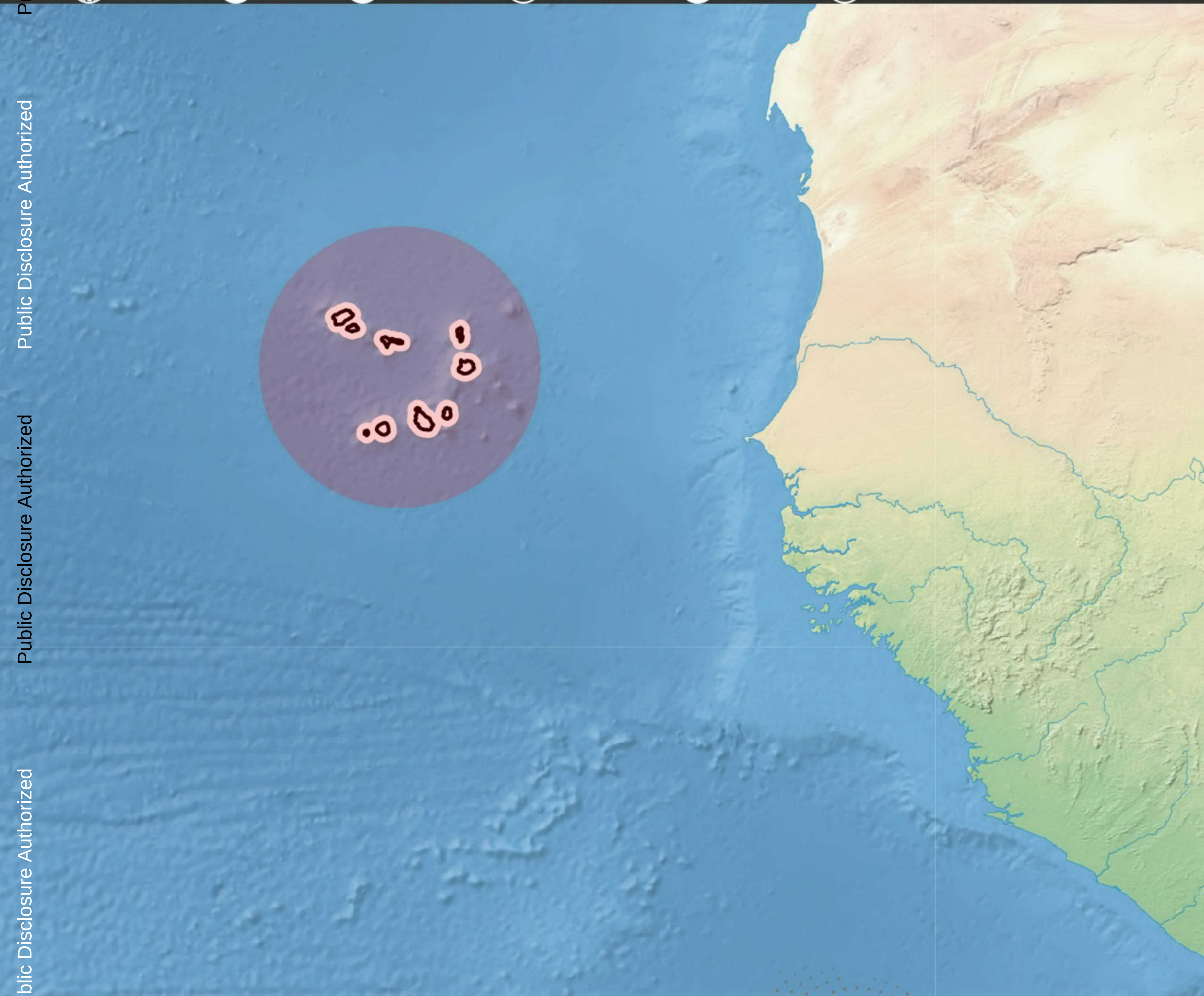
DISASTER RISK PROFILE

Cabo Verde

Drought Flood Landslide Earthquake Volcano Cyclone



Africa Disaster Risk Financing Initiative

Building Disaster Resilience in Sub-Saharan Africa

WORLD BANK GROUP

GFDRR
Global Facility for Disaster Reduction and Recovery

acp
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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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	✓	✓	✓	✓	✓	

- **Uganda** 1966 Toro earthquake: Mw6.8, 10 deaths, 500 injuries, over 5800 house damaged
- **Niger, Mali** 1968-1972 drought: 100k deaths, >100k dependent on food aid
- **Ethiopia** 1983-1985 drought: Hundreds of thousands killed, millions affected by famine
- **Mozambique** 1998 Mt Tumbine landslide: 200 deaths, 4k displaced. Roads, bridges and water supply destroyed
- **Mozambique** 2000 floods & Cyclone Eline: 700 deaths, >460k displaced, $500million damage
- **Ethiopia, Kenya** 2006 floods: >640 deaths, 200k affected in Ethiopia; In Kenya 2000 people displaced, 600 livestock killed.
- **Ethiopia, Kenya** 2006 drought: $190 million aid for 2.5 million people; 11 million affected across Horn of Africa
- **Mozambique** 2007 floods & Cyclone Favio: affected 500k people, $71mn damage, 277k ha crops destroyed
- **Uganda** 2010 Mt Elgon landslide: 350 deaths and 500k relocated
- **Ethiopia, Kenya** 2011-2012 drought: 13 million affected, tens of thousands of deaths. $1.4billion in aid required
- **Malawi** 2015 flooding: >1 million affected, $335 million damage; >250 fatalities

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.

RISK SUMMARY

CABO VERDE

GDP $1.6 billion* Population 500,000* *2015 estimates

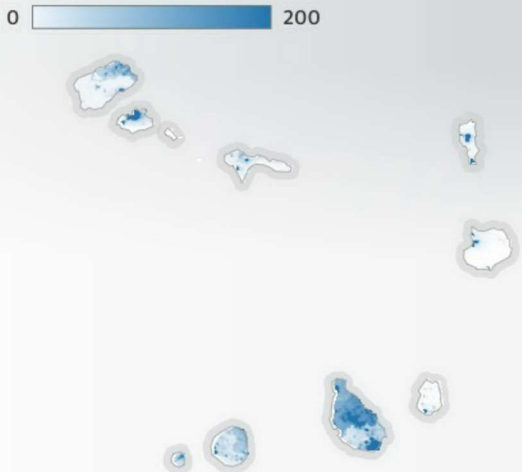
The population of Cabo Verde was just over 0.5 million in 2015 and is currently growing at a rate of about 1% each year. Most of the population on this volcanic archipelago is concentrated in the capital Praia (approximately 130,000 inhabitants)[1]. About 65% of the population is living in urban areas[1]. The country falls within the medium human development category (Cabo Verde's Human Development Index is 0.648[2]). About 16% of the population lives below the poverty line[1].

Cabo Verde's agricultural sector is relatively small and accounts for 8% of GDP[1]. The industrial sector, largely based on processing agricultural products, accounts for a further 18% of GDP, with the service sector contributing the remaining 74%[1].

Only a small portion of the archipelago is suitable for crop production (about 10%) which is mainly used for domestic production. Harvests have been severely affected by droughts in the past (e.g. 1977, 2018). Also, Hurricane Fred in 2015 had a major impact and destroyed different crops at the island.

