, hills, and mountains, and the country covers a total land area of more than 920,000 square kilometres. The broad, mostly flat valleys of the Niger and Benue Rivers form the country's largest physical region. The Niger River enters the country from the northwest, and the Benue from the northeast; the two rivers meet in Lokoja, in the south-central part of the country, and continue southward converging into a large delta where they empty into the Atlantic.¹

With a population of nearly 228 million, Nigeria is the most populous country in Africa. Among its states, Kano and Lagos have the highest populations, each with more than 9 million inhabitants. Lagos, and several states in the Niger Delta such as Anambra, Imo, Akwa Ibom, Abia, and Rivers, have the highest population densities in the country.

Large cities in coastal areas and major river basins, including Lagos, Port Harcourt and Warri, are home to millions of informal urban dwellers who are at risk of displacement. Many have moved as a result of conflict, previous disasters or lack of economic opportunities in rural areas. Their arrival has put pressure on Nigeria's urban infrastructure, fuelled a rise in urban poverty and increased people's vulnerability to disasters. The urban poor are often the first and worst affected by the impacts of floods, including displacement. Their homes are all too often built in flood-prone areas with materials unable to withstand the impacts of flooding.²

Although Nigeria lies entirely within the tropics, it experiences significant climatic variation. It has a dry season, generally from October to March, and a wet season between March, April and October, December with some regional variations.³ Three distinct climate zones span the country; a tropical monsoon climate in the south; a tropical savannah in the central regions, and a hot, semi-arid Sahelian climate in the north. Southern regions experience intense rainfall during the wet season, typically from March

to October, with annual totals often exceeding 2,000 mm and reaching over 4,000 mm in parts of the Niger Delta.^{4,5}

Rivers in Nigeria play a significant role in the country's economy, particularly in agriculture, trade, and transportation. The Niger and Benue Rivers, along with their tributaries, have historically facilitated trade, settlement development, and access to resources, contributing to the growth of various sectors. However, climate change has intensified existing pressures and introduced new challenges from the coast to inland. Rising temperatures and altered rainfall patterns are leading to reduced river runoff, water scarcity and increased flooding, particularly in the Niger River basin.⁶

Nigeria's population has more than doubled in the last 30 years. This growth has contributed to rapid and often unregulated urbanisation, which has been a major factor in increasing flood displacement risk. Left unaddressed, the risk will continue to increase given that 70 per cent of the country's population is projected to be living in urban areas by 2050.⁷

Most of the country receives substantial precipitation during the rainy season, and floods in both rural and urban areas are not uncommon.⁸ As a result, Nigeria reported the highest number of disaster displacements in Africa between 2008 and 2024 with 9.9 million movements.

Flooding in 2012 and 2022 was particularly severe. In 2012, the most damaging rainy season on record in the country led to widespread floods that triggered 3.9 million movements, making it the largest disaster displacement event in Africa that year. Heavily populated settlements in low-lying areas along the Niger and Benue basins were flooded, particularly in the states of Kogi, Bayelsa, Delta and Rivers.

Ten years later, and following recurrent and small-scale flood events over the decade, including in 2018 and 2020 across various states, the 2022 floods triggered more than 2.4 million displacements.

The southern state of Bayelsa on the Niger delta was again one of the worst affected, accounting for half of the total, while the neighbouring state of Anambra recorded more

than 500,000 movements. The release of excess water from the Lagdo dam in Cameroon again aggravated the impacts of the disaster.

The floods also had a devastating effect on agricultural livelihoods, reducing crop yields for 95 per cent of households in the worst affected states.

In 2024, disaster displacement in Nigeria exceeded one million movements for the third time, reaching 1.2 million. Displacements were recorded across all states over several months, due to flooding, in some cases overlapping with conflict.⁹

In Nigeria, droughts can occur even in regions that typically receive adequate rainfall. As one of the most complex and catastrophic disasters, drought is characterized by a prolonged reduction in precipitation, leading to significant environmental and socio-economic impacts. Factors such as interannual rainfall variability, delayed onset of the rainy season, and early cessation of rains can all contribute to drought conditions.¹⁰ The incidence and impact of droughts

in Nigeria vary across regions and over time. While it is incontrovertible that droughts occur over the entire Nigerian littoral, their impacts on lives and livelihoods are more severe in the northern part of the country.¹¹ Although there is no recorded evidence of drought-induced displacement in Nigeria, such events are often small in scale, affecting only a few families, which makes them difficult to track and monitor accurately.¹²

Lastly, the coastline, stretching over 800 km, is exposed to ocean surface waves that can unexpectedly reach at least twice the height of typical waves. These rogue waves are unusually large and sudden, posing a significant threat to communities, ships and coastal infrastructure. According to NEMA, in 2023, as of 7 November, a total of 2,100 people were displaced due to Ocean surge in Ondo.

IDMC has recorded 168 disaster events that triggered displacement between 2009 and 2024, the overwhelming majority of which have been triggered by weather-related hazards, mainly floods (see Figure 1 and Figure 2).

