COUNTRY RISK PROFILE
GEORGIA

TA-9878 REG: Developing a Disaster Risk Transfer Facility in the Central Asia Regional Economic Cooperation Region

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CAREC
Central Asia Regional Economic Cooperation Program

About this document

TA-9878 REG: Developing a Disaster Risk Transfer Facility in the Central Asia Regional Economic Cooperation Region aims at developing regional disaster risk financing solutions for CAREC member states. It provides high-level disaster risk profiles for all CAREC member states for earthquake, flood, and infectious disease risk. The TA will then design and pilot a bespoke regional disaster risk transfer facility. This is to support CAREC member states in their management of disaster risk.

The disaster risk profiles collate information on flood, earthquake and infectious disease exposure, hazards, physical and social vulnerability, coping capacity, historical losses and impacts, and risk analysis for all CAREC member states. Much of this information is being collated on a regionally consistent basis for the first time. This includes cutting-edge flood, earthquake, and infectious disease modeling.

The profiles are logically structured:

i. **Risk analysis:** results from risk modeling;
ii. **Historical losses and impacts:** data collected from national and international databases;
iii. **Hazard:** physical processes which cause floods, earthquakes and infectious disease outbreaks;
iv. **Exposure:** characteristics of livelihoods and economic value at risk and;
v. **Vulnerability:** socio-economic vulnerability and coping capacity;

These profiles are accompanied by a separate technical note which details the data and methodologies used, and discusses appropriate limitations.

Contents

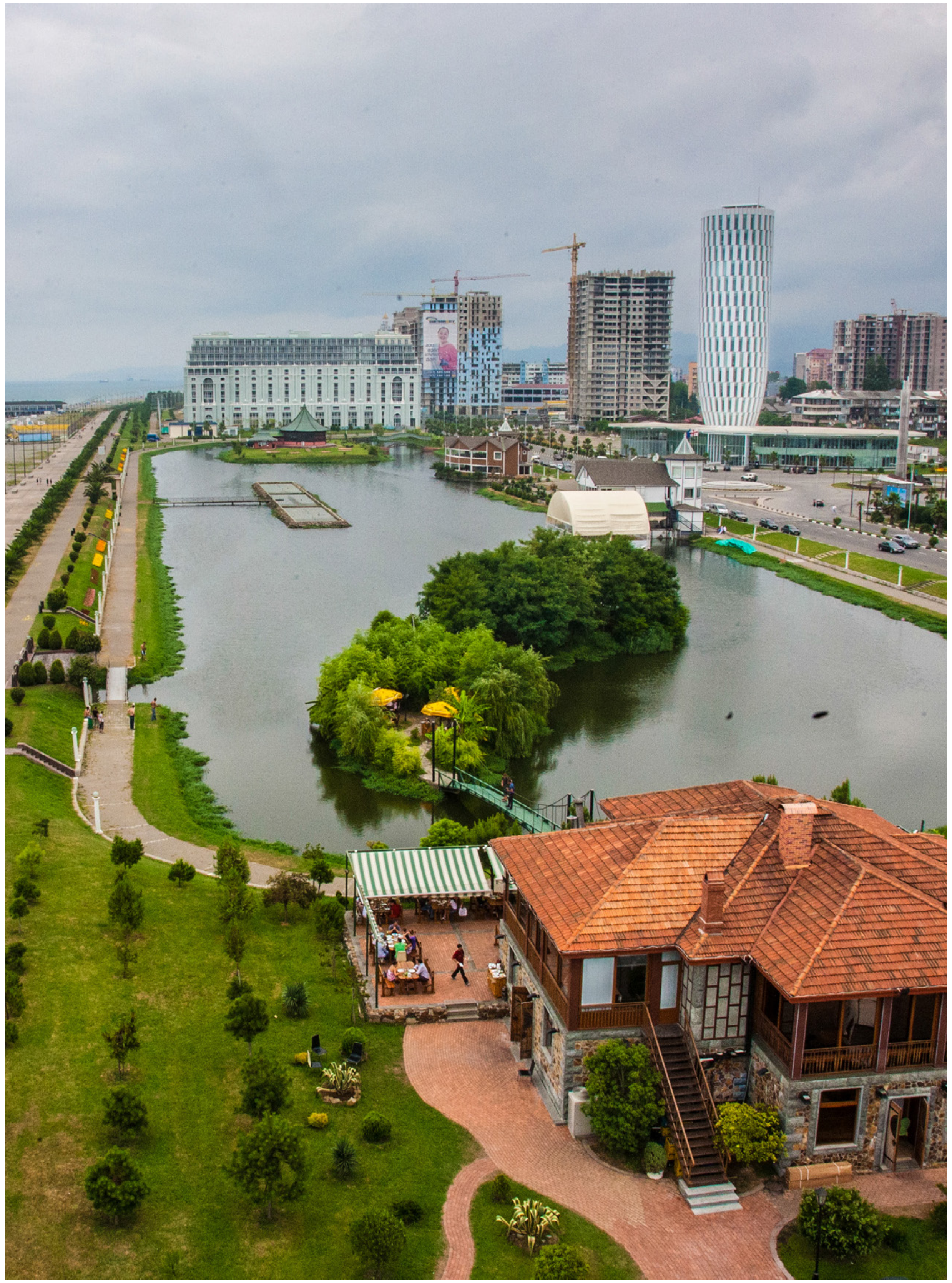
List of abbreviations

AAL	Average Annual Loss
AALR	Average Annual Loss Ratio
ADB	Asian Development Bank
ADM	Administrative Boundary
AAPA	Average Annual Number of People Affected
CAREC	Central Asia Regional Economic Cooperation
COVID-19	Coronavirus disease
CCHF	Crimean-Congo Hemorrhagic Fever
DRF	Disaster Risk Financing
EP	Exceedance Probability
EMS	Emergency Management System
GEM	Global Earthquake Model Foundation
IPCC	Intergovernmental Panel on Climate Change
IDPs	Internally displaced persons
JBA	Jeremy Benn Associates
RCP	Representative Concentration Pathway
TA	Technical Assistance

Currency

Currency Unit	United States Dollar/s ($)

List of figures and tables



Profile summary

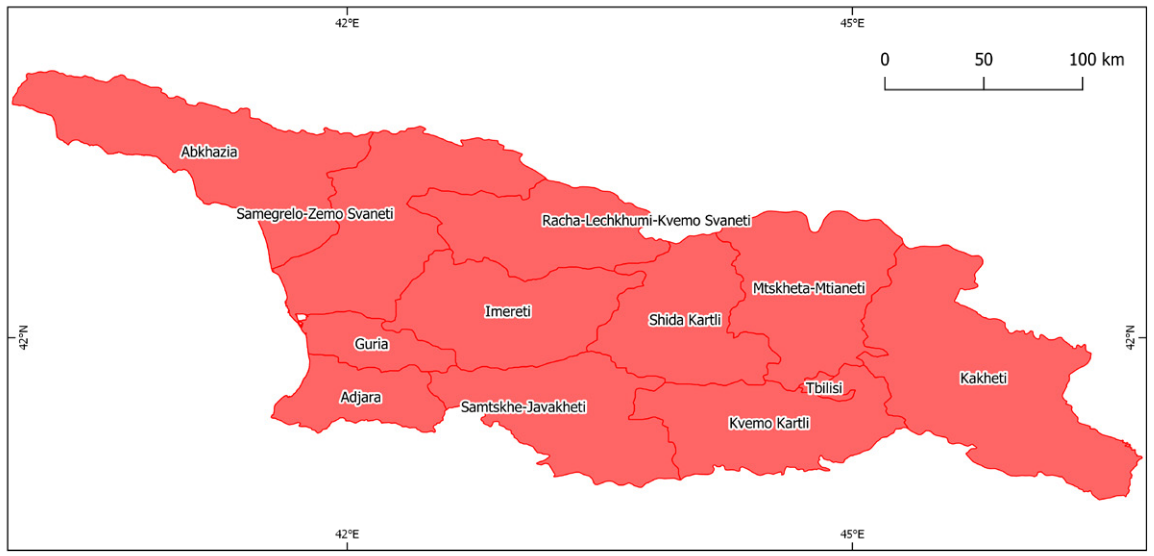
Situated in the Caucasus region, sustained economic reform and growth has propelled Georgia to stable middle-income country status. The 3.7 million people live across 11 regions and the Tbilisi municipality.[1]

A highly mountainous country, Georgia is exposed to moderate seismic and flood risk. Average annual fatalities are modelled to be 11 from earthquake and 165 from flooding.