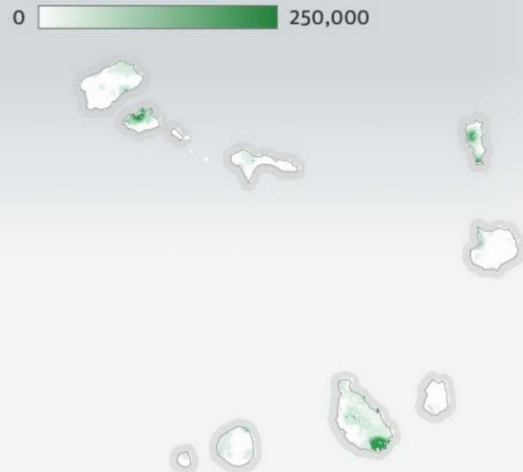
2010 Population

People per km^2



2010 GDP

US$ per km^2



Mindelo city, situated between the coast and steep volcanic terrain on Sao Vicente Island in Cabo Verde.

All $ amounts are in USD

CABO VERDE

Drought Flood Landslide Earthquake Volcano Cyclone

Floods pose the most significant and recurring risk to Cabo Verde.

Flash flooding poses a threat with over 150,000 people exposed to flash flood hazard. A much smaller number of people are at risk from **earthquakes, landslides and volcanoes**.

Droughts can cause substantial losses to agricultural production, which can impact livelihoods by reducing work opportunities and increased food prices.

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

Population Exposed to Flash Flood*

*All data is from 2010

Hazard Summary Table

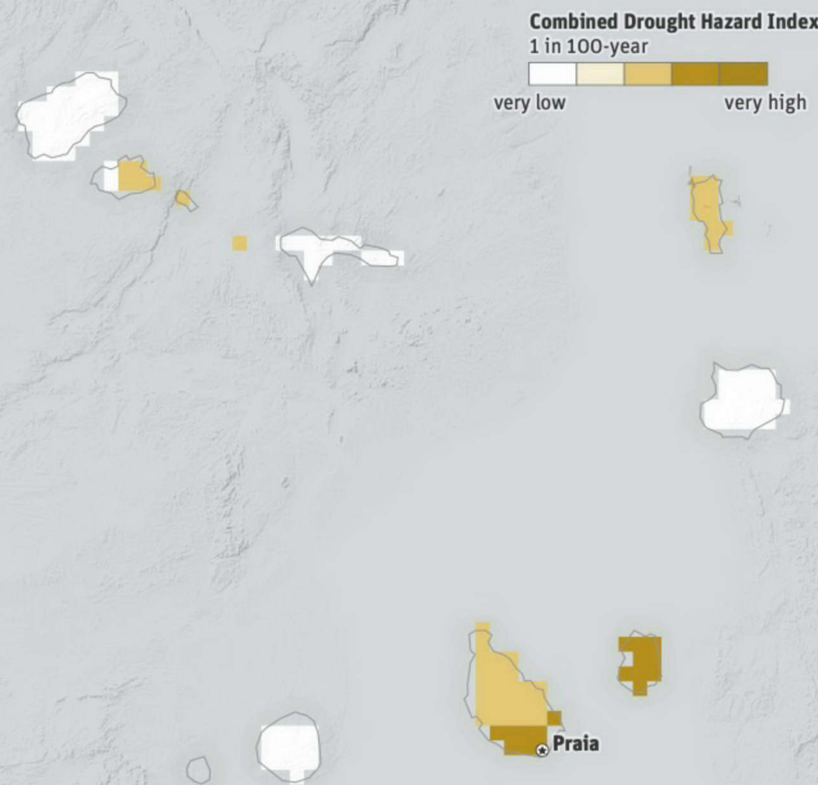
HAZARD	IMPACT
	On average, around $2 million of income is expected to be lost due to crop failure result from agricultural drought.
	Around 150,000 people are exposed to flash flood hazard in Cabo Verde.
	Landslide is a very localized hazard, but on average could cause damage of at least $200,000 per year, though a single large landslide could cause much greater damage.
	Damaging earthquakes are infrequent, but it is estimated that around 1,500 people could experience at least light ground shaking at least once every 50 years.
	Cabo Verde has active volcanoes; almost the entire populations of Fogo, Santo Antao and Bravo are potentially exposed to volcanic ashfall (70,000 in total).
	Tropical cyclone hazard is relatively low at the archipelago but can cause damage, as observed during Hurricane Fred (2015).

DROUGHT
CABO VERDE

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 hazards in general. Droughts in Cabo Verde are a well-known hazard. The archipelago has experienced ten periods of droughts in the past century according to historical records.

This risk profile assesses the effects of agricultural drought on crop income. Agricultural drought hazard is characterized by estimating precipitation and evapotranspiration from locally observed rainfall and temperature record, combined with climate model data. Agricultural drought is assessed by estimating the potential for lack of rainfall and its impact on rainfed agriculture. Agricultural income loss refers to the value of crops lost due to drought. Due to the size of the islands in Cabo Verde, it was not possible to use the global hydrological model to estimate impact of drought on the population affected by water scarcity.

The greatest rainfall deficits occur on the islands of Santiago and Maioof the archipelago(see main map). The bars below indicate the amount of agricultural income lost due to drought impacts on a range of crops, based on the average income from those crops.

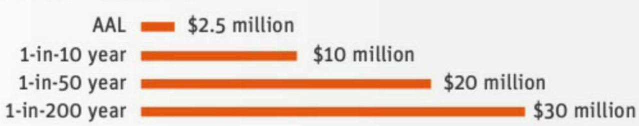


Key Facts

- The EM-dat database reports 10 droughts in the past century. Historically, droughts have had a large impact at Cabo Verde resulting in major famines and emigration. Although droughts have occurred in recent times, famines have not occurred due to own food import and food aid.

Modeled Impact

Agricultural Income Loss



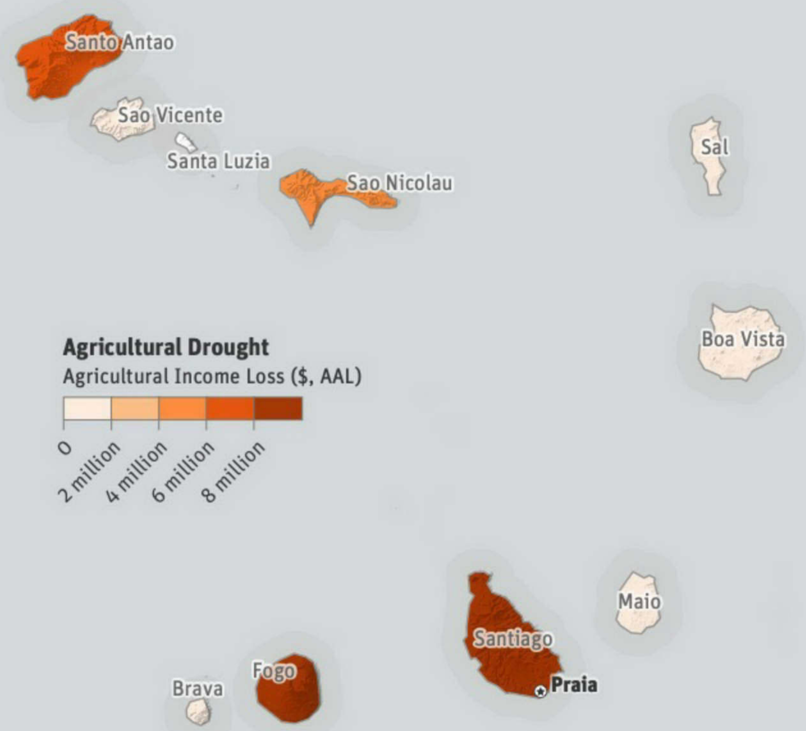
AAL = Average Annual Loss; 1-in-10 year return period equates to a 10% annual probability; 1-in-50 to 2% annual probability; and 1-in-200 to 0.4% annual probability.