Figure 1: Internal displacements by disasters in Nigeria, 2009-2024

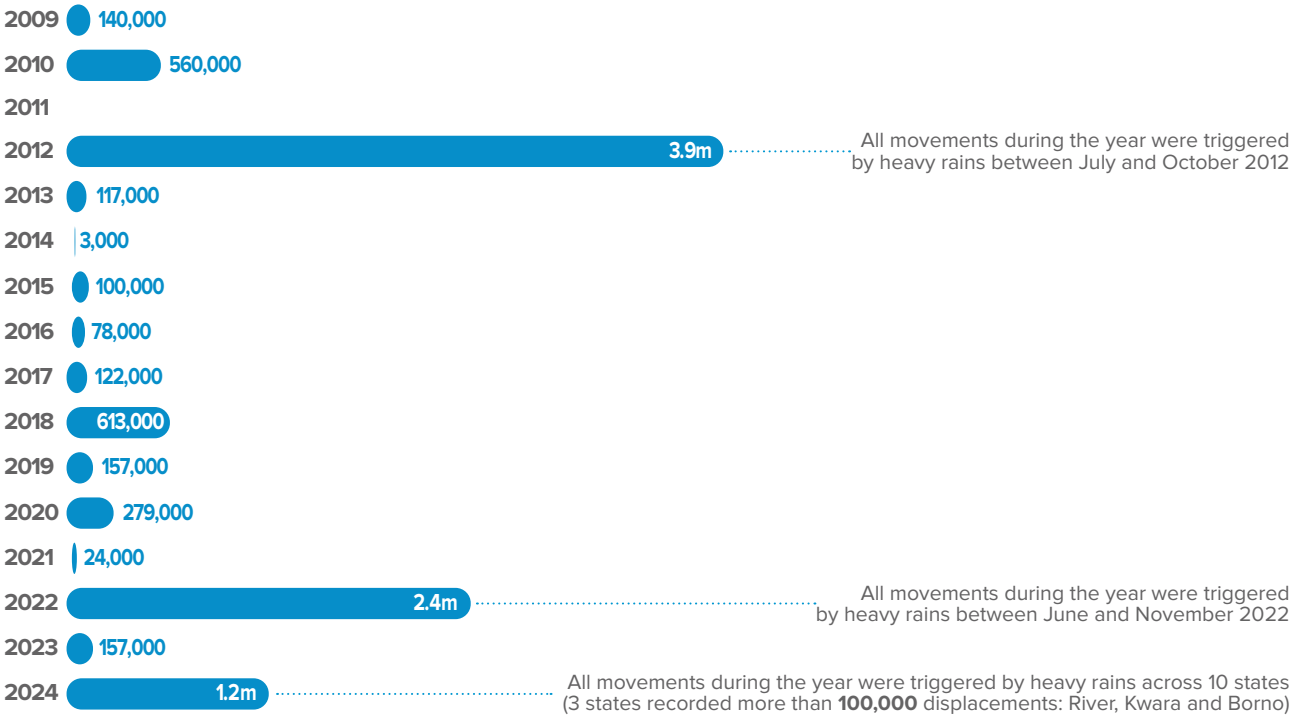
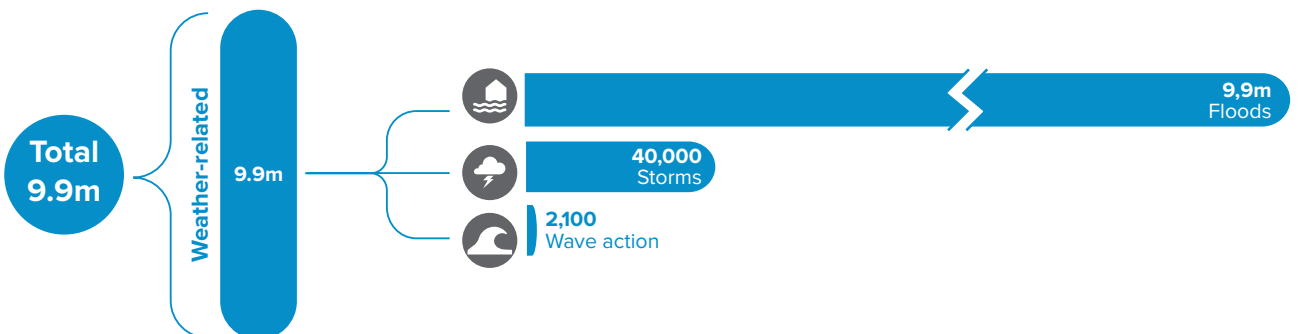


Figure 2: Breakdown of the total number of internal displacements by hazard in Nigeria, 2009-2024



Displacement risk concepts

The need for a broader approach, using probabilistic risk assessment

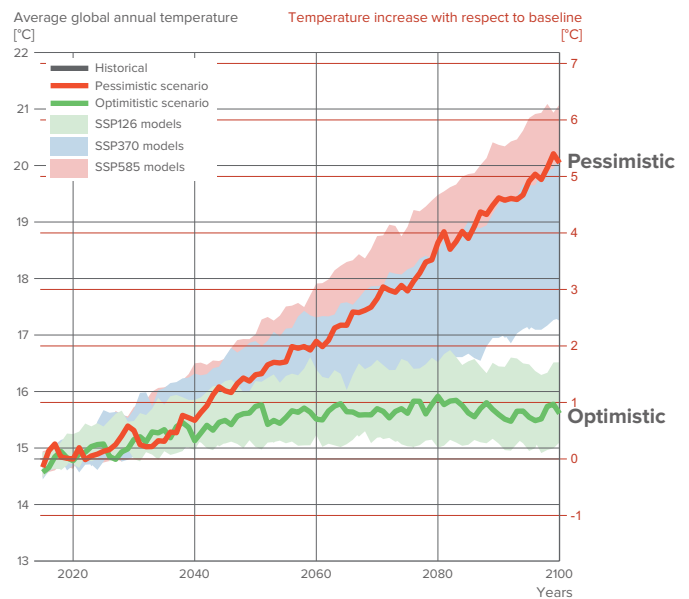
Before diving into the results of the displacement risk model, it is important to first understand key concepts underpinning the modeling approach and how it integrates diverse climate scenarios. These elements are essential to better interpret the outputs.

The baseline established by our new global disaster displacement risk model presents results at the national level downscaled at admin 1 resolution, and provides insight into future displacement situations in a changing climate in Nigeria.

It uses a probabilistic approach, applying statistical methods to estimate the likelihood and potential impact of different hazard scenarios. It accounts for uncertainty by analyzing a range of possible outcomes rather than a single deterministic prediction, and evaluates the risk of severe housing damage or destruction, along with livelihood loss for certain hazards, to estimate the likelihood of displacement. It primarily focuses on the risk of medium, to long-term displacement and does not include or model pre-emptive evacuations which means its estimates are inherently conservative.

The outputs are presented using two key metrics: Average Annual Displacement (AAD) and Probable Maximum Displacement (PMD), disaggregated by hazard type and downscaled to the administrative level 1 resolution.

Figure 3: Illustration of different climate scenarios



The new generation of the Global Displacement Risk Model integrates the potential impact of climate change on the future frequency and intensity of extreme events (see Methodology). To facilitate interpretation of the outputs, we have consolidated the results under three different scenarios:

- Under the **current** climate condition
- “**Optimistic**”, corresponding approximately to an average temperature rise of about +1°C by 2100
- “**Pessimistic**”, corresponding approximately to an average temperature rise of over +5°C by 2100

Displacement risk metrics

To represent how many people are at risk of displacement in a given country, the commonly used and comparable metric is **Average Annual Displacement (AAD)**, which measures the expected magnitude of future displacement by hazard type that a country is likely to experience. It does not indicate the actual number of displacements that will occur each year, but rather the average annual number projected over a long time period, taking into account all potential events. (See methodology section for more details.)

