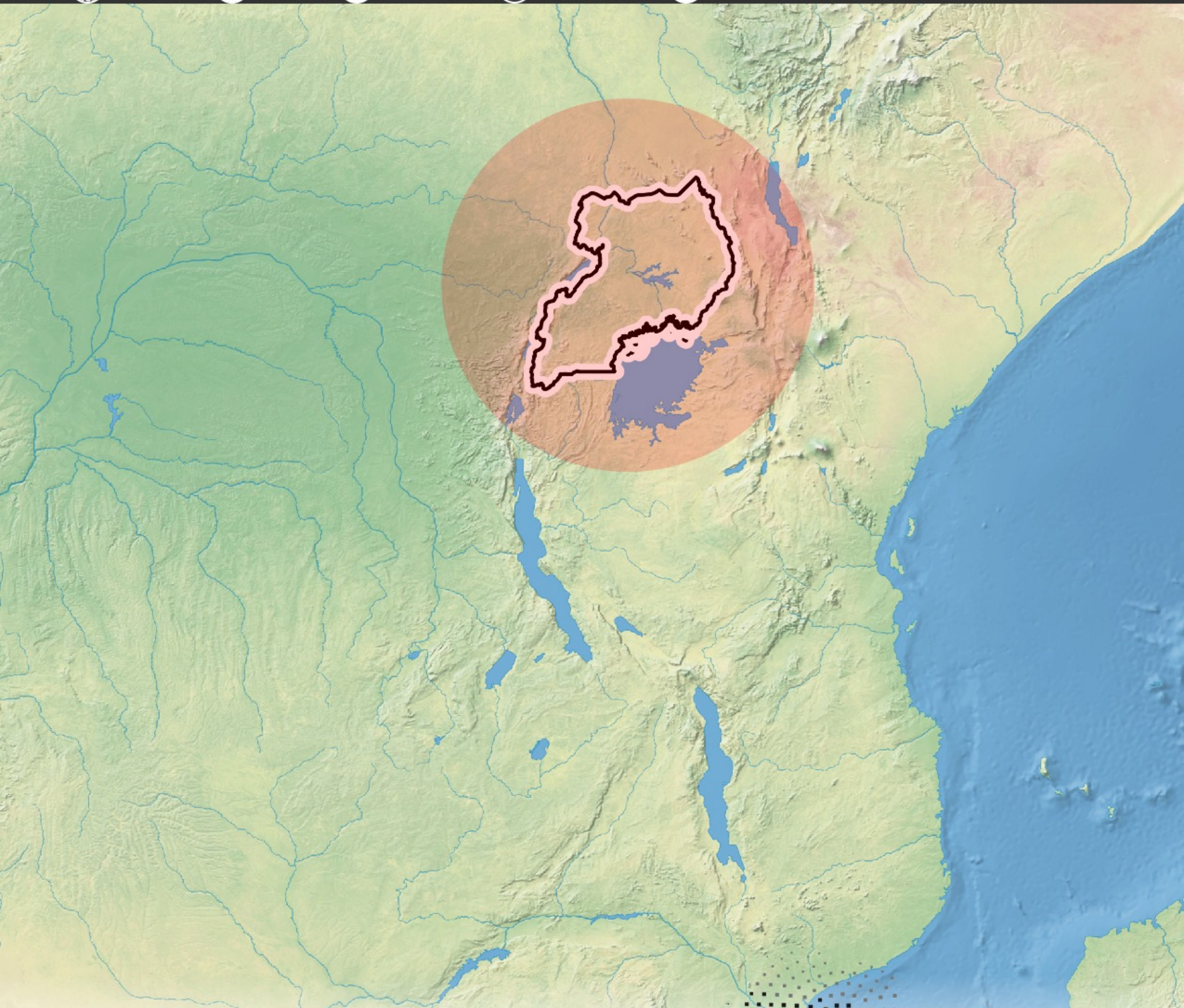
DISASTER RISK PROFILE

Uganda

Drought Flood Landslide Earthquake Volcano



Africa Disaster Risk Financing Initiative

Building Disaster Resilience in Sub-Saharan Africa

WORLD BANK GROUP

GFDRR
Global Facility for Disaster Reduction and Recovery

An initiative of the African, Caribbean and Pacific Group of States funded by the European Union

The International Bank for Reconstruction and Development
The World Bank Group
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Washington, D.C. 20433, USA
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INTRODUCTION

Overview

The Africa Disaster Risk Financing (ADRF) Initiative is one of five Result Areas of the European Union (EU) - Africa, Caribbean and Pacific (ACP) cooperation program *Building Disaster Resilience in Sub-Saharan Africa*, which is implemented by several partners, including the African Development Bank (AfDB), African Union Commission (AUC), the United Nations International Strategy for Disaster Reduction (UNISDR) and the World Bank (WB)-managed Global Facility for Disaster Reduction and Recovery (GFDRR). The Program's overall objective is to strengthen the resilience of Sub-Saharan African regions, countries and communities to the impacts of disasters, including the potential impact of climate change, to reduce poverty and promote sustainable development.

The ADRF Initiative, launched in 2015 and implemented by GFDRR and the World Bank, supports the development of risk financing strategies at regional, national and local levels to help African countries make informed decisions to improve post-disaster financial response capacity to mitigate the socio-economic, fiscal and financial impacts of disasters. One of the operational components to achieve this objective is to create an enabling data environment for risk financing. This aims to build the understanding and awareness of disaster and climate risks in Sub-Saharan Africa, providing a fundamental input to developing disaster risk financing strategy, approaches, and tools for financing risks. One of the activities is to develop national-level multiple-peril country risk profiles using globally available and readily accessible local datasets, in combination with scientifically proven methodologies. These are used to catalyze dialogue with government counterparts in the region on the primary disaster risks they face to formulate Disaster Risk Management strategies, such as financial protection and risk reduction investment programs. Furthermore, the risk profiles provide datasets that are a critical input for developing risk financing and insurance strategies.

National Risk Profiles

To create an enabling environment for dialogue on risk financing strategies and to further the understanding of disaster risk, national risk profiles have been developed for **eight countries** in the region. The risk profiles provide **visual information and data on the hazards, exposure, and risk for multiple hazards** in each country. The profiles provide an overview of which hazards, sectors and regions are most at risk of disasters, and contribute most to the national level of risk.

Specifically, the national risk profiles provide the estimated impact of disasters on population, building stock, transport networks, critical facilities, and agriculture at the national and sub-national levels. These profiles can guide initial strategic dialogue on financial protection and / or risk reduction investment opportunities to manage disaster risk, as well as help identify priorities for more detailed risk assessments if specific interventions are to be made.

Countries and Hazards

	Drought	Flood	Landslide	Earthquake	Volcano	Cyclone
Cabo Verde	✓	✓	✓	✓	✓	✓
Ethiopia	✓	✓	✓	✓	✓	
Kenya	✓	✓	✓	✓	✓	
Malawi	✓	✓	✓	✓		
Mali	✓	✓	✓			
Mozambique	✓	✓	✓	✓		✓
Niger	✓	✓	✓			
Uganda	✓	✓	✓	✓	✓	

METHODOLOGY AND LIMITATIONS

Use

These risk profiles provide a preliminary view of disaster risk at the national level, and distribution of risk across regions of the country and types of assets. They enable the identification and prioritization of risk drivers, to guide risk management activities and identify the need for further, more detailed risk assessment.

Due to limitations in the content and resolution of the publicly available global and national level exposure and hazard data used in their development, these profiles do not provide sufficient detail for taking final decisions on disaster management investments and policies, or for planning subnational and local scale mitigation projects, such as construction of flood defenses. Such decisions should be informed by a local, and possibly sector-specific disaster risk assessment, which estimates risk at a higher resolution with more locally-specific exposure, hazard, and vulnerability input data.

These risk profiles present a substantial part of the analysis results. However, it has not been possible to present all results in these documents. Full results for all asset types are available from GFDRR Innovation Lab.

Risk

Risk calculations require input data describing the hazard, assets ('exposure'), and vulnerability of those assets.

Disaster risk to structural and infrastructure assets is quantified here by estimating the cost to repair and/or replace assets damaged or destroyed in a disaster, i.e. due to ground shaking, flood depth or wind speed, over various time horizons. Assets analyzed are private and government-owned building stock, critical facilities (education and health), and transport networks (road, rail, and bridges).

Risk to population is quantified by assessing the number of people that are expected to be affected by the hazard.

For volcanoes, an indicative measure of volcano risk is given by estimating population and value of assets exposed to the volcanic hazards (no estimation of impact is made).

Losses additional to those incurred due to physical damage are not included in this analysis (e.g., business interruption due to disrupted infrastructure or supply chains).

The cost or number affected is estimated for most hazards at three time periods: a decade (this refers to the 1 in 10 year return period, or 10% chance of a loss being exceeded in any given year); a person's lifetime (1 in 50, or 2% in any year), or for an extreme event (1 in 250, or 0.4% in any year).