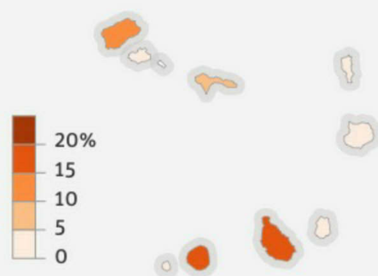
i The distribution of drought risk is determined by the occurrence of drought hazard/events, the location where assets intersect with this hazard, and the vulnerability of those assets. For more detail, see the Methodology section.

DROUGHT
CABO VERDE

On average, once every 10 years a loss of at least $10 million in agricultural income is expected to occur in Cabo Verde. A long-term average of $2.5 million of crop losses per year are expected in Cabo Verde under existing climate conditions and based on long-term average crop prices. There is significant uncertainty in the results of this analysis about how drought affects agriculture that uses fog-capture techniques, which are practiced in Cabo Verde but not included in this analysis.

The islands most affected by drought, in terms of impact on agriculture, are Santiago and Fogo in the south of the archipelago, and Santa Antão and São Nicolau in the northwest.



	Asset Distribution	Average Annual Loss Per region	Average Annual Loss Contribution to national average loss
Agricultural Income			

FLOOD
CABO VERDE

Cabo Verde is a volcanic archipelago consisting of 10 islands. The four most vulnerable islands to flash floods are São Vicente, São Nicolau, Santiago and Fogo. The central parts of these islands have elevations reaching around 1000 meters above Mean Sea Level.

The volcanic mountain range at each island is surrounded by small-scale catchments with rivers. These drain towards the Atlantic ocean. Because of the small size of these catchments, the low-lying areas of the islands are mainly susceptible to flash floods, i.e. very quick onset floods during local rainfall events. As flash flood (not river flooding) is the main hazard, this risk analysis presents the local flash flood potential according to local terrain and geological conditions. The greatest flood potential occurs during the months with the highest rainfall: August to October.

Modeled Impact

Population

Annual average — 40,000 people exposed

Buildings

Annual average — $550 million exposed

Education and Healh Facilities

Annual average — 150 facilities exposed

Transport

Annual average — 350 kilometers exposed

Key Facts

- The high rainfall intensity of 8th September 2015 led to considerable damage on the Santiago Island. The inundation caused road damages and landslides, and destroyed farms and households.

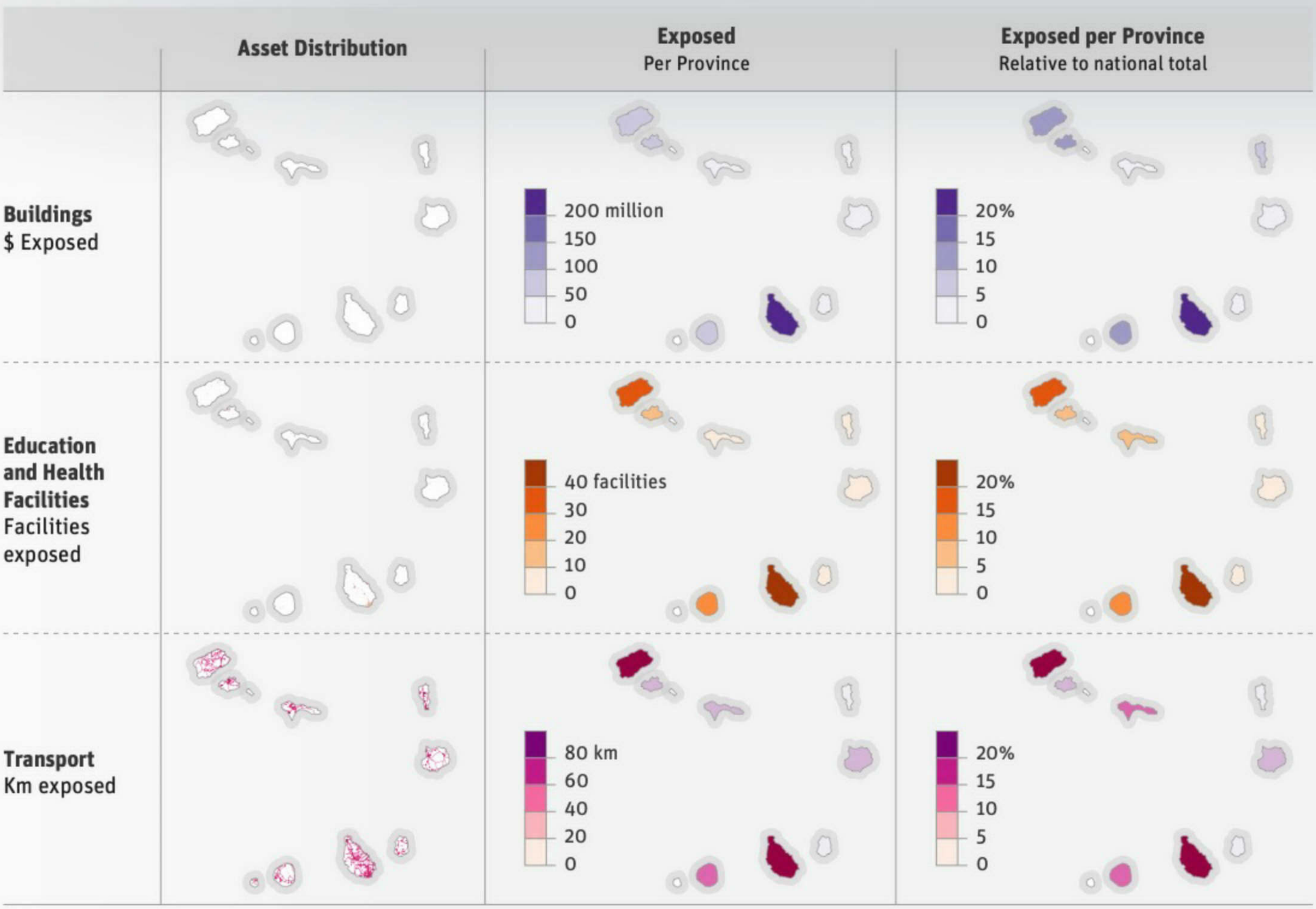
The distribution of flood risk is determined by the occurrence of flood events, the location where assets intersect with these hazards, and the vulnerability of those assets. For more detail, see the Methodology section.

FLOOD

CABO VERDE

Approximately $540 million of building stock and 43,000 people are exposed to high or very high flash flood hazard on Cabo Verde. Flash flood also has the potential to affect many education and health facilities.

The islands with greatest overall exposure to flash flood hazard are Santiago and São Vicente. Fogo, however, has the highest exposure relative to the total population and value of building stock on the island.



LANDSLIDE

CABO VERDE

Landslide hazard is widespread in Cabo Verde due to the volcanic terrain and geology of each island. Intense rainfall has the potential to trigger small debris flows or remobilize debris from landslides triggered by earthquakes. Large-scale volcanic eruptions can involve flank collapse of a volcano, which is a form of catastrophic landslide. There is evidence of such events occurring in the distant past around all of the larger islands of Cabo Verde. The most likely location for such an event in the future is the east coast of Fogo, where a flank collapse could also cause a tsunami.