AAD represents the annualized, accumulated effect of all events in the hazard catalogue. It is a compact metric that captures the expected displacement from both medium and extreme events. The model estimates that under the current climate conditions, 740,000 people could be displaced by riverine floods in Bangladesh in any given year in the future, on average.

While AAD is useful for conveying the scale of displacement risk on an annual basis, it tends to mask potential outliers. High-intensity but low-frequency events, such as a Category 5 cyclone or a magnitude 7 earthquake, could cause mass displacement, even if they occur only rarely.

To better account for such extremes, we also use a second metric: **Probable Maximum Displacement (PMD)**. PMD represents the maximum number of displacements expected within a given return period, capturing the outlier scenarios mentioned above. It is especially useful for preparedness planning, such as determining the size and scope of shelters, infrastructure, and emergency response assets a government may need.

The likelihood or probability of displacement is usually expressed in terms of a return period, which is often misunderstood. A return period is the average time interval in years that separates two consecutive events equal to or exceeding the given magnitude. The most common misconception is that an event with a 100-year return period will only occur once a century. In fact, it means that it has an exceedance probability of 1/100, so events of the same or greater intensity happen once every 100 years on average. It does not preclude more than one event with a 100-year return period happening within a century or even the very small probability of back-to-back events one year after another. Nor does it rule out a century passing without such an event occurring.

AAD

Average Annual Displacement (AAD)

is a measure of the magnitude of future displacement by hazard type that a country is likely to experience. It does not reflect the number of displacements it will face each year, but the number it can expect per year considering all the events that could occur over a long timeframe. AAD is a compact metric with low sensitivity to uncertainty.

PMD

Probable Maximum Displacement (PMD)

is the maximum displacement expected within a given time period. It answers the question: What is the maximum expected displacement within a range of X years? It represents the outlier event that could occur during a specific time frame. PMD can be used to determine the size of shelters and other assets that a government needs to provide to cope with the potential magnitude of displacement.

Disaster displacement risk in Nigeria: results by hazard type

Looking only to the past is not a reliable guide for understanding what may occur in the future or how best to prepare for it. As climate patterns shift and hazards evolve, it becomes increasingly important to use forward-looking tools, such as probabilistic modelling to anticipate future displacement risks and inform proactive planning and preparedness efforts.

Riverine floods

The analysis of flood displacement risk at a country level shows an Annual Average Displacement (AAD) value of around 540,000 people under current climate conditions. When looking at the results under optimistic and the pessimistic climate change scenarios, the model points at an increase in AAD values, which may double in the optimistic scenario and triple in the worst pessimistic one.

When downscaling the analysis to the district level, several notable trends emerge regarding how risk evolves under the two scenarios. In most of the states, the risk of displacement due to riverine flooding is projected to increase under the pessimistic scenario. However, in Akwa Ibom, in both scenarios the risk may decrease. With a current AAD of around 13,000 people at risk of displacement in any given year, the risk may fall to less than 3,000 in the worst-case scenarios.

In Delta, under the current climate condition, Annual Average Displacement (AAD) risk is the highest, affecting nearly 64,000 people. This risk may slightly increase by 5% under the optimistic climate scenario. However, under the pessimistic scenario, it could double of the current level.

Lagos, the smallest and most populous state in Nigeria, is home to over 15 million people, more than half of whom are vulnerable to flooding.

The state has a high proportion of poor and vulnerable people and suffers from regular widespread flooding.¹³ Under the current climate conditions, the risk of being medium to long term displaced seems limited in the state. However, Lagos presents the major increase in both opti-

mistic and pessimistic scenarios assuming the current population distribution remains unchanged. The Annual Average Displacement (AAD) risk, currently affecting around 1,000 people, could increase nearly 20-fold under optimistic scenarios and double that under pessimistic ones, reaching up to 40,000 people.

While the Annual Average Displacement (AAD) reflects the average number of flood-induced displacements over a long-time frame, it tends to mask potential outliers. Understanding the impacts of these outliers and estimating the number of people potentially displaced during frequent (low return period) or rare (high return period) events, is essential. It is evident that the number of people at risk of displacement increases significantly with higher return periods. Understanding the potential impact of such events is crucial for preparedness planning, such as determining the size and scope of shelters, infrastructure, and emergency response assets that a government may require.

For instance, under current climate conditions across the country, displacement figures nearly triple from frequent events (e.g., a 5-year return period) to rare events (e.g., a 100-year return period)

This trend is also observed when analyzing the Probable Maximum Displacement (PMD) under long-term optimistic and pessimistic climate scenarios. At national level, a 100-year event may result in displacement figures that double under the optimistic scenario and increase by 155% under the pessimistic one.

Under current climate conditions, a 50-year return period event, meaning a 2% chance of occurring in any given year, a 33% chance over the next 20 years, and a 64% chance over the next 50 years, could displace approximately 675,000 people in Rivers state, 463,000 in Delta and around 6,000 in Lagos.

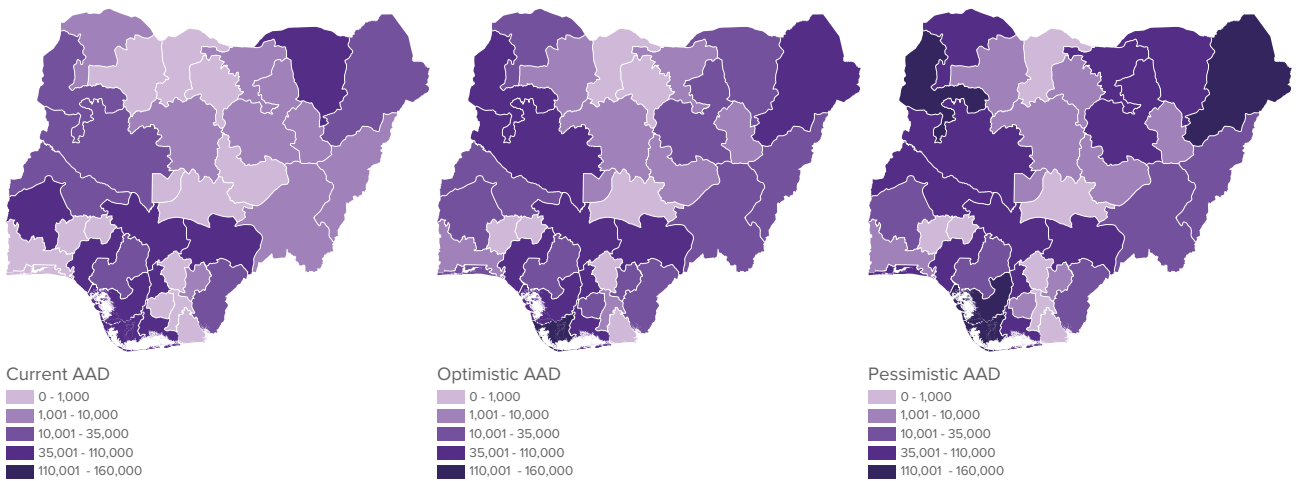
In two states, Rivers and Bayelsa, the Probable Maximum Displacement (PMD) may exceed half a million people under optimistic conditions, with estimates of 884,000 and 834,000, respectively.



