

Georgia

GDP \$13.7 billion*

Population 3.9 million*

AFFECTED
BY 100-YEAR
FLOOD

\$1 billion (10%)

400,000 (10%)

AFFECTED
BY 250-YEAR
EARTHQUAKE

\$10 billion (82%)

3 million (82%)

CAPITAL LOSS
FROM 250-YEAR
EARTHQUAKE

\$7 billion (53%)

20,000 (1%)

*2015 estimates



Georgia's population and economy are exposed to earthquakes and floods, with earthquakes posing the greater risk of a high impact, lower probability event. The model results for present-day risk shown in this risk profile are based on population and gross domestic product (GDP) estimates for 2015. The estimated damage caused by historical events is inflated to 2015 US dollars.

Just over half of Georgia's population lives in urban environments. The country's GDP was approximately US\$13.7 billion in 2015, with close

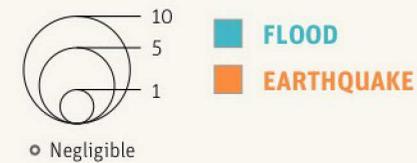
to 70 percent derived from services, most of the remainder generated by industry, and agriculture making a small contribution. Georgia's per capita GDP was \$3,500.

This map displays GDP by province in Georgia, with greater color saturation indicating greater GDP within a province. The blue circles indicate the risk of experiencing floods and the orange circles the risk of earthquakes

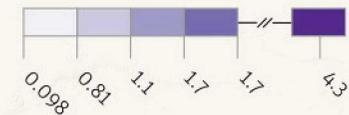
in terms of normalized annual average of affected GDP. The largest circles represent the greatest normalized risk. The risk is estimated using flood and earthquake risk models.

The table displays the provinces at greatest normalized risk for each peril. In relative terms, as shown in the table, the province at greatest risk of flood is Tbilisi, and the one at greatest risk of earthquakes is Kvemo Kartli. In absolute terms, the province at greatest risk of both floods and earthquakes is Tbilisi.

Annual Average of Affected GDP (%)



GDP (billions of \$)



There is a high correlation ($r=0.95$) between the population and GDP of a province.

RUSSIAN FEDERATION

TOP AFFECTED PROVINCES



FLOOD

ANNUAL AVERAGE OF
AFFECTED GDP (%)

Tbilisi	6
Racha-Lechkhumi and Kvemo (lower) Svaneti	3
Shida Kartli	2
Mtskheta-Mtianeti	2
Adjara Aut. Rep.	2
Samtskhe-Javakheti	2
Samergelo and Zemo (upper) Svaneti	2
Imereti	1
Kvemo Kartli	1
Kakheti	1



EARTHQUAKE

ANNUAL AVERAGE OF
AFFECTED GDP (%)

Kvemo Kartli	12
Tbilisi	8
Shida Kartli	7
Samergelo and Zemo (upper) Svaneti	6
Guria	6
Samtskhe-Javakheti	6
Kakheti	6
Mtskheta-Mtianeti	6
Imereti	5
Adjara Aut. Rep.	4

BLACK SEA

Abkhazia Aut. Rep.

Racha-Lechkhumi and Kvemo (lower) Svaneti
Samergelo and Zemo (upper) Svaneti

Imereti

Guria

Adjara Aut. Rep.

Samtskhe-Javakheti

Shida Kartli

Mtskheta-Mtianeti

Tbilisi

Kvemo Kartli

Tbilisi

Kakheti

TURKEY

ARMENIA

AZERBAIJAN

The most devastating floods in Georgia since it gained its independence in 1991 occurred in 1997. In that year, Georgia was hit by two floods, which together caused 7 fatalities and over \$40 million in damage. Flooding in 2012 caused less damage (\$3 million), but it affected over 100,000 people. Flooding in 2013 affected close to 25,000 people but also caused limited damage. Other floods occurred in 1995, 2004, 2005, and 2011, with fewer than 2,500 people affected and less than \$4 million in damage per event. According to a 2015 World Bank Post Disaster Needs Assessment (in press), the June 2015 flooding in Tbilisi caused 19 fatalities (in addition, three people are still missing), affected over 700 people, and caused over \$20 million in damages. All these events highlight Georgia's vulnerability to floods. They are not always devastating, but they follow each other quickly and have a large cumulative effect on the country.