Much of Santo Antão, Santiago, Fogo, Brava, São Nicolau, and São Vicente have high or very high susceptibility to landslides. When rainfall is considered as a triggering factor, landslide hazard remains high to very high across most of Santo Antão and significant areas of Brava, São Nicolau and São Vicente. Santiago and Fogo have generally moderate landslide hazard, except for high hazard on the upper slopes of Fogo volcano.

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 — 10 people affected

Buildings

AAL — $150,000 damage

Education

AAL — $9,500 damage

Health

AAL — $6,000 damage

Transport

AAL — $60,000 damage

Key Facts

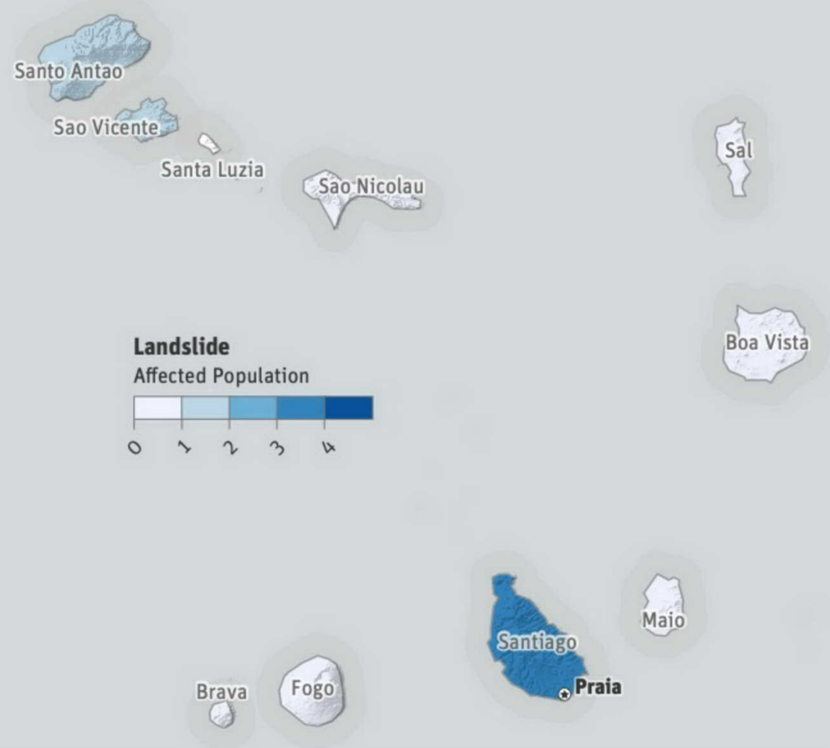
- There are limited records of landslides in Cabo Verde, however, there is evidence that landslides can be fatal here: three people were buried by a debris flows from a steep escarpment above the town of Covoada town, on São Nicolau in 2009, during an event which reportedly caused severe damage to structures and roads in several towns.
- Overall, 25% of the country is considered to have high or very high landslide hazard.

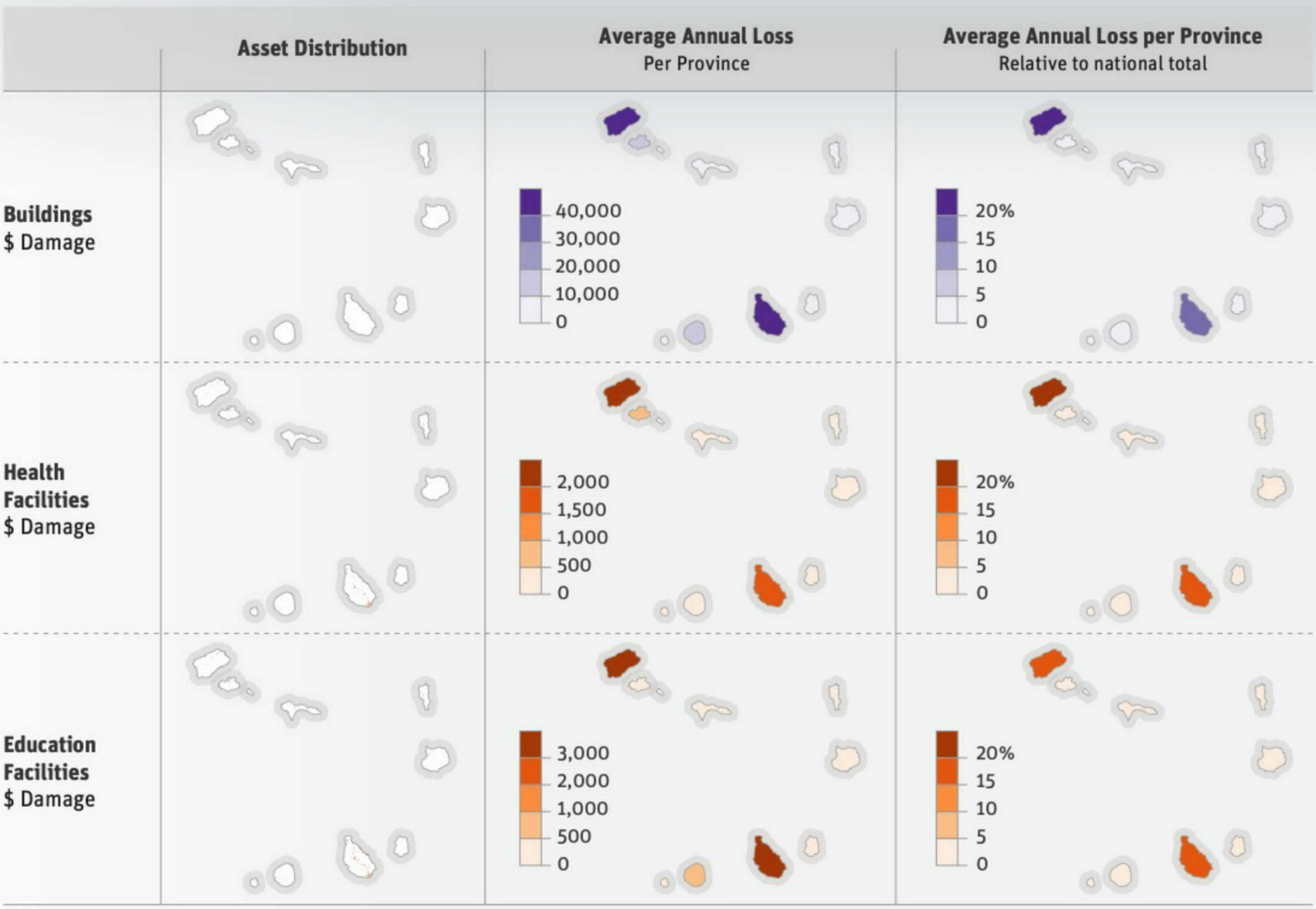
Landslide risk is a function of population and assets being located in areas susceptible to landslides (based on slope angle, vegetation cover and soil type), and the potential for earthquakes and rainfall to trigger landslides there. For more detail, see the Methodology section.

CABO VERDE

Over the long-term, the expected impacts in Cabo Verde due to landslide are expected to be very low, compared to other natural hazards. Damage to building stock is expected to exceed $150,000 per year on average, with 300,000 of national GDP affected in any given year (expected to increase to $2 million per year in 2050). The cost of damage to energy generation facilities could be double that of the rest of the building stock – at $350,000 per year on average. On average, the population affected each year is estimated to be around 10 people.

Despite the values above appearing very low, it should be considered that these are long-term averages, and that a sufficiently intense period of rainfall can have a devastating local effect, with even relatively small debris flows causing significant damage and loss of life (see 2009 event on the previous page).