Under pessimistic scenarios, and assuming the population remains constant, it is difficult to determine how the risk will evolve. For instance, in Bayelsa, the risk may slightly decrease, but in Rivers it could reach 1.1 million, and 838,000 in Delta.

Still under a pessimistic scenario, a 100-year return period flood event—meaning a 1% chance of occurring in any given year and a 39% chance over the next 50 years, could displace almost 1.2 million people in Delta and 1.3 million in Rivers.

Figure 4: Average Annual Displacement risk by riverine floods in Nigeria under different climate scenarios



Storm surges

Storm surge is the abnormal rise in seawater level during a storm. The surge is caused primarily by a storm's winds pushing water onshore. The amplitude of the storm surge at any given location depends on the orientation of the coastline with the storm track; the intensity, size, and speed of the storm; and the local bathymetry.¹⁴ Our model assesses the risk from storm surges, taking into account how sea-level rise in a changing climate could affect potential run-up in coastal areas.

The analysis of storm surge displacement risk at the national level shows an Annual Average Displacement (AAD) of approximately 4,000 people. Results under different climate scenarios highlight the significant influence of climate change and sea-level rise. In both optimistic and pessimistic scenarios, AAD values increase, more than quadrupling in the optimistic case and multiplying by a factor of 16 in the worst-case scenario.

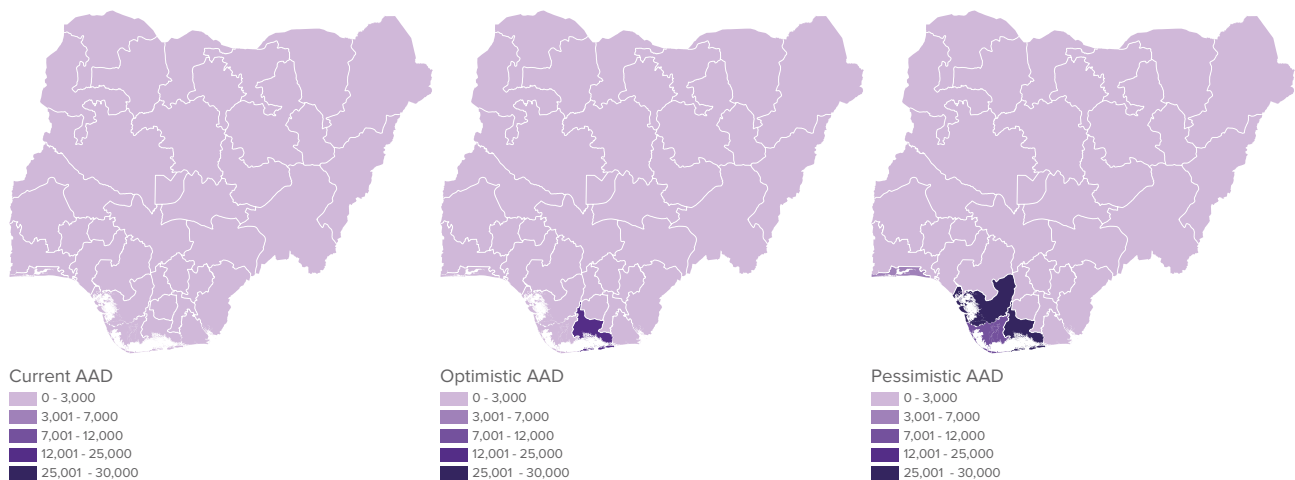
When downscaling the analysis to the state level, several notable trends emerge regarding how risk evolves under the two scenarios. In most of the 5 states at risk of storm surges, the risk of displacement is projected to increase under the optimistic and significantly increase under pessimistic scenario.

Lagos and Rivers States are the most exposed under current climate conditions. Lagos alone accounts for the majority of the displacement risk, representing 70% of the total of the country.

Lagos may not experience a significant increase in displacement risk under optimistic climate scenarios. However, under pessimistic scenarios, and assuming the current population distribution remains unchanged, the risk could double, reaching 4,000 people.

Delta and Rivers States could see a significant increase in displacement risk under pessimistic scenarios. In both states, the Annual Average Displacement (AAD) may exceed 26,000 people.

Figure 5: Average Annual Displacement risk by storm surges in Nigeria under different climate scenarios





A destroyed home in Northeast Nigeria. Historic flooding in 2024 damaged housing, farmland and essential infrastructure, triggering widespread internal displacement. © IOM/Elijah Elaigwu

Droughts

Droughts are one of the most complex hazards, causing severe damage to agricultural livelihoods and the economy. Many communities across the country rely on agriculture and natural resources which are vulnerable to climate shocks, including drought.

While ENSO oscillations can bring exceptionally heavy and prolonged rains, extended dry seasons also occur and have significant consequences.^{15, 16}

While there are no historical records in terms of drought-induced displacement in Nigeria, this is more a consequence of data gaps and lack of monitoring.¹⁷ As a result, compared with other hazards analysed in the model, no historical baseline can be used to calibrate it. That said, to better assess drought-related displacement, the model incorporates economic, social, and environmental factors to refine risk estimates.

The analysis of drought displacement risk at the country level reveals an Annual Average Displacement (AAD) of approximately 628,000 people. However, results under different climate scenarios highlight the significant influence of climate change. Notably, the risk may increase by 50% under the optimistic scenario and could triple under the pessimistic one, reaching 1.9 million displaced individuals in any given year.

When downscaling the analysis to the states level, an important fact highlights that all states are at risk of drought displacement. All states have more than thousands of people at risk of displacement. From 3,200 AAD in the capital states, Lagos, to 41,000 in Kano states.

Except in a few states where the risk may decrease under optimistic scenarios, such as a 50% reduction in Kano and Katsina, all other states may experience either a minor increase, or in some cases, no change at all, as in Gombe, Akwa Ibom, and Sokoto.