Hazard and Vulnerability Data

Drought hazard analysis comprises agricultural (soil moisture deficit) and hydrological (river flow) drought. Drought duration and deficit volume per year are determined by event-based modeling to estimate population affected by water scarcity. Monetary loss reflects the loss in yield and long term average price for each modelled per crop.

River flood risk (urban/surface flooding is excluded) is estimated at 1km resolution using global meteorological data, global hydrological and flood-routing models. Loss estimates are generated by simulating rainfall statistics for 10,000 years based on 40 years of previous rainfall data. Damage functions for four types of buildings, and for roads/railways, are used to estimate loss as a function of flood depth. Population are considered 'affected' if flooding of any depth occurs in the same 1km area. Agriculture loss is estimated by assuming that catastrophic flooding will result in a loss of the annual crop yield.

Earthquake hazard describes the distribution of ground shaking intensity (i.e., peak ground acceleration), based on the locations of known seismic faults and location/size of previous earthquakes. Losses are estimated using fragility and vulnerability models that translate ground shaking into the expected level of (a) damage to different types of structure, and (b) displacement of roads and rails. Based on damage to buildings, a casualty model has been used to estimate the risk of fatalities as well as the population affected by ground shaking. This study includes losses due to damage from earthquake ground shaking only. Secondary hazards (liquefaction and fire following an earthquake) are not accounted for. Landslide hazard is considered under the separate landslide section, where ground shaking is considered as a potential trigger of landslides.

Landslide susceptibility has been defined across each country using an assessment of factors that increase potential for landslides (including slope, vegetation and soil types) combined with landslide trigger events (rainfall and seismic shaking) to create landslide hazard maps. Long-term average annual cost to structures and transport networks has been estimated using vulnerability of different asset types to landslides, based on extensive literature review, empirical data, and expert judgement.

DISASTER RISK PROFILES

METHODOLOGY AND LIMITATIONS

Average annual population affected, and fatalities, are estimated.

Volcanic eruption scenarios at a small number of key volcanoes are used to estimate the population, and replacement cost of structures and infrastructure exposed to ashfall hazard (i.e. are located in an area that could receive ash in an eruption) and topographic analysis is used to determine the assets and population exposed to flow hazards. Full quantification of risk at all volcanoes is not possible due to limited information on potential frequency and eruption style at many volcanoes in Sub-Saharan Africa.

Cyclone and storm surge hazards are assessed using a record of historical cyclone tracks and wind field modelling, to determine maximum wind speeds on land and accompanying water levels along the coast. Vulnerability of structures to wind and surge is estimated based on previously observed damage sustained at different wind speeds and literature on flood depth impact of different types of structures.

Asset Database

Open and freely available national, regional, and global data sets are used to develop, for the first time, a database of population and multiple built asset types for risk analysis. This is used to inform this risk assessment, in a region where there is significant variability in the availability and content of inventories describing building stock and infrastructure.

Population density is described using WorldPop data. Building stock is described using six development types: rural, residential, high-density residential, informal, urban, and industrial, based on land use data and satellite imagery. In each cell of a 0.5 km resolution grid, the number of buildings and total floor area of each development type is given. The number of buildings is further disaggregated into different construction types to account for the impact different levels of structural vulnerability in the risk analysis.

Critical facilities include education and health facilities. Where possible, the assets have been analyzed using accurate geolocation given in an available building inventory. However, many assets had no geolocation given and were distributed using building density as a proxy for their location; the proportion of geolocated assets varies by country. Education facilities (classified as primary school, secondary school, or universities) and health facilities (hospital or clinics) have been assigned an estimated construction type based on interviews with structural engineers in each country and used to approximate construction cost per square meter.

Transportation data include roads, railways, and bridges, where present. Road surface type (paved, unpaved) is also included where available. Agriculture exposure is described by crop type and subnational distribution, average annual yield, and crop price for risk calculations.

Replacement costs for building stock and critical facilities are calculated using construction cost per square meter for each building or facility type, and cost per kilometer for roads based on road type and for railway lines, based on terrain. Estimates of replacement cost were developed through interviews with local engineering and construction professionals (numbers and sources varied in each country). These were validated and adjusted where necessary using several sources, including site surveys and international literature on construction. Replacement costs used are representative of typical building infrastructure and replacement costs for the entire country. Subnational variations in costs and building distributions (due to cost of materials and labor) will vary and are not accounted for.

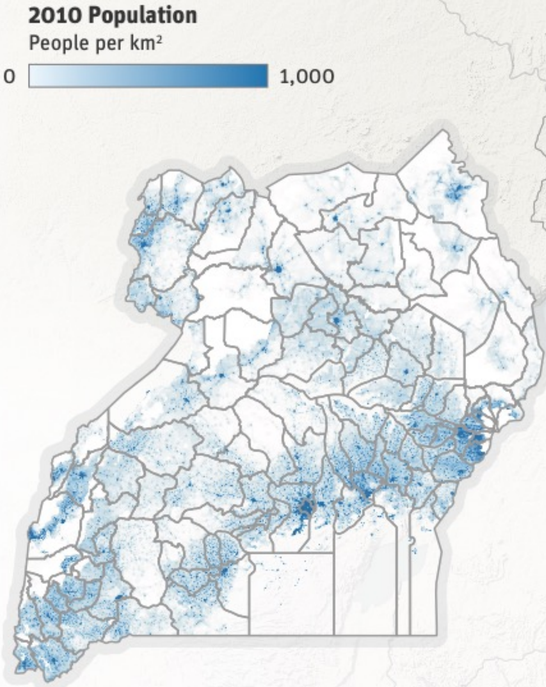
UGANDA

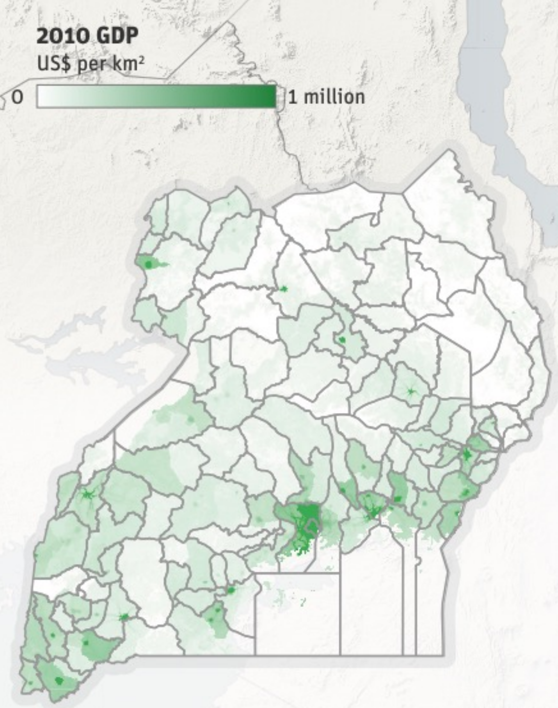
GDP $27 billion* | Population 40 million* | *2015 estimates

In 2015 Uganda had a population of 40 million, and a population growth of 3%. Approximately 84% of the population lives in rural areas[1]. The urban population is concentrated in the capital, Kampala, which has a population of nearly 2 million[2]. An estimated 20% of the population lives below the poverty line[3]. The country is one of the least developed countries in the world (Uganda's Human Development Index is 0.483[4]).

Agriculture is an important sector of the economy, employing one-third of the work force. Over 80% of the population depends on rain-fed agriculture. The industrial sector accounts for 22% of GDP and the service sector makes up 51% of GDP.

Although Uganda's agriculture is dominated by rain-fed agriculture, a large percentage of the population is considered to be food secure (89%). Nevertheless, the 2017 drought has shown Uganda's vulnerability to this hazard with more than 1 million people in urgent need of food aid.





Examples of multi-storey buildings in Kampala, Uganda.

Water scarcity and floods pose the most significant and recurring risks to Uganda. Water scarcity primarily affects areas near Lake Victoria and in the northeast.

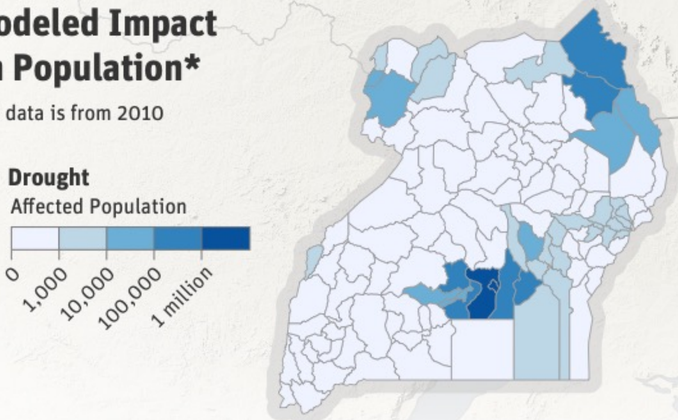
On average, around 10% of the population are expected to experience water scarcity in any given year. This number can be substantially higher in dry years.