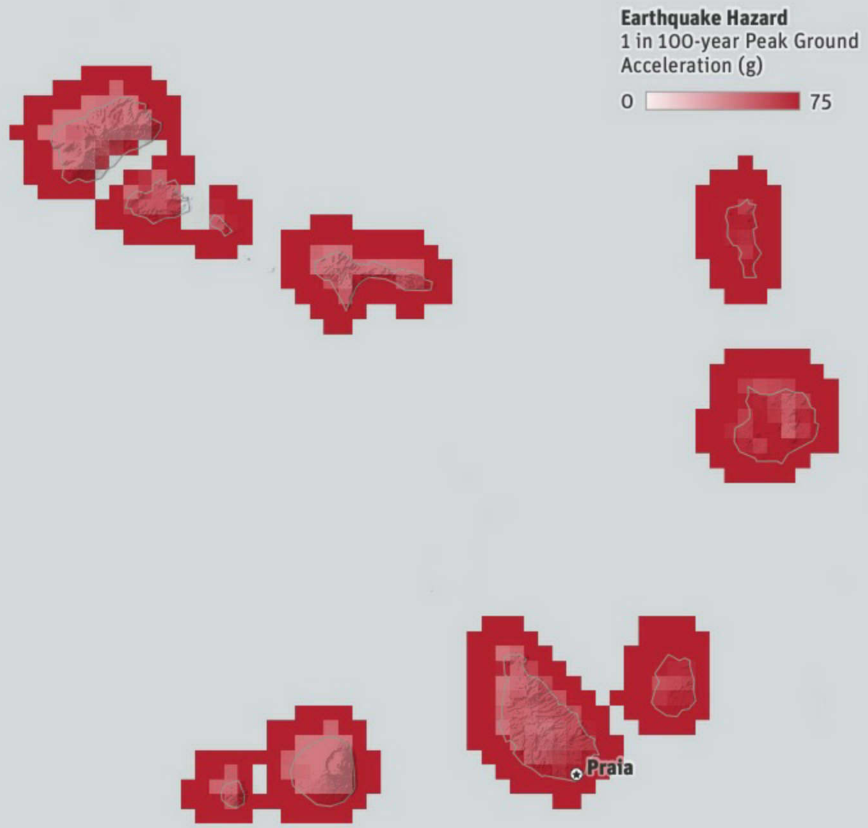


EARTHQUAKE

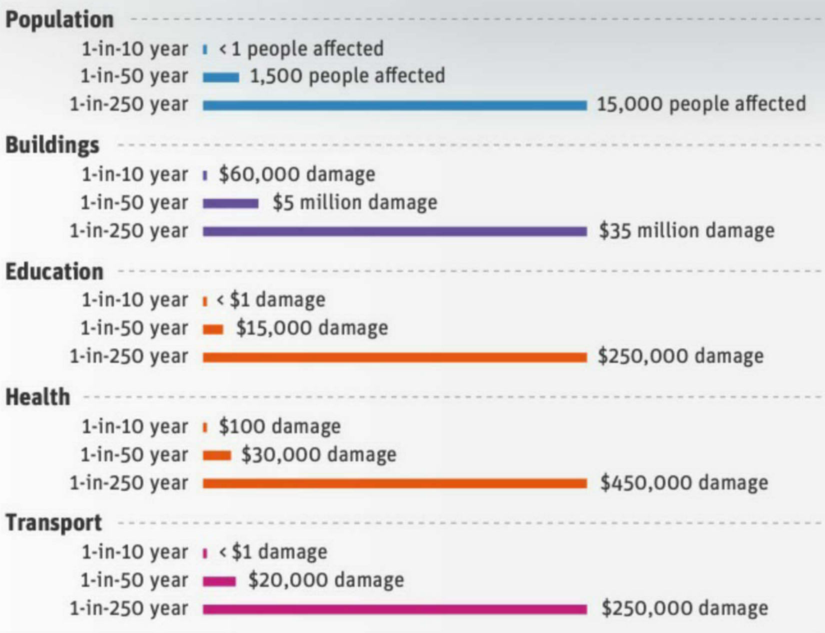
CABO VERDE

Earthquakes pose the threat of building damage and collapse, particularly where seismic-resistant design of buildings is not generally applied, as in Cabo Verde. 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).

Cabo Verde is in an area of low seismicity. Only 24 earthquakes were recorded since 1938, and less than 13 events since 1973, with epicenters generally to the southwest of the volcanic Brava and Fogo islands, and to the west of Santo Antão. The largest recorded earthquake was Mw6.5 in 1941. Low-magnitude seismicity occurs in the same regions, associated with volcanic activity.



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

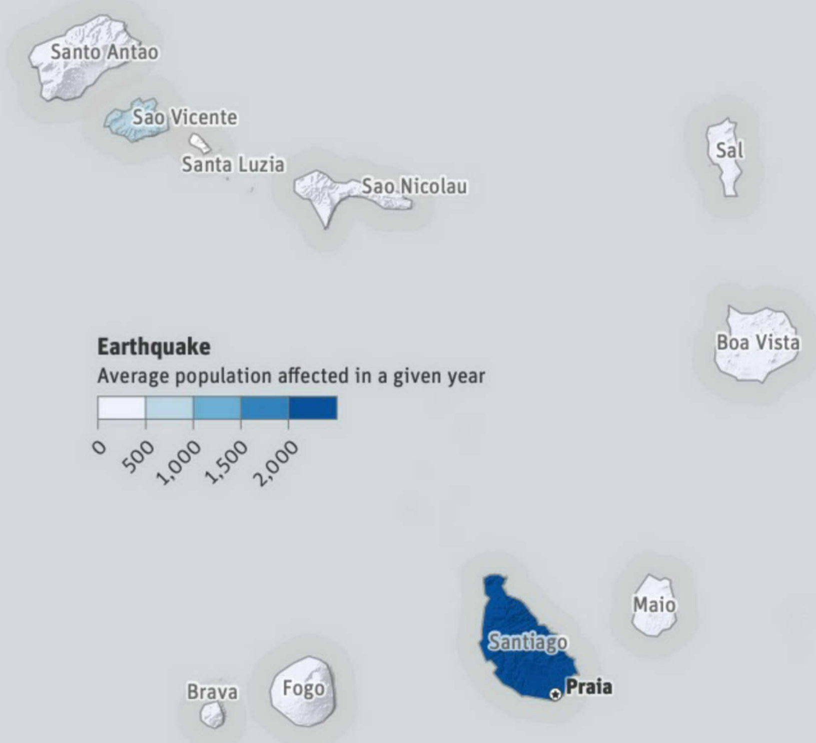
- Moderate to strong ground shaking is expected to occur at least once in a 500-year period. Seismicity in Cabo Verde is generally shallow, and located to the west of the archipelago – closest to the active volcanic islands. Despite the location of greatest seismicity being to the west, the greatest seismic hazard occurs on the eastern islands, due to the amplifying effect of soils present in the east.
- The private building stock of Cabo Verde is largely constructed of unreinforced masonry concrete block, which is highly susceptible to damage during earthquake ground shaking.

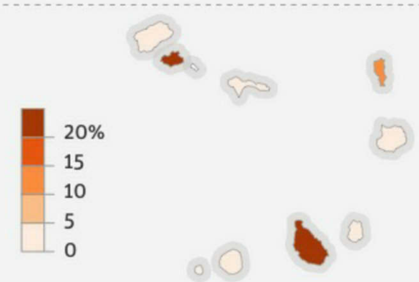
i The distribution of earthquake risk is determined by modeled earthquake hazard events, the location where assets intersect with these hazards, and the vulnerability of those assets. For more detail, see the Methodology section.