In contrast, some states may see a major increase, with risk rising by up to 350% in Enugu and more than quadrupling, up to a 400% increase, in Kwara, reaching 39,000 displaced individuals in any given year. Benue could be the

state with the highest number of people at risk of drought displacement under the optimistic scenario, with an Annual Average Displacement (AAD) of 82,000.

Under the pessimistic scenario, all states in Nigeria may experience an increase in drought-related displacement. In 22 states, the risk may rise by more than 100%, meaning it could at least double.

In Benue, Kogi, and Enugu, the risk of displacement is projected to increase drastically under pessimistic scenarios, rising to between six and sevenfold compared to current climate conditions. In the worst-case climate scenario, up to 123,000 people in Benue, 110,000 in Kogi, and 94,000 in Enugu could be displaced.

Looking at the Probable Maximum Displacement (PMD) under current climate conditions, a 100-year return period drought event with a 1% chance of occurring in any given year and a 39% chance over the next 50 years could displace more than 1 million people in Kano.

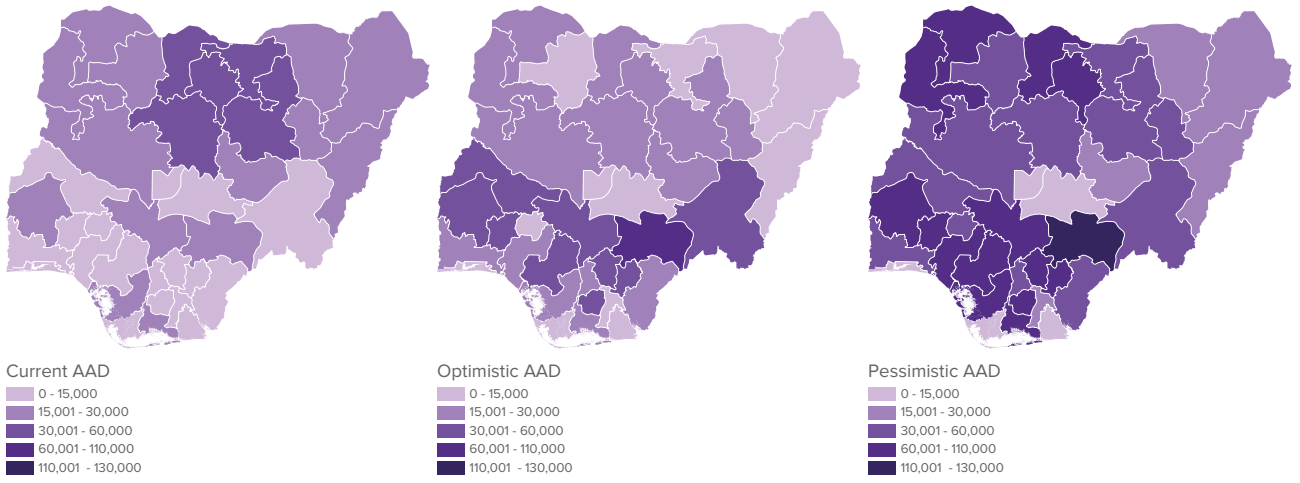
In the optimistic scenario for Kano, a similar event may displace only a quarter of the number expected under current climate conditions. However, under the pessimistic scenario, 1.4 million people could be displaced due to a drought event with a 100-year return period.

Eight states may experience displacement of over one million people under the pessimistic scenario involving a 100-year return period event. These states include Benue, Kano (as explained above), Katsina, Kebbi, Kogi, Oyo, Rivers, and Sokoto.

It is also important to note that a 25-year return period event, with a 33% probability of occurring in the next 20 years, may displace 82,000 people in Benue under current climate conditions, rising to 620,000 under the optimistic scenario and 886,000 under the pessimistic one.

Kogi State may experience a similar increase, where a 25-year return period event could displace 60,000 people under current conditions, rising to 489,000 under the optimistic scenario and nearly doubling under the pessimistic scenario to reach 802,000.

Figure 6: Average Annual Displacement risk by drought in Nigeria under different climate scenarios



Conclusion

Disaster displacement is one of the most significant humanitarian and development challenges we face in the 21st century.

The insights from probabilistic risk models underscore the need for proactive policy interventions to prevent and manage future displacement driven by natural hazards in a changing climate. They also provide insights into how and where that displacement may occur. To minimise the risk of displacement and its most adverse impacts, the government in Nigeria and all actors managing disaster risk reduction can use this information to move beyond reactive responses to displacement events and adopt forward-thinking strategies that anticipate risks and build resilience in vulnerable communities.

Our study outlines an effort to create and apply a multi-hazards displacement risk model that utilizes novel methods for vulnerability assessment. The methodology gauges the potential displacement of individuals due to riverine floods, storm surges, cyclonic winds and drought.

The quantification of risk is expressed in terms of Average Annual Displacement (AAD) and Probable Maximum Displacement, calculated under current climate conditions as well as long-term projections based on both optimistic and pessimistic scenarios. This methodology, first applied in two small Pacific islands, Fiji and Vanuatu, was later scaled up to the regional level in the Horn of Africa before being implemented globally. The resulting outputs provide valuable insights into the proportion of housing rendered uninhabitable and the loss of livelihoods caused by floods and droughts, both of which can trigger displacement. We present outputs at Admin level 1 highlighting where the spatial risk pattern increases under projected conditions influenced by climate change, considering optimistic and pessimistic scenarios.

The model's results can be used to inform national and subnational disaster risk reduction measures, identify areas where large numbers of people could be made homeless by floods, and calculate evacuation centre capacities and the amount of investment needed to support displaced

people. Through this report, we present some recommendations that can serve as a foundation for developing comprehensive policies and strategies to mitigate displacement risks associated with hazards highlighted in this report floods and protect the rights and wellbeing of affected populations.

Tangible steps must be reinforced to identify and target vulnerable populations who are at higher risk of displacement. Tailored strategies should be developed to protect their rights and well-being. Additionally, investment in flood-resistant infrastructure (riverine and storm surges) and improved building standards is essential to reduce displacement and property damage. Finally, continued advocacy for and implementation of climate mitigation measures remains crucial.

Data availability, technological advances and growing international recognition of the scale and increasing risk of disaster displacement mean the time is right for more and better-coordinated action to build on good practices and address the challenge of designing effective displacement risk models.

