First Street

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GLOBAL RISK ASSESSMENT

THE 15TH RISK ASSESSMENT

# Defining The Globe's Flood Risk

A comprehensive analysis of
flood risk exposure, economic impact,
and future projections across the globe.

# Defining The Globe's Flood Risk

The 15th Risk Assessment

First Street

2025



# Inside This Report

GLOBAL FLOOD REPORT: 2025

# Executive Summary

Flooding is the most economically consequential natural disaster worldwide, responsible for more than 86% of weather-related damages since 1980. Annual flood damages have risen more than tenfold, from $11.2 billion in 1980 to $125.8 billion in 2023, as climate hazards intensify and populations concentrate in vulnerable areas.

**$125.8B**

ANNUAL FLOOD DAMAGES IN 2023

Yet global awareness of flood risk remains limited: many national maps are outdated or incomplete, pluvial and compound floods are often underrepresented, and existing global models rely on simplified methods that cannot capture real hydraulic behavior.

To close these gaps, First Street developed the First Street Global Flood Model (FS-GFM), the first-ever global deployment of the HEC-RAS 2D hydraulic solver. HEC-RAS is the gold standard for engineering-grade flood modeling, widely used by agencies and engineers to simulate the actual physics of water movement, but historically restricted to small local studies due to its data and computational demands.

IMAGE: Aerial view of flooded houses from the Dnister River in Halych, Ukraine

IMAGE: North Yorkshire, United Kingdom

IMAGE: Kampala, Uganda

FS-GFM operationalizes HEC-RAS at a global scale through a cloud-native, tile-based system capable of running thousands of parallel simulations at 30-meter resolution. This enables consistent, physics-based modeling of fluvial, pluvial, and coastal flooding worldwide under present and future climate conditions.

> Using FS-GFM and gridded UN population data, First Street estimates that as of 2025, 1.92 billion people (23.3% of the global population) are exposed to at least 10 cm of flooding in a 1-in-100-year event, with a 10% chance of experiencing such flooding over a 10-year period.

KEY STATISTICS

| 1.92B | 86% | 23.3% |
|---|---|---|
| PEOPLE EXPOSED | WEATHER DAMAGES | GLOBAL POP. |

Under a moderate climate scenario, exposure increases nearly 6% by 2100, keeping population constant,and by almost 13% to 2.16 billion people when accounting for demographic change.

These findings reveal a world where flood risk is both widespread and underestimated, underscoring the urgent need for physics-based, property-relevant tools to support governments, insurers, investors, and communities in making informed resilience decisions.

IMAGE: Tanah Laut Regency, South Kalimantan, Indonesia

KEY FINDINGS

# 10 Key Takeaways

01

**Flooding is the costliest weather-related disaster on Earth**

Since 1980, weather-related disasters have caused over $5.1 trillion in global losses, and more than 86% of those damages, or over $4.4 trillion, are attributable to flood hazards, making flooding the most economically consequential natural disaster worldwide.

02

**Flood losses are accelerating faster than economic growth**

Annual flood-related damages have increased more than eleven-fold, rising from $11.2 billion in 1980 to $125.8 billion in 2023, with average annual losses climbing from roughly $31 billion in the 1990s to $51 billion since 2020, an average growth rate of 5.8% per year.

03

**Global exposure is baked into where people live**

Nearly 2 billion people, or close to 30% of the world's population, live in coastal regions, and more than 50% live within 3 km of a freshwater body, structurally anchoring households and businesses in zones where riverine, coastal, and compound flooding are most likely to occur.

04

**A warming climate is broadening the geography of flood risk**

Extreme rainfall events have increased by roughly 30% since the 1980s, and short-duration downpours, the main driver of pluvial flooding, are strengthening at twice the rate of total precipitation, pushing damaging floods into arid and historically "low-risk" areas.

05

**Nearly one in four people already faces substantial flood risk**

In 2025, an estimated 1.92 billion people (23.3% of the global population) reside in areas exposed to substantial flooding, defined as at least 10 cm of floodwater during a 100-year flood — an event that has a 1% chance of occurring in any given year. Over a typical 10-year period, communities in these areas face an almost 10% chance of experiencing flooding of this magnitude.

06

**Over $18.8 trillion in economic activity is exposed to flood disruptions**

As of 2025, approximately $18.8 trillion in global economic output, or about 16% of worldwide production, is located in areas exposed to flooding during a 100-year flood, creating significant potential for economic disruption.

07

**Flood exposure is projected to grow, even under moderate climate scenarios**.

Under a middle-of-the-road climate pathway (SSP-RCP 2-4.5) and holding population constant, global exposure to substantial flood risk increases by nearly 6%, from 1.92 billion people today to 1.99 billion by 2100; when accounting for projected population growth, exposure rises by almost 13% to 2.16 billion people.

08

**Risk is concentrated in a handful of regions and administrative divisions**.

Today, Asia-Pacific (30.7%) and MENA (29.7%) have the highest shares of their populations facing substantial flood risk, while Sub-Saharan Africa and Latin America see the fastest growth in exposure. At the subnational level, large population centers in India, Pakistan, China, Bangladesh, Egypt, and major coastal cities worldwide dominate both current risk and future increases.

09

**National safety nets for flood risk are uneven and often incomplete**.

High-income countries rely on a patchwork of national flood insurance schemes, catastrophe pools, and large-scale defenses, while many low- and middle-income countries depend on post-disaster aid and sovereign risk pools, leaving households and small businesses with limited access to pre-disaster financial protection.

10

**The FS-GFM sets a new benchmark for understanding global flood risk**.

By operationalizing the HEC-RAS 2D hydraulic solver at 30-meter global resolution, the First Street Global Flood Model delivers engineering-grade, physics-based flood simulations at a planetary scale, enabling consistent, comparable, and asset-relevant risk insights that can inform national programs, financial markets, and local decision-makers alike.

INTRODUCTION

# Global Trends in Flood Disaster Damages

Weather-related disasters continue to impose extraordinary and accelerating costs on the global economy. After adjusting for inflation, these events, including extreme precipitation, coastal and riverine flooding, tropical cyclones, wildfires, extreme temperatures, and drought, have generated more than $5.1 trillion in property damage and economic disruption since 1980.

Flooding, in particular, stands out as the dominant driver of global losses. When accounting for damages from riverine and coastal flooding, pluvial (precipitation-driven) flooding, and flood impacts associated with extreme weather events, over 86% of all weather-related losses, or more than $4.4 trillion, stem from flood hazards alone, making flooding not only the most frequent but also the most economically consequential natural disaster globally (**Figure 1**).

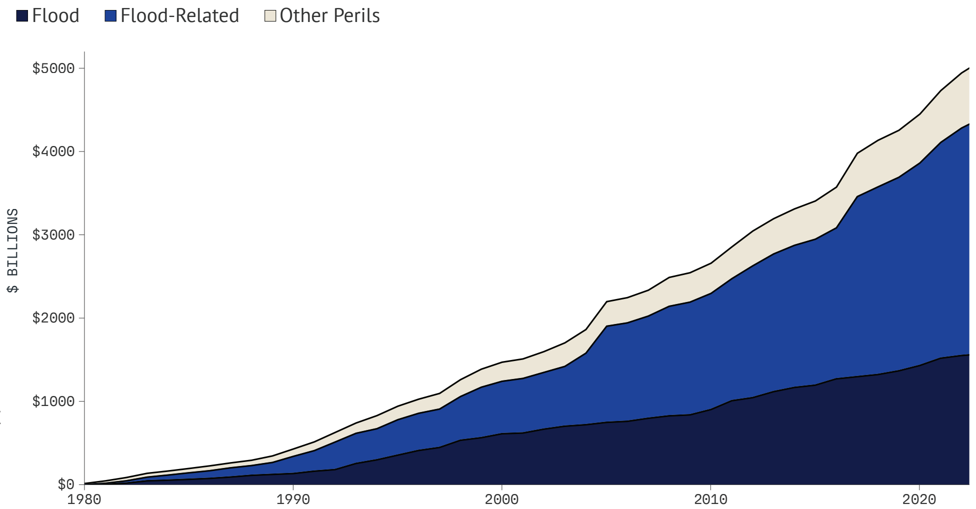


**FIGURE 1.** Cumulative Global Weather-Related Disaster Damages, 1980-2023

## Accelerating Losses

The scale and pace of losses are increasing. Total annual flood losses have grown more than eleven-fold, from $11.2 billion in 1980 to $125.8 billion in 2023, representing an average annual growth rate of 5.8%. This growth reflects both the increasing severity of flood hazards in a warming climate and the rising value of exposed assets and populations in high-risk locations.
A significant share of this exposure is structural: roughly 2 billion people, nearly 30% of the global population, live in coastal regions, a proportion that continues to grow more rapidly than inland populations (Cosby et al., 2024). Coastal communities face compounding risks driven by sea-level rise, storm surge, and the intensification of tropical cyclones. At the same time, more than 50% of the world's population lives within 3 km of a freshwater body such as a river or lake (Kummu et al., 2011), placing enormous numbers of people and assets in proximity to riverine floodplains.

Intensifying precipitation patterns are driving a rapid rise in pluvial (surface-water) flooding, even in regions historically considered arid or low-risk. Globally, the frequency of extreme rainfall events has

## Intensifying Precipitation

increased by roughly 30% since the 1980s, and short-duration downpours—the primary driver of pluvial flooding—are growing at twice the rate of total precipitation increases (Li et al., 2024; Fowler et al., 2021).

Recent events underscore this shift: the United Arab Emirates (UAE) recorded its heaviest rainfall in 75 years in 2024, receiving over 250 mm in 24 hours (Al Jazeera, 2024). Australia has similarly seen a 27% rise in short-duration extreme rainfall since the 1960s, contributing to unprecedented urban flooding (Cleugh et al., 2020). These trends demonstrate that flood exposure is no longer constrained to water-adjacent communities; instead, a warming climate is broadening the geography of flood risk worldwide.

**IMAGE:** Abandoned vehicles on a flooded highway in Dubai, April 17, 2025. Francois Nel / Getty Images

## Global Mitigation Frameworks: National Backstops and Flood Insurance

As flood hazards intensify and their geographic reach widens, countries have adopted a range of national programs to manage and distribute flood risk for households and businesses. Approaches vary substantially, but most fall along a spectrum that includes national flood insurance schemes, public-private catastrophe pools, and large-scale mitigation or protection programs.

Northern European countries such as Norway and Switzerland also provide automatic flood coverage through compulsory multi-peril property insurance frameworks, ensuring extremely high penetration rates and widespread financial protection for both households and enterprises (Norwegian Natural Perils Pool, 2025; EKGV, 2025). In the U.S., flood is excluded from standard homeowners and commercial insurance policies and must instead be purchased separately through the National Flood Insurance Program (NFIP), a model that has produced the world's largest dedicated flood insurance system but remains highly sensitive to affordability and participation challenges (FEMA, 2025). However, recent developments suggest a shift to private insurers, sparking concerns about affordability and availability of flood insurance (CNN, 2025).

By contrast many European countries embed flood protection directly within standard property insurance. France's CatNat regime mandates that all property policies include natural catastrophe coverage, including floods, supported by a state-backed reinsurance structure through CCR (CCR, 2025). Spain's Consorcio de Compensación de Seguros (CCS) operates a similar solidarity-based pool, funded through a surcharge on homeowners and commercial insurance, which provides near-universal protection against "extraordinary risks," including fluvial, pluvial, and coastal flooding (CCS, 2025).

KEY PROGRAMS

- NFIP (USA)
- CatNat (France)
- CCS (Spain)
- Flood Re (UK)
- Delta Programme (Netherlands)
- EQCover (New Zealand)
- ARC (Africa)
- CCRIF (Caribbean)

Other countries rely more heavily on national mitigation programs or engineering protection rather than dedicated flood insurance systems. The Netherlands, for example, focuses on state-led flood defense through its long-term Delta Programme, which sets stringent national safety standards, invests in large-scale protective infrastructure, and guides spatial planning to reduce exposure in the absence of a household flood insurance mandate (Delta Programme, 2025). In the United Kingdom, flood coverage is technically included in standard home insurance, but affordability concerns in high-risk areas led to the creation of Flood Re, a national reinsurance pool that subsidizes premiums for eligible properties while maintaining broad market participation (Flood Re, 2025).

Across the Asia–Pacific region, flood insurance is often bundled within multi-peril home and commercial policies, though pricing is increasingly risk-based. In Australia, flood is typically included in standard homeowners insurance, but premiums have escalated sharply in high-risk regions, prompting national discussions about affordability and mitigation funding (Insurance Council of Australia, 2025). New Zealand similarly includes flood-related natural hazards within its national EQCover framework, backed by public reinsurance and complemented by private insurers (Toka Tū Ake EQC, 2025). In Japan, flood is generally included in residential and commercial multi-peril policies and supplemented by robust national disaster relief and early warning systems (Japan General Insurance Association, 2025).

In many low- and middle-income countries, however, household and business flood insurance penetration remains limited and often unavailable, with most recovery driven by post-disaster government aid or sovereign catastrophe risk pools such as the African Risk Capacity (ARC) or the Caribbean Catastrophe Risk Insurance Facility (CCRIF) (OECD, 2015; ARC, 2025; CCRIF, 2025). In these regions, the financial burden of flood losses falls disproportionately on vulnerable households, small enterprises, and informal economies, many of whom lack access to pre-disaster financial protection, resilient infrastructure, or risk-informed land-use planning.

Despite the range of national programs designed to insure against or mitigate flood risk, a fundamental challenge persists across both high-income and low-income regions: households, businesses, and even governments often lack clear, accessible, and property-specific information about their true flood exposure. The complexity of flood hazards means that risk varies dramatically not only across countries but also within neighborhoods and individual parcels. Yet in many regions, flood maps are outdated, incomplete, or entirely unavailable; national datasets may exclude pluvial flooding or fail to incorporate climate change; and insurance pricing rarely reflects asset-level likelihoods. As a result, decision-makers frequently underestimate both the probability and potential severity of flood events, especially in areas experiencing newly emerging or rapidly accelerating risks driven by shifting precipitation patterns, land-use change, and sea-level rise.

> As flood hazards continue to intensify globally, improving transparency, accessibility, and accuracy of flood-risk information will be essential to reducing losses for households, businesses, and communities alike.

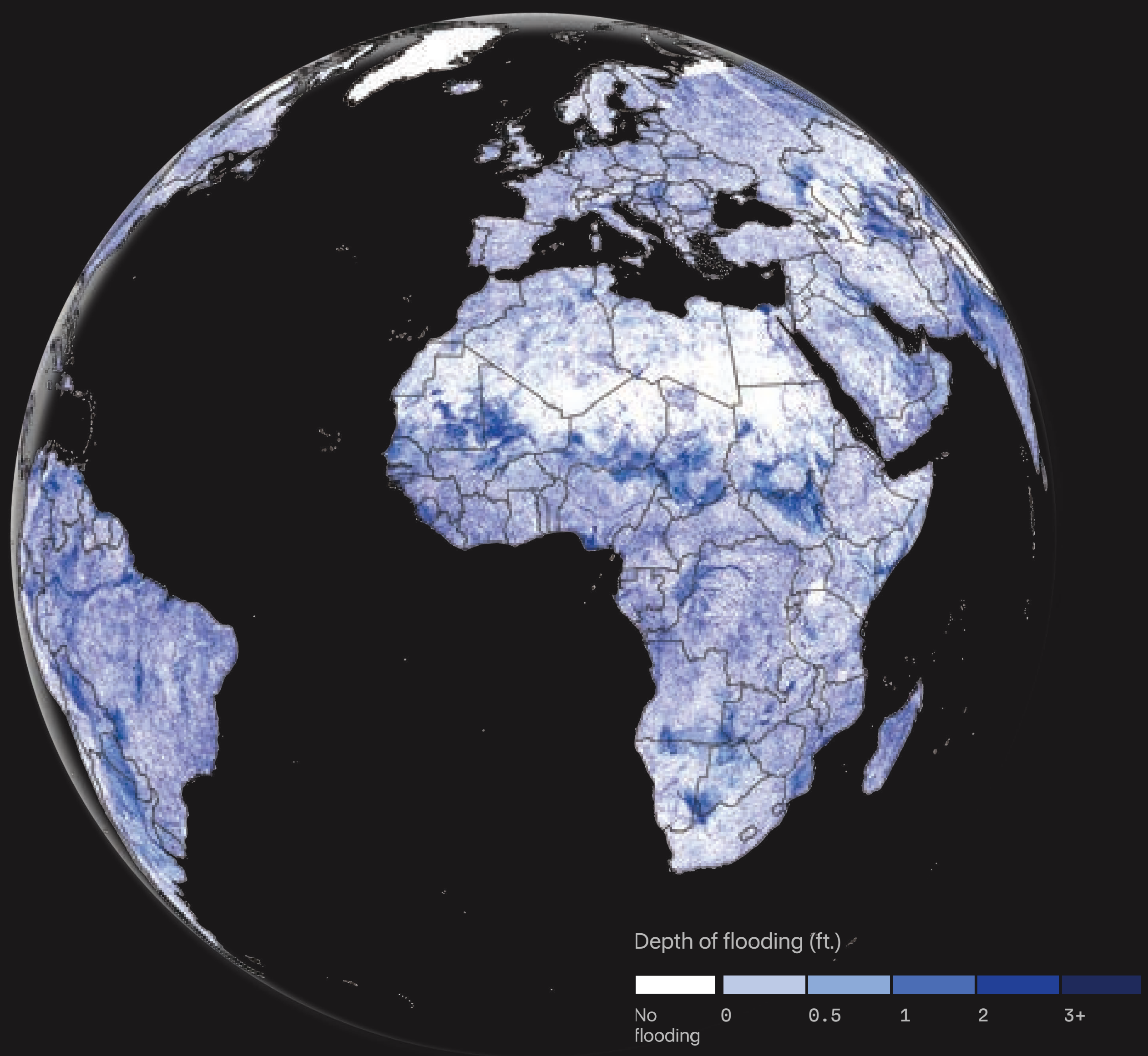


**FIGURE 2.** Average Flood Depth in 1-in-100 Year Flood Events Across the Globe

METHODOLOGY

# First Street Global Flood Model

Model (FS-GFM) extends First Street's climate risk intelligence from national to global scales, leveraging the proven success of its U.S.-based flood modeling platform. Built to assess climate-driven flood risks worldwide, the FS-GFM incorporates cutting-edge methodologies, state-of-the-art computational tools, and collaborative insights from international domain experts.