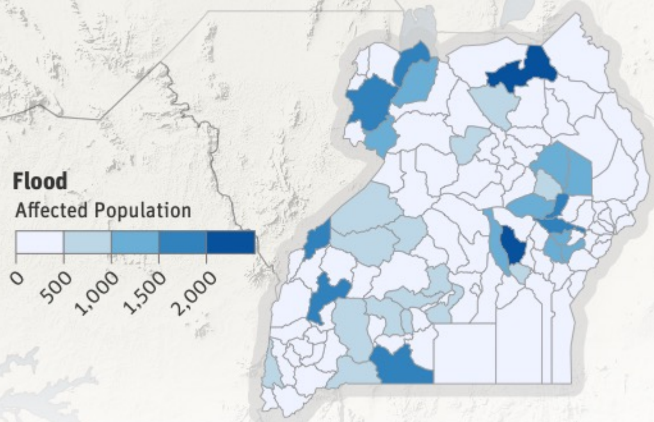
Flood risk is distributed and variable across Uganda but on average up to 45,000 people could be affected by floods each year. A much smaller number of people are at risk from earthquakes, landslides and volcanoes.

Future changes in Uganda's population and economy, coupled with changes in climate-related hazards, are expected to increase the impacts of droughts and floods.

Modeled Impact on Population*

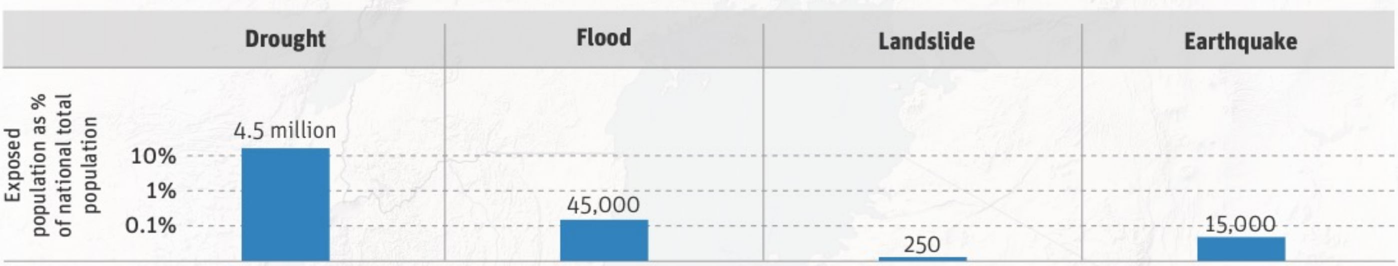
*All data is from 2010





Modeled Impact*

*All data is from 2010



Hazard Summary Table

HAZARD	IMPACT
Drought	Around 4.5 million people are affected by water scarcity each year on average, mainly in southeast and northeastern regions of Uganda. Agricultural drought risk is greatest through central Uganda (page 7).
Flood	On average, river flooding affects at least 45,000 people but relatively few (around 40) education and healthcare facilities are affected.
Landslide	Landslide is a very localized hazard, which is highest on the eastern and western borders of the country. Long-term average damage to buildings could exceed $850,000 annually, with over 250 people at risk annually.
Earthquake	Earthquake risk is concentrated along the western border, and it is estimated that around 150,000 people could experience at least light ground shaking at least once every 50 years.
Volcano	Southwest Uganda has several extensive volcanic fields, which could put hundreds of thousands of people at risk, should they erupt. A quarter of a million people are exposed to volcanic hazards at Bunyaruguru field alone.

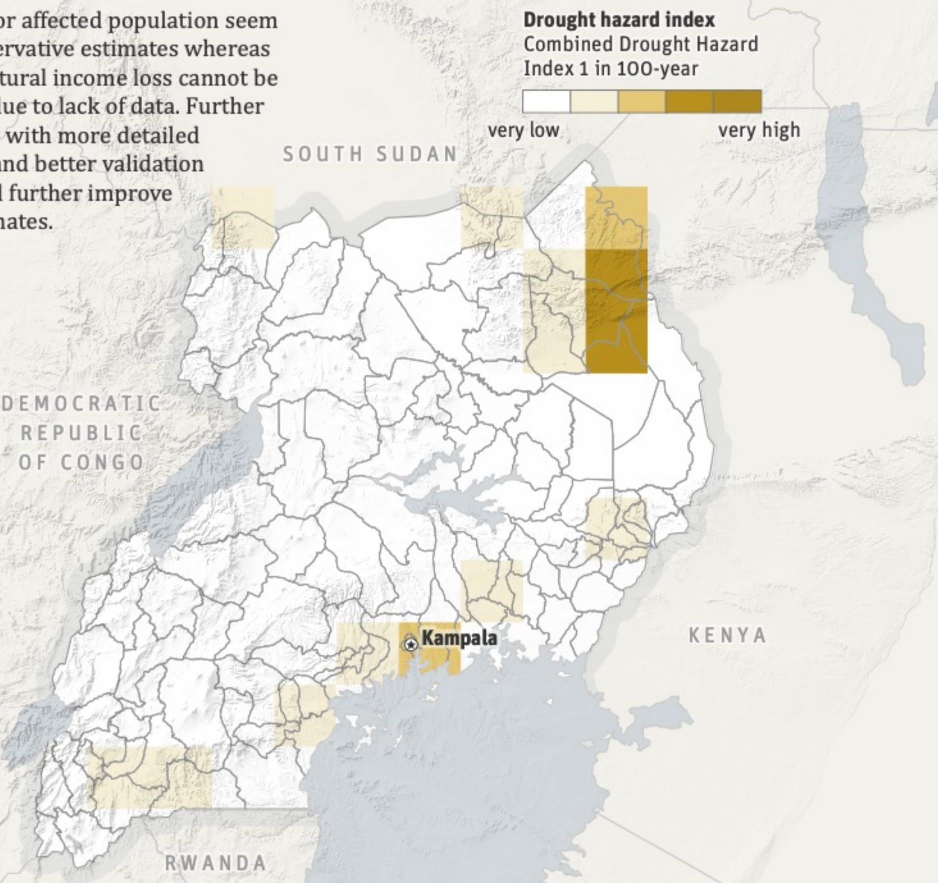
DROUGHT
UGANDA

Droughts are sustained periods of below-normal water availability. Droughts occur due to natural atmospheric variability (e.g. El Niño conditions), and desertification caused by land degradation. Increasing rainfall variability and extremes are increasing drought hazard in Africa. Although Uganda has not been as seriously affected by recent droughts as nearby countries in the Greater Horn of Africa, drought has had significant negative impacts on the country's economy and food security.

This risk profile assesses hydrological drought impacts on population and the effects of agricultural drought on crop income.

Hydrological drought is characterized by estimating the potential deficit of water availability in rivers and reservoirs. The arid and semiarid regions of Uganda in the northeast, and the high population concentration in and around Kampala are particularly susceptible to water scarcity (see main map). Agricultural drought is assessed by estimating the potential for lack of rainfall and its impact on rainfed agriculture.

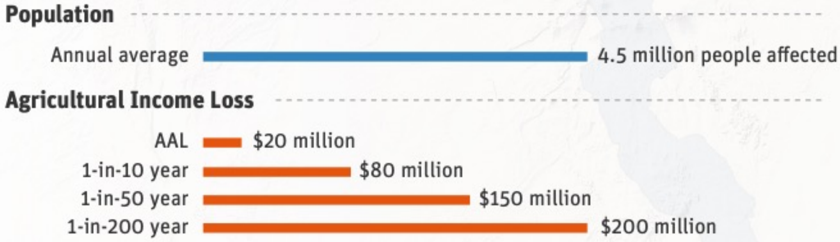
The bars below indicate the population located in areas affected by water scarcity, and the estimated losses to agricultural income due to drought-induced crop failure. These are modeled estimates and are inherently uncertain. Based on the limited historical numbers recorded from previous droughts, the modeled numbers for affected population seem to be conservative estimates whereas the agricultural income loss cannot be validated due to lack of data. Further fine tuning with more detailed modeling and better validation data would further improve these estimates.



Key Facts

- Droughts are a recurrent hazard in Uganda. Notable drought events occurred in 1967, 1979, 1987, 1998, 1999, 2002, 2005, 2008, 2010 and 2017.
- The 2017 drought left more than 1 million people in urgent need of food assistance in Uganda.

Modeled Impact



AAL = Average Annual Loss; 1-in-10 year return period equates to a 10% annual probability; 1-in-50 to 2% annual probability; and 1-in-200 to 0.4% annual probability.