Further efforts are required to effectively quantify future hazard risks, especially with the dynamic background of evolving "riscscapes" in Nigeria. The effectiveness of our efforts will naturally improve with the availability of additional data to refine and calibrate our models. This necessitates a comprehensive understanding of population and socioeconomic patterns, along with fluctuations in the frequency and intensity of hazards associated with climate change. To achieve this, we must leverage open-access data, refine terrain models for greater accuracy and acquire more hydrometeorological, and meteorological data. The risk of disaster-induced displacement is a global reality, present in every country. Now is the opportune time to demonstrate our collective commitment to the principle of leaving no one behind, particularly those already enduring the challenges of protracted and repeated displacement.



A boy with his bike in Northeastern Nigeria, where communities face recurrent internal displacement triggered by conflict and disasters. © IOM/Great Ovie Taghwo



Figure Annex

Figure 7: Map of Nigeria by states



Figure 8: Probable Maximum Displacement per states for riverine flood

Legend



By States	Current PMD50	Optimistic PMD50	Pessimistic PMD50
Abia	4,000	8,100	8,600
Adamawa	29,000	70,000	114,000
Akwa Ibom	11,000	7,300	12,000
Anambra	137,000	195,000	245,000
Bauchi	21,000	64,000	123,000
Bayelsa	378,000	835,000	720,000
Benue	119,000	182,000	172,000
Borno	55,000	153,000	328,000
Cross River	32,000	98,000	94,000
Delta	463,000	459,000	839,000
Ebonyi	5,300	26,000	20,000
Edo	26,000	55,000	48,000
Ekiti	0	5	0
Enugu	1	4,600	5,500
Federal Cap. Terr.	4,200	7,200	9,100
Gombe	14,000	24,000	43,000
Imo	6,700	29,000	40,000
Jigawa	13,000	51,000	103,000
Kaduna	30,000	12,000	26,000
Kano	2,900	8,300	10,000
Katsina	770	2,400	3,400
Kebbi	86,000	216,000	407,000
Kogi	137,000	233,000	242,000
Kwara	79,000	110,000	143,000
Lagos	6,200	114,000	164,000
Nasarawa	95,000	124,000	135,000
Niger	112,000	239,000	305,000
Ogun	2,600	21,000	22,000
Ondo	175,000	181,000	255,000
Osun	340	1,500	2,000
Oyo	55,000	91,000	110,000
Plateau	980	3,000	4,600
Rivers	675,000	885,000	1100,000
Sokoto	8,800	76,000	186,000
Taraba	18,000	47,000	79,000
Yobe	31,000	92,000	178,000
Zamfara	4,000	13,000	25,000

By States	Current PMD100	Optimistic PMD100	Pessimistic PMD100
Abia	4,600	25,000	25,000
Adamawa	32,000	75,000	126,000
Akwa Ibom	11,000	8,000	13,000
Anambra	150,000	235,000	291,000
Bauchi	29,000	76,000	138,000
Bayelsa	411,000	910,000	790,000
Benue	134,000	190,000	185,000
Borno	69,000	180,000	414,000
Cross River	34,000	110,000	107,000
Delta	843,000	655,000	1,200,000
Ebonyi	5,700	31,000	21,000
Edo	27,000	58,000	49,000
Ekiti	0	0	0
Enugu	1,000	5,700	6,700
Federal Cap. Terr.	4,300	7,500	9,500
Gombe	15,000	24,000	46,000
Imo	7,000	32,000	43,000
Jigawa	16,000	56,000	134,000
Kaduna	34,000	81,000	185,000
Kano	3,300	9,400	12,000
Katsina	1,100	3,000	4,100
Kebbi	94,000	243,000	430,000
Kogi	142,000	246,000	253,000
Kwara	79,000	115,000	147,000
Lagos	6,500	123,000	267,000
Nasarawa	96,000	126,000	137,000
Niger	126,000	248,000	325,000
Ogun	3,400	33,000	28,000
Ondo	177,000	231,000	264,000
Osun	670	1,800	2,200
Oyo	57,000	94,000	115,000
Plateau	1,100	3,200	5,600
Rivers	714,000	1,000,000	1,300,000
Sokoto	11,000	81,000	209,000
Taraba	19,000	49,000	83,000
Yobe	43,000	109,000	185,000
Zamfara	4,600	15,000	29,000



Figure 9: Probable Maximum Displacement per states for storm surge

Legend



By States	Current PMD50	Optimistic PMD50	Pessimistic PMD50
Bayelsa	54	2,100	13,000
Cross River	0	0	1,300
Delta	360	500	30,000
Lagos	2,600	2,200	4,800
Rivers	1,000	11,000	35,000

By States	Current PMD100	Optimistic PMD100	Pessimistic PMD100
Bayelsa	54	2,100	14,000
Cross River	0	10	1,600
Delta	360	500	30,000
Lagos	2,600	2,400	4,800
Rivers	1,000	11,000	36,000

Figure 10: Probable Maximum Displacement per states for drought

Legend



By States	Current PMD50	Optimistic PMD50	Pessimistic PMD50
Abia	27,000	70,000	138,000
Adamawa	60,000	67,000	222,000
Akwa Ibom	56,000	97,000	212,000
Anambra	24,000	233,000	350,000
Bauchi	117,000	108,000	418,000
Bayelsa	23,000	19,000	43,000
Benue	79,000	620,000	886,000
Borno	69,000	68,000	211,000
Cross River	44,000	165,000	283,000
Delta	62,000	210,000	545,000
Ebonyi	47,000	285,000	505,000
Edo	49,000	336,000	613,000
Ekiti	35,000	96,000	285,000
Enugu	49,000	449,000	658,000
Federal Cap. Terr.	27,000	36,000	55,000
Gombe	61,000	100,000	395,000
Imo	35,000	297,000	434,000
Jigawa	116,000	80,000	237,000
Kaduna	115,000	130,000	327,000
Kano	155,000	120,000	531,000
Katsina	139,000	113,000	566,000
Kebbi	102,000	137,000	714,000
Kogi	67,000	489,000	802,000
Kwara	29,000	305,000	471,000
Lagos	12,000	9,100	28,000
Nasarawa	34,000	112,000	143,000
Niger	82,000	109,000	343,000
Ogun	46,000	114,000	304,000
Ondo	47,000	245,000	489,000
Osun	50,000	450,000	582,000
Oyo	61,000	476,000	665,000
Plateau	60,000	135,000	212,000
Rivers	73,000	209,000	598,000
Sokoto	98,000	171,000	669,000
Taraba	37,000	299,000	374,000
Yobe	60,000	57,000	240,000
Zamfara	87,000	78,000	500,000