The model is purposefully engineered to capture the diverse and complex nature of global flood hazards, fluvial, pluvial, and coastal flooding, at a 30-meter high-resolution, under climate conditions projected through the year 2100. Through a focus on precision, scalability, and scientific rigor, FS-GFM sets a new global benchmark in flood risk modeling.



## 01. DATA FOUNDATION

Integrating Global Climate Data & Geospatial Data

- ✓ Comprehensive Data Integration
- ✓ Precipitation, Streamflow, Sea Level
- ✓ Elevation & Land Cover

## 02. THE ENGINE

Future Climate Scenarios & Physical Simulation

- ✓ **Future Scenarios**

  2025, 2055, 2100 (Low, Med, High Emissions)
- ✓ **Flood Hazards**

  Pluvial (Rain), Fluvial (River), Coastal (Surge)
- ✓ **Physics Core**

  HEC-RAS 2D Solver (Gold Standard)

## 03. CLOUD SCALABILITY

First-of-its-kind Massive Parallel Processing

- ✓ Distributed Computing Grid
- ✓ Dynamic Resource Allocation
- ✓ Global Scale Performance

## 04. THE OUTPUT

High-Resolution Hazard Maps

- ✓ 30-Meter Precision
- ✓ Property-Level Granularity
- ✓ Actionable Flood Hazard Layers

## A Gold Standard in Global Flood Modeling

At the core of the FS-GFM is the world's first large-scale, cloud-based implementation of the HEC-RAS 2D hydraulic solver. This integration allows the FS-GFM to produce physically reliable, numerically stable, and reproducible simulations at a resolution and global extent that were not previously achievable.

The U.S. Army Corps of Engineers' HEC-RAS 2D hydraulic solver is one of the most trusted tools in the world for physics-based simulations of how water moves through rivers, across floodplains, and over the land's surface, widely regarded as the global standard for hydraulic modeling. It uses the underlying laws of physics, specifically the shallow-water equations, to describe the depth, speed, and direction of flowing water, making it highly reliable for capturing real-world flood behavior.

> For decades, HEC-RAS has served as the gold standard in hydraulic engineering and flood analysis. It is routinely used by government agencies, engineers, and researchers to design bridges, levees, and culverts; evaluate local community flood risk; benchmark or validate other flood models; and generate legally defensible assessments for permitting and infrastructure planning.

Because the software is continuously developed and maintained by the U.S. Army Corps of Engineers, it reflects decades of scientific and engineering expertise and is viewed as one of the most authoritative sources for simulating flood hydraulics.

Traditionally, HEC-RAS has been used for very localized studies, often covering only a single river reach, a town, or a specific piece of infrastructure. This is due to the detailed terrain data it requires, the expert configuration needed for each study, the significant computational demands, and the fact that the software was never designed for large-scale or automated execution.

Consequently, while HEC-RAS has long served as the benchmark for validating other flood models, it has never been integrated as the core computational engine of a national or global flood modeling system.

### Operationalizing Innovation

The FS-GFM represents the first time HEC-RAS has been operationalized as part of a global, end-to-end flood modeling framework. First Street engineered a cloud-native, tile-based system that allows HEC-RAS to run thousands of simulations in parallel across the entire world, something that was previously considered infeasible. This required solving major challenges in automation, consistency, data handling, and computational performance.



## Scaling HEC-RAS Globally

- **Physically realistic flood behavior at global scale**
  Many global flood models rely on simplified hydraulic assumptions or statistical approximations; in contrast, HEC-RAS directly solves the physics of water movement. This allows for more realistic representations of river overflows, floodplain dynamics, flow paths, velocities, and terrain interactions, achieving a level of fidelity previously limited to local engineering studies.

- **Unprecedented scientific credibility to global modeling**
  HEC-RAS has been validated in thousands of engineering, regulatory, and academic applications. Embedding its solver at the core of a global model means the FS-GFM inherits that scientific rigor, setting a higher standard for global-scale flood assessment.

- **Methodological consistency across regions**
  Whereas local HEC-RAS studies vary in methods and assumptions depending on the analyst or region, First Street's implementation enforces standardized physics, parameters, and processing globally. This overcomes one of the largest challenges in traditional flood modeling: inconsistent results between regions.

- **Ability to integrate the best available terrain and climate data**
  The physics-based nature of HEC-RAS allows the model to seamlessly integrate new global datasets. Because it does not rely on region-specific calibration, the FS-GFM can rapidly incorporate improved Digital Terrain Models (DTMs), updated rainfall and river discharge data, new sea-level or storm surge conditions, and enhanced future climate projections.

- **A foundation for future scientific innovation**
  Using HEC-RAS as foundation enables future First Street models to incorporate higher-resolution terrain, model complex urban or compound flooding, and integrate evolving climate or storm information. By embedding a trusted hydraulic solver in a scalable global system, the FS-GFM establishes a sustainable framework for continuous scientific refinement and next-generation climate risk modeling.

> This creates a scientifically rigorous baseline that can be augmented by AI and machine learning without sacrificing the physical integrity of the model.

## Comparisons to Other Models

Global flood models differ primarily in how they represent the physics of water movement. Commonly used large-scale approaches such as HAND and LISFLOOD-FP have supported global and continental flood mapping for years, but they rely on simplified hydraulic assumptions or reduced-physics flow representations. As a result, they can miss important flood dynamics, including backwater effects, complex river-floodplain interactions, flow routing around infrastructure, and changes in flow speed over varied terrain.

HEC-RAS takes a more physically complete approach by solving the two-dimensional shallow-water equations, enabling more realistic simulations of how water moves across rivers, floodplains, and built environments. Its modeling framework also supports ultra-high-resolution simulations, including sub-meter numerical modeling, a capability that remains difficult to achieve within most global flood modeling approaches. This allows HEC-RAS to more accurately capture flood extent, depth, and velocity across a wide range of flood types and landscapes, particularly in areas with complex hydraulics or limited data. The comparison table below illustrates these modeling differences in more detail.

Using HEC-RAS as the core hydraulic engine of a global flood model enables realistic, physics-based flood simulations from the outset, without being constrained by the simplified assumptions common in many large-scale flood modeling approaches. Actively maintained and advanced by the U.S. Army Corps of Engineers, HEC-RAS continues to incorporate improvements in solver performance, numerical stability, resolution, and process representation that can be directly leveraged over time. Combined, these advantages underpin the strong performance of First Street's HEC-RAS-based FS-GFM today while establishing a scalable foundation for ongoing improvement.

| MODELING ELEMENT | HAND | LISFLOOD-FP | HEC-RAS |
|---|---|---|---|
| How it predicts flooding | Fils low areas on the map like a bathtub | Simulates water flowing downhill, but in a simplified way | Simulates water movement realistically, using full physics |
| How water movement is treated | No real movement; only water "levels" rising | Some movement, but misses fast or complex flow | Full movement: speeding up, slowing down, turning, wave effects |
| Backwater & river interactions | Not included | Partially included | Fully included; handles complex river behavior |
| How it handles obstacles (roads, levees, buildings) | Cannot show water pushing around objects | Shows some blockage but not the true forces | Realistic; shows water pushing, slowing, splitting, or backing up |
| How much it depends on elevation data | Very high; small errors can produce big mistakes | High; still heavily dependent on terrain | Lower; physics help correct bad elevation details |
| Accuracy in real-world conditions | Low | Medium | High |
| Best use case | Quick, rough screening | Large-area mapping with moderate accuracy | Detailed, accurate flood hazard modeling |
| Speed vs. detail | Very fast, but least detailed | Fast, moderately detailed | Slowest, but most realistic |
| Trust & scientific backing | Limited scientific rigor | Solid academic tool | Gold-standard, engineering-grade model with decades of testing |

**TABLE 1**. Comparison Across Flood Models

RESULTS

# Flood Exposure Results

To estimate the overall level of global flood exposure both today and in the future, First Street assessed both population and economic output exposure as a proxy for where flooding poses meaningful consequences. Specifically, First Street's Global Flood Model flood layers are overlaid with gridded population and GDP data derived from baseline 1 km raster files from NASA SEDAC and Wang & Sun (2022). These datasets are then scaled using national-level United Nations World Population Prospects (UNWPP) and International Monetary Fund (IMF) projections to reflect estimates for 2025 and "keeping these figures constant through 2100 as flood risk changes to align where people live and where economic activity takes place with modeled flood depths across scenarios and years.

To focus the results on community-level impacts, any 1-km cells with fewer than 10 residents and with less than 10cm of flooding are excluded. The 10-person threshold limits noise from very small or uncertain population counts, while the 10-centimeter threshold captures the point at which water becomes disruptive and begins causing measurable damage: high enough to indicate true exposure, but low enough to include early, consequential flooding. The result is a count of people and share of the population exposed to at least this level of flood disruption across the modeled scenarios.

Flood risk can be understood not only by whether flooding occurs, but by how likely floods of different severities are to happen. This likelihood is commonly expressed through return periods, which describe the annual exceedance probability (AEP), the chance that an event of a given magnitude will occur in any given year. In this analysis, First Street focuses on three core return periods:

- **5-year floods**
  Which have a 20% AEP and represent events that are *almost certain* to recur regularly
- **100-year floods**
  With a 1% AEP, representing *substantial* flood events capable of causing widespread disruption and damage
- **500-year floods**
  Which are rare events with just a 0.2% AEP but can signal exposure to *severe, high-impact* flooding

Crucially, the 100-year return period, or 1% AEP threshold, is widely used by national flood programs to define substantial flood risk. Many countries, including the United States, United Kingdom, Australia, New Zealand, the Netherlands (for certain non-primary defenses), and Canada, apply the 1% AEP threshold in flood mapping, mitigation requirements, municipal planning, or building standards. This broad adoption underscores the 1% annual probability event as a globally recognized indicator of significant flood hazard, forming a common foundation for risk communication.

## Global

Using these definitions, this analysis shows that as of 2025, nearly one in four people worldwide (23.3%), or 1.92 billion individuals, are exposed to substantial flood risk from events severe enough to cause significant damage and long-lasting communityand economic impacts (**Table 2**).

Cumulatively over a typical 10-year hold period, the population in these areas face a nearly 1 in 10 chance of experiencing flooding of this magnitude.
This exposure also represents a significant share of global economic activity. As of 2025, approximately $18.8 trillion in global GDP, or about 16.0% of the world's total economic output, is located in areas facing substantial flood risk.

Even more striking is that nearly $11.7 trillion in GDP, or 10.0% of global output, is exposed to almost certain flood disruption, with a close to guaranteed chance of flooding occurring at least once over a 10-year period.

**TABLE 2**. Global Population Exposed to Flood Risk Today, by Risk Category

| FIRST STREET RISK DESCRIPTION | RETURN PERIOD | ANNUAL PROBABILITY * | CUMULATIVE PROBABILITY † | POPULATION EXPOSED IN 2025 ‡ | PERCENT OF POPULATION | GDP EXPOSED IN 2025 § | PERCENT OF GDP |
|---|---|---|---|---|---|---|---|
| Almost Certain Risk | 5 Year (1 in 5) | 20.0% | 89.3% | 1.36B | 16.5% | $11.7T | 10.0% |
| Substantial Risk | 100 Year (1 in 100) | 1.0% | 9.6% | 1.92B | 23.3% | $18.8T | 16.0% |
| Any Risk | 500 Year (1 in 500) | 0.2% | 2.0% | 1.99B | 26.3% | $22.2T | 18.9% |

*Flooding at least 10cm
† Over the next 10 years
‡ Based on a 2025 population of 8.22 billion
§ Based on a 2025 GDP of $117 trillion

**TABLE 3**. Substantial Flood Risk Population Exposure By Global Region

| REGION | POP EXPOSED 2025 | PERCENT EXPOSED 2025 | POP EXPOSED 2100 | PERCENT EXPOSED 2100 | GROWTH IN POP EXPOSURE | PERCENT GROWTH |
|---|---|---|---|---|---|---|
| Asia-Pacific | 1.44B | 30.7% | 1.49B | 31.9% | +56.2M | 3.9% |
| Europe | 78.3M | 10.5% | 78.4M | 10.5% | +91.5K | 0.1% |
| Latin America | 52.7M | 12.0% | 54.8M | 12.5% | +2.2M | 4.1% |
| MENA | 128.4M | 29.7% | 128.3M | 29.7% | -95.2K | -0.1% |
| North America | 45.8M | 7.5% | 47.5M | 7.8% | +1.7M | 3.7% |
| Sub-Saharan Africa | 178.3M | 13.5% | 186.5M | 14.1% | +8.2M | 4.6% |
| Global | 1.92B | 23.3% | 1.99B | 24.2% | +68.3M | 3.6% |

**TABLE 4**. Substantial Flood Risk GDP Exposure By Global Region

| REGION | GDP EXPOSED 2025 | PERCENT EXPOSED 2025 | GDP EXPOSED 2100 | PERCENT EXPOSED 2100 | GROWTH IN GDP EXPOSURE | PERCENT GROWTH |
|---|---|---|---|---|---|---|
| Asia-Pacific | $11.9T | 27.8% | $12.5T | 29.3% | +$617.8B | 5.2% |
| Europe | $3.2T | 11.3% | $3.2T | 11.4% | +$7.9B | 0.3% |
| Latin America | $576.3B | 12.2% | $602.3B | 12.8% | +$26B | 4.5% |
| MENA | $395B | 13.1% | $407.4B | 13.5% | +$12.4B | 3.1% |
| North America | $2.2T | 6.1% | $2.3T | 6.4% | +$99.3B | 4.6% |
| Sub-Saharan Africa | $584.1B | 18.5% | $595.4B | 18.9% | +$11.4B | 1.9% |
| Global | $18.8T | 16.0% | $19.6T | 16.7% | +$774.8B | 4.1% |

While today's level of flood risk is already substantial, First Street projects that exposure will continue to grow throughout the century (**Table 3**). Under a middle-of-the-road climate scenario (SSP-RCP 2-4.5) and assuming a constant global population, the number of people exposed to flooding is projected to increase by roughly 3.6%, rising from 1.92 billion today to 1.99 billion in 2100. When expected population growth is incorporated, based on UNWPP projections to 2100, exposure increases even further, rising by almost 13% to 2.16 billion people by the end of the century.

A similar pattern emerges for economic exposure. Holding today's global economic footprint constant, the amount of GDP exposed to substantial flood risk is projected to grow by about 4.1% by 2100, increasing from $18.8 trillion today to $19.6 trillion (**Table 4**). Notably, this increase outpaces growth in population exposure under the same assumptions, indicating that flood risk is expanding disproportionately into more economically productive areas. This rise reflects the expanding physical footprint of flood risk under climate change, even without accounting for future economic growth or development. Regionally, flood risk to the global population is most concentrated in Asia-Pacific (APAC) and the Middle East and North Africa (MENA), which currently account for 30.7% and 29.7% of people exposed to substantial flood risk, respectively. These regions also contain the largest shares of global GDP exposure, led by APAC, which represents nearly 28% of exposed GDP today and grows to over 29% by 2100. Europe and North America face lower overall exposure shares but still see gradual increases in both population and GDP at risk over time.

In contrast, Sub-Saharan Africa and Latin America experience the fastest growth in population exposure, 4.6% and 4.1%, respectively, when populations are held constant at today's levels. While their absolute GDP exposure remains smaller than that of higher-income regions, both regions also see notable growth in economic exposure, underscoring the increasing vulnerability of developing economies to flood risk as climate pressures intensify.

While today's level of flood risk is already substantial, First Street projects that exposure will continue to grow throughout the century (**Table 3**). Under a middle-of-the-road climate scenario (SSP-RCP 2-4.5) and assuming a constant global population, the number of people exposed to flooding is projected to increase by roughly 3.6%, rising from 1.92 billion today to 1.99 billion in 2100. When expected population growth is incorporated, based on UNWPP projections to 2100, exposure increases even further, rising by almost 13% to 2.16 billion people by the end of the century.

Regionally, flood risk to the global population appears to be most concentrated in Asia-Pacific (APAC) and the Middle East North Africa (MENA), each facing 30.7% and 29.7% of population exposed to substantial flood risk today, respectively. However, Sub-Saharan Africa and Latin America face the fastest growing flood risk, with their populations seeing a 4.6% and 4.1% increase in exposure, respectively, keeping populations constant at today's levels.

Further analysis of primary subnational units (such as U.S. states, Chinese provinces, and European regions) identifies where substantial flood exposure is highest today and where it is expected to grow most over time. The remainder of this report focuses primarily on population exposure, ranking subnational regions by both the share and number of people exposed to substantial flood risk, as well as projected changes through the end of the century.

GLOBAL ANALYSIS

# Administrative Hotspots

These subnational results reveal patterns not visible at broader scales, including granular regions where flood risk affects a large share of residents despite relatively small total populations, as well as areas where growth in exposure is driven primarily by changing climatic conditions and built environment characteristics that intensify flood hazards. While GDP exposure is expected to be highly correlated with population exposure in most regions, population provides the most direct and consistent measure of flood risk to communities, capturing where repeated disruption, displace-

At the global scale, flood exposure is concentrated in South and East Asia, where extremely large populations living across expansive river floodplains drive the world's highest absolute exposure totals. In countries such as India and Pakistan, dense and geographically extensive settlement along major river systems means inundation can affect tens of millions of people at once. The highest exposure shares globally occur in deltaic and low-lying basin environments, particularly in North Africa and Southeast Asia, where flat terrain, dense settlement, and rising sea levels leave little population outside flood-prone areas, as seen most clearly in parts of Egypt and Thailand. Looking ahead, the fastest growth in flood exposure is concentrated in large riverine cities and rapidly urbanizing lowland metros across Asia and Africa, where expanding flood extents increasingly intersect dense populations, driving sharp increases in people exposed even when overall hazard changes are relatively modest.