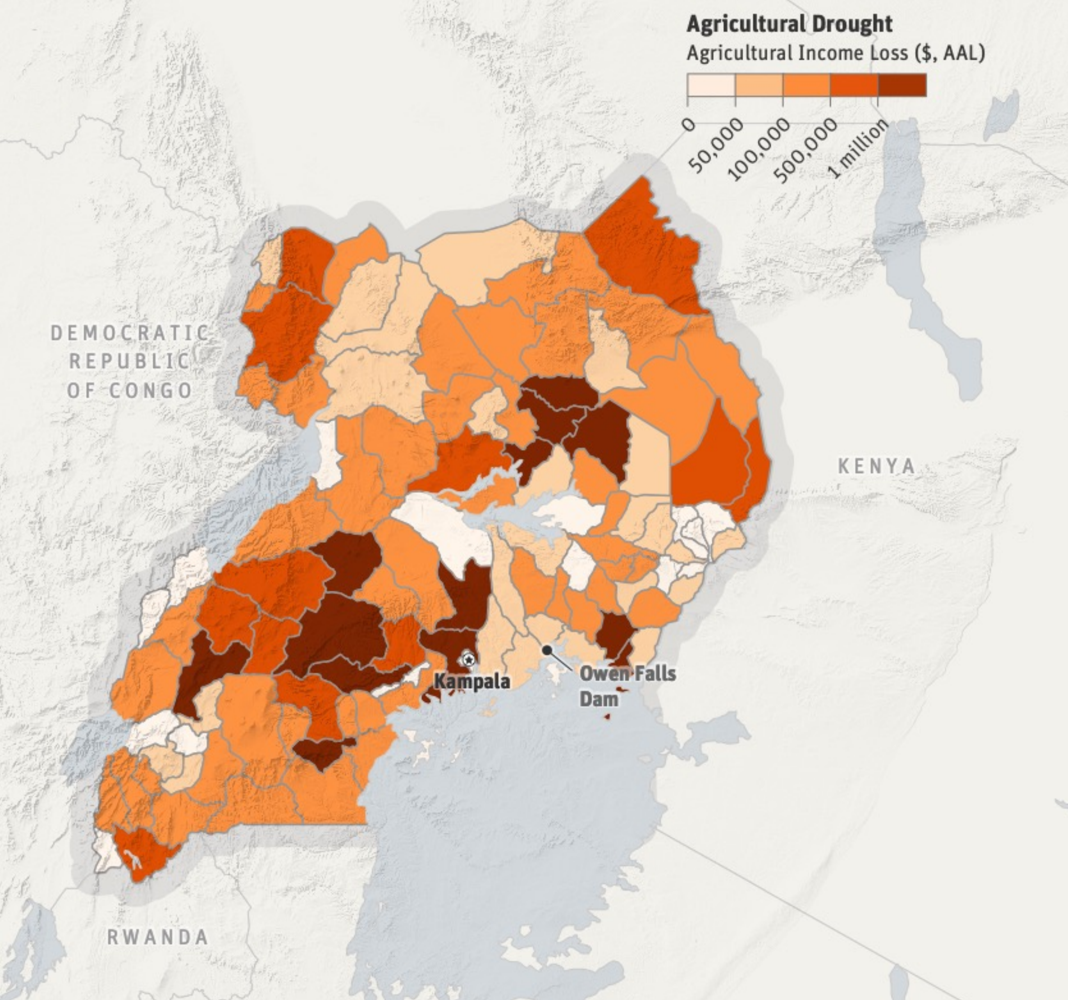
The distribution of drought risk is determined by the occurrence of drought hazard/events, the location where assets intersect with this hazard, and the vulnerability of those assets. For more detail, see the Methodology section.

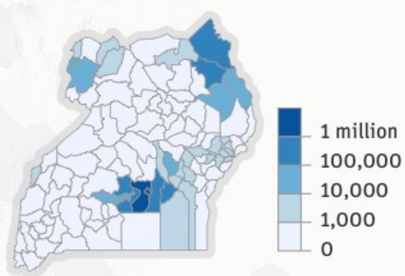
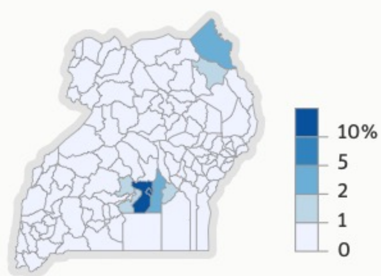
DROUGHT
UGANDA

Hydrological drought risk is greatest in the districts of Mubende, Wakiso, and Otuke. On average, each year water scarcity affects over 100,000 people in each of these provinces based on the modeling results.

It is noted that the modeled number of affected people appears to be a conservative estimate in view of historical records. This may be due to several factors: uncertainty and (conservative) assumptions in the modeling approach but also the omission of emergency measures taken during droughts which can mitigate the impact. Another potential factor is incomplete of historical drought impacts. Further analysis is necessary based on more detailed modeling and event data collection to refine these results.

On average, once every 10 years a loss of $80 million in agricultural income is expected to occur in Uganda. The main map shows the uneven distribution of expected crops losses. Districts with relatively high crop losses are Mubende, Luwero and Otuke. Due to limited data, the modeled crop losses cannot be validated against historical recordings and should therefore be interpreted with care.



	Asset Distribution	Average annual affected (water scarcity) Per district	Average Annual Loss Contribution to national average loss
Population Pop. exposed to water scarcity			

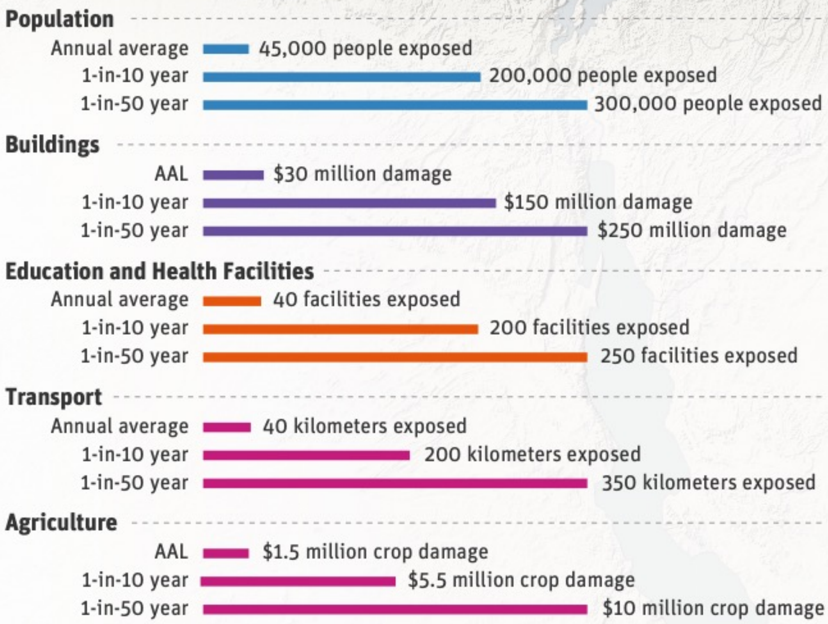
FLOOD
UGANDA

Flood hazard in Uganda is particularly concentrated in four areas: in the northwestern region along the White Nile; south along the Semliki River on the border with the Democratic Republic of Congo; in the Central region, east of Lake Kyoga and Lake Nakuwa; and in the region around the southern lakes in Rakai, Isingiro, and Kiruhura districts. The national scale of these profiles means the focus is on river flooding, and surface flooding (including urban flood) is not included in the risk estimates.

Here, the computed flood potential in the main map resembles the flood-prone areas described above. In Uganda, the greatest flood potential occurs during and following the most intense and sustained rainfalls in the March to May rainy season.

Uganda is rich of surface water with many large lakes and multiple rivers. The country lies almost completely in the River Nile basin. The River Nile flows from Lake Victoria in the south of Uganda at Jinja towards Lake Kyoga and then in western direction to Lake Albert. Further downstream, the river heads north towards the border with Sudan. The Semliki River flows from Lake Edward to Lake Albert. In the eastern part of Uganda, the Suam River is a separate drainage basin flowing into Kenya.

Modeled Impact



AAL = Average Annual Loss; 1-in-10 year return period equates to a 10% annual probability; and 1-in-50 to 2% annual probability.

Key Facts

- In 2007, devastating floods occurred in northern and northeastern Uganda. Hundreds of thousands of people were displaced. Nationally, half a million people were affected, 21 reported dead and 170 schools flooded.
- The DesInventar database of disaster impacts reports on over 1,000 flood events since 2011. In that time, flooding has caused at least 480 deaths, damaged 50,000 Hectares of crops, and indirectly affected over 4 million people. The number of people directly affected is not well known but, on average, at least 20,000 people have been relocated or evacuated each year since 2001.