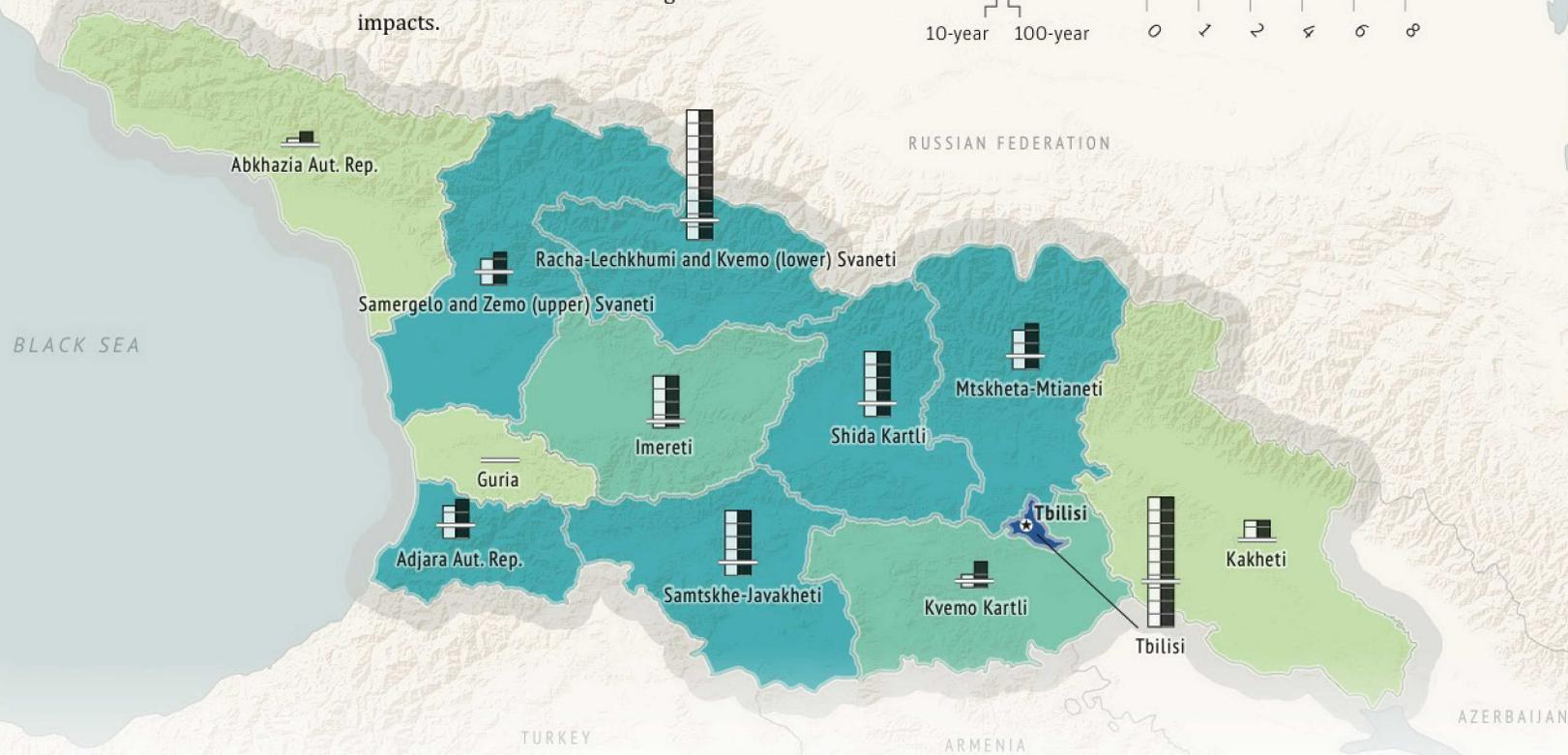
This map depicts the impact of flooding on provinces' GDPs, represented as percentages of their annual average GDPs affected, with greater color saturation indicating higher percentages. The bar graphs represent GDP affected by floods with return periods of 10 years (white) and 100 years (black). The horizontal line across the bars also shows the annual average of GDP affected by floods.