The recorded history illustrates that earthquakes can bring substantial economic damage. The 1991 Racha earthquake, magnitude 6.96, is the most powerful recorded in Georgia, with at least 270 fatalities and up to $3.2 billion in damage.[2] Severe flooding occurs more frequently, and though spatial footprints of floods tend to be low, event intensity can be high.

A total value at risk of $21. 5 billion is concentrated in Tbilisi and Imereti. Natural resource extraction is focused in Imereti, accounting for this agglomeration of economic activity outside the capital center.

Figure 1: Georgia regions



Seismicity in Georgia is mainly shallow and spread across the country. Tbilisi and Imereti are modelled as the highest sources of loss. With seismic hazard distributed across the country, earthquake loss likely tracks the pattern of value-at-risk.

Flood losses are higher than earthquake, with the modelled average annual loss (AAL) effectively doubled. The majority (75%) of flood losses are concentrated in just four regions. Kvemo Kartli alone accounts for almost 30% of total flood losses ($7.9m). Importantly, engineered management measures have reduced flood risk in Tbilisi to $3.4m. The modelled mortality from flooding follows a very different pattern, reflective of the population at risk.

Climate change scenario analysis indicates that although the general rainfall pattern may remain the same for most parts of the country, there could be substantial changes to extreme rainfall by the 2050s. Importantly, western areas could experience a dramatic uplift in extreme 24-hour total rainfall such that a current 100-year event becomes a 50-year

[1] *World Bank Open Data 2019*

[2] *National Geophysical Data Center / World Data Service (NGDC/WDS): NCEI/WDS Global Significant Earthquake Database. NOAA National Centers for Environmental Information. doi:10.7289/V5TD9V7K.*

Box 1: Key facts

GDP: $17,743,000,000 (2019) **Population: 3,700,000 (2019)**

1 IN 100 YEAR FLOOD ECONOMIC LOSS **$230,000,000**

1 IN 100 YEAR EARTHQUAKE LOSS **$300,000,000**

AVERAGE ANNUAL LOSS FLOOD **$31,800,000**

AVERAGE ANNUAL LOSS EARTHQUAKE **$14,300,000**

AVERAGE ANNUAL PEOPLE AFFECTED FLOOD **22,483**

AVERAGE ANNUAL PEOPLE AFFECTED EARTHQUAKE **34,608**

AVERAGE ANNUAL PEOPLE AFFECTED INFECTIOUS DISEASE **52,203**

EVENT FREQUENCY WHERE FLOOD LOSS EXCEEDS EXISTING COVER **1 IN 5**

EVENT FREQUENCY WHERE EARTHQUAKE LOSS EXCEEDS EXISTING COVER **1 IN 20**

event, and a current 500-year event becomes a 100-year. Extreme event intensities are relevant for estimating future flood risk.

A CURRENT 100-YEAR EVENT FOR EXTREME RAINFALL COULD BECOME A 50-YEAR EVENT BY 2050

Georgia is exposed to respiratory outbreaks, with a very low background risk to other pathogens. Respiratory pathogens present the possibility of many infections and deaths, a risk which applies to many countries regionally and globally. COVID-19 is just one type of respiratory infectious disease outbreak.

Georgia instituted its first national disaster risk reduction strategy in 2017, targeting a proactive approach to disaster risk management. However, there is no formal disaster risk financing policy. Reserves exist at a national and municipal level, though these tend to be insufficient for financing the recovery and reconstruction from floods and earthquakes. Funding gaps from recent flooding, such as in 2015, underscore the importance of formal risk financing.

Georgia is in a stronger place to manage the financial impacts of disasters than many other countries in the CAREC region. Its reserve funds are large enough to cope with the average annual losses or the emergency response costs associated with a 1 in 200-year earthquake or flood event. The macroeconomic context and high levels of financial inclusion and social assistance provide further financial resilience.

However, current risk retention mechanisms would be exhausted by floods with a return period of just 1 in 5 years. This is a financing gap, especially outside of Tbilisi where insurance uptake is weak. The region of Kvemo-Kartli is also highly exposed.

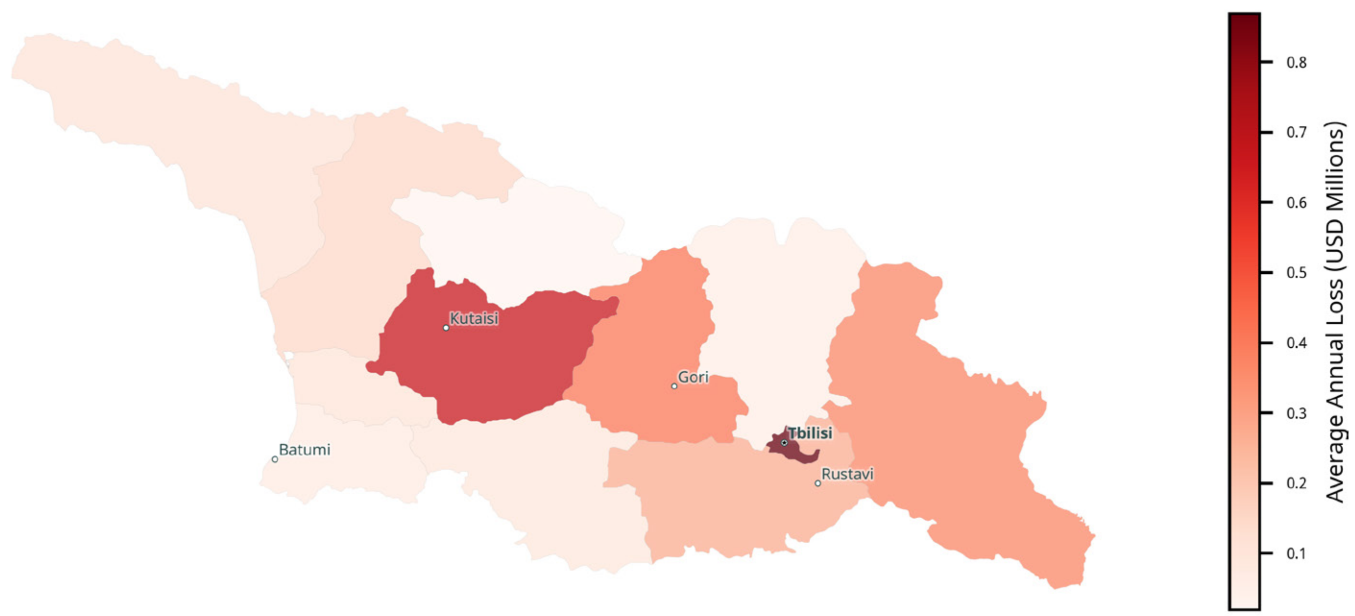
Risk analysis

The extent and geographic pattern of earthquake, flooding, and infectious disease across Georgia is revealed through probabilistic modelling. Such modeling helps illustrate how natural phenomena interact with areas of high concentrations of population and assets to cause economic loss and damage.