By States	Current PMD100	Optimistic PMD100	Pessimistic PMD100
Abia	201,000	185,000	262,000
Adamawa	422,000	263,000	500,000
Akwa Ibom	383,000	344,000	523,000
Anambra	176,000	335,000	471,000
Bauchi	788,000	301,000	928,000
Bayelsa	158,000	102,000	166,000
Benue	542,000	954,000	1300,000
Borno	474,000	239,000	544,000
Cross River	308,000	342,000	533,000
Delta	433,000	515,000	957,000
Ebonyi	337,000	519,000	727,000
Edo	336,000	590,000	892,000
Ekiti	229,000	279,000	525,000
Enugu	345,000	641,000	838,000
Federal Cap. Terr.	185,000	100,000	160,000
Gombe	418,000	347,000	683,000
Imo	236,000	482,000	703,000
Jigawa	795,000	150,000	738,000
Kaduna	815,000	507,000	895,000
Kano	1000,000	251,000	1400,000
Katsina	943,000	374,000	1400,000
Kebbi	697,000	544,000	1200,000
Kogi	449,000	781,000	1200,000
Kwara	199,000	405,000	564,000
Lagos	82,000	31,000	102,000
Nasarawa	242,000	292,000	330,000
Niger	584,000	401,000	771,000
Ogun	327,000	377,000	560,000
Ondo	324,000	496,000	779,000
Osun	342,000	745,000	957,000
Oyo	430,000	814,000	1100,000
Plateau	421,000	349,000	447,000
Rivers	496,000	602,000	1000,000
Sokoto	703,000	699,000	1200,000
Taraba	262,000	464,000	553,000
Yobe	394,000	192,000	526,000
Zamfara	599,000	272,000	953,000

Methodological Annex

The true benefits of a probabilistic risk assessment are frequently misconstrued because it is regarded as a complex and challenging method to implement and follow, with a communication hurdle when presenting outcomes. A probabilistic disaster displacement risk profile must be seen as a diagnostic tool, because it offers insights into potential hazard occurrences and their consequences.

Such profiles cover all possible risk scenarios in a certain geographical area. Both low-frequency, high-impact events and high-frequency, low-impact events are considered. Their probability of occurrence, all elements of the risk equation (risk = hazard X exposure X vulnerability), and their variability and uncertainty ranges are all included (see Figure 11).

Events that have rarely been recorded but might occur more often under climate projections are thus also considered. This feature is particularly useful because climate change is increasing uncertainty about future hazard patterns. To be prepared, societies need to calculate the worst possible impact. Viewed through this lens, there is no valid alternative to a probabilistic analysis to address such uncertainty in a usable, quantitative way.

Displacement risk information, expressed in average annual displacement (AAD) and probable maximum displacement (PMD), is calculated at the subnational regions and aggregated at country level, allowing for a geographic and quantitative comparison within and between countries. These analyses and comparison exercises are an important step in risk awareness processes and key to pushing for risk reduction, adaptation and management mechanisms to be put in place.

The PMD curve illustrates the probability of a specific scenario leading to an estimated number of displacements. This likelihood is usually measured in terms of return period, which is often misunderstood. A return period is the average time interval in years that separates two consecutive events equal to or exceeding the given magnitude. The most common misconception is that an event with

a 100-year return period will only occur once a century, when instead it means that it has an exceedance probability of 1 in 100, so events of the same or greater intensity happen once every 100 years on average. This does not preclude the possibility of several events with a 100-year return period happening within a century, or even the rare chance of consecutive events transpiring in consecutive years. Neither does it eliminate the possibility of an entire century passing without such an event occurring.

Our model assesses the risk of severe housing damage or destruction, as well as the loss of livelihoods for certain hazards such as droughts and floods, to estimate the likelihood of displacement. In essence, it focuses on the risk of medium- to long-term displacement and does not account for or model pre-emptive evacuations. This means the figures presented here are highly conservative. Our approach looks at people who may suffer the consequences of their homes becoming uninhabitable and who are forced to be displaced for weeks, months, or even years.

Using the similar approach of “catastrophe Modeling” CAT assessing economic losses associated with disasters (Average Annual Loss -AAL- and Probable Maximum Loss -PML-), we “humanised” the approach by looking, instead of the monetary value of residential building, how many people lives in it, **to estimate the probability of people getting displaced**. Our outputs are presented under two main metrics: Average Annual Displacement (AAD) and Probable Maximum Displacement (PMD) for each hazard type and downscaled at admin 1 resolution (see section - *Making sense of displacement risk metrics*).

Displacement risk from the four hazards is estimated using two distinct risk modeling framework, one from CIMA foundation for riverine floods and CLIMADA for the other hazards, each of which estimates human displacement resulting from the interplay of the hazard, exposure, and vulnerability data. This consistency allows for a comparative analysis of outputs across models.



Figure 11: The displacement risk equation



Displacement risk from **riverine floods** is assessed using the risk model developed by [CIMA foundation](#), while displacement from **tropical cyclones** (winds) and **coastal floods** (storm surge and sea level rise) is calculated using the Python implementation of CLIMADA under the [Weather and Climate Risks at ETH Zürich](#). Drought-related displacement is modeled using an earlier version of CLIMADA, implemented in Matlab, by [United Nations Universities - Institute for Environment and Human Security](#).

Hazards

River flood hazard maps were generated using a climate-hydrology-inundation framework with bias-corrected CMIP6 projections from 15 global climate models. The Continuum hydrological model simulated river discharge, which was processed through the REFLEX inundation model to produce flood hazard maps. A synthetic 3,000-year event catalogue was created to improve risk estimates. ([CIMA foundation](#))

To capture the spread of possible climate scenarios, we compared 15 models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP3b), which provides bias-corrected Coupled Model Intercomparison Project Phase 6 (CMIP6) climate scenarios for pre-industrial, historical, SSP1-RCP2.6, SSP3-RCP7.0 and SSP5-RCP8.5 conditions, in terms of temperature and precipitation rise in 2016. Temperature and precipitation trends proved to be highly correlated in the models considered, so we referred only to temperature trends to define representative scenarios, from which we selected, optimistic and pessimistic.