**FIGURE 3**. Global Share of Population Exposed By Primary Subnational Unit

Percentage Share of GDP Exposed

3.5% 6.5% 10.0% 20% +

GDP Value ($trillions)

$4T $3T $2T $1T

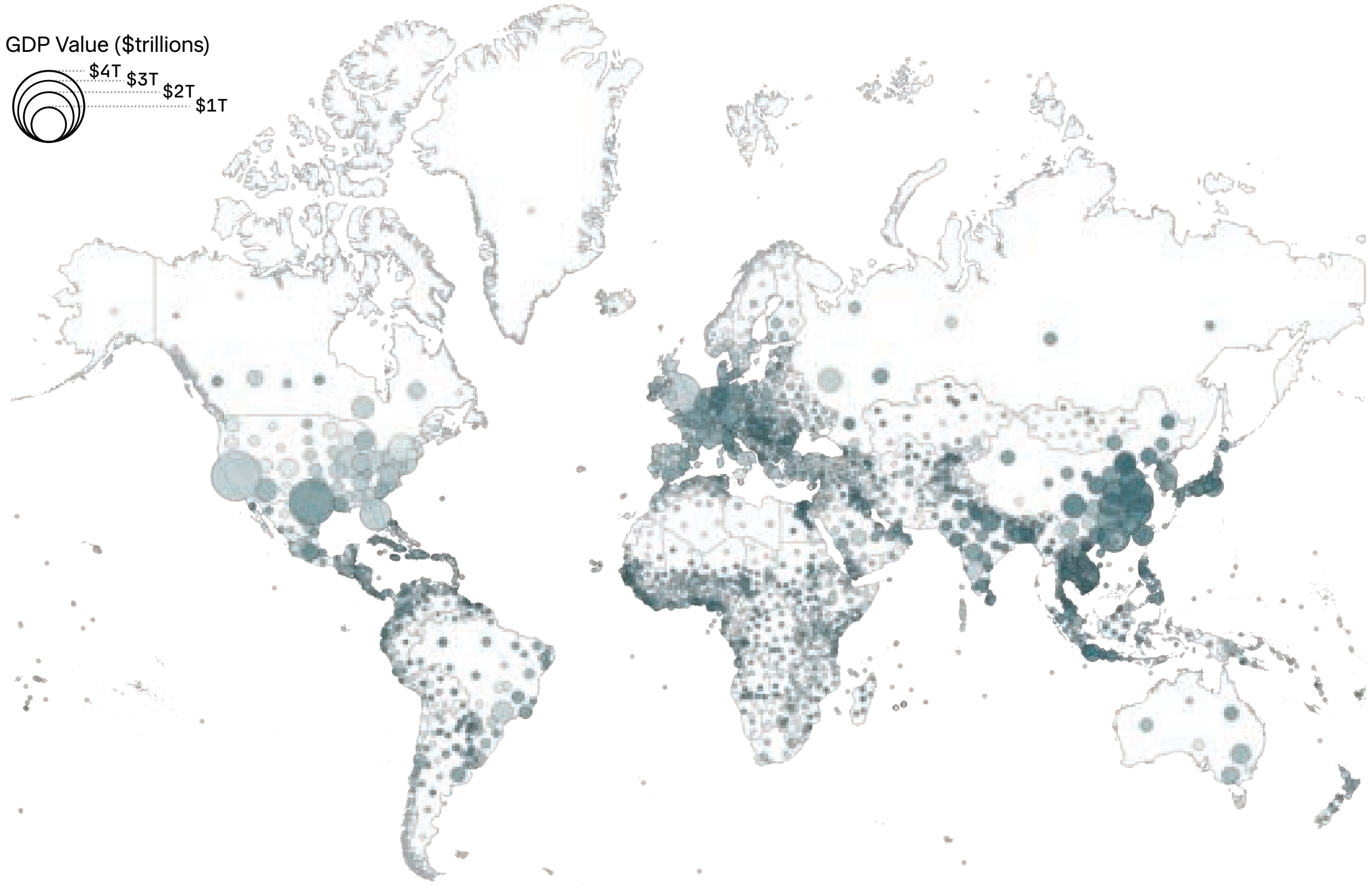

**FIGURE 4**. Global Share of GDP Exposed By Primary Subnational Unit

Percent Share of Population Exposed

3.5% 6.5% 10.0% 17.5% +

Population Count (millions)

100M 50M 10M 1M

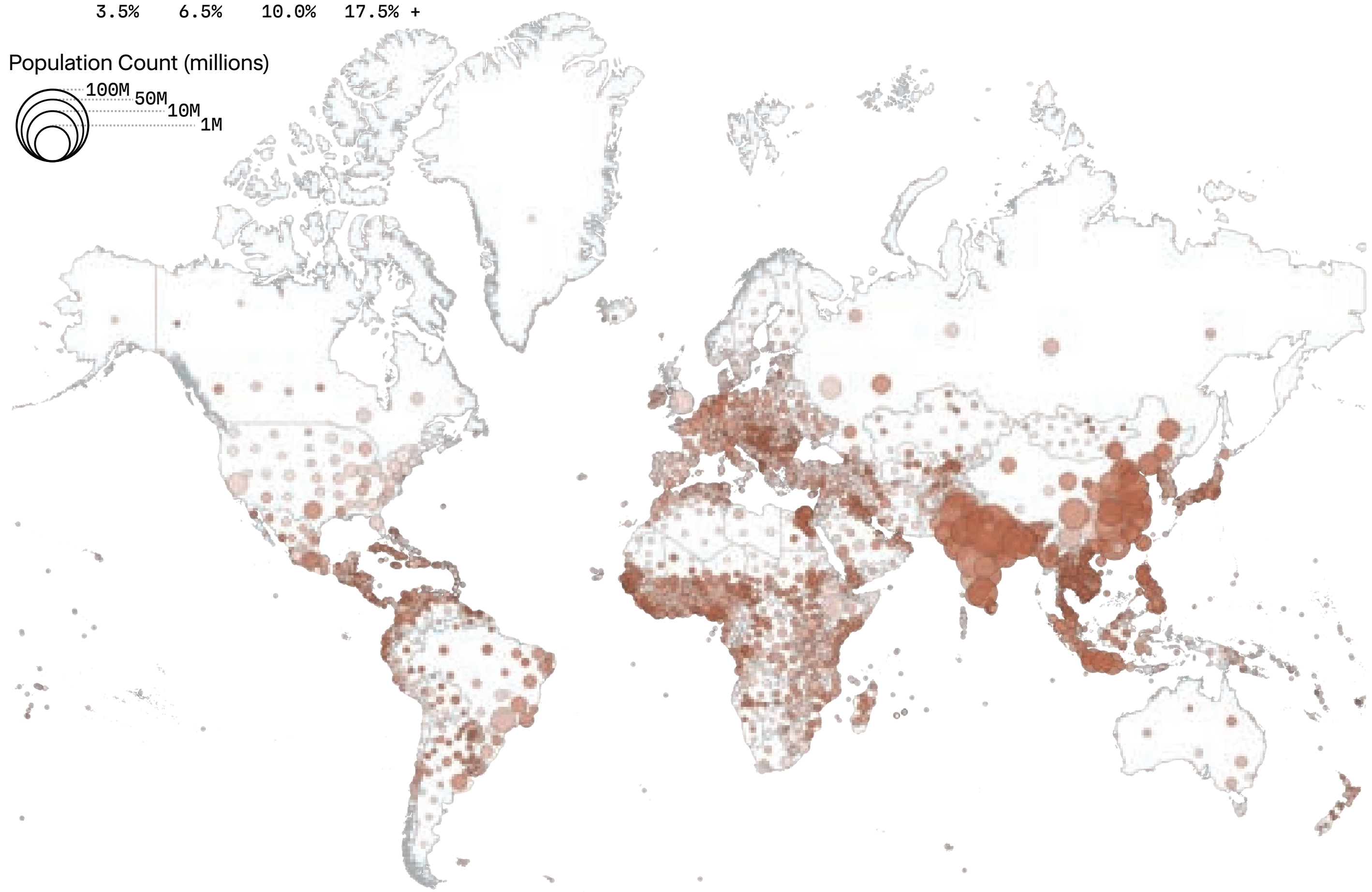

**FIGURE 5**. Global Change in Population Exposed By Primary Subnational Unit

Change in Population Exposed

-1.0% 0% 3.5% 6.0% +

Population Count (millions)

100M 50M 10M 1M

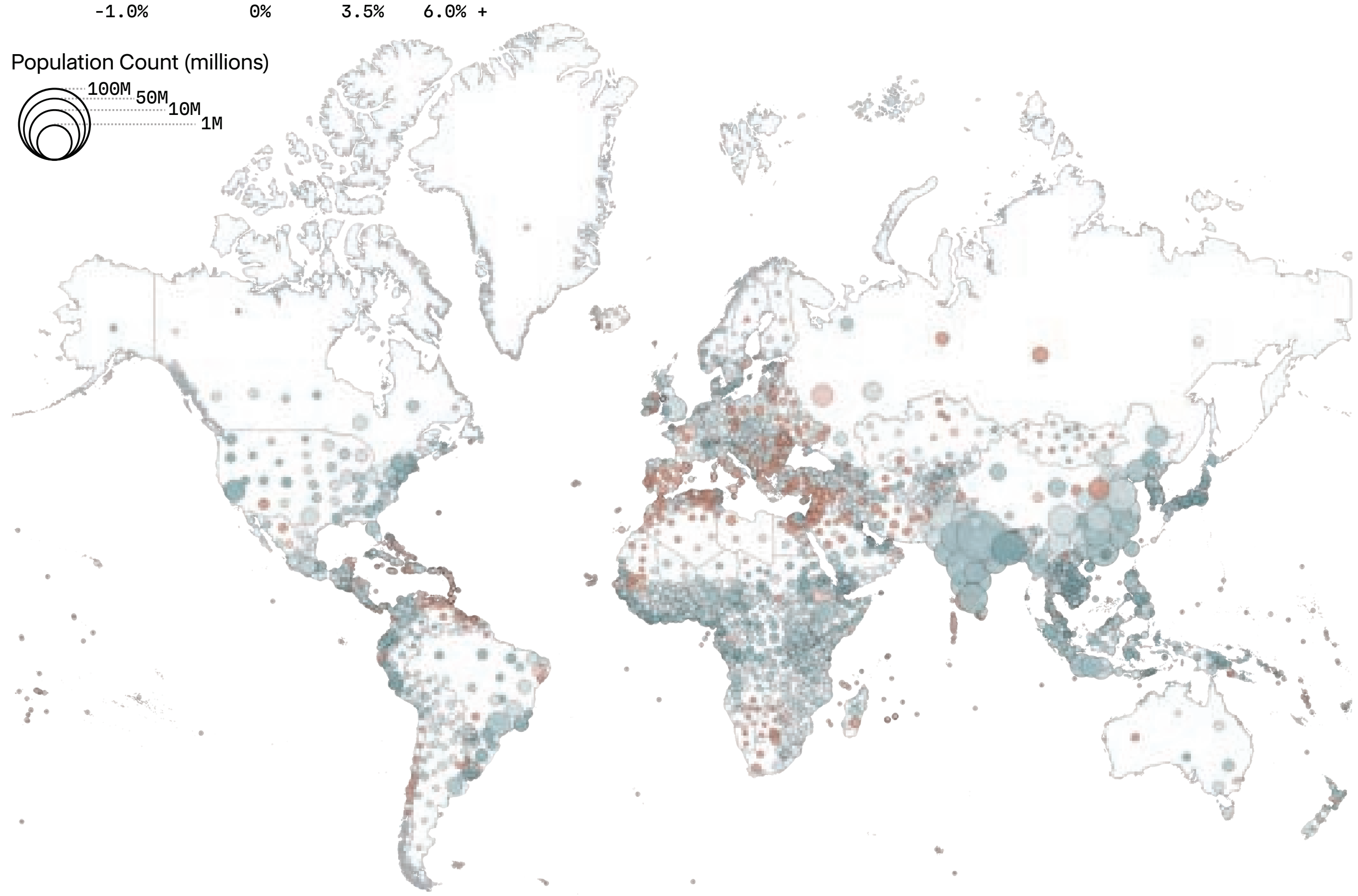

**TABLE 5**. Greatest Number of People Exposed to Substantial Flooding

| ADMINISTRATIVE UNIT | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Uttar Pradesh, IN | 141.45M | 57.7% | 146.85M | 59.9% | +5.39M | +3.8% |
| Bihar, IN | 86.17M | 72.2% | 88.4M | 74.0% | +2.23M | +2.6% |
| Punjab, PK | 84.85M | 59.0% | 86.77M | 60.3% | +1.92M | +2.3% |
| West Bengal, IN | 51.85M | 47.1% | 55.88M | 50.7% | +4.02M | +7.8% |
| Jiangsu Province, CN | 47.95M | 57.1% | 49.57M | 59.1% | +1.62M | +3.4% |
| Henan Province, CN | 42.56M | 40.0% | 44.16M | 41.5% | +1.6M | +3.8% |
| Shandong Province, CN | 41.99M | 39.3% | 43.21M | 40.4% | +1.22M | +2.9% |
| Hebei Province, CN | 36.37M | 44.4% | 37.34M | 45.6% | +0.98M | +2.7% |
| Sindh, PK | 31.27M | 58.9% | 31.81M | 59.9% | +535.6K | +1.7% |
| Anhui Province, CN | 29.78M | 43.0% | 30.83M | 44.6% | +1.05M | +3.5% |
| Guangdong Province, CN | 26.59M | 26.9% | 27.84M | 28.2% | +1.25M | +4.7% |
| Tamil Nadu, IN | 24.25M | 27.8% | 25.3M | 29.0% | +1.05M | +4.3% |
| Hubei Province, CN | 23.96M | 36.2% | 24.65M | 37.3% | +695.3K | +2.9% |
| Gujarat, IN | 22.94M | 33.1% | 24.12M | 34.8% | +1.18M | +5.1% |
| Assam, IN | 22.77M | 61.3% | 23.26M | 62.6% | +487.9K | +2.1% |
| Dhaka, BD | 22.18M | 50.0% | 23.04M | 52.0% | +866.8K | +3.9% |
| Maharashtra, IN | 20.22M | 15.3% | 20.99M | 15.9% | +767.4K | +3.8% |
| Punjab, IN | 20.01M | 54.8% | 20.59M | 56.3% | +572.7K | +2.9% |
| Rajasthan, IN | 19.01M | 22.6% | 19.74M | 23.5% | +733.8K | +3.9% |
| Andhra Pradesh, IN | 18.90M | 29.1% | 19.77M | 30.5% | +872.9K | +4.6% |

**TABLE 6**. Greatest Share of People Exposed to Substantial Flooding*

| ADMINISTRATIVE UNIT | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Kafr El-Shikh, EG | 5.54M | 93.1% | 5.52M | 92.8% | -14.4K | -0.3% |
| Menoufia, EG | 6.28M | 92.4% | 6.3M | 92.5% | +11.1K | +0.2% |
| Bangkok, TH | 6.73M | 90.5% | 6.84M | 91.9% | +110.3K | +1.6% |
| Giza, EG | 7.82M | 89.2% | 7.65M | 87.2% | -172.7K | -2.2% |
| Dakahlia, EG | 8.86M | 84.7% | 9.18M | 87.8% | +315.3K | +3.6% |
| Gharbia, EG | 7.65M | 84.5% | 7.66M | 84.6% | +4.3K | +0.1% |
| Behera, EG | 9.68M | 84.4% | 9.62M | 83.9% | -62.3K | -0.6% |
| Kalyoubia, EG | 5.15M | 82.7% | 5.06M | 81.2% | -90.1K | -1.8% |
| Sharkia, EG | 10.4M | 81.4% | 10.56M | 82.7% | +165.7K | +1.6% |
| Bihar, IN | 86.17M | 72.2% | 88.4M | 74.0% | +2.23M | +2.6% |
| Ha Noi, VN | 5.39M | 71.0% | 5.5M | 72.5% | +114K | +2.1% |
| Baghdad, IQ | 8.71M | 66.4% | 8.85M | 67.5% | +146K | +1.7% |
| Rajshahi, BD | 16.36M | 66.2% | 16.81M | 68.0% | +450K | +2.8% |
| Mymensingh, BD | 9.07M | 64.0% | 9.37M | 66.1% | +300.9K | +3.3% |
| Rangpur, BD | 12.3M | 63.6% | 12.61M | 65.1% | +305.3K | +2.5% |
| Tianjin, CN | 7.99M | 62.8% | 8.1M | 63.7% | +115.7K | +1.4% |
| Assam, IN | 22.77M | 61.3% | 23.26M | 62.6% | +487.9K | +2.1% |
| Sylhet, BD | 6.79M | 60.4% | 6.98M | 62.0% | +182.2K | +2.7% |
| Punjab, PK | 84.85M | 59.0% | 86.77M | 60.3% | +1.92M | +2.3% |
| Sindh, PK | 31.27M | 58.9% | 31.81M | 59.9% | +535.6K | +1.7% |

**TABLE 7**. Greatest Relative Growth in Population Exposed to Substantial Flooding*

| ADMINISTRATIVE UNIT | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Chongqing, CN | 2.16M | 6.9% | 4.41M | 14.0% | +2.25M | +103.8% |
| Abidjan, CI | 821.6K | 15.2% | 1.21M | 22.3% | +385.3K | +46.9% |
| Khartoum, SD | 1.39M | 18.5% | 1.87M | 24.8% | +476.6K | +34.2% |
| Seoul, KR | 803K | 7.9% | 1.05M | 10.4% | +251.2K | +31.3% |
| Kanagawa, JP | 798.7K | 10.7% | 973.1K | 13.0% | +174.4K | +21.8% |
| Shanghai, CN | 6.96M | 36.1% | 8.23M | 42.6% | +1.26M | +18.1% |
| Tokyo, JP | 1.82M | 17.7% | 2.12M | 20.6% | +299.8K | +16.5% |
| Kinshasa, CD | 2.2M | 22.5% | 2.53M | 25.9% | +329.4K | +14.9% |
| Hong Kong, HK | 382.3K | 5.2% | 437.1K | 5.9% | +54.7K | +14.3% |
| Saitama, JP | 2.56M | 34.4% | 2.92M | 39.2% | +356.7K | +13.9% |
| Massachusetts, US | 212.2K | 2.8% | 241.6K | 3.2% | +29.4K | +13.9% |
| Aj Jazirah, SD | 1.52M | 27.7% | 1.73M | 31.4% | +206.8K | +13.6% |
| Lima, PE | 1.16M | 9.8% | 1.3M | 11.0% | +144.5K | +12.5% |
| Rio De Janeiro, BR | 3.1M | 16.4% | 3.48M | 18.4% | +378.1K | +12.2% |
| Aichi, JP | 1.75M | 28.0% | 1.97M | 31.4% | +213.6K | +12.2% |
| Rio Grande Do Sul, BR | 1.3M | 9.7% | 1.46M | 10.8% | +153.6K | +11.8% |
| Louisiana, US | 718.4K | 13.1% | 803K | 14.7% | +84.6K | +11.8% |
| New Jersey, US | 605.6K | 5.4% | 675.2K | 6.0% | +69.6K | +11.5% |
| Kalimantan Barat, ID | 1.93M | 34.1% | 2.15M | 38.0% | +220.6K | 11.4% |
| New York, US | 670.8K | 3.5% | 746.5K | 3.9% | +75.8K | 11.3% |

*Risk is calculated as the aggregate figures for 1 km areas within each administrative area facing inundation of 10 cm or more and populations of 10 people or more for a 100 year return period (1% annual risk). Threshold of countries with at least 1 million population shown.