Earthquake Risk

The highest average annual loss (AAL) from earthquake induced property damage at the regional level is observed in Tbilisi, at just under $4 million. The regions of Imereti and Shida Kartli follow Tbilisi, with AAL values of $3.0 million and $1.8 million respectively. The spatial pattern of losses is shown in Figure 2.

Figure 2: Average annual loss ($ million) - earthquake



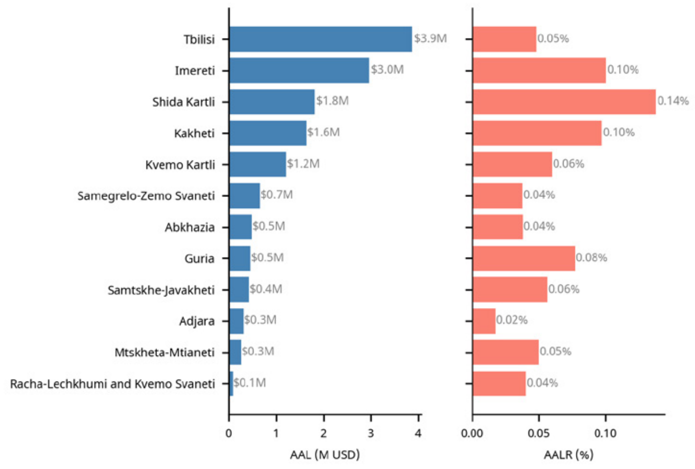
Source: Global Earthquake Model

The high concentration of exposed built asset value is the main driver of losses in Tbilisi. This is due to the high seismic hazard and high seismic vulnerability, particularly with some of the building stock dating to the first half of the 20th century.

The average annual loss ratio (AALR) in each region is the AAL for the region normalized by the total exposed value of buildings in that region. The AALR represents the proportion of the replacement value of the building stock that is expected to be lost due to damage. As a normalized risk metric, the AALR enables comparison of the relative risk across the different regions of the country.

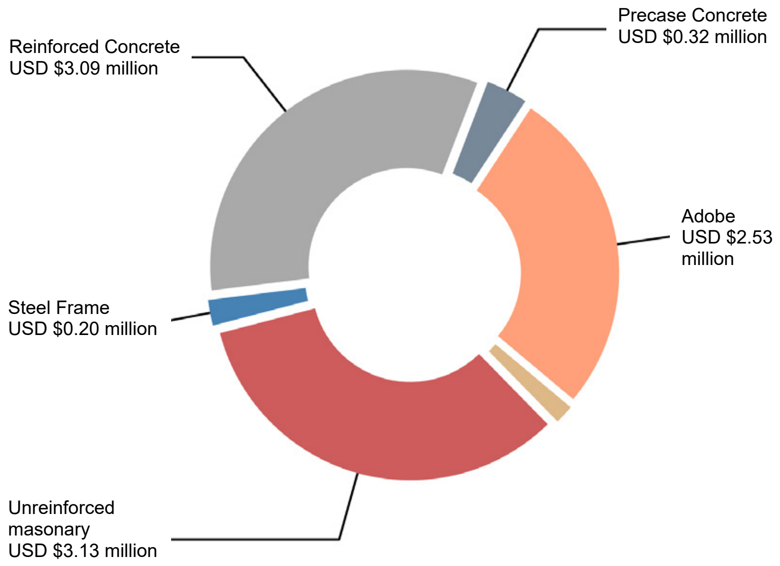
Figure 3 compares the AAL and the AALR for each region, with the AALR expressed as a percentage of the total replacement value in that region. Shida Kartli, Imereti, and Kakheti represent the regions with the highest relative risk in the country, with AALR values of 0.14%, 0.10%, and 0.10% respectively. The AALR for Tbilisi is 0.05%.

Figure 3: Breakdown of earthquake average annual loss and loss ratio by region



Source: Global Earthquake Model

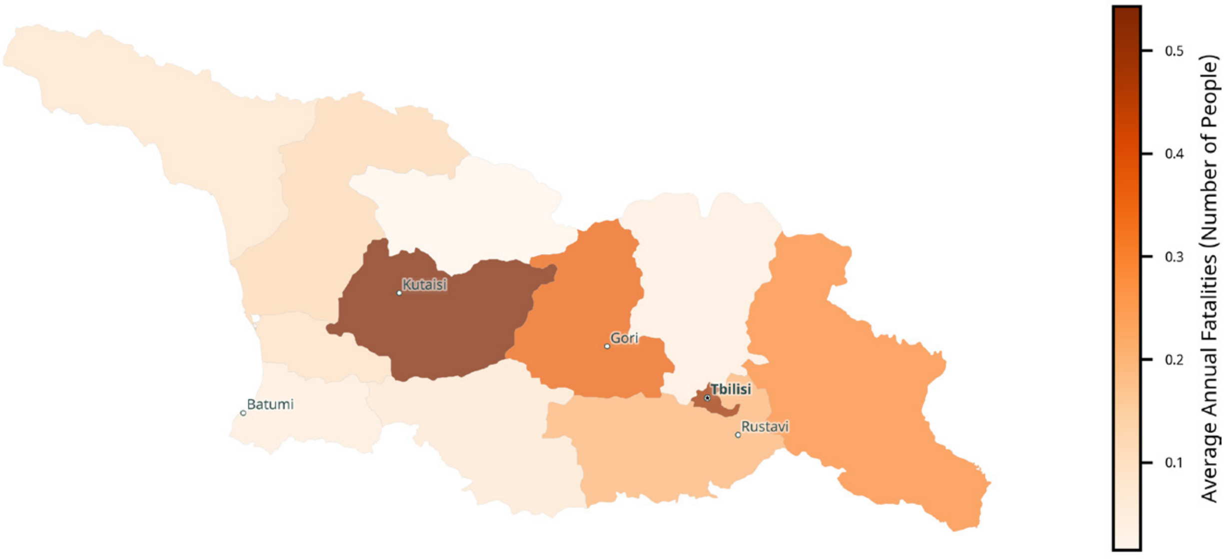
Figure 4: Average annual loss by asset types – earthquakes