CABO VERDE

It is possible that, at least once in a person's lifetime, an earthquake could occur that affects 1,300 people with at least light ground shaking (see bars, opposite). In such an earthquake, there is likely to be at least light to moderate building damage in some areas. The cost of this would be approximately $5 million, with potential for $45,000 of damage to education and health facilities.

The island of Santiago contributes the greatest population affected, though relative to the population of the island the greatest risk occurs on Sal, Boa Vista and Maio, all on the eastern side of Cabo Verde. The greatest cost of damage to building stock would be expected on Santiago, Sal and São Vicente.



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

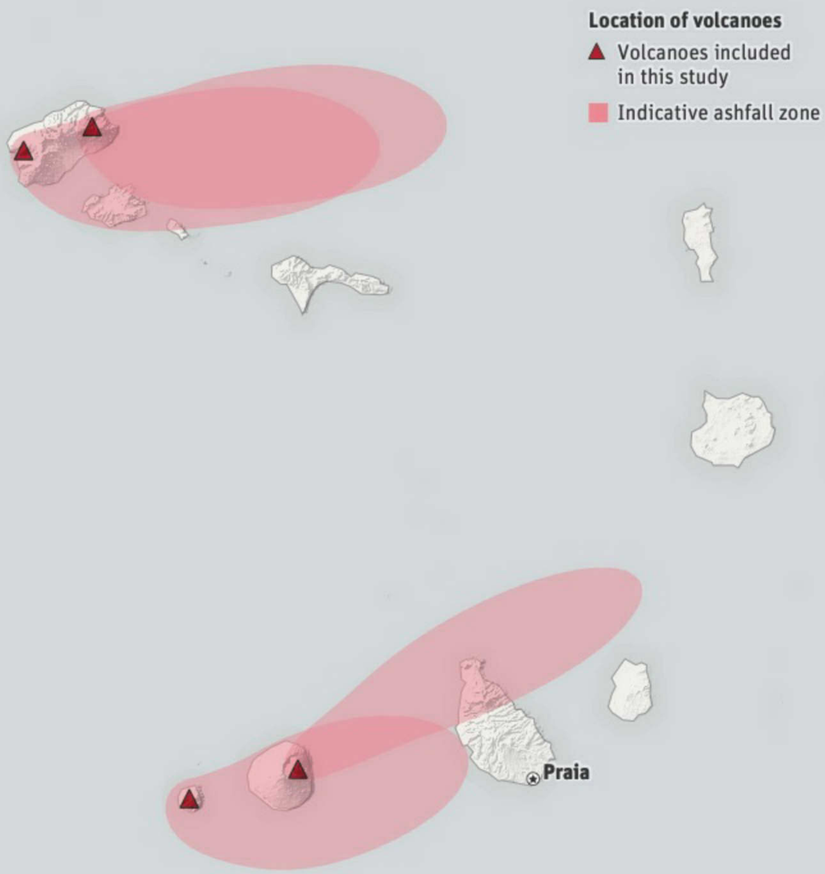
VOLCANO

CABO VERDE

There is an active volcano on three islands of Cabo Verde: Fogo, Brava and Santo Antão, although all of the islands are of volcanic origin. Fogo has erupted in recent decades, and both Brava and Santo Antão have experienced seismic activity indicating movement of magma beneath the volcano, though there have been no recent eruptions. Two potential vent locations were analyzed on Santo Antão: Topo de Coroa on the western side of the island, and Cova de Paul at the eastern end of the island.

Each of the above volcanoes has the potential to cause pyroclastic flows (of superheated gas and debris), lahars (volcanic mud flows) and ashfall during explosive eruptions. This analysis did not include additional volcanic hazards such as lava flow, explosive fire fountaining (ballistic impact close to a vent), ground fissuring, or volcanic gases (which affect people, livestock and crops).

There is very poor information on eruption history in Cabo Verde, so the assessment of potential eruption location, frequency and severity relied heavily on expert input, including from the national volcano observatory, to inform simulation of flow hazards and ash dispersal. Despite the expert input, there is significant uncertainty around the potential frequency of explosive eruptions, and where on the volcano an eruption might occur (the vent location), which influences the hazard extent.



Key Facts

- The most recent eruptions in Cabo Verde were on Fogo, in 1951, 1995 and 2014-2015. There is evidence of previous large explosive eruptions of VEI5 and above, which is an extremely destructive event.
- Shallow seismic activity on Brava became more frequent and intense in late 2015 and continued through 2016, culminating in the evacuation of 300 people from the summit area in August 2016 due to concerns of a potential eruption.
- The impacts of an explosive eruption at any of the volcanoes could affect multiple islands, especially in the dry season, when winds blow predominantly towards the east; this is shown in the map above, for a VEI4 eruption at each volcano.