**TABLE 8**. Greatest Number of People Exposed to Substantial Flooding by Country*

| ADMINISTRATIVE UNIT | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| India | 522.1M | 35.7% | 542.8M | 37.1% | +20.7M | +4.0% |
| China | 397M | 28.0% | 413.1M | 29.2% | +16.1M | +4.1% |
| Pakistan | 125.8M | 49.3% | 128.4M | 50.3% | +2.6M | +2.1% |
| Bangladesh | 98.1M | 55.8% | 102.3M | 58.2% | +4.2M | +4.3% |
| Egypt | 90M | 76.0% | 89.7M | 75.8% | -241.2K | -0.3% |
| Indonesia | 66.8M | 23.4% | 69.4M | 24.3% | +2.6M | +3.9% |
| Vietnam | 47.8M | 47.1% | 49.6M | 48.8% | +1.7M | +3.6% |
| Nigeria | 43.4M | 18.3% | 45.3M | 19.1% | +1.9M | +4.4% |
| Thailand | 28.9M | 40.4% | 29.7M | 41.5% | +820K | +2.8% |
| Philippines | 25.6M | 21.9% | 26.9M | 23.0% | +1.3M | +5.1% |
| Brazil | 22.3M | 10.5% | 23.6M | 11.1% | +1.2M | +5.5% |
| Japan | 21.2M | 17.2% | 23.2M | 18.8% | +2M | +9.3% |
| Myanmar | 19.9M | 36.3% | 20.6M | 37.6% | +744.4K | +3.7% |
| United States of America | 18.8M | 5.4% | 19.8M | 5.8% | +1M | +5.6% |
| Iraq | 18.6M | 39.6% | 18.8M | 40.0% | +157.1K | +0.8% |
| Mexico | 15.1M | 11.5% | 15.5M | 11.8% | +392K | +2.6% |
| Democratic Republic of the Congo | 13.6M | 12.1% | 14.5M | 12.8% | +863K | +6.3% |
| Germany | 13.6M | 16.1% | 13.7M | 16.3% | +118.7K | +0.9% |
| Russia | 12.2M | 8.5% | 12.2M | 8.5% | -28.2K | -0.2% |
| Sudan | 10M | 19.3% | 11M | 21.4% | +1M | +10.5% |

**TABLE 9**. Greatest Share of People Exposed to Substantial Flooding by Country*

| ADMINISTRATIVE UNIT | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Egypt | 90M | 76.0% | 89.7M | 75.8% | -241.2K | -0.3% |
| Bangladesh | 98.1M | 55.8% | 102.3M | 58.2% | +4.2M | +4.3% |
| Pakistan | 125.8M | 49.3% | 128.4M | 50.3% | +2.6M | +2.1% |
| Vietnam | 47.8M | 47.1% | 49.6M | 48.8% | +1.7M | +3.6% |
| South Sudan | 5.6M | 46.0% | 5.8M | 47.8% | 219.3K | +3.9% |
| Cambodia | 8M | 45.0% | 8.7M | 48.9% | +706.2K | +8.8% |
| Thailand | 28.9M | 40.4% | 29.7M | 41.5% | +820K | +2.8% |
| Iraq | 18.6M | 39.6% | 18.8M | 40.0% | +157.1K | +0.8% |
| Myanmar | 19.9M | 36.3% | 20.6M | 37.6% | +744.4K | +3.7% |
| India | 522.1M | 35.7% | 542.8M | 37.1% | +20.7M | +4.0% |
| Chad | 6M | 28.6% | 6.3M | 30.1% | +324.4K | +5.4% |
| China | 397M | 28.0% | 413.1M | 29.2% | +16.1M | +4.1% |
| Uzbekistan | 9.9M | 26.8% | 10.2M | 27.4% | +240.8K | +2.4% |
| Mali | 6.3M | 24.9% | 6.4M | 25.4% | +147.6K | +2.4% |
| Nepal | 7.3M | 24.7% | 7.5M | 25.5% | +226.7K | +3.1% |
| Laos | 1.9M | 24.7% | 2.1M | 26.8% | +163K | +8.4% |
| Somalia | 4.8M | 24.3% | 5M | 25.3% | +197.9K | +4.2% |
| Hungary | 2.3M | 23.4% | 2.3M | 23.7% | +29.4K | +1.3% |
| Indonesia | 66.8M | 23.4% | 69.4M | 24.3% | +2.6M | +3.9% |
| Serbia | 1.5M | 23.1% | 1.5M | 23.1% | +0.3K | +0.0% |

**TABLE 10**. Greatest Relative Growth in Population Exposed to Substantial Flooding by Country*

| ADMINISTRATIVE UNIT | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Côte D'Ivoire | 4.1M | 12.6% | 4.6M | 14.2% | +527.9K | 12.8% |
| Republic of the Congo | 1.1M | 16.4% | 1.2M | 18.4% | +134K | 12.6% |
| Republic Of Korea | 4.8M | 9.2% | 5.3M | 10.2% | +528.2K | 11.1% |
| Sudan | 10M | 19.3% | 11M | 21.4% | +1M | 10.5% |
| Japan | 21.2M | 17.2% | 23.2M | 18.8% | +2M | 9.3% |
| Cambodia | 8M | 45.0% | 8.7M | 48.9% | +706.2K | 8.8% |
| Laos | 1.9M | 24.7% | 2.1M | 26.8% | +163K | 8.4% |
| Peru | 3.7M | 10.8% | 4M | 11.6% | +255.9K | 6.9% |
| Malaysia | 7.7M | 21.3% | 8.2M | 22.7% | +500.2K | 6.5% |
| Democratic Republic of the Congo | 13.6M | 12.1% | 14.5M | 12.8% | +863K | 6.3% |
| Yemen | 3.9M | 9.4% | 4.2M | 10.0% | +247.9K | 6.3% |
| Cameroon | 4M | 13.3% | 4.2M | 14.1% | +248.6K | 6.3% |
| Togo | 1.1M | 11.6% | 1.2M | 12.3% | +69.9K | 6.2% |
| United States of America | 18.8M | 5.4% | 19.8M | 5.8% | +1M | 5.6% |
| Brazil | 22.3M | 10.5% | 23.6M | 11.1% | +1.2M | 5.5% |
| Chad | 6M | 28.6% | 6.3M | 30.1% | +324.4K | 5.4% |
| Philippines | 25.6M | 21.9% | 26.9M | 23.0% | +1.3M | 5.1% |
| Guinea | 2M | 13.4% | 2.1M | 14.0% | +101.7K | 5.0% |
| Ecuador | 2.6M | 14.0% | 2.7M | 14.6% | +123.2K | 4.8% |
| Uganda | 4.7M | 9.3% | 5M | 9.8% | +225.5K | 4.8% |

*Risk is calculated as the aggregate figures for 1 km areas within each administrative area facing inundation of 10 cm or more and populations of 10 people or more for a 100 year return period (1% annual risk). Threshold of countries with at least 1 million population shown.

REGIONS

# Asia-Pacific

Across Asia-Pacific, flood risk is already immense and continues to rise, with roughly 1.44 billion people exposed in 2025, increasing to 1.49 billion by 2100, alongside $11.9 trillion in GDP exposed today, growing to $12.5 trillion by century's end. Absolute exposure is dominated by China's large municipalities and river plains, where population scale and dense development amplify impacts; major administrative regions such as Shanghai Municipality (Shanghai), Tianjin Municipality (Tianjin), Chongqing Municipality (Chongqing), and Hubei Province (Wuhan) illustrate how urban cores embedded within the Yangtze and Yellow River systems drive very high exposed totals.

The highest exposure shares occur in South Asia's Indo-Gangetic Plain, where settlement closely tracks low-lying river corridors, affecting a large fraction of residents in areas that include Kolkata (West Bengal) and Patna (Bihar). Looking ahead, growth in flood exposure is concentrated in low-lying delta and coastal regions, including Dhaka and Khulna Divisions in Bangladesh and administrative areas encompassing Ho Chi Minh City (Vietnam) and the Jakarta Special Capital Region (Indonesia), where modest changes in flood dynamics translate into large increases in people and economic activity affected.

**Total number of people exposed**

In 2025
**1.43**

In 2100
1.49B

75-year change
▲ 56.2M (3.9%)

**Total GDP exposed to flood disruptions**

In 2025
**$11.9T**

In 2100
$12.5T

75-year change
▲ +$617.8B (5.2%)

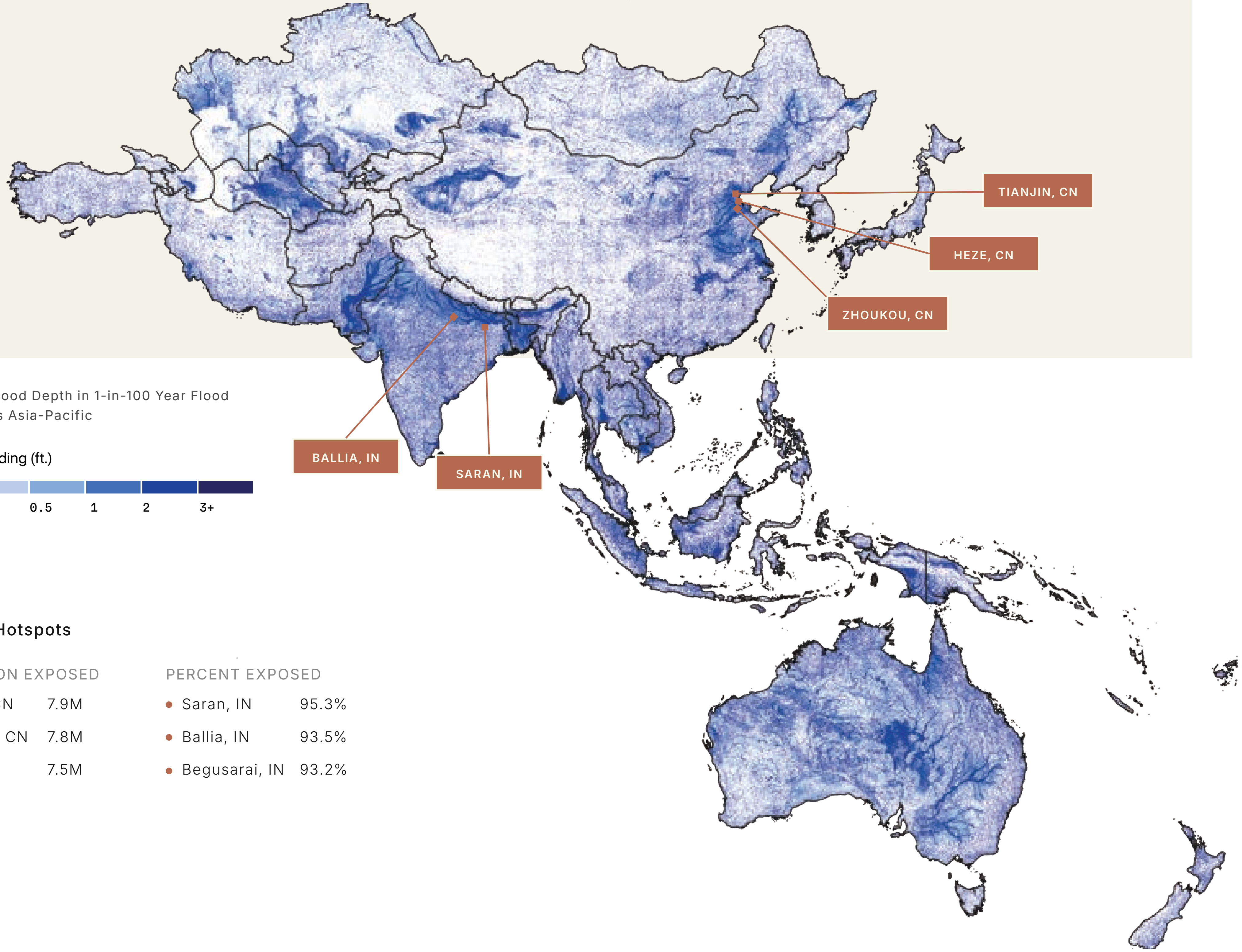


**FIGURE 6**. Flood Depth in 1-in-100 Year Flood Event Across Asia-Pacific

Depth of flooding (ft.)

No flooding | 0 | 0.5 | 1 | 2 | 3+

## Regional Hotspots

| POPULATION EXPOSED | | PERCENT EXPOSED | |
|---|---|---|---|
| Tianjin, CN | 7.9M | Saran, IN | 95.3% |
| Zhoukou, CN | 7.8M | Ballia, IN | 93.5% |
| Heze, CN | 7.5M | Begusarai, IN | 93.2% |

ASIA-PACIFIC

# Exposure

**TABLE 11**. Greatest Number of People Exposed to Substantial Flooding*

| ADMINISTRATIVE NAME | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Tianjin, CN | 7.99M | 62.8% | 8.1M | 63.7% | +0.12M | 1.4% |
| Zhoukou, CN | 7.89M | 70.9% | 8.11M | 72.8% | +0.22M | 2.8% |
| Heze, CN | 7.53M | 74.0% | 7.5M | 73.7% | -0.03M | -0.4% |
| Beijing, CN | 7.36M | 36.9% | 7.64M | 38.3% | +0.27M | 3.7% |
| Shanghai, CN | 6.96M | 36.1% | 8.23M | 42.6% | +1.26M | 18.1% |
| Yancheng, CN | 6.42M | 62.6% | 6.63M | 64.6% | +0.2M | 3.1% |
| Cangzhou, CN | 6.27M | 79.9% | 6.38M | 81.1% | +0.1M | 1.6% |
| Nantong, CN | 6.02M | 77.2% | 6.36M | 81.7% | +0.34M | 5.7% |
| Fuyang, CN | 6.01M | 64.1% | 6.31M | 67.3% | +0.3M | 5.0% |
| Murshidabad, IN | 5.96M | 76.0% | 6.15M | 78.4% | +0.19M | 3.1% |

**FIGURE 7**. Global Share of Population Exposed Across Asia-Pacific By Secondary Subnational Unit

Percentage Share of Population Exposed

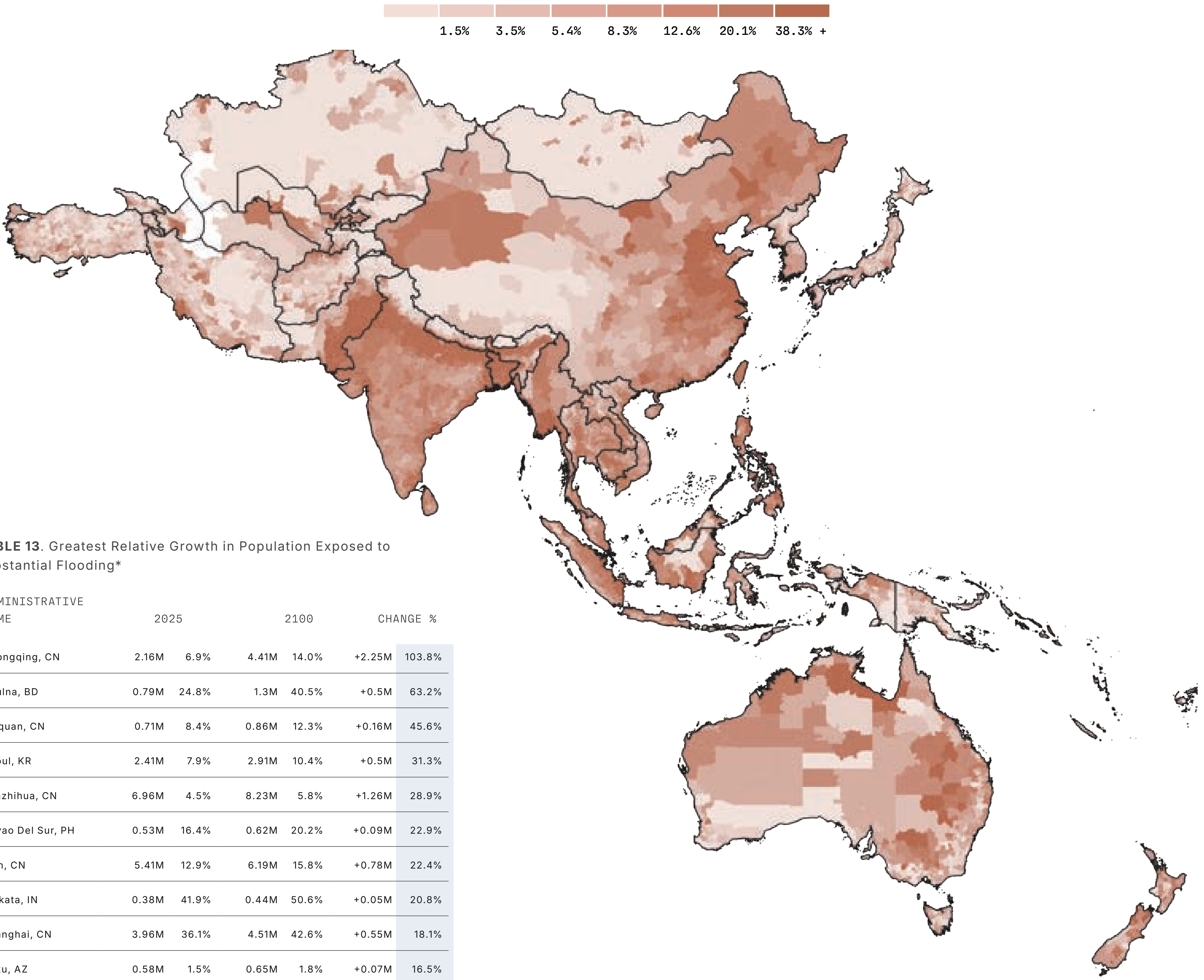


**TABLE 12**. Greatest Share of People Exposed to Substantial Flooding*

| ADMINISTRATIVE NAME | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Saran, IN | 4.35M | 4.39M | 95.9% | +0.03M | +0.12M | 0.7% |
| Ballia, IN | 3.85M | 3.91M | 94.7% | +0.05M | +0.22M | 1.4% |
| Begusarai, IN | 3.24M | 3.25M | 93.6% | +0.01M | -0.03M | 0.4% |
| Siwan, IN | 3.47M | 3.55M | 91.0% | +0.08M | +0.27M | 2.3% |
| Rahim Yar Khan, PK | 5.33M | 5.36M | 89.0% | +0.02M | +1.26M | 0.4% |
| Vaishali, IN | 3.87M | 4M | 91.2% | +0.13M | +0.2M | 3.4% |
| Samastipur, IN | 4.44M | 4.53M | 90.0% | +0.09M | +0.1M | 2.1% |
| Multan, PK | 4.73M | 4.81M | 89.5% | +0.09M | +0.34M | 1.8% |
| Sirajganj, BD | 3.3M | 3.32M | 87.2% | +0.02M | +0.3M | 0.6% |
| Muzaffargarh, PK | 4.18M | 4.21M | 87.2% | +0.03M | +0.19M | 0.7% |