Source: Global Earthquake Model

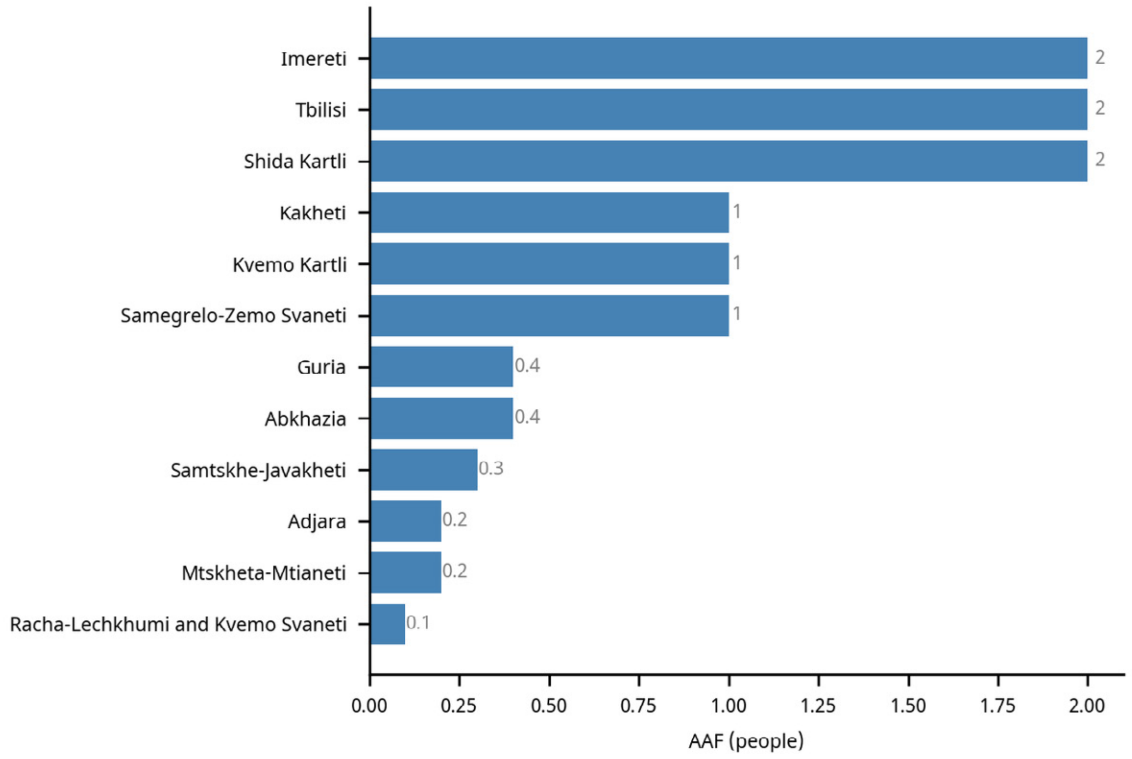
Building damage contributing to average annual loss from earthquake is partially a reflection of the types of construction across Georgia, as shown in Figure 4. The unreinforced masonry structures, which do not exhibit ductile behavior under earthquake loading and hence are amongst the most vulnerable construction types, form the largest contributing building type. Adobe structures are also particularly vulnerable to earthquakes and are the structures found more commonly in the rural parts of the country. The older reinforced concrete building stock, constructed prior to the existence of seismic design codes and that have been poorly maintained, also contribute considerably to the AAL.

Figure 5: Average annual fatalities - earthquake



Source: Global Earthquake Model

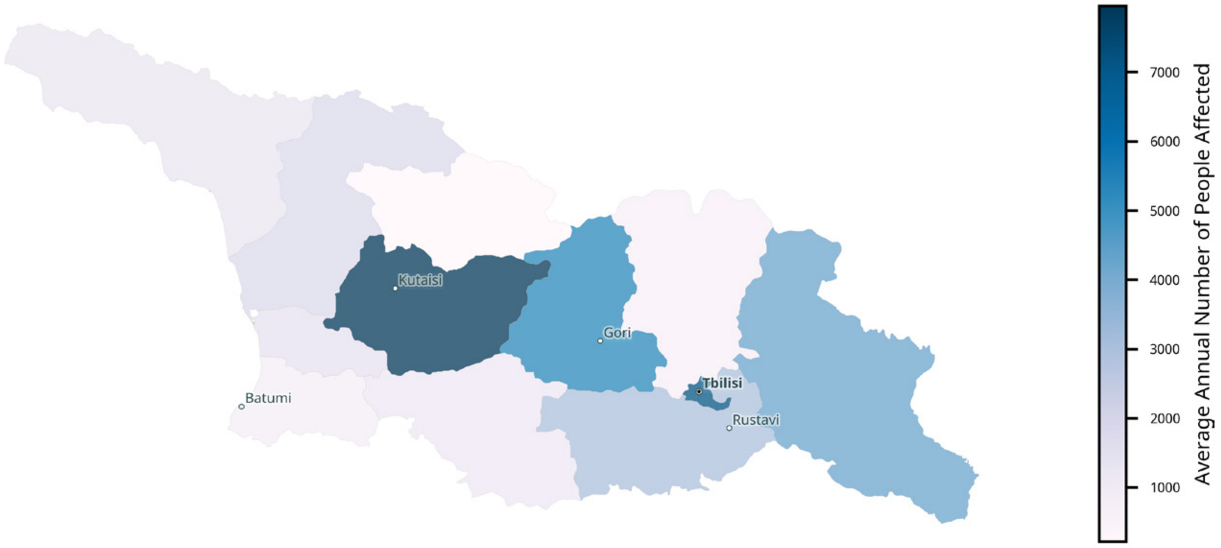
Figure 6: Breakdown of earthquake average annual fatalities and ratio by region



Source: JBA Risk Management

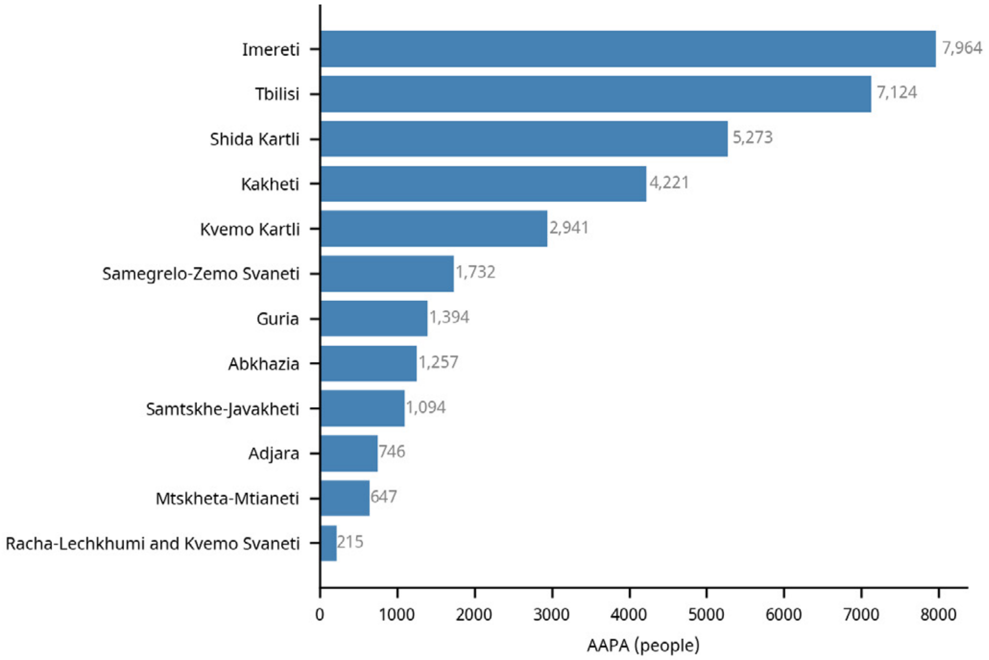
Given the relatively lower seismicity in the country, absolute values of average annual fatalities lower in Georgia than in other CAREC countries. A total expected value of 11 fatalities is modeled on an annual average basis, as displayed in Figure 5. The highest average annual fatalities are in the Imereti and the capital territory of Tbilisi, with 2.4 fatalities expected in each region. Figure 6 provides the breakdown of modeled fatalities by region. Relative to the population base, the Shida Kartli region has the highest average annual fatality rate of 0.60 per 100,000 people.