Modeled Exposure

Population

Ashfall Exposure — 35,000 people exposed

Buildings

Ashfall Exposure — $400 million exposed

Education and Health Facilities

Ashfall Exposure — $70 million exposed

Transport

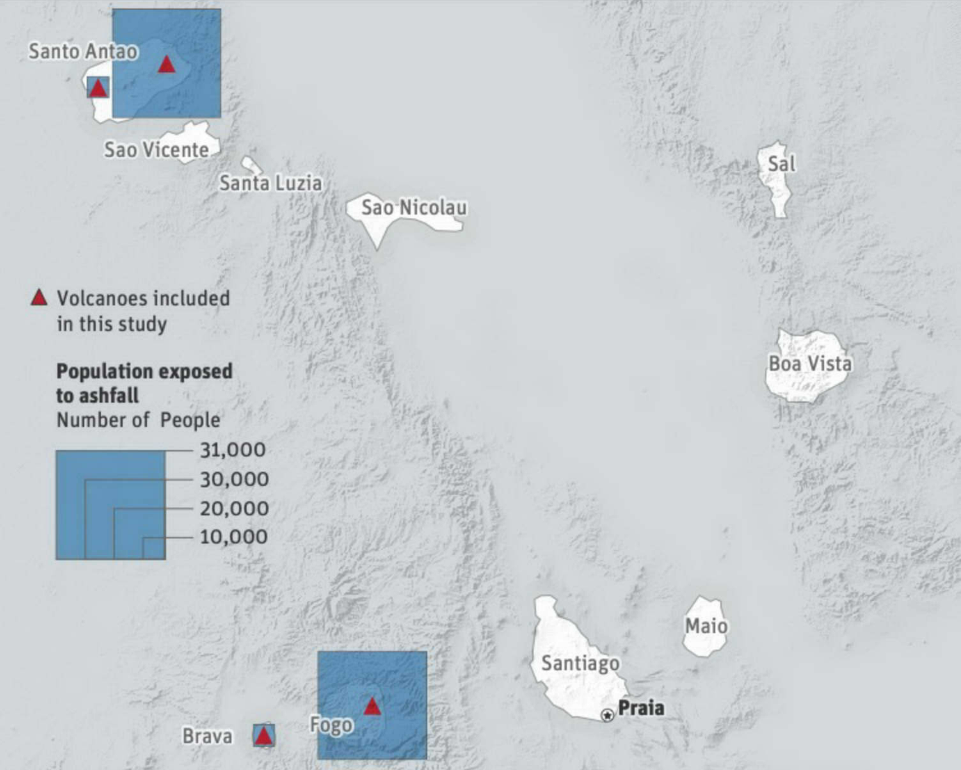
Ashfall Exposure — $50 million exposed

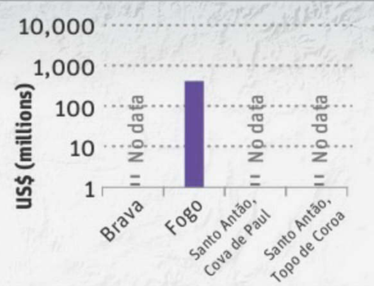
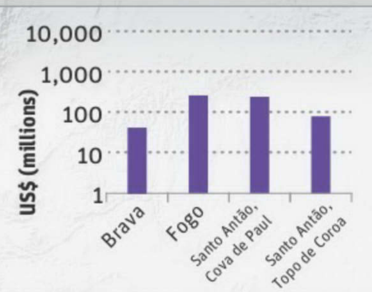
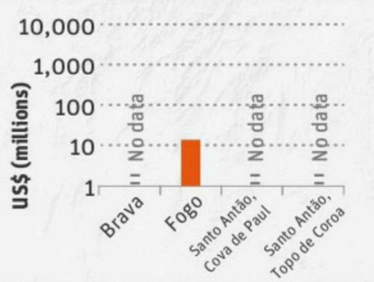
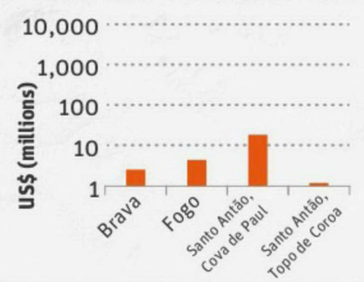
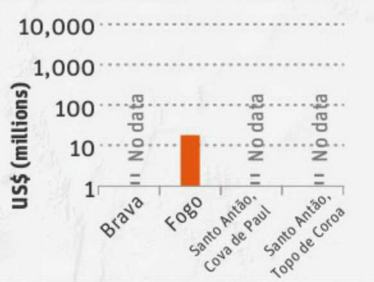
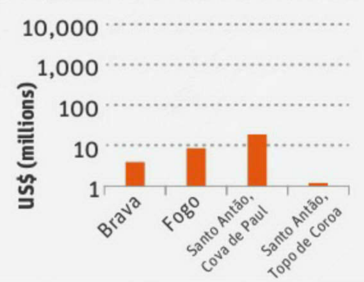
The distribution of volcano exposure is determined by analyzing the intersection of volcanic hazard with location of assets. For more detail, see the Methodology section.

CABO VERDE

Volcanic risk is presented as population or value of assets exposed to volcanic hazards (flow hazards within 100km of a volcano, and ashfall at greater distances for selected eruption scenarios) at the volcanoes analyzed, and are intended to be indicative of the volcanic risk. Due to a present lack of information around eruption frequency and type of these volcanoes, and vulnerability of asset types to volcanic hazards, it is not possible to estimate the likelihood and magnitude of losses with a reasonable degree of confidence.

Over 30,000 people are exposed to volcanic ash and flow hazards at Fogo - an island of only 37,000 people. Another 30,000 are exposed at Santo Antão (island population 44,000) and 6,000 at Brava, which is the entire population of the island. Building stock exposed is $46 million on Brava, over $400 million at Fogo, and $240 million at Santo Antão. Between $30 and $100 million of critical facilities (energy, education and health facilities) are also exposed at each volcano.



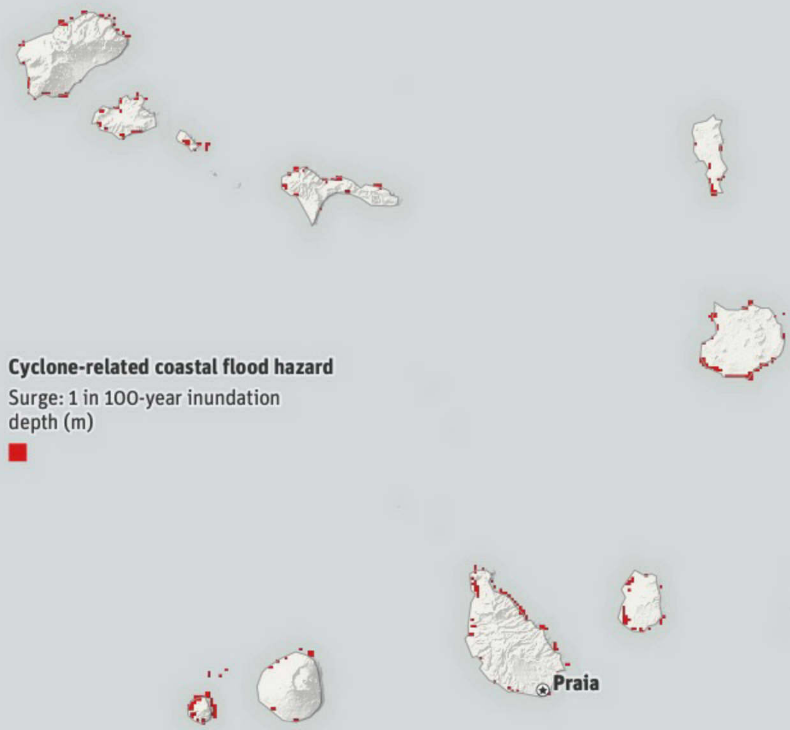
	Asset Distribution	Ashfall Exposure (Millions US$)	Flow Hazard Exposure (Millions US$)
Buildings $ Exposed Value			
Health Facilities $ Exposed Value			
Education Facilities $ Exposed Value			

CYCLONE
CABO VERDE

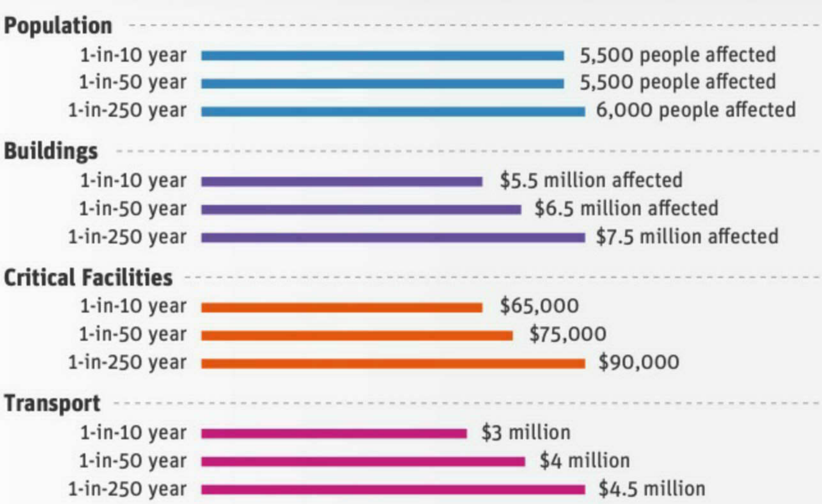
Cabo Verde is located very close to an area of tropical cyclone genesis. However, the tropical cyclones tend to move westward away from Cabo Verde. The occurrence of tropical cyclones across any of the islands is therefore quite rare and their intensity also low. The Category 1 hurricane Fred (2015) was the first hurricane moving through Cabo Verde since 1892. Extratropical weather systems and other distant storms are also important for defining extreme coastal (swell) waves and water levels at Cabo Verde.

Cabo Verde's archipelago is surrounded by deep waters and have steep foreshores before the coast. The mountainous nature of volcanic islands means that no large coastal areas are impacted by to storm surge during a cyclone. Wave-induced setup, waves and wind are the most important features causing impact along narrow coastal strips because much of the economic activity and infrastructure is oriented towards the coast, e.g. harbors, fishing villages and tourist resorts.