**TABLE 13**. Greatest Relative Growth in Population Exposed to Substantial Flooding*

| ADMINISTRATIVE NAME | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Chongqing, CN | 2.16M | 6.9% | 4.41M | 14.0% | +2.25M | 103.8% |
| Khulna, BD | 0.79M | 24.8% | 1.3M | 40.5% | +0.5M | 63.2% |
| Jiuquan, CN | 0.71M | 8.4% | 0.86M | 12.3% | +0.16M | 45.6% |
| Seoul, KR | 2.41M | 7.9% | 2.91M | 10.4% | +0.5M | 31.3% |
| Panzhihua, CN | 6.96M | 4.5% | 8.23M | 5.8% | +1.26M | 28.9% |
| Davao Del Sur, PH | 0.53M | 16.4% | 0.62M | 20.2% | +0.09M | 22.9% |
| Jilin, CN | 5.41M | 12.9% | 6.19M | 15.8% | +0.78M | 22.4% |
| Kolkata, IN | 0.38M | 41.9% | 0.44M | 50.6% | +0.05M | 20.8% |
| Shanghai, CN | 3.96M | 36.1% | 4.51M | 42.6% | +0.55M | 18.1% |
| Baku, AZ | 0.58M | 1.5% | 0.65M | 1.8% | +0.07M | 16.5% |

*Risk is calculated as the aggregate figures for 1 km areas within each administrative area facing inundation of 10 cm or more and populations of 10 people or more for a 100 year return period (1% annual risk). Threshold of administrative areas with at least 3 million population shown.

REGIONS

# Europe

Across Europe, flood exposure remains comparatively stable but persistently high, with 78.3 million people exposed in 2025, increasing slightly to 78.4 million by 2100, alongside $3.2 trillion in GDP exposed today, remaining relatively stable growing by $7.9 billion through the end of the century. Absolute exposure is concentrated in large metropolitan regions along major river corridors and lowland urban networks, where dense settlement and critical infrastructure intersect flood-prone terrain. Prominent examples include Lombardy region (Milan), where a large metropolitan population occupies a low-relief basin influenced by riverine and surface-water flooding; North Rhine-Westphalia (Cologne), where extensive development along the Rhine places substantial populations within flood-influenced corridors; and Tuscany (Florence), where historic settlement along the Arno Valley continues to shape present-day exposure, though projected declines suggest contracting flood extents by 2100.

The highest exposure shares occur where population distribution closely follows river valleys and floodplain-adjacent development, notably in North Rhine-Westphalia (Cologne) and Veneto Region (Padua), where settlement across interconnected lowland river systems places a large fraction of residents within areas affected by 1 percent annual chance flooding. Looking ahead, relative growth in flood exposure is led by coastal and tidally influenced regions of Great Britain, including Lancashire, Hampshire, and Surrey (London metropolitan area), where sea level rise and tidal backwater effects expand flood influence inland despite stable populations, highlighting growing sensitivity in developed lowlands, particularly where aging flood defenses may provide diminishing protection over time.

**Total number of people exposed**

In 2025
**78.3M**

In 2100
78.4M

75-year change
▲ +91.5K (+0.1%)

**Total GDP exposed to flood disruptions**

In 2025
**$3.2T**

In 2100
$3.2T

75-year change
▲ +$7.9B (+0.3%)

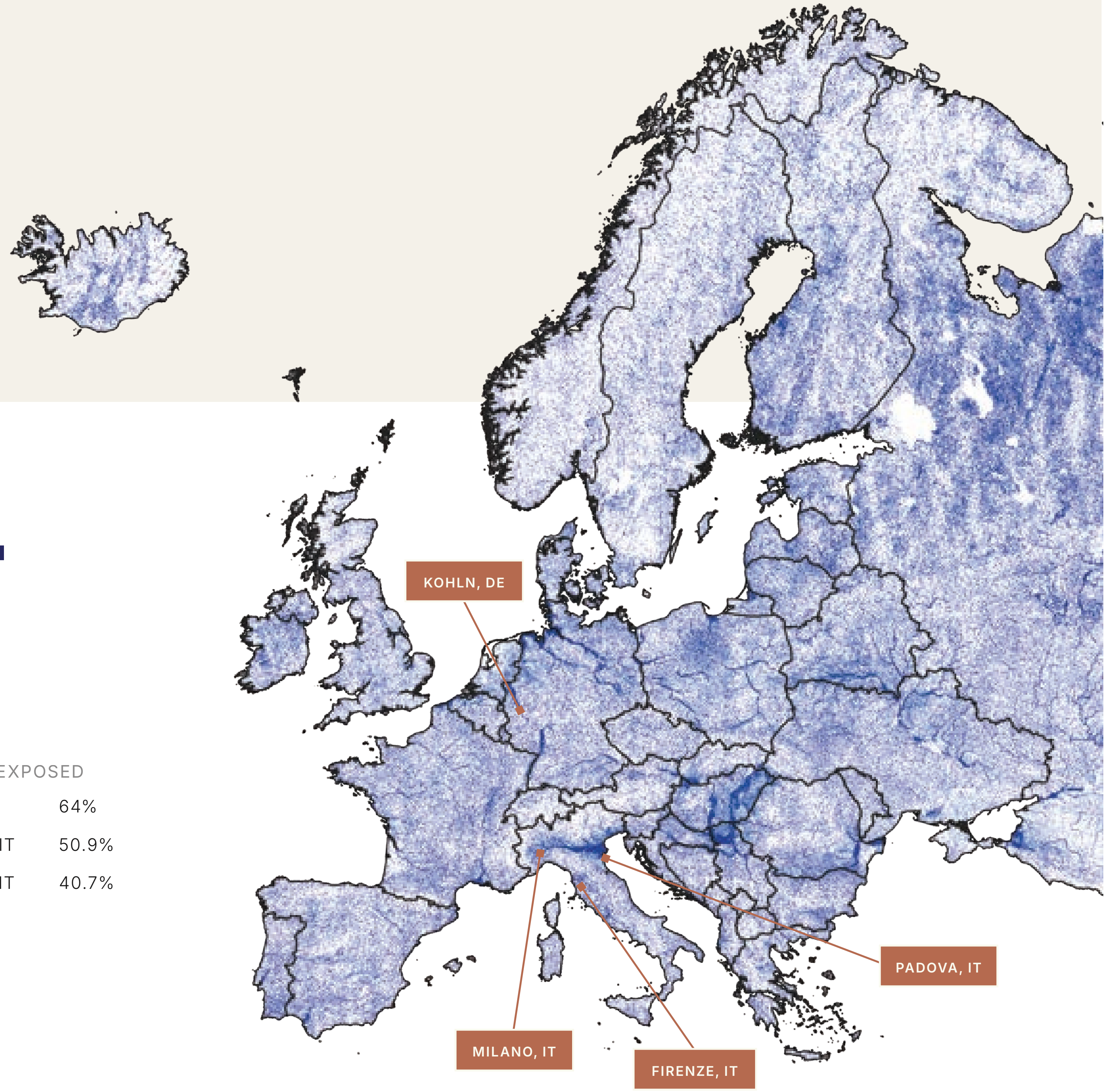


**FIGURE 8**. Flood Depth in 1-in-100 Year Flood Event Across Europe

Depth of flooding (ft.)

No flooding | 0 | 0.5 | 1 | 2 | 3+

## Regional Hotspots

| POPULATION EXPOSED | | PERCENT EXPOSED | |
|---|---|---|---|
| Milano, IT | 714.9K | Köln, DE | 64% |
| Köln, DE | 643.8K | Firenze, IT | 50.9% |
| Firenze, IT | 592K | Padova, IT | 40.7% |

EUROPE

# Exposure

**TABLE 14**. Greatest Number of People Exposed to Substantial Flooding*

| ADMINISTRATIVE NAME | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Milano, IT | 714.9K | 20.4% | 724.8K | 20.6% | +9.9K | 1.4% |
| Köln, DE | 643.8K | 64.0% | 656K | 65.2% | +12.3K | 1.9% |
| Firenze, IT | 592K | 50.9% | 398.5K | 34.3% | -193.5K | -32.7% |
| Barcelona, ES | 580.9K | 10.3% | 541.4K | 9.6% | -39.5K | -6.8% |
| Hamburg, DE | 548.7K | 33.0% | 555.9K | 33.4% | +7.2K | 1.3% |
| Sevilla, ES | 545.1K | 24.5% | 511K | 23.0% | -34K | -6.2% |
| Rhône, FR | 535.9K | 24.6% | 536.9K | 24.7% | +1K | 0.2% |
| Berlin, DE | 495.7K | 15.3% | 462.6K | 14.3% | -33K | -6.7% |
| Paris, FR | 408.5K | 18.5% | 408.4K | 18.5% | -0.2K | 0.0% |
| Padova, IT | 408.1K | 40.7% | 422.1K | 42.1% | +14K | 3.4% |

**FIGURE 9**. Global Share of Population Exposed Across Europe By Secondary Subnational Unit

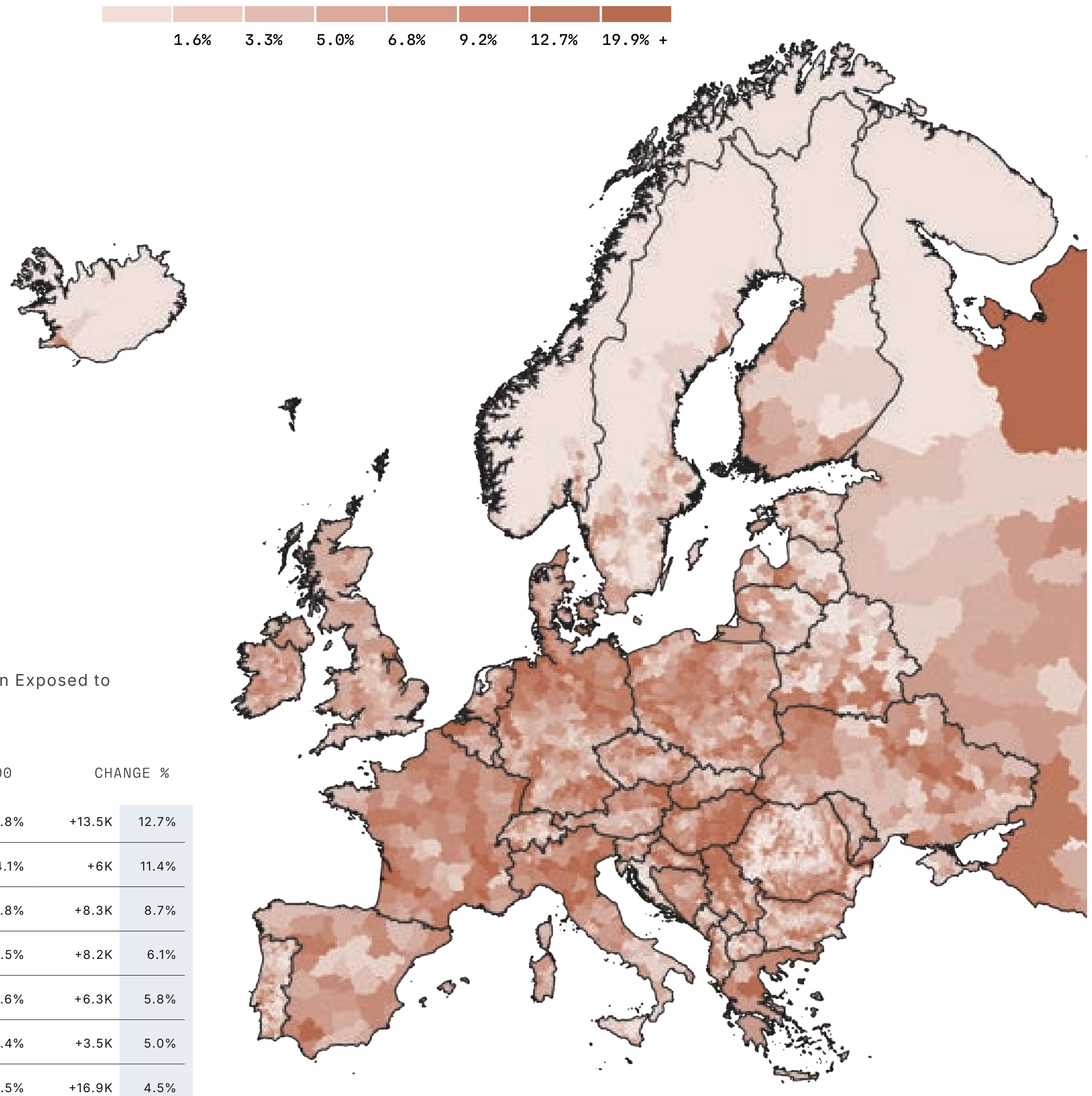


**TABLE 15**. Greatest Share of People Exposed to Substantial Flooding*

| ADMINISTRATIVE NAME | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Köln, DE | 643.8K | 64.0% | 656K | 65.2% | +12.3K | 1.9% |
| Firenze, IT | 592K | 50.9% | 398.5K | 34.3% | -193.5K | -32.7% |
| Padova, IT | 408.1K | 40.7% | 422.1K | 42.1% | +14K | 3.4% |
| Hamburg, DE | 548.7K | 33.0% | 555.9K | 33.4% | +7.2K | 1.3% |
| Bas-Rhin, FR | 285K | 27.1% | 290.8K | 27.7% | +5.8K | 2.0% |
| Wien, AT | 368.9K | 26.2% | 374.1K | 26.5% | +5.2K | 1.4% |
| Val-De-Marne, FR | 395.8K | 25.8% | 396K | 25.8% | +0.2K | 0.0% |
| Rhône, FR | 535.9K | 24.6% | 536.9K | 24.7% | +1K | 0.2% |
| Province Of West Flanders, BE | 276.9K | 24.6% | 287.9K | 25.6% | +11K | 4.0% |
| Sevilla, ES | 545.1K | 24.5% | 511K | 23.0% | -34K | -6.2% |

**TABLE 16**. Greatest Relative Growth in Population Exposed to Substantial Flooding*

| ADMINISTRATIVE NAME | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Lancashire, GB | 106.2K | 6.0% | 119.7K | 6.8% | +13.5K | 12.7% |
| Hampshire, GB | 52.9K | 3.7% | 58.9K | 4.1% | +6K | 11.4% |
| Surrey, GB | 95.6K | 5.3% | 103.9K | 5.8% | +8.3K | 8.7% |
| München, DE | 134.6K | 12.7% | 142.8K | 13.5% | +8.2K | 6.1% |
| Uusimaa, FI | 110.1K | 6.2% | 116.5K | 6.6% | +6.3K | 5.8% |
| Hertfordshire, GB | 70.9K | 4.2% | 74.4K | 4.4% | +3.5K | 5.0% |
| Nord, FR | 372.7K | 12.9% | 389.6K | 13.5% | +16.9K | 4.5% |
| Torino, IT | 242.2K | 9.5% | 252K | 9.9% | +9.8K | 4.1% |
| Province Of West Flanders, BE | 276.9K | 24.6% | 287.9K | 25.6% | +11K | 4.0% |
| Isère, FR | 261.9K | 20.3% | 272K | 21.0% | +10.1K | 3.9% |

*Risk is calculated as the aggregate figures for 1 km areas within each administrative area facing inundation of 10 cm or more and populations of 10 people or more for a 100 year return period (1% annual risk). Threshold of administrative areas with at least 1 million population shown.

REGIONS

# Latin America

Across Latin America, flood exposure is substantial and increases steadily over time, with 52.7 million people exposed in 2025, rising to 54.8 million by 2100, alongside $576.3 billion in GDP exposed today, growing to $602.3 billion by the end of the century. Absolute exposure is concentrated in the region's largest metropolitan areas, where high population totals and extensive built environments amplify flood impacts. Cities such as Lima (Lima Province, Peru), São Paulo (São Paulo State, Brazil), and Rio de Janeiro (Rio de Janeiro State, Brazil) exemplify this pattern, as urban development spans river corridors, drainage basins, and low-lying coastal terrain, placing millions of residents and significant economic activity within flood-prone areas.

The highest exposure shares occur where population is concentrated on lowland plains and basin floors, increasing the proportion of residents affected even outside megacities. Administrative areas including Andrés Ibáñez Department (Santa Cruz de la Sierra, Bolivia) and Recife Metropolitan Region (Pernambuco, Brazil) illustrate how settlement patterns closely aligned with flood-prone terrain drive high exposure shares, while cities such as Chiclayo (Lambayeque, Peru) see rising shares as urban growth increasingly overlaps with flood-influenced areas. Looking ahead, growth in flood exposure is driven by expanding impacts across urban municipalities such as Curitiba (Paraná, Brazil) and Duque de Caxias (Rio de Janeiro State, Brazil), with Lima also standing out as exposure continues to increase across densely populated river-adjacent corridors through 2100.