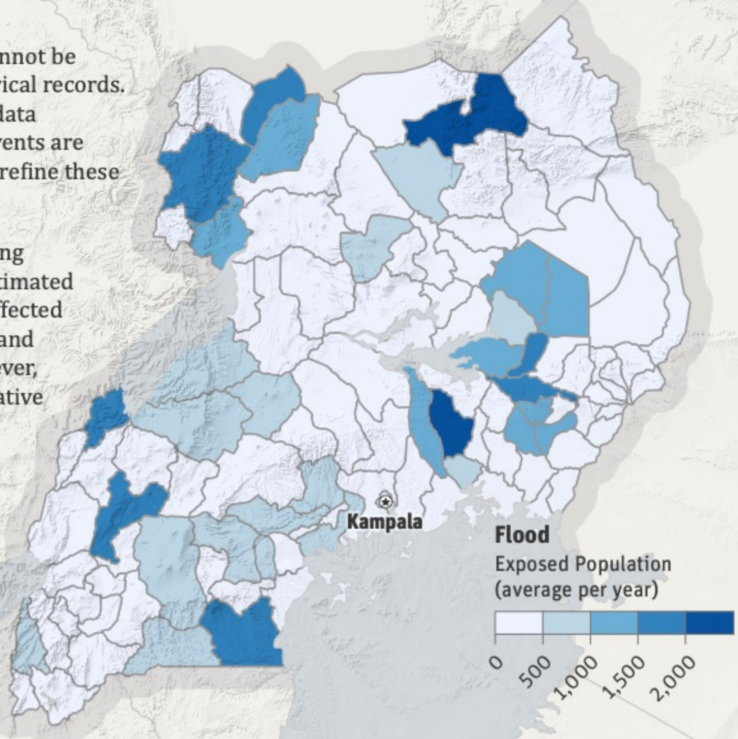
The distribution of flood risk is determined by the occurrence of flood events, the location where assets intersect with these hazards, and the vulnerability of those assets. For more detail, see the Methodology section.

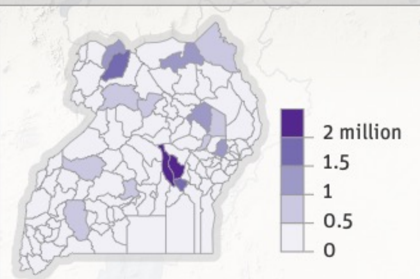
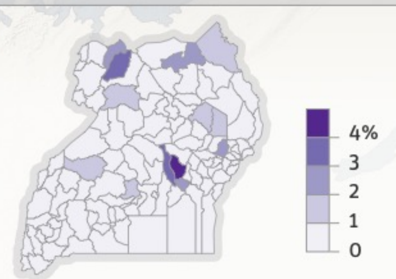
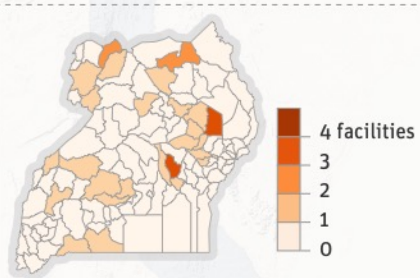
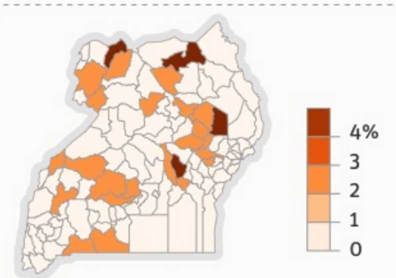
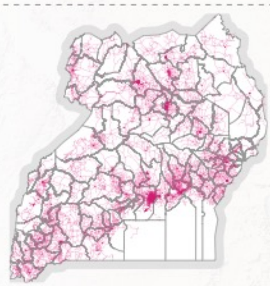
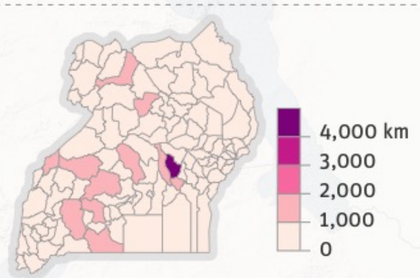
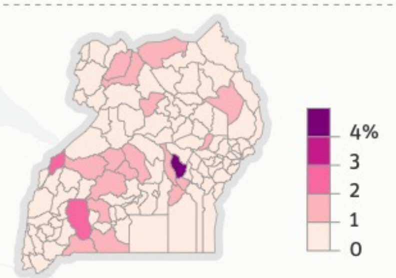
FLOOD
UGANDA

There is flood hazard in various parts of Uganda. Damage of over $10 million to crops and $250 million of damage to the building stock may occur in at least one flood in a person's lifetime. It is expected that on average each year, 50,000 people will be affected by flooding. In addition, each year flooding is expected to affect 40 education and health facilities and 40 kilometers of transport infrastructure will be exposed to floods. With climate change and increased population these numbers will very likely increase in the coming decades.

Validating the modeled flood risk estimates for Uganda is challenging due to lack of data. The order of magnitude of the estimated number of (directly) affected people appears to be in line with historical records. The estimates for damage to building and agriculture crop cannot be validated against historical records. Further modeling and data collection after flood events are needed to validate and refine these numbers.

The districts contributing most to the national estimated building damage and affected population are Kamuli and Kayunga. Kitgum, however, has the highest risk relative to the population and value of building stock within the region.



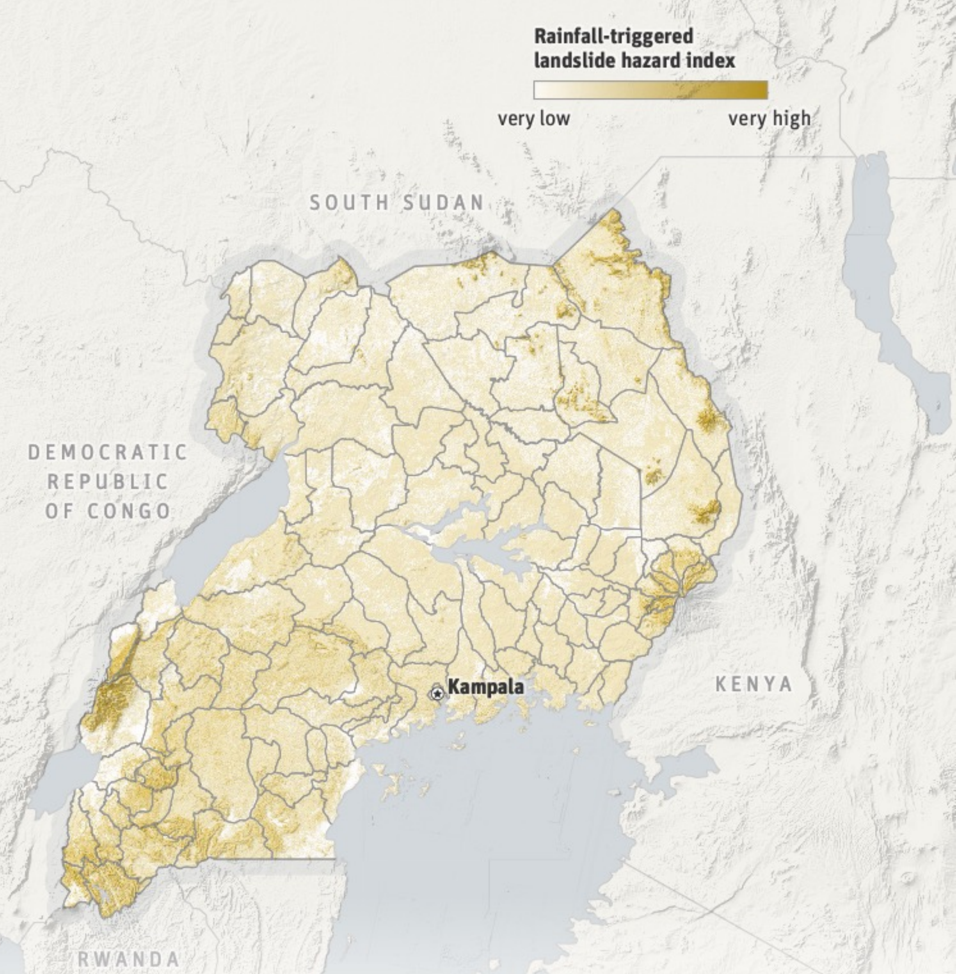
	Asset Distribution	Average Annual Loss Per District	Average Annual Loss per District Relative to national total
Buildings $ Damage			
Education and Health Facilities Facilities exposed			
Transport Km exposed			

LANDSLIDE
UGANDA

The highest landslide hazard in Uganda exists in the Rwenzori Mountains of the southwest, and along the eastern border with Kenya, around Mount Elgon and in various areas of the northeastern border. These areas coincide with some of the highest population density in Uganda except for the capital city Kampala.