Figure 7: Average annual number of people affected - earthquake



Source: Global Earthquake Model

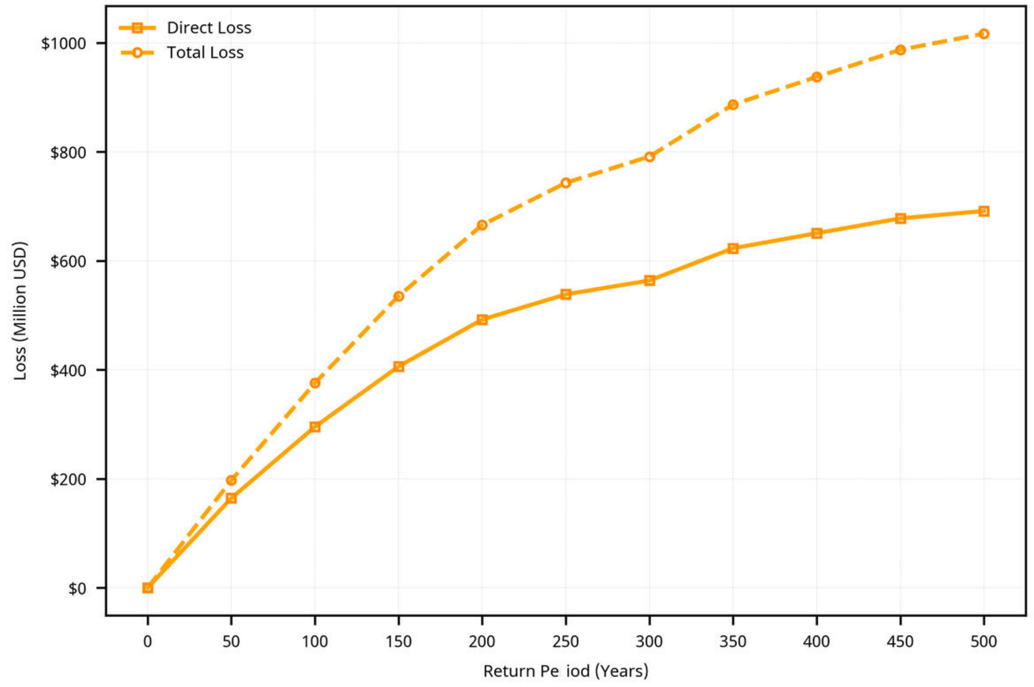
Figure 8: Breakdown of earthquake average annual number of people affected by region



Source: Global Earthquake Model

The average annual number of people affected (AAPA) by earthquakes follows a similar pattern as the average annual fatalities. Figure 7 shows the regional overview and Figure 8 provides the breakdown by region. Imereti and Tbilisi are the two regions with the highest AAPA, at 7,964 and 7,124 people respectively.

Figure 9: Exceedance probability curve – earthquake



Source: Global Earthquake Model

The exceedance probability curve shows the total loss from all events in any given year. Direct loss displays the modeled loss to residential, industrial and commercial assets. Total loss includes secondary impacts from the onset of disaster events, accounting for the reconstruction time.

Figure 9 shows the EP curve for direct and total loss from earthquakes in Georgia. The direct loss for the 100-year return period is modeled at just under $300 million, corresponding to 1.7% of the country's nominal GDP. This value increases to $500 million for the 200-year return period and to $700 million for the 500-year return period.

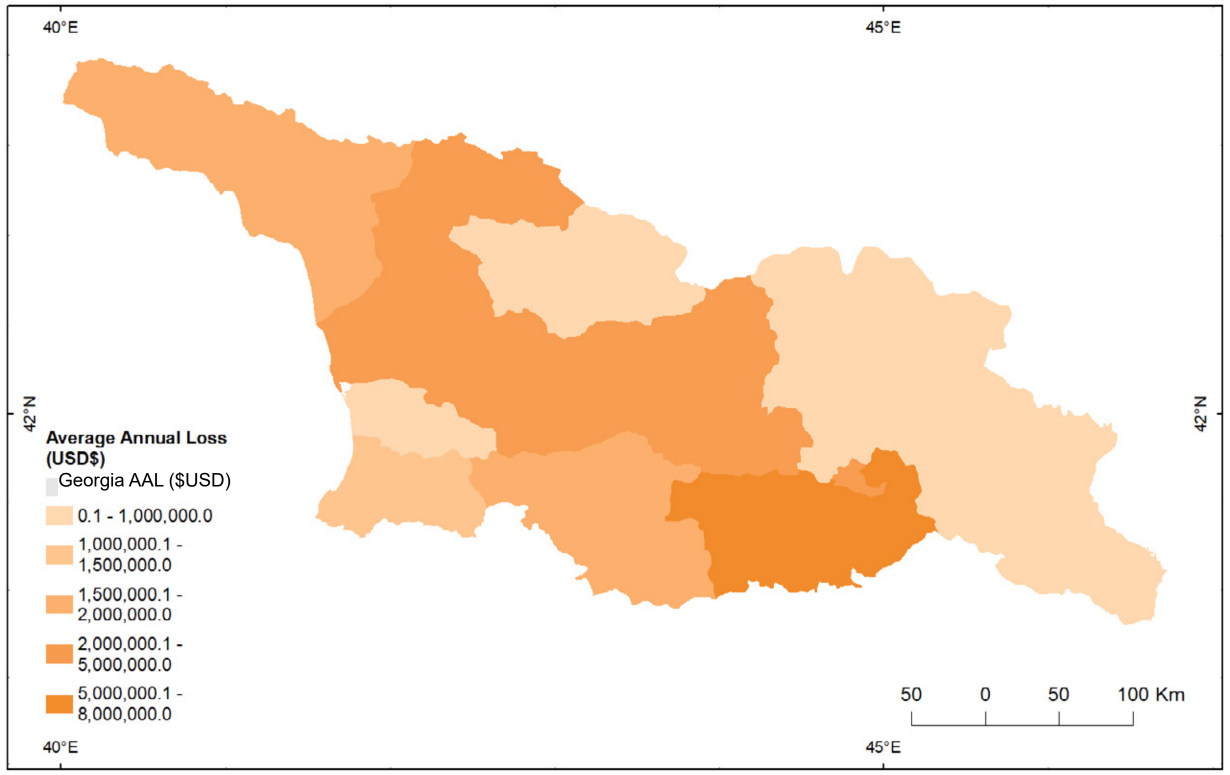
Flood Risk

Modeled losses from flood are highest in a band running across the central and southern regions of Georgia as displayed in Figure 10. This includes the regions of Kvemo Kartli, Shida Kartli and Imereti, which all have AALs above $4 million. Both the Mtkvari river in the East and the Rioni river in the West have several large population centers along their banks. The historic events detailed in Table 4 provide some corroboration on the geographic pattern of flood risk, with many impacts recorded in Kvemo Kartli.

Figure 11 provides the breakdown of flood AAL. These same regions have the highest loss ratio, a measure of loss relative to the overall exposure that highlights areas at proportionately higher risk.