When a flood has a 10-year return period, it means the probability of occurrence of a flood of that magnitude or greater is 10 percent per year. A 100-year flood has a probability of occurrence of 1 percent per year. This means that over a long period of time, a flood of that magnitude will, on average, occur once every 100 years. It does not mean a 100-year flood will occur exactly once every 100 years. In fact, it is possible for a flood of any return period to occur more than once in the same year, or to appear in consecutive years, or not

to happen at all over a long period of time.

If the 10- and 100-year bars are the same height, then the impact of a 10-year event is as large as that of a 100-year event, and the annual average of affected GDP is dominated by events that happen relatively frequently. If the impact of a 100-year event is much greater than that of a 10-year event, then less frequent events make a larger contribution to the annual average of affected GDP. Thus, even if a province's annual affected GDP seems small, less frequent and more intense events can still have large impacts.

The annual average population affected by flooding in Georgia is about 100,000 and the annual average affected GDP about \$400 million. Within the various provinces, the 10- and 100-year impacts do not differ much, so relatively frequent floods have large impacts on these averages.



Georgia's worst earthquake since 1900 occurred in 1991, with a magnitude of 7. It caused over 250 fatalities and close to \$3 billion in damage. An earthquake in 2002 affected nearly 20,000 people and caused about \$500 million in damage. The impact of earthquakes in 1992 and 2009 was less extensive.