**Total number of people exposed**

In 2025
**52.7M**

In 2100
54.8M

75-year change
▲ +2.2M (4.1%)

**Total GDP exposed to flood disruptions**

In 2025
**$576.3B**

In 2100
$602.3B

75-year change
▲ +$26B (+4.5%)

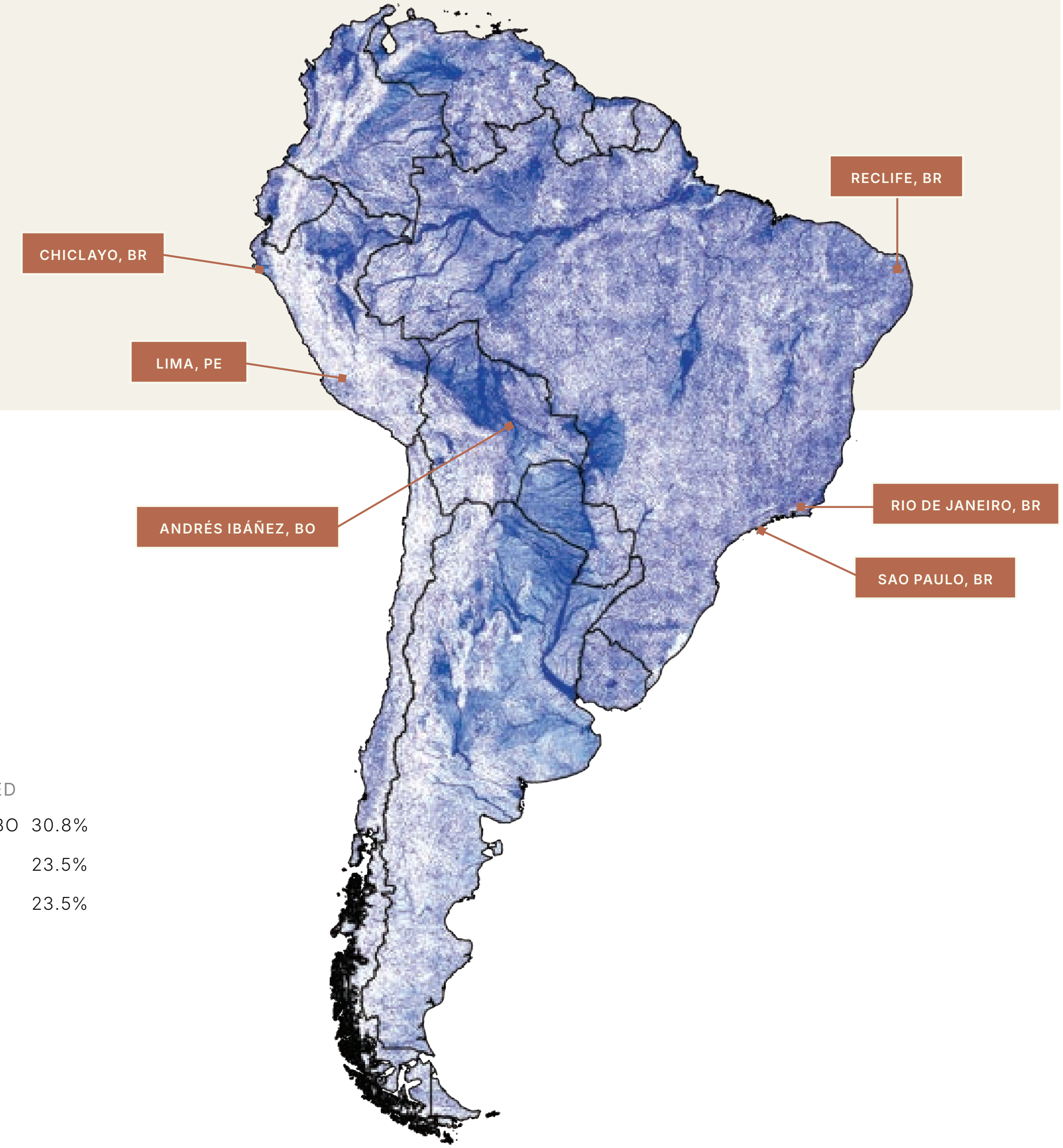


**FIGURE 10**. Flood Depth in 1-in-100 Year Flood Event Across Latin America

Depth of flooding (ft.)

No flooding | 0 | 0.5 | 1 | 2 | 3+

## Regional Hotspots

| POPULATION EXPOSED | | PERCENT EXPOSED | |
|---|---|---|---|
| Lima, PE | 1.13M | Andrés Ibáñez, BO | 30.8% |
| São Paulo, BR | 937.8K | Recife, BR | 23.5% |
| Rio De Janeiro, BR | 902.7K | Chiclayo, PE | 23.5% |

LATIN AMERICA

# Exposure

**FIGURE 11**. Global Share of Population Exposed Across Latin America By Secondary Subnational Unit

Percentage Share of Population Exposed

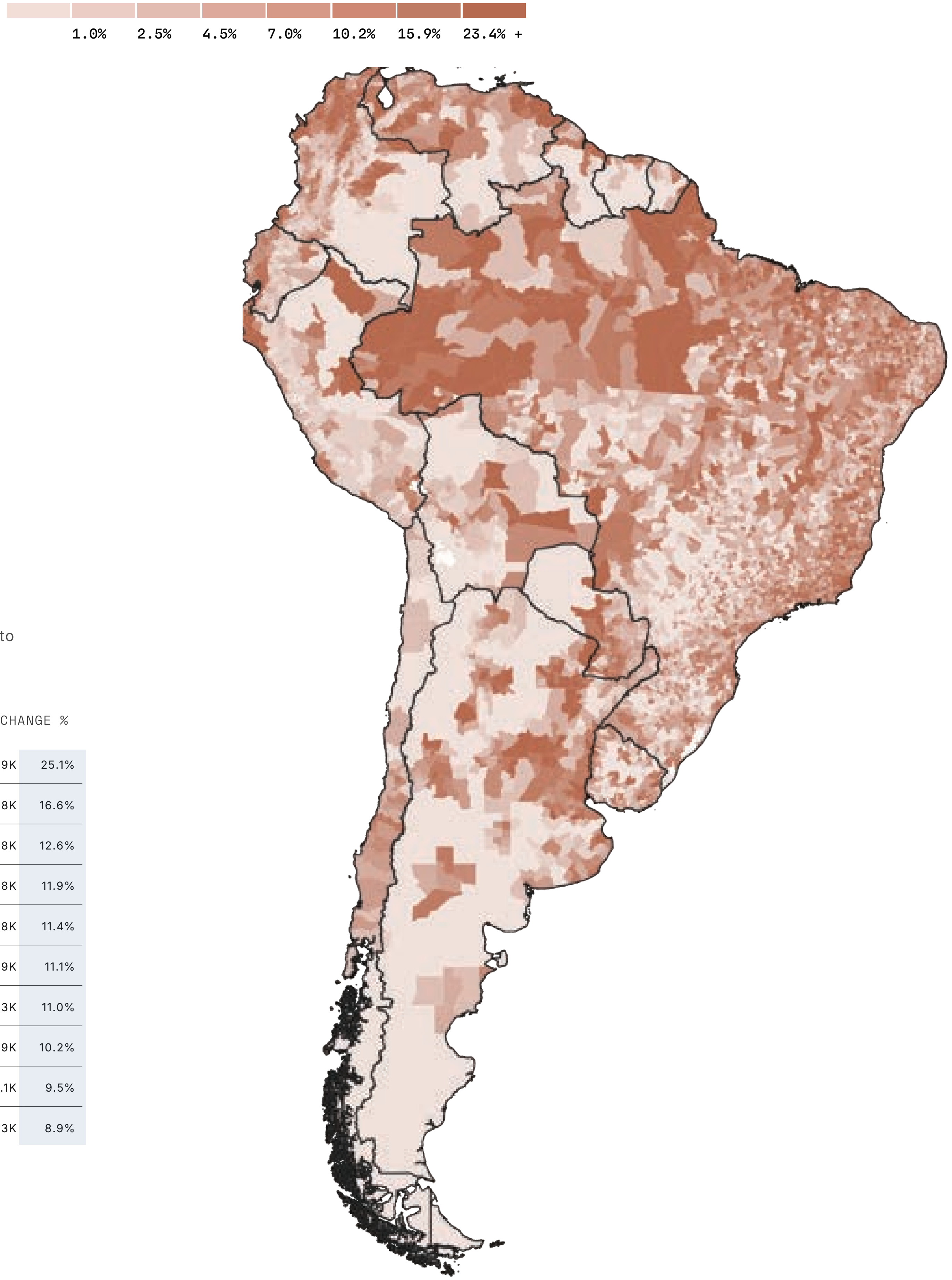


**TABLE 17**. Greatest Number of People Exposed to Substantial Flooding*

| ADMINISTRATIVE NAME | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Lima, PE | 1.13M | 10.8% | 1.28M | 12.1% | +142.8K | 12.6% |
| São Paulo, BR | 937.8K | 5.7% | 1.02M | 6.2% | +83.3K | 8.9% |
| Rio De Janeiro, BR | 902.7K | 13.5% | 994.6K | 14.8% | +91.9K | 10.2% |
| Andrés Ibáñez, BO | 583.7K | 30.8% | 595K | 31.4% | +11.3K | 1.9% |
| Santiago, CL | 577.2K | 10.4% | 585.5K | 10.6% | +8.3K | 1.4% |
| Bogota, D.C., CO | 479.1K | 10.2% | 494.5K | 10.5% | +15.4K | 3.2% |
| Chacabuco, CL | 420.6K | 20.8% | 429.5K | 21.3% | +8.9K | 2.1% |
| La Matanza, AR | 378.3K | 17.6% | 397.2K | 18.5% | +18.9K | 5.0% |
| Guayaquil, EC | 358.1K | 13.8% | 398K | 15.3% | +39.9K | 11.1% |
| Cali, CO | 313.7K | 14.4% | 322.7K | 14.8% | +8.9K | 2.8% |

**TABLE 18**. Greatest Share of People Exposed to Substantial Flooding*

| ADMINISTRATIVE NAME | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Andrés Ibáñez, BO | 583.7K | 30.8% | 595K | 31.4% | +11.3K | 1.9% |
| Recife, BR | 296.6K | 23.5% | 272.7K | 21.6% | -24K | -8.1% |
| Chiclayo, PE | 294.1K | 23.5% | 322.2K | 25.8% | +28.1K | 9.5% |
| Chacabuco, CL | 420.6K | 20.8% | 429.5K | 21.3% | +8.9K | 2.1% |
| Rosario, AR | 198.4K | 18.0% | 205.7K | 18.7% | +7.3K | 3.7% |
| La Matanza, AR | 378.3K | 17.6% | 397.2K | 18.5% | +18.9K | 5.0% |
| Duque De Caxias, BR | 179.5K | 15.6% | 209.3K | 18.2% | +29.8K | 16.6% |
| Nova Iguaçu, BR | 216.7K | 15.2% | 242.4K | 17.0% | +25.8K | 11.9% |
| Barranquilla, CO | 157,071 | 14.9% | 174,419 | 16.6% | +17.3K | 11.0% |
| Cali, CO | 313,726 | 14.4% | 322,650 | 14.8% | +8.9K | 2.8% |

**TABLE 19**. Greatest Relative Growth in Population Exposed to Substantial Flooding*

| ADMINISTRATIVE NAME | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Curitiba, BR | 67.3K | 3.7% | 84.2K | 4.6% | +16.9K | 25.1% |
| Duque De Caxias, BR | 179.5K | 15.6% | 209.3K | 18.2% | +29.8K | 16.6% |
| Lima, PE | 1.13M | 10.8% | 1.28M | 12.1% | +142.8K | 12.6% |
| Nova Iguaçu, BR | 216.7K | 15.2% | 242.4K | 17.0% | +25.8K | 11.9% |
| Montevideo, UY | 70.1K | 6.3% | 78.1K | 7.0% | +8K | 11.4% |
| Guayaquil, EC | 358.1K | 13.8% | 398K | 15.3% | +39.9K | 11.1% |
| Barranquilla, CO | 157.1K | 14.9% | 174.4K | 16.6% | +17.3K | 11.0% |
| Rio De Janeiro, BR | 902.7K | 13.5% | 994.6K | 14.8% | +91.9K | 10.2% |
| Chiclayo, PE | 294.1K | 23.5% | 322.2K | 25.8% | +28.1K | 9.5% |
| São Paulo, BR | 937.8K | 5.7% | 1.02M | 6.2% | +83.3K | 8.9% |

*Risk is calculated as the aggregate figures for 1 km areas within each administrative area facing inundation of 10 cm or more and populations of 10 people or more for a 100 year return period (1% annual risk). Threshold of administrative areas with at least 1 million population shown.

REGIONS

# Middle East and North Africa

Across the Middle East and North Africa (MENA), flood exposure remains high but relatively stable, with 128.4 million people exposed in 2025, declining slightly by 95 thousand by 2100 to 128.3 million, alongside $395 billion in GDP exposed today, increasing by $12.4 billion through the end of the century as exposure grows in more productive parts of the region and falls in more rural areas. Absolute exposure is concentrated in dense urban districts and major river lowlands, particularly Baghdad Governorate (Baghdad, Iraq) along the Tigris River and across Egypt's Nile Delta, where large populations occupy low-elevation terrain influenced by riverine flooding, intense rainfall, and limited drainage capacity.

The highest exposure shares are overwhelmingly concentrated in the Nile Delta, where flat topography, dense settlement, and rising coastal influence leave little population outside flood-prone areas. Governorates including Kafr El-Sheikh, Dakahlia (Sinbillawin), and Sharqia (Minya Al-Qamh) exhibit near-total exposure today, with projections indicating further expansion of flood coverage across already vulnerable communities by 2100. While overall population exposure changes are modest, relative growth in flood exposure is concentrated in low-elevation urban and coastal areas, including Casablanca (Morocco) and parts of coastal Kuwait, where expanding pluvial flooding and coastal inundation increasingly intersect developed districts, producing notable proportional increases in people and economic activity exposed.

**Total number of people exposed**

In 2025: **128.4M**

In 2100: 128.3M

75-year change: ▼ -95.2K ( -0.1%)

**Total GDP exposed to flood disruptions**

In 2025: **$395B**

In 2100: $407.4B

75-year change: ▲ +$12.4B (+3.1%)

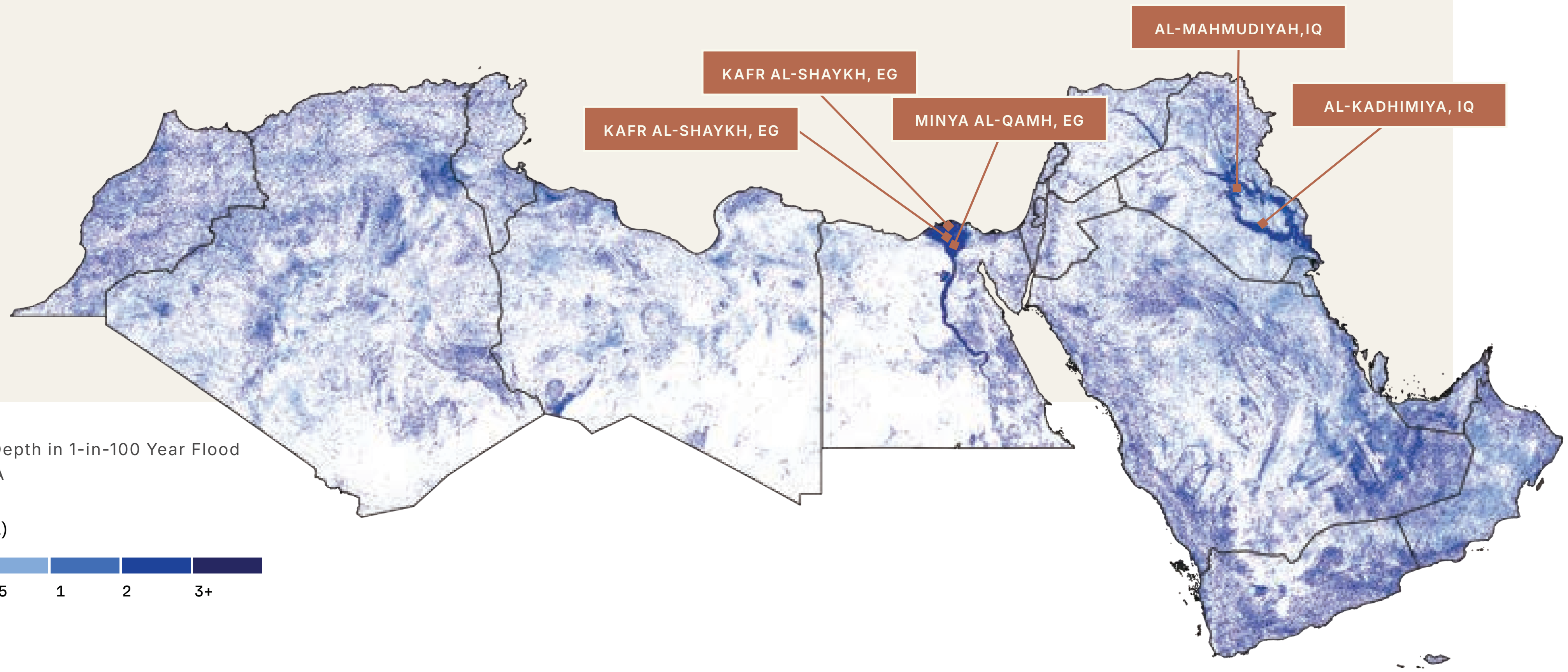


**FIGURE 12**. Flood Depth in 1-in-100 Year Flood Event Across MENA

## Regional Hotspots

| POPULATION EXPOSED | | PERCENT EXPOSED | |
|---|---|---|---|
| Al-Kadhmiyah, IQ | 3.06M | Kafr Al-Shaykh Center, EG | 99.2% |
| Zemam Out, EG | 2.82M | Sinbillawin, EG | 98.9% |
| Al-Mahmoudiya, IQ | 2.65M | Minya Al-Qamh, EG | 96.8% |