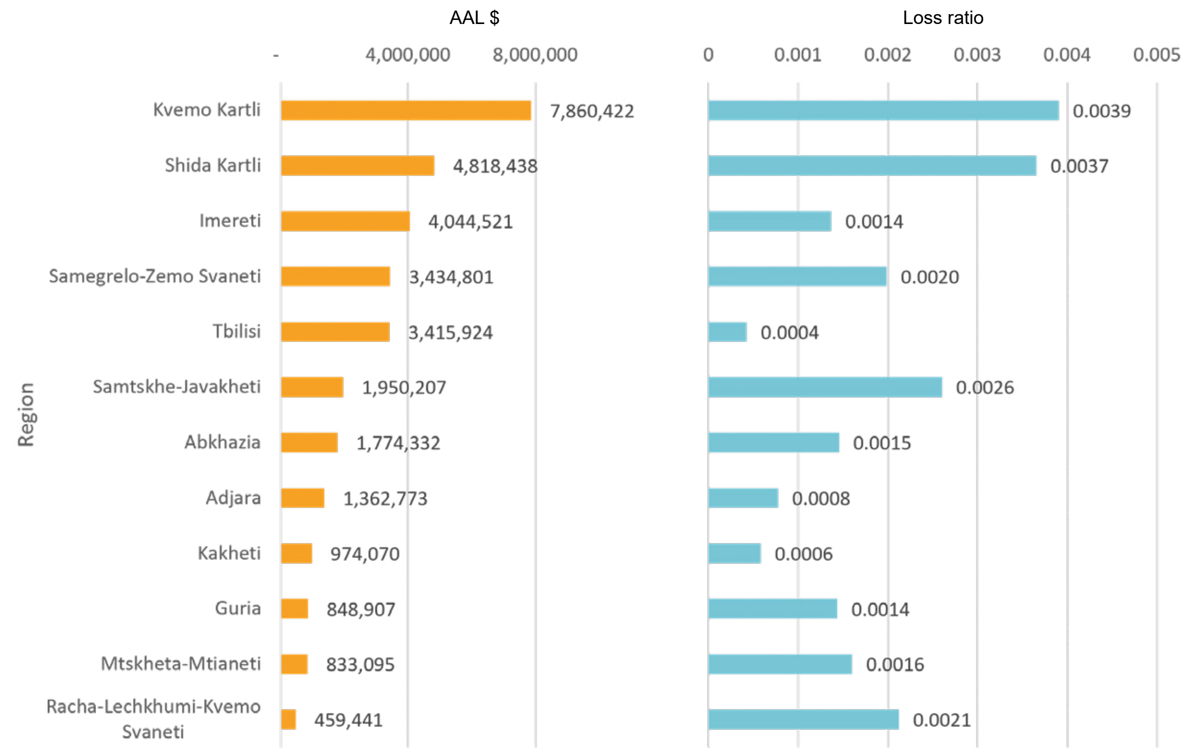
It is noticeable that the AALR is relatively low for Tbilisi, which may be an indication that flood defenses provide effective mitigation of river flooding in the city.

Figure 10: Average annual loss – flood



Source: JBA Risk Management

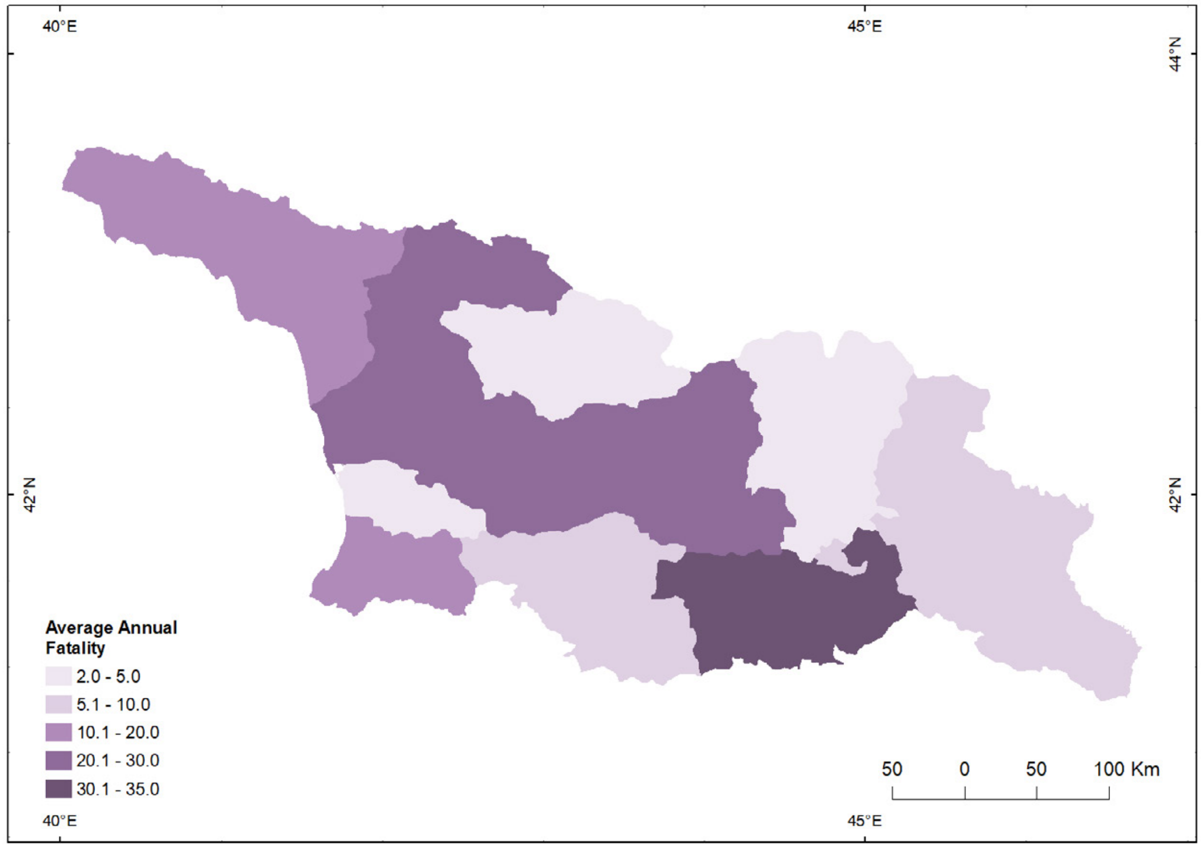
Figure 11: Breakdown of flood average annual loss and loss ratio by region



Source: JBA Risk Management

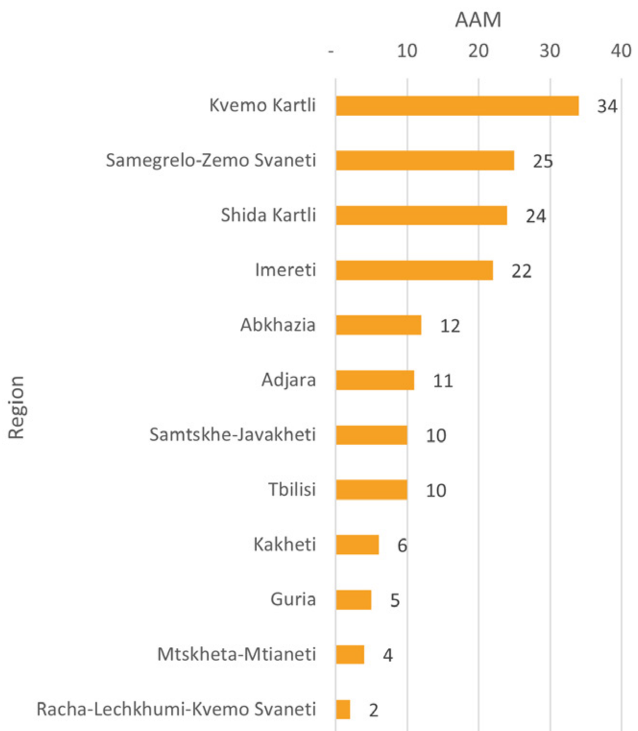
MODELED LOSSES ARE HIGHEST IN A BAND ACROSS THE CENTRAL AND SOUTHERN REGIONS OF GEORGIA