Coastal flood hazard maps were developed based on storm surges and sea-level rise (SLR) projections, considering future scenarios for 2050 and 2100 under SSP1-2.6

and SSP5-8.5. ([Disaster Analytics for Society Lab](#) - Nanyang Technological University - NTU Singapore)

Drought hazard conditions were analysed using the Standardized Precipitation Index (SPI₁₂), which measures long-term precipitation anomalies. Data from the Cordex dataset at a 0.22° resolution were used, incorporating RCP2.6 and RCP8.5 scenarios. Drought intensity and frequency were assessed for return periods of 10 to 100 years. (UNU-EHS – Climate Risk Analytics)

Tropical cyclone wind hazards. We used synthetic tropical cyclone event sets from the MIT model, downscaled from ERA-5 reanalysis data for historical periods and from nine GCMs for future climate scenarios (SSP2-4.5 and SSP5-8.5) for 2041–2060 and 2081–2100. Wind-driven impacts were modelled using the Holland (2008) parametric wind model, with maximum sustained wind speeds serving as the hazard intensity variable. Storm surge effects were categorized under coastal flooding, while rainfall impacts were excluded. (MIT - [Weather and Climate Risks at ETH Zürich](#))

Exposure

We use the Global Building Exposure Model at 1km resolution globally to assess how different hazards impact communities and infrastructure. This model helps us understand which buildings and populations are most at risk from disasters like cyclones, floods, and droughts. By integrating high-resolution data on population, land use, and economic activity, we can better estimate potential displacement and improve disaster response planning. (The GIRI global building exposure model (BEM) - UNEP-GRID-Geneva-CDRI-IDMC).

Vulnerability

In hazard risk modelling, vulnerability is represented through impact functions, which estimate structural damage and displacement risk from hazards like tropical cyclones, floods, and droughts. We use CAPRA impact functions to assess building damage based on wind speed and flood depth, while a separate function estimates livelihood loss due to flooding in agricultural areas. (CAPRA - [Comprehensive Approach to Probabilistic Risk Assessment: international initiative for risk management effectiveness](#) and Rossi and al. [A new methodology for probabilistic flood displacement risk assessment](#))

For drought-related displacement, our model considers economic, social, and environmental factors to refine risk estimates at national and subnational levels. This approach ensures a comprehensive understanding of displacement drivers and informs more effective resilience planning.

This risk assessment considers a large number of possible scenarios, their likelihood, and the resulting damage to housing, while also accounting for livelihood damages, mainly from medium- to large-scale events. Small and recurrent events still require daily monitoring of empirical information to understand and capture the true scale of displacement risk by different triggers.

For this iteration, we did not account for changes in exposure between current and future scenarios, although factors such as population growth and distribution—such as rapid urban sprawl reducing natural areas that absorb floodwater—may significantly alter the future “riskscape.” However, for drought-related displacement, we explore potential changes in population distribution and dynamics over time using United Nations population projections for 2050 and 2100.

It is important to note that the results exclude individuals involved in pre-emptive evacuations. Our outputs focus on people at risk of medium- to long-term displacement,

primarily due to severe damage to homes. For floods, we also explore the risk of loss of livelihoods, incorporating a complex process to avoid double-counting individuals who may experience both housing and livelihood loss in the same scenario. However, since droughts rarely damage built environments, we focus on how they impact agriculture, undermining livelihoods and forcing communities into displacement situation in search of alternatives.

Lastly, even with the use of more accurate exposure layers at a 1 km x 1 km resolution, the resolution of certain hazard datasets did not allow for proper subnational displacement risk assessments. The outputs should be viewed as tools to raise awareness and guide further discussions on disaster risk reduction investments centered on internal displacement. The model and its current resolution are not suitable for informing land use or urban planning decisions. Additional efforts are needed to develop more accurate and higher-resolution data on hazards and exposure, as well as customized vulnerability assessments that incorporate coping mechanisms from different regions within the country. This would enable the design of more detailed and effective measures to actively reduce displacement risk at the local level. Currently, the outputs are intended to support discussions at the national level.

IDMC has been working with numerous partners since the mid-2010s to put our data to use in estimating disaster displacement risk. Collaborating with diverse and respected partners allows us to use the most up-to-date data and methodologies for various components of displacement risk and apply strict scientific rigour and quality assurance in our models.

Our current consortium of partners includes the [CIMA Foundation](#), [ETH-Zurich's Weather and climate risk group](#), the [Nanyang Technological University - NTU Singapore](#), the [Potsdam Institute for Climate Impact Research \(PIK\)](#), The United Nations University's Institute for Environment and Human Security ([UNU-EHS](#)).



A cart travels along a rural road in Katsina State, Nigeria. The northwest continues to face overlapping pressures from floods, conflict and criminal violence, which together drive internal displacement. © TOM/Great Ovie Taghwo

Endnotes

- 1 <https://nigeriaembassy.org.vn/geography/> accessed on 23.06.2025
- 2 <https://www.internal-displacement.org/publications/internal-displacement-in-africa/> accessed on 24.05.2025
- 3 <https://nimet.gov.ng/scp> accessed on 26.06.2025
- 4 <https://climateknowledgeportal.worldbank.org/country/nigeria/climate-data-historical> accessed on 23.06.2025
- 5 <https://nimet.gov.ng/> accessed on 23.06.2025
- 6 <https://www.sciencedirect.com/science/article/pii/S2211464524000083> accessed on 23.06.2025
- 7 World Bank, Climate Risk Profile: Nigeria, 2021, accessed on 23.06.2025
- 8 World Bank, Climate Risk Profile: Nigeria, 2021 Ahmed Abubakar, Flooding
- 9 <https://cch.icddrb.org/droughts> accessed on 18.06.2025
- 10 https://www.unccd.int/sites/default/files/country_profile_documents/1%2520FINAL_NDP_Nigeria.pdf accessed on 24.06.2025
- 11 *ibid*
- 12 *ibid*
- 13 <https://www.insdevforum.org/wp-content/uploads/2022/11/Nigeria-Tripartite-Project-Fact-sheet-MASTER.pdf> accessed on 23.06.2025
- 14 <https://oceanservice.noaa.gov/facts/storm-surge-stormtide.html> accessed on 25.06.2025
- 15 https://academicjournals.org/article/article1380798777_At%20et%20al.pdf accessed on 05.07.2025
- 16 <https://www.mdpi.com/2225-1154/4/1/5> accessed on 05.07.2025
- 17 https://www.droughtmanagement.info/wp-content/uploads/2016/10/WS6-Nigeria_EN.pdf Accessed on 10.07.2025



A farmer living in a displacement camp in Borno State, Nigeria. The overlap of conflict and disasters continues to displace people across the state, which reported more than 121,000 disaster displacements in 2024. © UNOCHA/Adedeji Ademigbuji

Every day, people flee conflict and disasters and become displaced inside their own countries. IDMC provides data and analysis and supports partners to identify and implement solutions to internal displacement.

Join us as we work to make real and lasting change for internally displaced people in the decade ahead.



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