MIDDLE EAST AND NORTH AFRICA

# Exposure

**TABLE 20**. Greatest Number of People Exposed to Substantial Flooding*

| ADMINISTRATIVE NAME | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Al-Kadhmiyah, IQ | 3.06M | 72.6% | 3.09M | 73.3% | +31K | 1.0% |
| Zemam Out, EG | 2.82M | 86.9% | 2.81M | 86.7% | -8.2K | -0.3% |
| Al-Mahmoudiya, IQ | 2.65M | 83.8% | 2.64M | 83.4% | -9.8K | -0.4% |
| El Mahalla El Kobra, EG | 1.84M | 84.5% | 1.83M | 84.4% | -1.6K | -0.1% |
| Al-Mada'In, IQ | 1.63M | 50.6% | 1.69M | 52.2% | +54K | 3.3% |
| Kafr Al-Dawwar Center, EG | 1.51M | 92.1% | 1.49M | 91.0% | -17.2K | -1.1% |
| Zaqaziq, EG | 1.38M | 87.9% | 1.39M | 88.2% | +3.8K | 0.3% |
| Minya Al-Qamh, EG | 1.34M | 96.8% | 1.35M | 97.1% | +4.9K | 0.4% |
| Zemam Out, EG | 1.23M | 95.9% | 1.23M | 95.9% | <0K | 0.0% |
| Tanta, EG | 1.21M | 75.6% | 1.21M | 75.6% | -0.1K | 0.0% |

**FIGURE 13**. Global Share of Population Exposed Across MENA By Secondary Subnational Unit

Percentage Share of Population Exposed

2.0% 3.4% 4.6% 5.7% 7.2% 10.0% 20.9% +

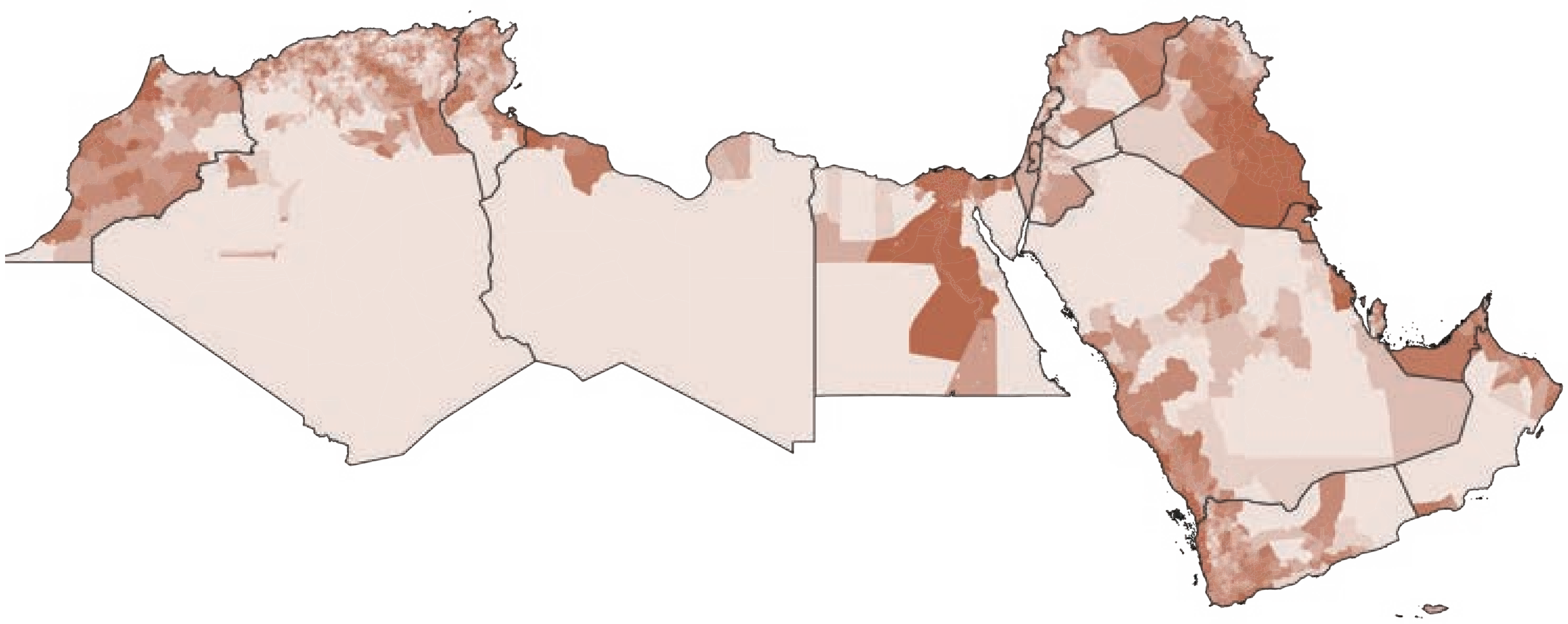

**TABLE 21.** Greatest Share of People Exposed to Substantial Flooding*

| ADMINISTRATIVE NAME | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Kafr Al-Shaykh Center, EG | 1.11M | 99.2% | 1.11M | 99.2% | <0K | 0.0% |
| Sinbillawin, EG | 1.13M | 98.9% | 1.13M | 99.1% | +2.5K | 0.2% |
| Minya Al-Qamh, EG | 1.34M | 96.8% | 1.35M | 97.1% | +4.9K | 0.4% |
| Zemam Out, EG | 1.23M | 95.9% | 1.23M | 95.9% | <0K | 0.0% |
| Abu Hummus, EG | 1.04M | 95.9% | 1.04M | 95.9% | +0.1K | 0.0% |
| Damanhur Center, EG | 1.17M | 95.2% | 1.17M | 95.2% | <0K | 0.0% |
| Zifta, EG | 1.03M | 94.3% | 1.04M | 94.8% | +6K | 0.6% |
| Ashmun, EG | 1.2M | 92.4% | 1.2M | 92.6% | +2.4K | 0.2% |
| Zemam Out, EG | 991.7K | 92.4% | 993.8K | 92.6% | +2.1K | 0.2% |
| Kafr Al-Dawwar Center, EG | 1.51M | 92.1% | 1.49M | 91.0% | -17.2K | -1.1% |

**TABLE 22**. Greatest Relative Growth in Population Exposed to Substantial Flooding*

| ADMINISTRATIVE NAME | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Casablanca, MA | 34.9K | 3.2% | 42.4K | 3.9% | +7.6K | 21.7% |
| Al-Husayniya, EG | 705.7K | 56.4% | 801.7K | 64.1% | +95.9K | 13.6% |
| Al Jahra, KW | 106.6K | 6.3% | 119.8K | 7.0% | +13.2K | 12.4% |
| Bani Hushaysh, YE | 60.8K | 5.8% | 66.6K | 6.4% | +5.8K | 9.6% |
| At Ta'Iziyah, YE | 81.7K | 7.4% | 88.9K | 8.0% | +7.2K | 8.8% |
| Salé, MA | 85.4K | 7.9% | 92.3K | 8.5% | +6.8K | 8.0% |
| As Sulayyil, SA | 6.9K | 0.6% | 7.4K | 0.7% | +0.5K | 6.7% |
| Al Taif, SA | 85.9K | 8.5% | 91.2K | 9.0% | +5.3K | 6.1% |
| Bani Al Harith, YE | 181.9K | 16.8% | 192.4K | 17.8% | +10.5K | 5.8% |
| Zemam Out, EG | 335.3K | 29.3% | 352.6K | 30.8% | +17.3K | 5.2% |

*Risk is calculated as the aggregate figures for 1 km areas within each administrative area facing inundation of 10 cm or more and populations of 10 people or more for a 100 year return period (1% annual risk). Threshold of administrative areas with at least 1 million population shown.

REGIONS

# North America

Across North America, flood exposure is substantial and continues to rise, with 45.8 million people exposed in 2025, increasing to 47.5 million by 2100, alongside $2.2 trillion in GDP exposed today, growing by $99.3 billion to $2.3 trillion by century's end. Absolute exposure is concentrated in large metropolitan counties and dense urban municipalities, where extensive development overlaps major floodplains, engineered drainage systems, and coastal flood pathways. Harris County, Texas (Houston) leads the region, as the metropolitan area spans multiple flood-prone watersheds and low-lying corridors exposed to both riverine flooding and coastal storm surge. In Mexico, municipalities within the Mexico City basin, including Nezahualcóyotl and Gustavo A. Madero, also rank among the highest, reflecting extremely dense populations built across flat, flood-influenced basin floors with limited drainage efficiency.

The highest exposure shares in North America are concentrated in the Mexico City basin, where urban development sits atop the former Lake Texcoco lakebed, an area characterized by subsidence and heightened sensitivity to rainfall-driven flooding. Nezahualcóyotl, Gustavo A. Madero, and Atenco exhibit persistently high shares, as a large fraction of residents occupy low-lying terrain where inundation can affect most of the population. Looking ahead, relative growth in flood exposure is driven by expanding hazards in areas that historically experienced lower exposure, including Clark County, Nevada (Las Vegas), where intense rainfall increasingly overwhelms drainage systems, and coastal and tidal regions of the northeastern United States, such as Nassau County and The Bronx in New York, where sea level rise and elevated tidal and river levels extend flooding farther into dense urban neighborhoods.

**Total number of people exposed**

In 2025
**45.8M**

In 2100
47.5M

75-year change
▲ +1.7 (+3.7%)

**Total GDP exposed to flood disruptions**

In 2025
**$2.2T**

In 2100
$2.3T

75-year change
▲ +$99.3B (+4.6%)

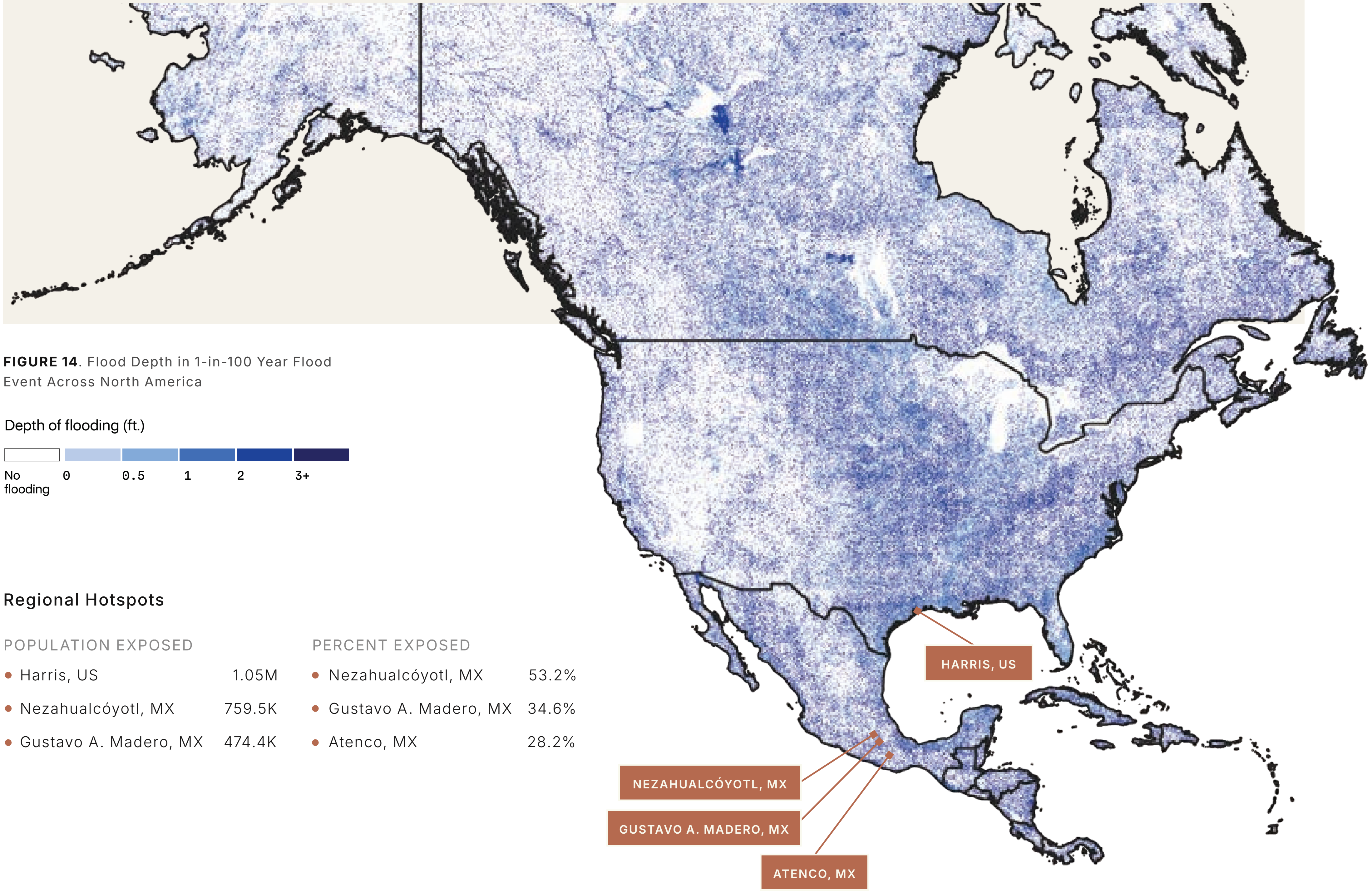


**FIGURE 14**. Flood Depth in 1-in-100 Year Flood Event Across North America

Depth of flooding (ft.)

No flooding | 0 | 0.5 | 1 | 2 | 3+

## Regional Hotspots

| POPULATION EXPOSED | | PERCENT EXPOSED | |
|---|---|---|---|
| Harris, US | 1.05M | Nezahualcóyotl, MX | 53.2% |
| Nezahualcóyotl, MX | 759.5K | Gustavo A. Madero, MX | 34.6% |
| Gustavo A. Madero, MX | 474.4K | Atenco, MX | 28.2% |

NORTH AMERCIA

# Exposure

**TABLE 23**. Greatest Number of People Exposed to Substantial Flooding*

| ADMINISTRATIVE NAME | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Harris, US | 1.05M | 24.3% | 1.06M | 24.5% | +8.2K | 0.8% |
| Nezahualcóyotl, MX | 759.5K | 53.2% | 771.3K | 54.1% | +11.8K | 1.6% |
| Gustavo A. Madero, MX | 474.4K | 34.6% | 481.9K | 35.2% | +7.5K | 1.6% |
| Orange, US | 467.2K | 13.2% | 488.5K | 13.8% | +21.3K | 4.6% |
| Santo Domingo, DO | 418.4K | 13.1% | 419.5K | 13.1% | +1.1K | 0.3% |
| Iztapalapa, MX | 408.4K | 16.4% | 413.6K | 16.6% | +5.2K | 1.3% |
| Cook, US | 401.1K | 6.4% | 407.2K | 6.5% | +6.1K | 1.5% |
| Texcoco, MX | 391K | 26.2% | 394.2K | 26.4% | +3.3K | 0.8% |
| Maricopa, US | 348.2K | 8.6% | 337.2K | 8.3% | -11K | -3.2% |
| Wayne, US | 312.3K | 13.2% | 316.9K | 13.3% | +4.6K | 1.5% |

**FIGURE 15**. Global Share of Population Exposed Across North America By Secondary Subnational Unit

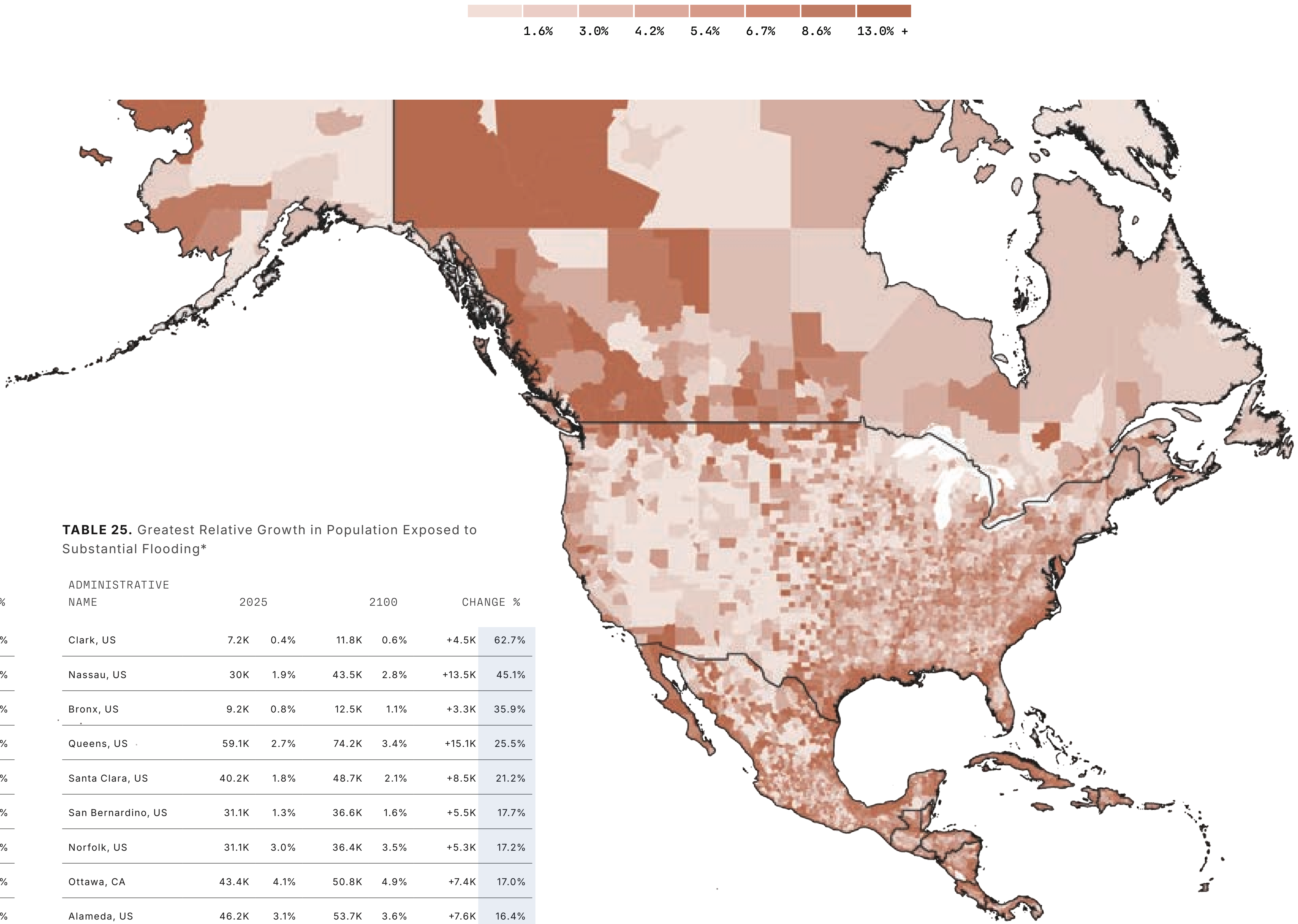


**TABLE 24**. Greatest Share of People Exposed to Substantial Flooding*

| ADMINISTRATIVE NAME | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Nezahualcóyotl, MX | 759.5K | 53.2% | 771.3K | 54.1% | +11.8K | 1.6% |
| Gustavo A. Madero, MX | 474.4K | 34.6% | 481.9K | 35.2% | +7.5K | 1.6% |
| Atenco, MX | 296.1K | 28.2% | 296.5K | 28.2% | +0.4K | 0.1% |
| Texcoco, MX | 391K | 26.2% | 394.2K | 26.4% | +3.3K | 0.8% |
| Harris, US | 1.05M | 24.3% | 1.06M | 24.5% | +8.2K | 0.8% |
| Ixtapaluca, MX | 234K | 20.1% | 241.4K | 20.7% | +7.4K | 3.2% |
| Iztapalapa, MX | 408.4K | 16.4% | 413.6K | 16.6% | +5.2K | 1.3% |
| Ecatepec De Morelos, MX | 282.2K | 15.4% | 285.8K | 15.6% | +3.6K | 1.3% |
| Tláhuac, MX | 136.2K | 13.6% | 139.2K | 13.9% | +3.1K | 2.2% |
| Orange, US | 467.2K | 13.2% | 488.5K | 13.8% | +21.3K | 4.6% |