Figure 12: Average annual fatalities – flood



Source: JBA Risk Management

Figure 13: Breakdown of flood average annual fatalities by region

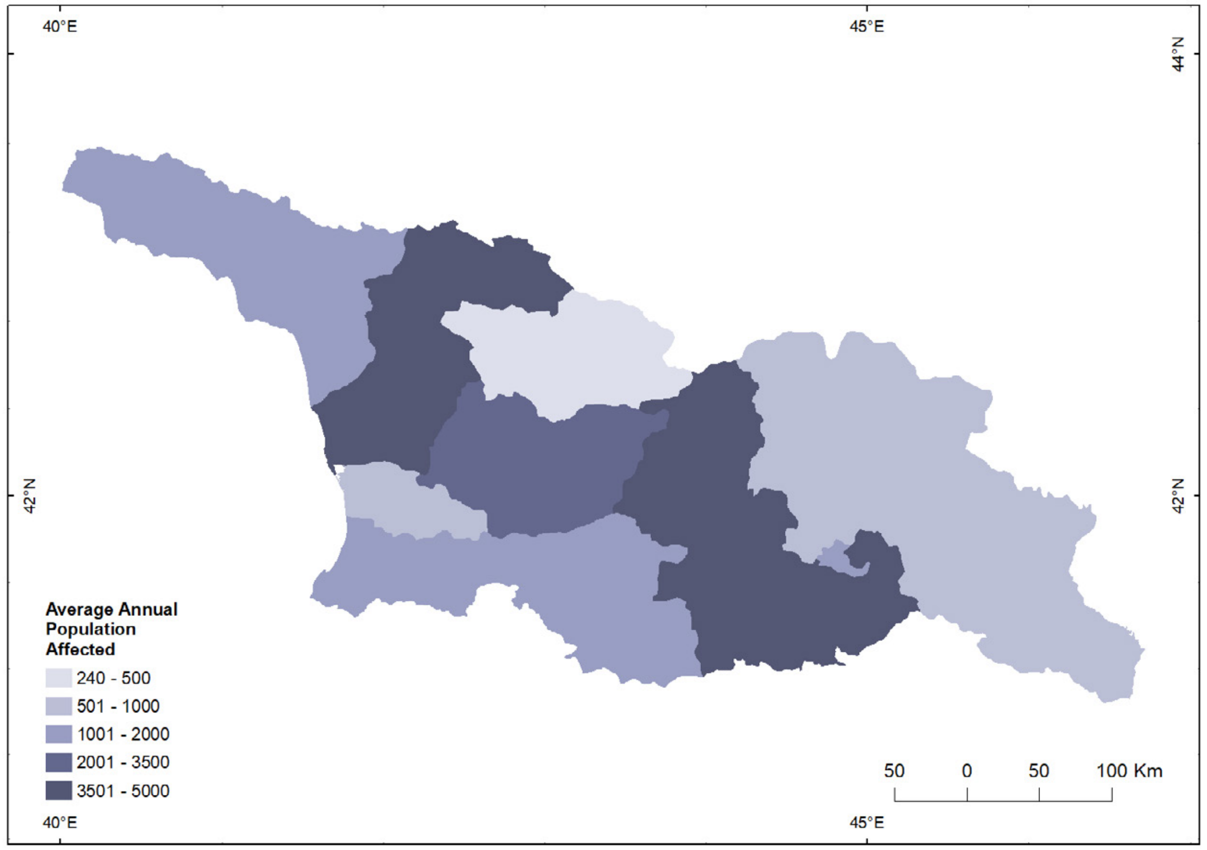


Source: JBA Risk Management

The pattern of modeled fatalities correlates to areas of highest flood risk. This is evident in Figure 12. Flood risk and population density are the two components in modeled mortality and population affected from severe flooding. As such, the highest values are associated with the populated river valleys of Shida Kartli and West Georgia.

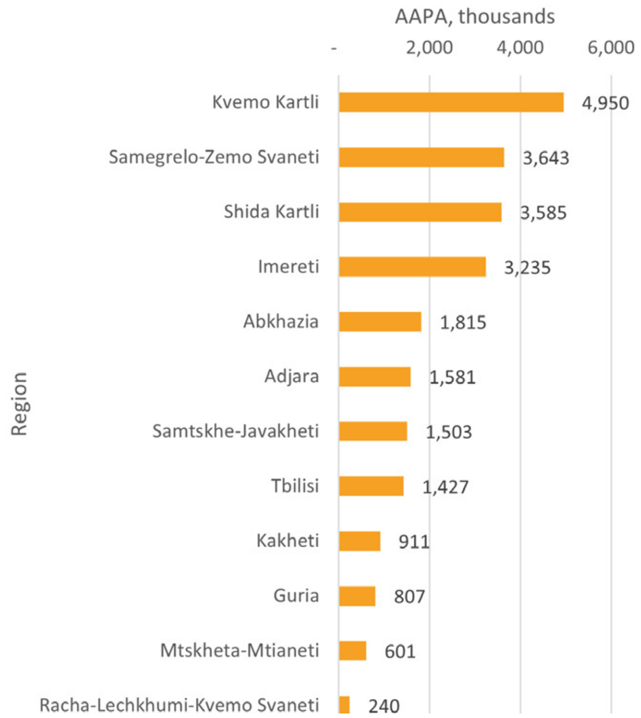
The breakdown of fatalities by region in Figure 13 provides further insight on the pattern. Despite the high population density only 10 people on average are affected in Tbilisi, as the defences in place provide effective protection from flood events.

Figure 14: Average annual number of people affected - flood



Source: JBA Risk Management

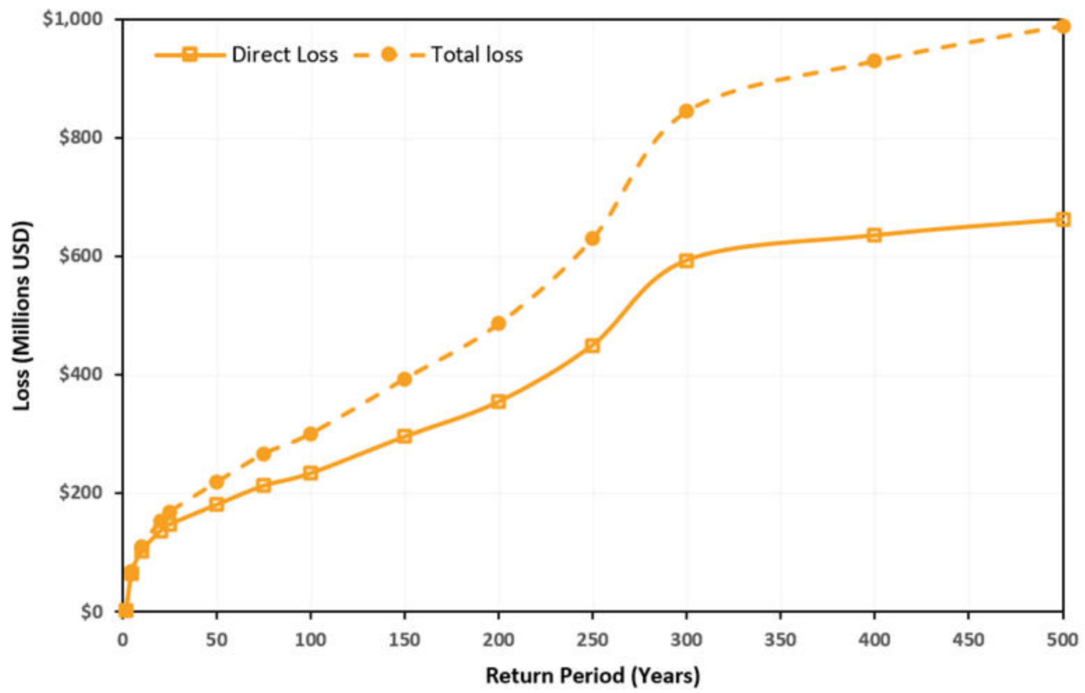
Figure 15: Breakdown of flood average annual number of people affected by region



Source: JBA Risk Management

The spread and number of people affected is similar to that of modeled fatalities. This is shown in Figure 14 and Figure 15. However, the concentration of population along the Adjara and Guria coast also increases the number of people affected.