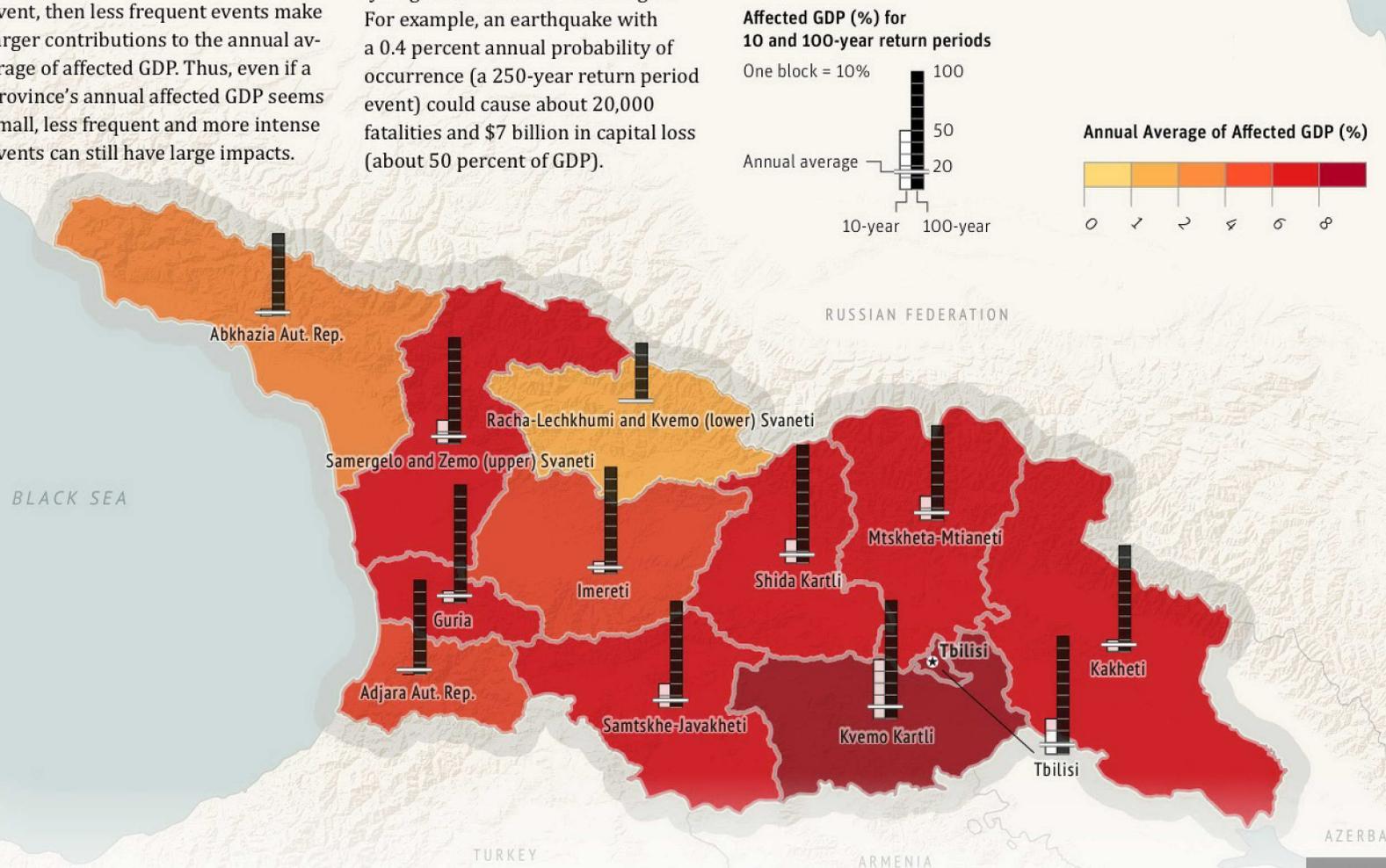
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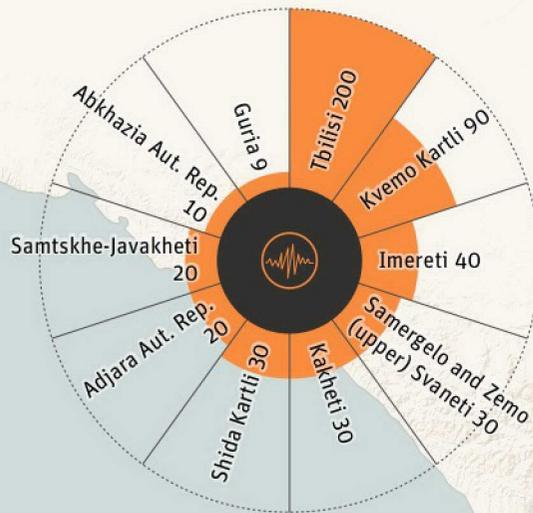
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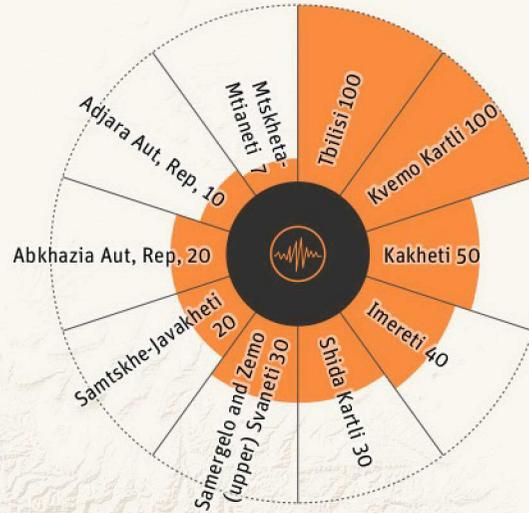
The annual average population affected by earthquakes in Georgia is about 300,000 and the annual average affected GDP about \$900 million. The annual averages of fatalities and capital losses caused by earthquakes are about 500 and about \$500 million, respectively. The fatalities and capital losses caused by more intense, less frequent events can be substantially larger than the annual averages. For example, an earthquake with a 0.4 percent annual probability of occurrence (a 250-year return period event) could cause about 20,000 fatalities and \$7 billion in capital loss (about 50 percent of GDP).