**TABLE 25.** Greatest Relative Growth in Population Exposed to Substantial Flooding*

| ADMINISTRATIVE NAME | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Clark, US | 7.2K | 0.4% | 11.8K | 0.6% | +4.5K | 62.7% |
| Nassau, US | 30K | 1.9% | 43.5K | 2.8% | +13.5K | 45.1% |
| Bronx, US | 9.2K | 0.8% | 12.5K | 1.1% | +3.3K | 35.9% |
| Queens, US | 59.1K | 2.7% | 74.2K | 3.4% | +15.1K | 25.5% |
| Santa Clara, US | 40.2K | 1.8% | 48.7K | 2.1% | +8.5K | 21.2% |
| San Bernardino, US | 31.1K | 1.3% | 36.6K | 1.6% | +5.5K | 17.7% |
| Norfolk, US | 31.1K | 3.0% | 36.4K | 3.5% | +5.3K | 17.2% |
| Ottawa, CA | 43.4K | 4.1% | 50.8K | 4.9% | +7.4K | 17.0% |
| Alameda, US | 46.2K | 3.1% | 53.7K | 3.6% | +7.6K | 16.4% |
| Bergen, US | 65.2K | 4.1% | 74.4K | 4.7% | +9.2K | 14.1% |

*Risk is calculated as the aggregate figures for 1 km areas within each administrative area facing inundation of 10 cm or more and populations of 10 people or more for a 100 year return period (1% annual risk). Threshold of administrative areas with at least 1 million population shown.

REGIONS

# Africa

Across Sub-Saharan Africa, flood exposure is already high and continues to rise, with 178.3 million people exposed in 2025, increasing by to 186.5 million by 2100, alongside $584.1 billion in GDP exposed today, growing to $595.4 billion through the end of the century. Absolute exposure is concentrated in capital regions and major urban districts located within flood-prone valleys and lowland basins, where large populations intersect river systems and rainfall-driven flood pathways. Analamanga Region (Antananarivo, Madagascar) leads the region, as dense settlement across valley floors and low-lying floodplains results in widespread exposure during heavy rainfall events. The Autonomous District of Abidjan (Côte d'Ivoire) also ranks highly, reflecting its position within a lagoon-connected coastal lowland where intense rainfall and constrained drainage affect large portions of the urban population, while Kati Cercle (Mali) illustrates how settlement along flood-influenced corridors near the Niger River drives high exposed totals despite limited projected growth.

The highest exposure shares occur where population is concentrated within low-elevation urban corridors and flood-prone valleys, creating extensive overlap between settlement and flood extents. Analamanga and Abidjan exhibit particularly high shares, as dense populations occupy poorly drained terrain subject to rainfall-driven flooding, while Kati maintains persistently high shares linked to river-adjacent settlement patterns. Looking ahead, relative growth in flood exposure is driven by expanding flood extents across urban and regional population centers, led by Abidjan, where intensifying rainfall increases urban inundation, and parts of Ethiopia, including Jimma and West Gojam, where more intense seasonal rainfall and river overflow along the Omo–Gibe and Nile systems extend flooding into low-lying populated areas.

**Total number of people exposed**

In 2025: **178.3M**

In 2100: 186.5M

75-year change: ▲ +8.2M (+4.6%)

**Total GDP exposed to flood disruptions**

In 2025: **$584.1B**

In 2100: $595.4B

75-year change: ▲ +$11.4B ( +1.9%)

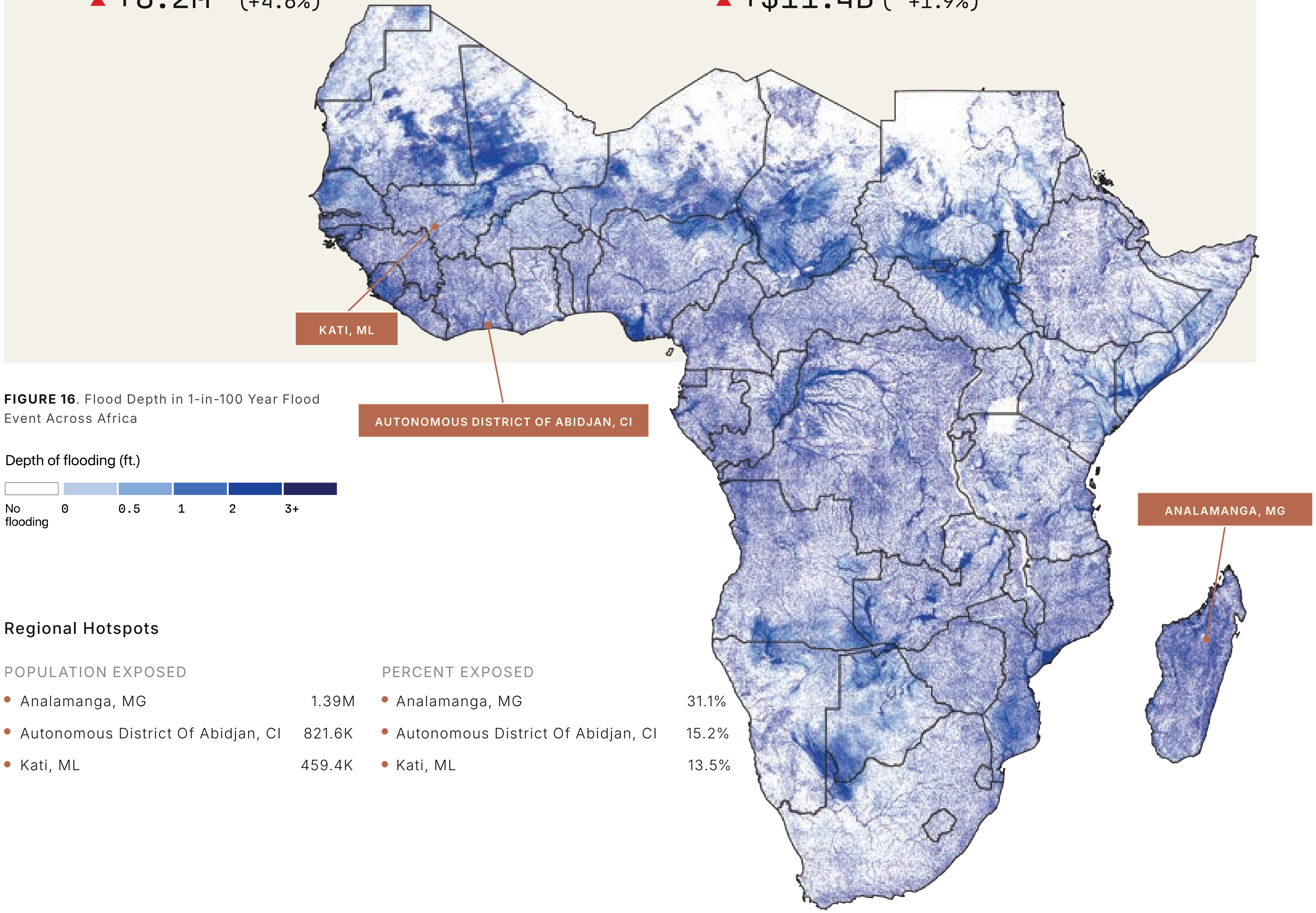


**FIGURE 16**. Flood Depth in 1-in-100 Year Flood Event Across Africa

## Regional Hotspots

| POPULATION EXPOSED | | PERCENT EXPOSED | |
|---|---|---|---|
| Analamanga, MG | 1.39M | Analamanga, MG | 31.1% |
| Autonomous District Of Abidjan, CI | 821.6K | Autonomous District Of Abidjan, CI | 15.2% |
| Kati, ML | 459.4K | Kati, ML | 13.5% |

AFRICA

# Exposure

**TABLE 26**. Greatest Number of People Exposed to Substantial Flooding*

| ADMINISTRATIVE NAME | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Analamanga, MG | 1.39M | 31.1% | 1.45M | 32.5% | +64.5K | 4.6% |
| Autonomous District Of Abidjan, CI | 821.6K | 15.2% | 1.21M | 22.3% | +385.3K | 46.9% |
| Kati, ML | 459.4K | 13.5% | 486.3K | 14.3% | +27K | 5.9% |
| West Gojam, ET | 360.9K | 7.3% | 388.1K | 7.9% | +27.2K | 7.5% |
| Sidama, ET | 354.4K | 7.0% | 371.1K | 7.3% | +16.7K | 4.7% |
| Vakinankaratra, MG | 341.4K | 10.8% | 347.2K | 11.0% | +5.8K | 1.7% |
| Jimma, ET | 326.9K | 6.3% | 355.6K | 6.9% | +28.7K | 8.8% |
| South Gondar, ET | 280.6K | 6.5% | 281.3K | 6.6% | +0.7K | 0.2% |
| City Of Cape Town, ZA | 278.6K | 8.3% | 273.1K | 8.1% | -5.4K | -1.9% |
| Arsi, ET | 260.8K | 5.5% | 272.1K | 5.8% | +11.3K | 4.3% |

**FIGURE 17**. Global Share of Population Exposed Across Africa By Secondary Subnational Unit

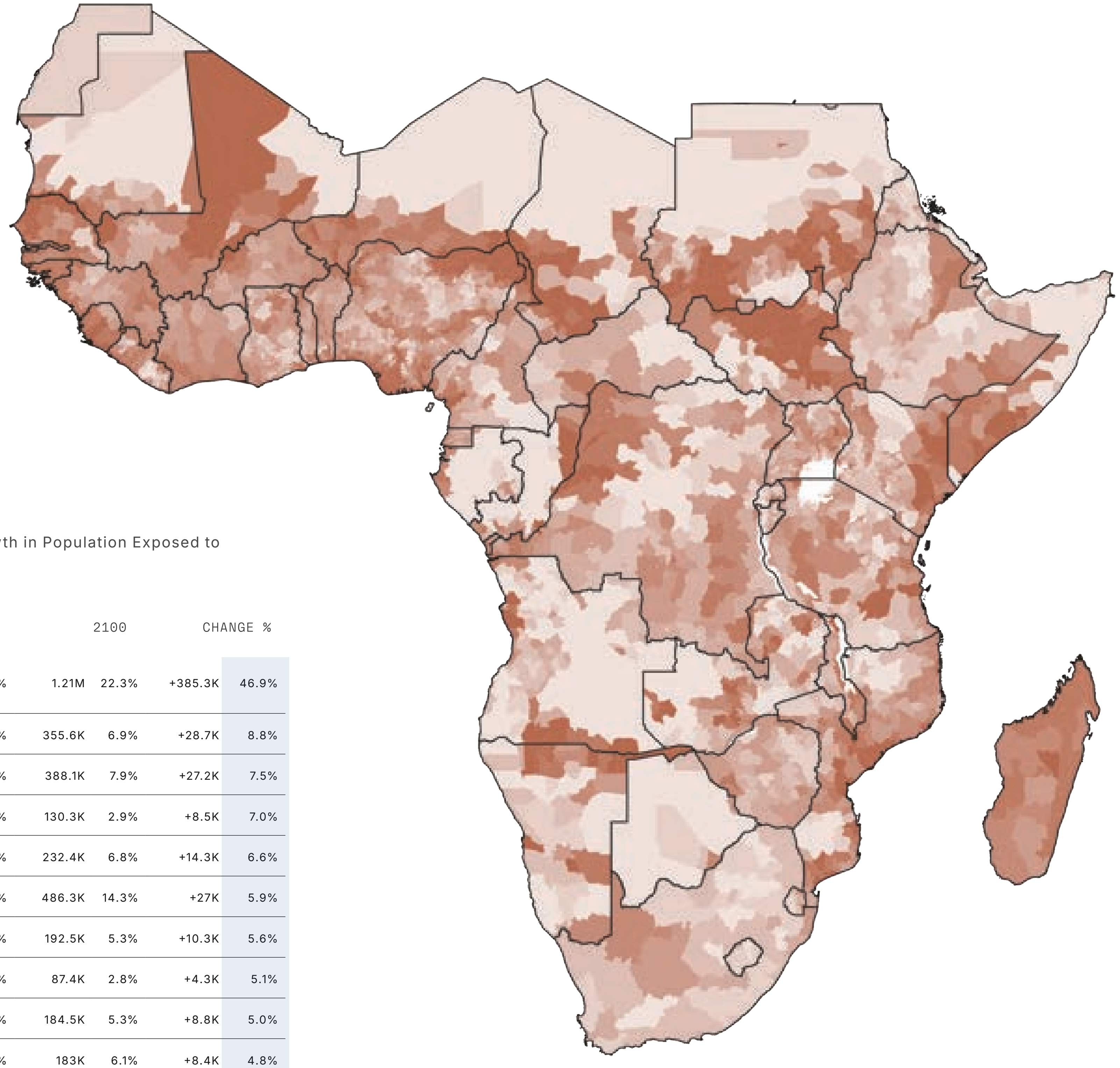


**TABLE 27**. Greatest Share of People Exposed to Substantial Flooding*

| ADMINISTRATIVE NAME | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Analamanga, MG | 1.39M | 31.1% | 1.45M | 32.5% | +64.5K | 4.6% |
| Autonomous District Of Abidjan, CI | 821.6K | 15.2% | 1.21M | 22.3% | +385.3K | 46.9% |
| Kati, ML | 459.4K | 13.5% | 486.3K | 14.3% | +27K | 5.9% |
| Vakinankaratra, MG | 341.4K | 10.8% | 347.2K | 11.0% | +5.8K | 1.7% |
| City Of Cape Town, ZA | 278.6K | 8.3% | 273.1K | 8.1% | +-5.4K | -1.9% |
| West Gojam, ET | 360.9K | 7.3% | 388.1K | 7.9% | +27.2K | 7.5% |
| Sidama, ET | 354.4K | 7.0% | 371.1K | 7.3% | +16.7K | 4.7% |
| South Gondar, ET | 280.6K | 6.5% | 281.3K | 6.6% | +0.7K | 0.2% |
| West Arsi, ET | 218.1K | 6.4% | 232.4K | 6.8% | +14.3K | 6.6% |
| Jimma, ET | 326.9K | 6.3% | 355.6K | 6.9% | +28.7K | 8.8% |

**TABLE 28**. Greatest Relative Growth in Population Exposed to Substantial Flooding*

| ADMINISTRATIVE NAME | 2025 | | 2100 | | CHANGE % | |
|---|---|---|---|---|---|---|
| Autonomous District Of Abidjan, CI | 821.6K | 15.2% | 1.21M | 22.3% | +385.3K | 46.9% |
| Jimma, ET | 326.9K | 6.3% | 355.6K | 6.9% | +28.7K | 8.8% |
| West Gojam, ET | 360.9K | 7.3% | 388.1K | 7.9% | +27.2K | 7.5% |
| East Hararge, ET | 121.8K | 2.7% | 130.3K | 2.9% | +8.5K | 7.0% |
| West Arsi, ET | 218.1K | 6.4% | 232.4K | 6.8% | +14.3K | 6.6% |
| Kati, ML | 459.4K | 13.5% | 486.3K | 14.3% | +27K | 5.9% |
| West Shewa, ET | 182.2K | 5.0% | 192.5K | 5.3% | +10.3K | 5.6% |
| West Hararge, ET | 83.2K | 2.7% | 87.4K | 2.8% | +4.3K | 5.1% |
| Central Gondar, ET | 175.7K | 5.1% | 184.5K | 5.3% | +8.8K | 5.0% |
| Wolayita, ET | 174.6K | 5.8% | 183K | 6.1% | +8.4K | 4.8% |

*Risk is calculated as the aggregate figures for 1 km areas within each administrative area facing inundation of 10 cm or more and populations of 10 people or more for a 100 year return period (1% annual risk). Threshold of administrative areas with at least 3 million population shown.



CONCLUSION

# Flood Risk Is Already Here

Taken together, the findings from the FS-GFM indicate that substantial flood risk is already embedded in the global footprint of where people live and economies operate — and that this footprint is poised to expand further under moderate warming conditions.

With 1.92 billion people and roughly $18.8 trillion in GDP already exposed to disruptive flooding in a 1% annual chance event, the central challenge is not simply that floods are getting worse, but that risk is already present and intersects with a large portion of inhabited parts of the globe and high-value activity across river basins, deltas, and urban centers.

By bringing engineering-grade hydraulics to a consistent global framework, the FS-GFM and the results in this report provide a clearer basis for prioritizing resilience investments and improving financial protection, so that adaptation can be directed toward the communities and systems most likely to face repeated, high-consequence flooding today and over the coming decades.

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