The highlands are susceptible to various types and sizes of landslide due to their variable topography and geology. Prolonged low intensity rainfall is the primary trigger of landslides here. Deforestation and cultivation of slopes is recognized as a destabilizing factor, resulting in higher landslide susceptibility.

Damage due to landslide has been estimated across the whole country using a novel method that enables estimation of annual average risk using landslide susceptibility factors combined with earthquake and rainfall triggers, and the potential impact of different size landslides on the population, buildings, and transport networks.



Modeled Impact

Population
Annual average — 250 people affected

Buildings
AAL — $850,000 damage

Education
AAL — $150,000 damage

Health
AAL — $85,000 damage

Transport
AAL — $100,000 damage

Key Facts

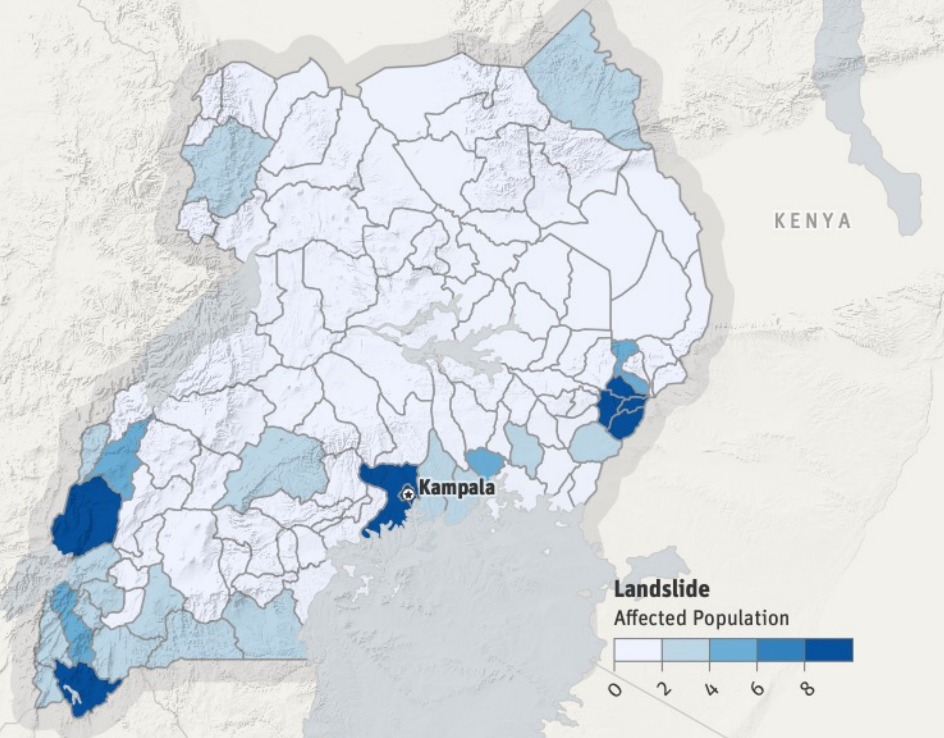
- A devastating landslide on the slopes of Mount Elgon in 2010 demonstrates the scale of landslide hazard in these mountainous areas: that single event killed over 350 people in Uganda, and prompted calls for relocation of up to 500,000 people.
- According to the Desinventar database of disaster impacts, there have been over 1,500 fatalities in Uganda due to landslides, since the year 2000.

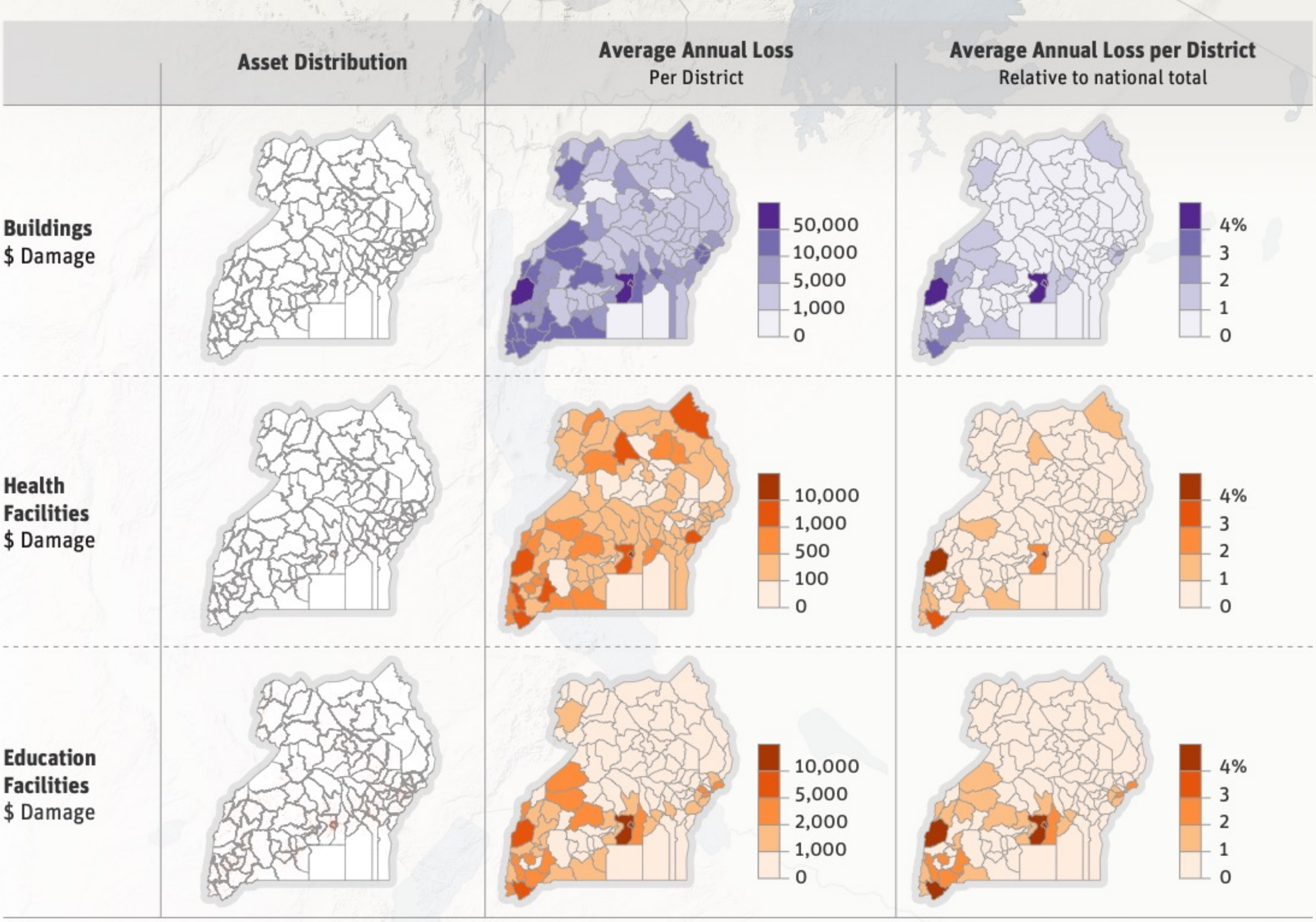
i Landslide risk is a function of population and assets being located in areas susceptible to landslides (based on slope angle, vegetation cover and soil type), and the potential for earthquakes and rainfall to trigger landslides there. For more detail, see the Methodology section.

On average, each year 250 people are at risk of being affected by landslides, with a long term average of 20 fatalities per year nationally. The annual average damage to building stock is expected to be around $850,000. This analysis also suggests the combined cost of damage to education, and health facilities could be over $200,000 per year on average.

The districts at most risk in terms of affected population are those in the Rwenzori and Mount Elgon areas. Kampala has the highest annual affected population and second-highest annual building damage (behind Kasese), owing to its high population density.

The distribution of risk relative to the number of buildings, education and health facilities in each district is shown in the maps (right-most column), below.