EARTHQUAKE
ANNUAL AVERAGE CAPITAL LOSS (MILLIONS \$)

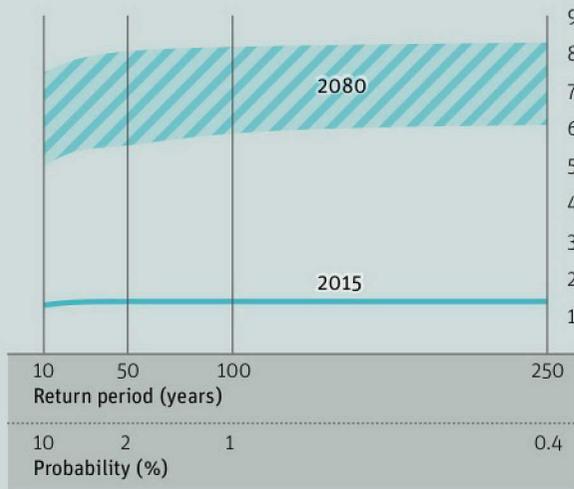


EARTHQUAKE
ANNUAL AVERAGE FATALITIES

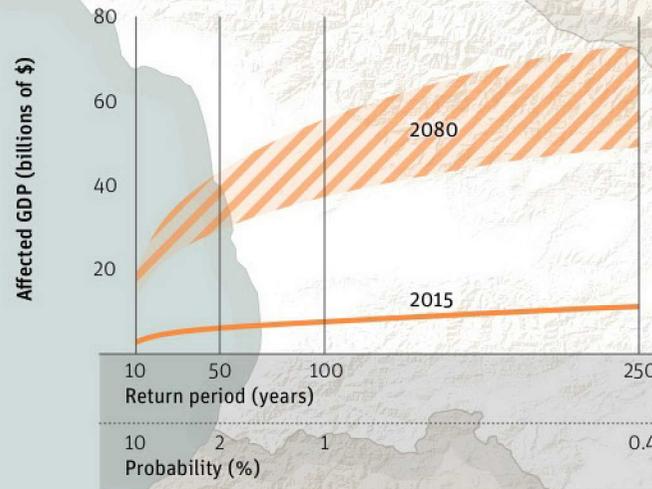


The rose diagrams show the provinces with the potential for greatest annual average capital losses and highest annual average numbers of fatalities, as determined using an earthquake risk model. The potential for greatest capital loss occurs in Tbilisi, which is not surprising, given the economic importance of the province.

FLOOD
EXCEEDANCE PROBABILITY CURVE, 2015 AND 2080



EARTHQUAKE
EXCEEDANCE PROBABILITY CURVE, 2015 AND 2080



The exceedance probability curves display the GDP affected by, respectively, floods and earthquakes for varying probabilities of occurrence. Values for two different time periods are shown. A solid line depicts the affected GDP for 2015 conditions. A diagonally striped band depicts the range of affected GDP based on a selection of climate and socioeconomic scenarios for 2080. For example, if Georgia had experienced a 100-year return period flood event in 2015, the affected GDP would have been an estimated \$1 billion. In 2080, however, affected GDP from the same type of event would range from about \$6 billion to about \$8 billion. If Georgia experienced a 250-year earthquake event in 2015, the affected GDP would have been about \$10 billion. In 2080, the affected GDP from the same type of event would range from about \$50 billion to about \$70 billion, due to population growth, urbanization, and the increase in exposed assets.

All historical data on floods, unless otherwise noted, and earthquakes are from, respectively, D. Guha-Sapir, R. Below, and Ph. Hoyois, EM-DAT: International Disaster Database (Université Catholique de Louvain, Brussels, Belgium), www.emdat.be, and the National Geophysical Data Center/World Data Service (NGDC/WDS), Significant Earthquake Database (National Geophysical Data Center, NOAA) doi:10.7289/V5TD9V7K. Damage estimates for all historical events have been inflated to 2015 US\$.