The cyclone analysis for Cabo Verde included the effect of tides, surge, wave-setup and waves as a result of nearby or distant storms. Coastal flood hazard maps have been created to define inundation for different return periods (see main map). The analysis, however, did not take into account the compounding effect of rainfall and local flash floods (e.g. during cyclones). This combination could potentially worsen the situation. Also, the wind hazard and risk were not analyzed due to lack of data for this island.



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

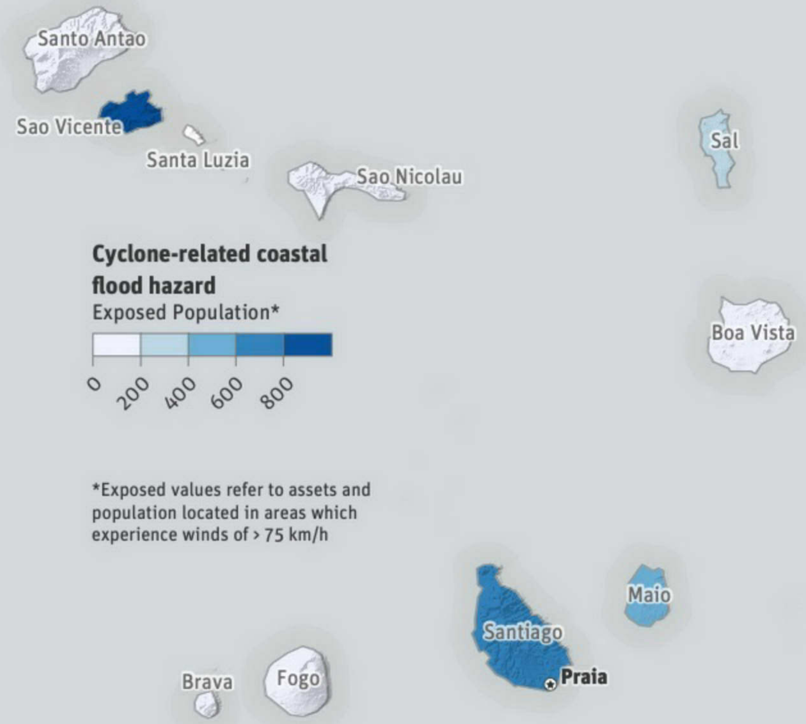
- Hurricane Fred (2015) was the first hurricane hitting Cabo Verde since 1892. The cyclone produced over 300 millimeters of rain over Santiago, the largest island of the archipelago –more than the annual average rainfall for the island's capital, Praia.
- The material damage was estimated at $2.5 million during this hurricane. Damage occurred to roofs and roads due to wind and flooding. No casualties were reported.

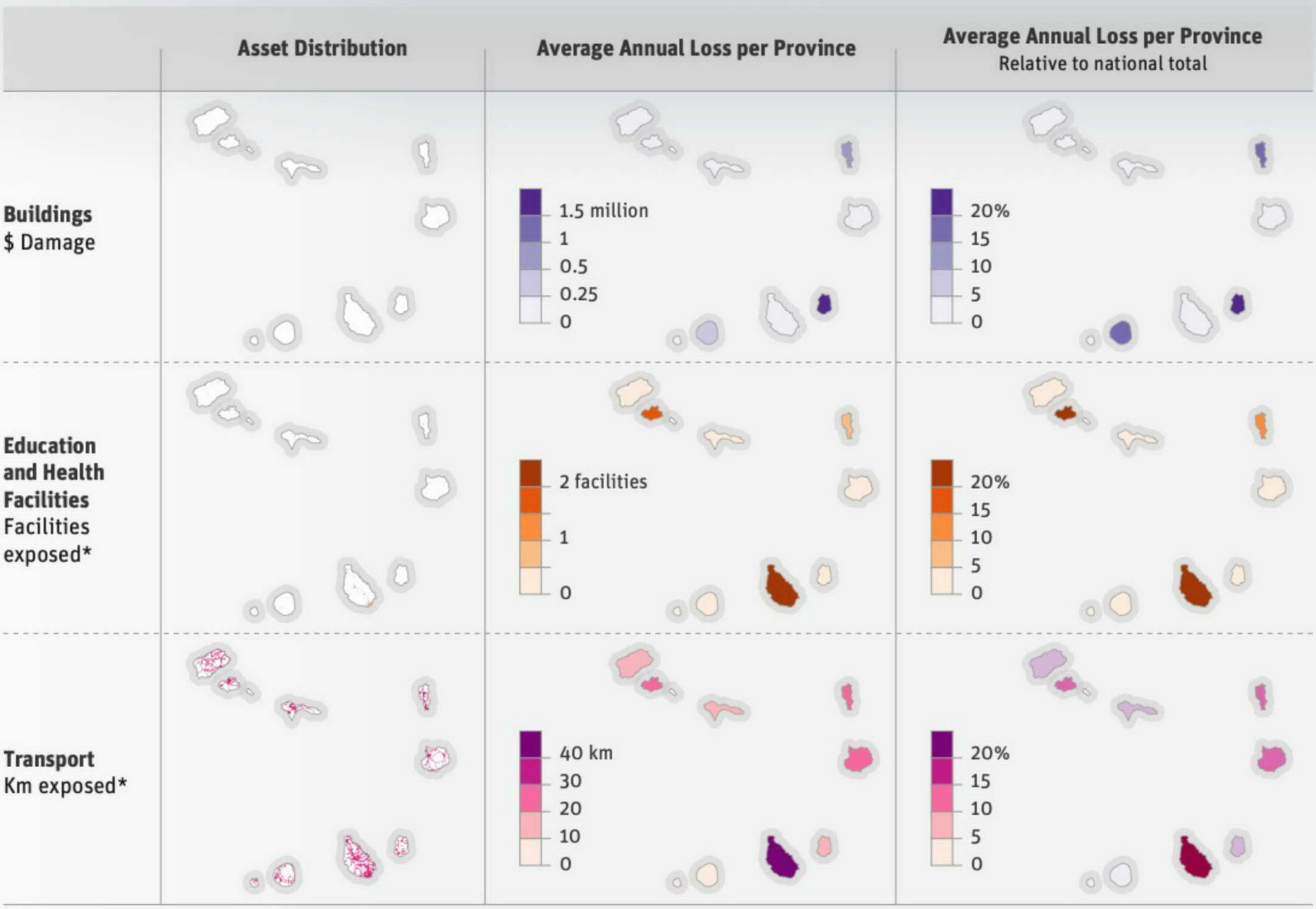
The distribution of cyclone risk is determined by the occurrence of cyclone events, the location where assets intersect with these hazards, and the vulnerability of those assets. For more detail, see the Methodology section.

CABO VERDE

Coastal risk is presented as population exposed to coastal flooding for Cabo Verde. These effects are intended to be indicative of the risk of coastal flooding. In addition to this, indicative estimates are provided of the likelihood and magnitude of damage to building stock. Also, the total exposed healthcare and educational facilities and transport system are listed. The damage due to wind and/or rainfall has not been estimated due to lack of data.

Coastal flood in Cabo Verde affects a relatively low percentage of the population. On a yearly basis, the average number of people affected by coastal flood is about 1,500. The islands of Maio, Sal, Santiago and São Vincente are the main contributors. The estimated damage to private building stock is estimated at $3 million on average every year, occurring predominantly on Maio. This number is, however, relatively high compared to historical records. Hence, these damage estimates shall be used with care and further assessment is necessary based on more detailed modeling.





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-world-factbook/.

[2] 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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