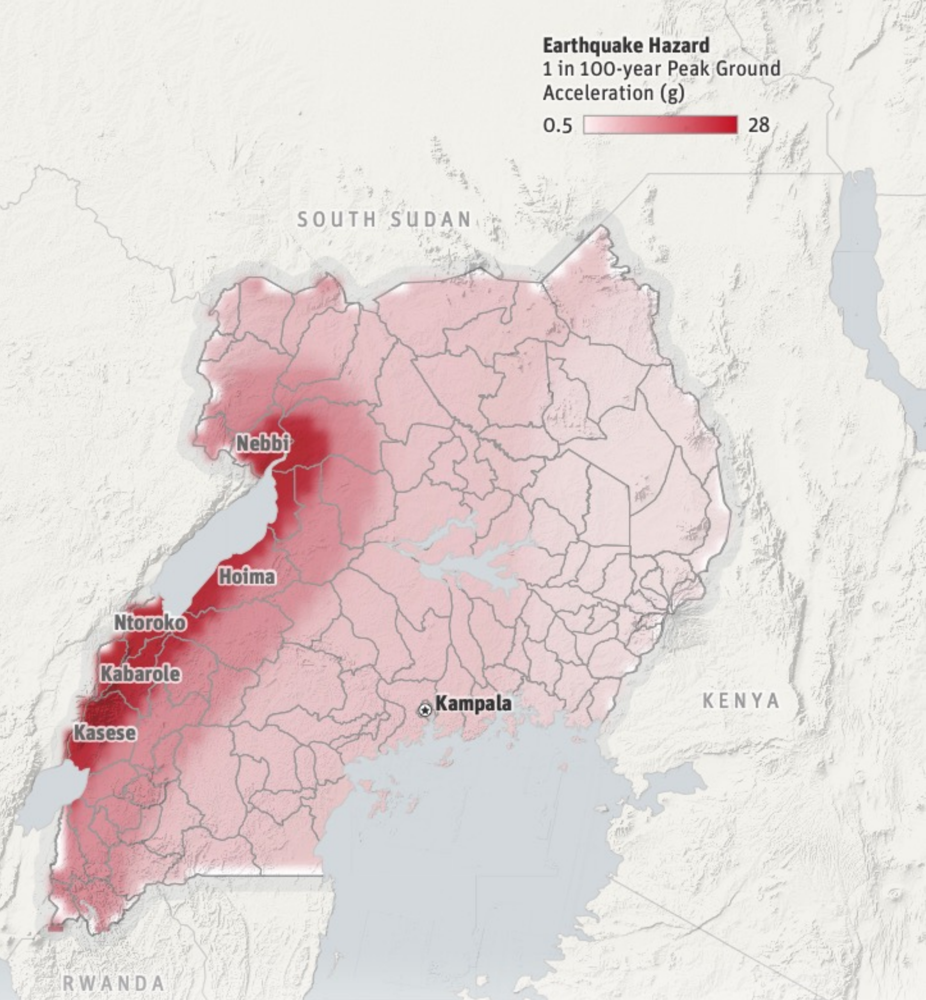




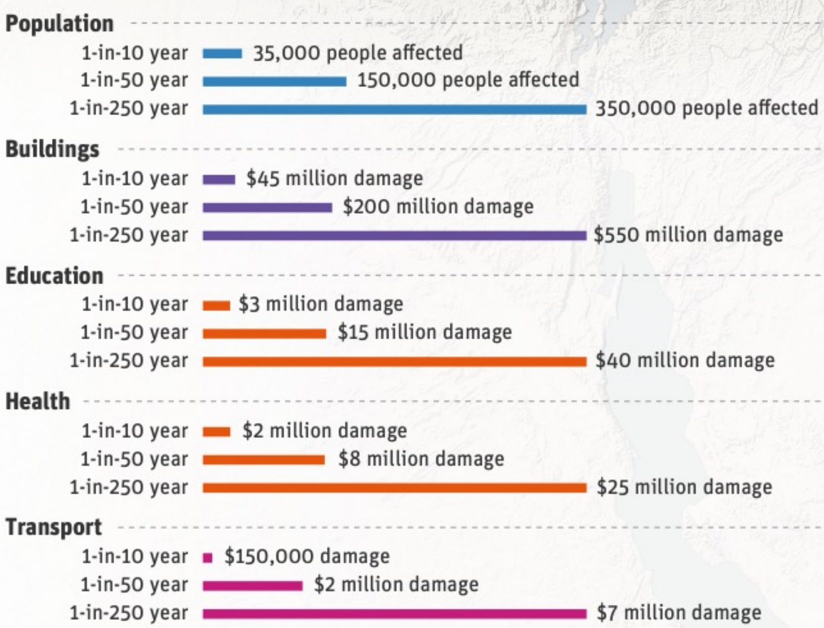
EARTHQUAKE
UGANDA

Earthquakes pose the threat of building damage and collapse, particularly where seismic-resistant design of buildings is not generally applied, as in Uganda. They can also cause damage and disruption to transport networks and essential services due to ground motion displacing roads, rails, bridges and other essential services. Earthquakes can cause sufficient ground shaking to trigger rockfalls and landslides in areas susceptible to such hazards (i.e. steep terrain).

Western Uganda is a seismically active region. The Ethiopian Rift Valley runs through the western region of the country and occasionally produces devastating earthquakes, the most recent in 1994. Since 1900, there have been five severe earthquakes in the southwest. Seismic hazard decreases significantly in the central and eastern parts of Uganda.



Modeled Impact



AAL = Average Annual Loss; 1-in-10 year return period equates to a 10% annual probability; 1-in-50 to 2% annual probability; and 1-in-250 to 0.4% annual probability.

Key Facts

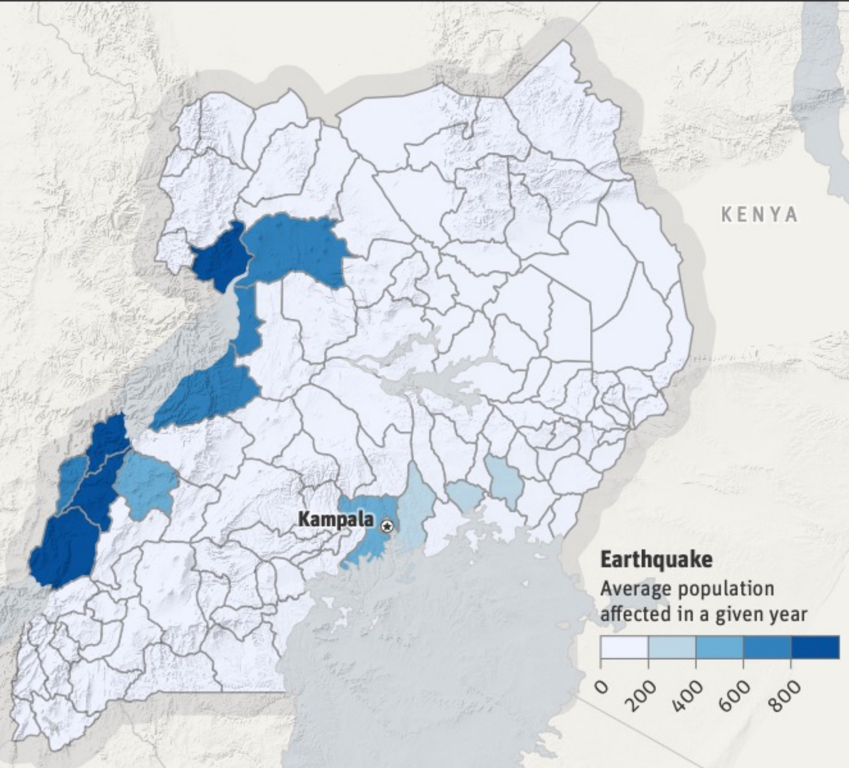
- Most known earthquakes in Uganda have been shallow (<25km deep). These can cause significant damage even with moderate magnitudes of 5-6, especially if they occur beneath or close to major urban areas.
- The 1966 Toro Mw6.8 earthquake occurred on the western border with the Democratic Republic of Congo, causing 100 deaths and 500 injuries in Uganda, leaving 5800 houses damaged.
- A magnitude 6.2 earthquake in 1994 near Fort Portal, Kabarole district, caused $70 million in damages to buildings and eight deaths.

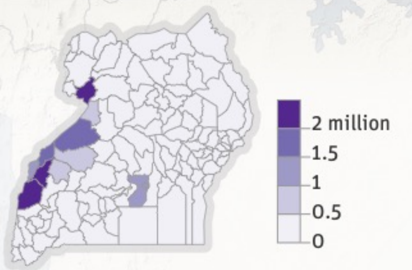
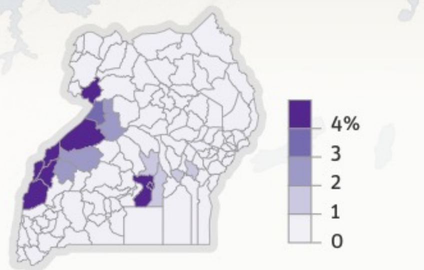
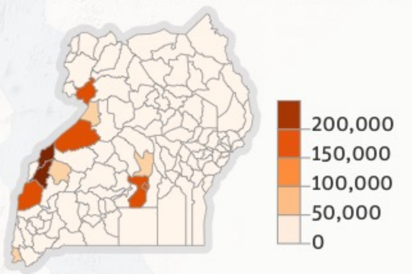
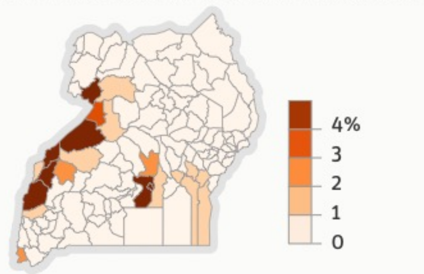
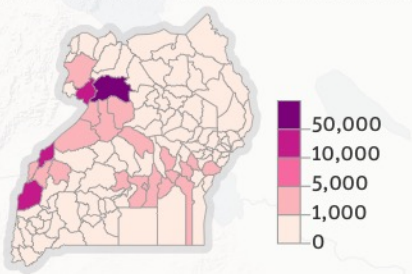
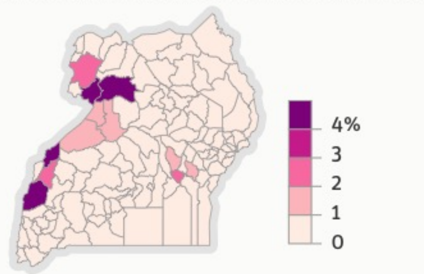
i The distribution of earthquake risk is determined by modeled earthquake hazard events, the location where assets intersect with these hazards, and the vulnerability of those assets. For more detail, see the Methodology section.

EARTHQUAKE
UGANDA

In Uganda an earthquake that could cause strong ground shaking for 150,000 people, would be expected to occur on average about once in a person's lifetime (see bars, opposite). In such an event, there would likely be light to moderate building damage, and the corresponding cost of damage nationally is estimated to be approximately $200 million, with the potential for an additional $25 million of damage to education and health facilities.

Ntokoro, Kasese, Kabarole, and Nebbi districts contribute most to the risk in terms of average annual population affected. Wakiso, Kampala, and Bundibugyo are the other districts contributing most to annual average building damage costs, with over $1 million of damage anticipated per year as a long term average. Kampala's relatively high absolute damage cost is due to the concentration of exposure in the capital, which is situated in an area of low to moderate seismic hazard.



	Asset Distribution	Average Annual Loss Per District	Average Annual Loss per District Relative to national total
Buildings **$ Damage**			
Education and Health Facilities **$ Damage**			
Transport **$ Damage**			

VOLCANO
UGANDA

Volcanic fields are extensive areas containing tens to hundreds of volcanic vents at which eruptions could occur. Five such fields exist in the southwest of Uganda, in the western branch of the East African Rift. Each field covers an area of hundreds of square kilometers. Four fields primarily comprise deposits of explosive eruptions, while the Bufumbira volcanic field comprises mainly lava flows. There are several active volcanoes across the southern border with Rwanda and the Democratic Republic of Congo which could pose a hazard in Uganda during eruptions. There are also numerous extinct volcanoes in this area, indicating the long history of volcanism in the area.

This analysis has shown the potential maximum extent of pyroclastic flows (of superheated gas and volcanic debris) and lahars (volcanic mud flow) in the Bunyaruguru volcanic field. Bunyaruguru volcanic field is perhaps the most-studied field in Uganda, though still very little is known about its eruption history. Additional volcanic hazards not included in this analysis are: ashfall, lava flow, impact of ballistics (e.g. large boulders thrown by explosive eruptions) close to a vent, ground fissuring, or volcanic gases (which affect people, livestock and crops).

Modeled Exposure

Key Facts

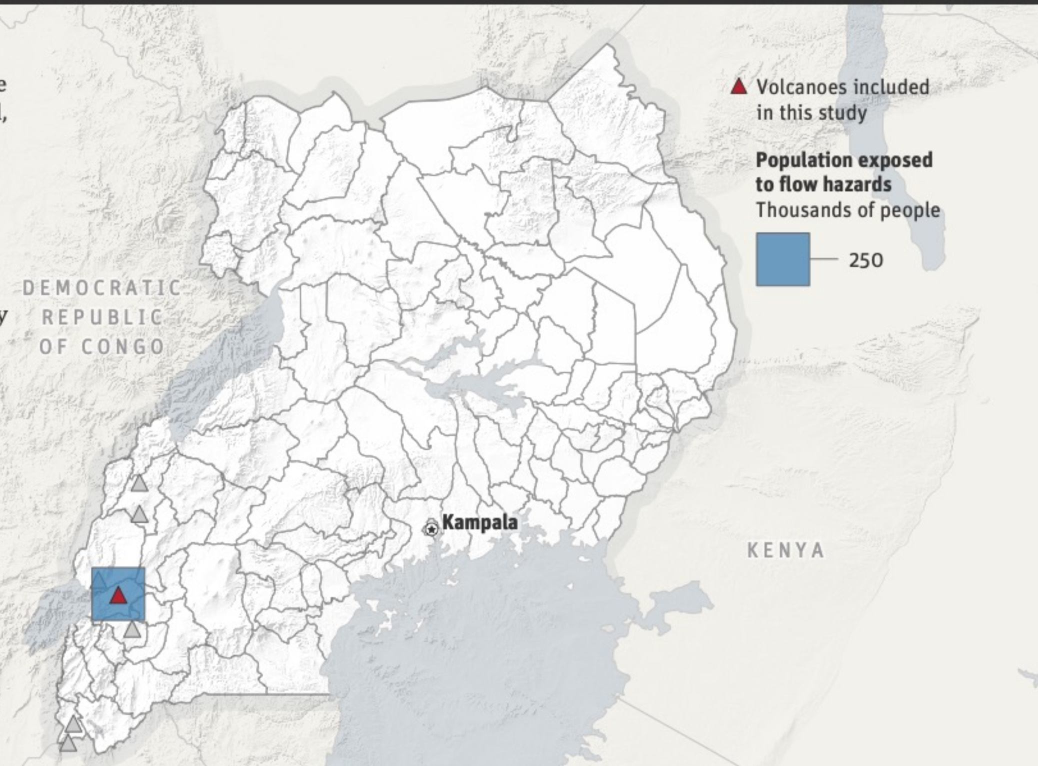
- Due to the many possible eruption sites in a volcanic field, analysis of ashfall hazard is not feasible; the focus here is on topographic analysis to define areas that could be affected by highly destructive pyroclastic flows and lahars.
- Deposits at Bunyaruguru volcanic field indicate the potential for explosive volcanic activity here, and although the main deposits of upto 100m thick are thought to be 50,000 years old, local oral histories suggest much more recent activity here.

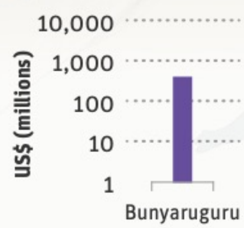
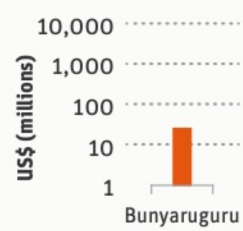
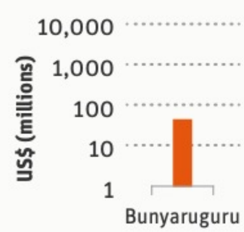
The distribution of volcano exposure is determined by analyzing the intersection of volcanic hazard with location of assets. For more detail, see the Methodology section.

UGANDA

Exposure to volcanic flow hazards at the Bunyaruguru volcanic field is assessed, as an indicator of volcanic hazard in the southwest of Uganda, but is by no means a full risk assessment. Due to a lack of information on frequency and severity of potential eruptions in Uganda, and limited understanding of vulnerability to volcanic hazards, it is not possible to reliably estimate the likelihood and magnitude of losses nationally.

Over 250,000 people are exposed to flow hazards across the Bunyaruguru field. Around 44,000 buildings are exposed, with a potential total replacement cost of $400 million, $75 million of which is education and health facilities.



	Asset Distribution	Flow Hazard Exposure (Millions US$)
Buildings $ Exposed Value		
Health Facilities $ Exposed Value		
Education Facilities $ Exposed Value		

DISASTER RISK PROFILES

GLOSSARY AND NOTES

Glossary

Average annual loss

Average annual loss (AAL) is the estimated impact (in monetary terms or number of people) that a specific hazard is likely to cause, on average, in any given year. It is calculated based on losses (including zero losses) produced by all hazard occurrences over many years.

Exposure

Exposure refers to the location, characteristics, and value of assets such as people, buildings, critical facilities, and transport networks located in an area that may be subject to a hazard event.

Hazard

Hazard refers to the damaging forces produced by a peril, such as ground shaking induced by an earthquake or water inundation associated with flooding.

Risk

Disaster risk is a function of hazard, exposure, and vulnerability. It is quantified in probabilistic terms (e.g., Average Damage Per Year, and return period losses) using the impacts of all events produced by a model.

Vulnerability

Vulnerability is the susceptibility of assets to the forces of a hazard event. For example, the seismic vulnerability of a building depends on a variety of factors, including its structural material, quality of construction, and height.

Notes

[1] Central Intelligence Agency, The World Factbook, 2015, https://www.cia.gov/library/publications/the-worldfactbook/.

[2] Ibid.

[3] Ibid.

[4] United Nations Development Programme, Human Development Report 2015: *Work for Human Development* (New York: United Nations Development Programme, 2015), http://hdr.undp.org/en/data.

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