Figure 16: Exceedance probability curve - flood

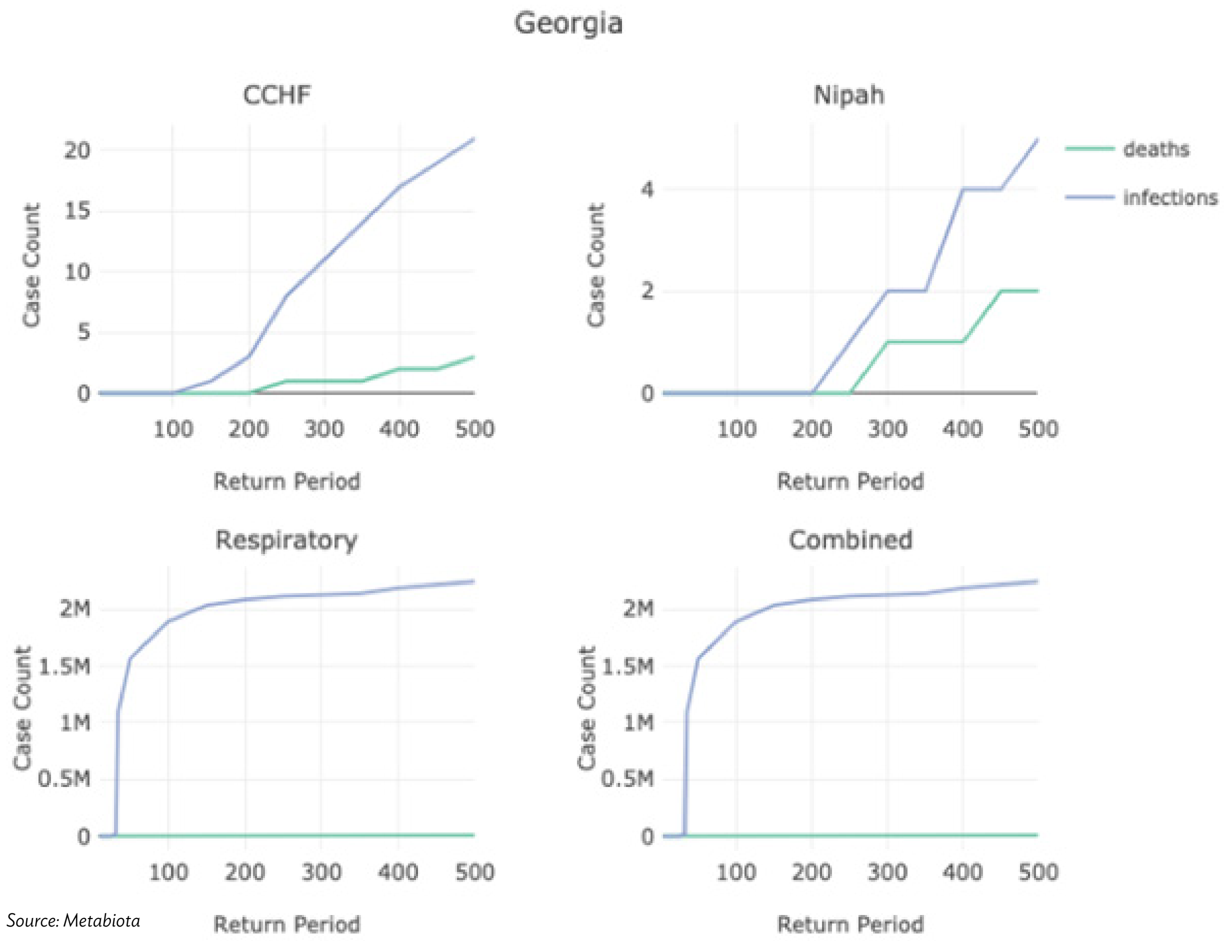


Source: JBA Risk Management

The exceedance probability curve shows the total losses from all events in any given year. The flood curve in Figure 16 shows that damage is modeled to accumulate at a slower rate than for earthquake. Losses at the 100-year return period is modeled at just over $230 million, about 1.1% of Georgia's nominal GDP. There is a significant increase between the 200- and 300-year event, suggesting sensitivity to events in this range. Above the 300-year return periods, losses grow at a very low rate, levelling off around $700 million. Total losses at the 500-year return period are modelled to reach nearly $1 billion

Infectious disease

Figure 17: Exceedance probability curves: infectious disease outbreaks, including Crimean-Congo haemorrhagic fever, Nipah virus, respiratory viruses and combined (all pathogens)



Source: Metabiota

Box 1: Pathogens modelled

- Respiratory: a range of novel respiratory pathogens are included such as pandemic influenza, emergent coronaviruses (Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS)). This does not include endemic pathogens such as measles. A re-emergence of SARS-CoV-1 or a new SARS coronavirus are included.
- Crimean-Congo haemorrhagic fever is caused by a tick virus is transmitted by tick bites or through contact with infected animal blood or tissues. Symptoms include fever, muscle ache and pain, dizziness, nausea, vomiting, diarrhoea, sleepiness, and depression. The case fatality rate is estimated between 10-40%. Some medicines seem to be effective.[3]
- Nipah virus is a zoonotic virus (it is transmitted from animals to humans) ; it is also transmitted through food or people. It can cause a range of illnesses, from asymptomatic infection to severe respiratory illness and fatal encephalitis. The case fatality rate is estimated between 40-75% and there is currently no treatment or vaccine available.[4]

[3] https://www.who.int/news-room/fact-sheets/detail/crimean-congo-haemorrhagic-fever
[4] WHO: https://www.who.int/news-room/fact-sheets/detail/nipah-virus

Table 1: Average annual losses - pandemic, including Crimean-Congo haemorrhagic fever, Nipah virus infection, respiratory viruses and combined (all pathogens)

Pathogen	Average Annual Loss - Infections	Average Annual Loss - Deaths
Combined	52,203	76
Respiratory	52,202	76
Nipah	<1	<1
CCHF	<1	<1

Source: Metabiota

The modeled exceedance probability (EP) curves include only those infections and deaths that are in excess of the regularly occurring annual baseline. For the included respiratory diseases like pandemic influenza and novel coronaviruses, this baseline will be zero, but for diseases like Crimean-Congo Hemorrhagic Fever (CCHF), which is endemic in some CAREC countries, the baseline will be higher than zero.

The pathogen EP curves for Georgia in Figure 17 highlight that. highlight that respiratory pathogens account for the majority of epidemic risk. The respiratory pathogens EP curve climbs rapidly and steeply. This is due to the fact that respiratory pathogens tend to be highly transmissible and cause very large pandemics when they occur; COVID-19 and pandemic influenza are notable examples.

CCHF and Nipah virus have much lower transmission leading to much smaller outbreaks which is consistent with what is shown in the EP curves: a few cases showing up at higher return periods.

Historical losses and impacts

Georgia is prone to earthquakes and floods, which often result in landslides and mudflows. Earthquakes and floods combined constitute about 85% of the recorded historical disaster events in the country since 1990.

They account for all of the recorded fatalities, 21% of the total number of people affected, and around 90% of total estimated damage. Total losses recorded due to flood and earthquake amounted to around $3.77 to 3.9 billion between 1990 and 2019.

Floods have been the most frequently recorded type of disaster in Georgia in the past 30 years, totaling an estimated $81 to $112 million in damage losses since 1990.

One of the most severe floods in Georgia recently occurred in 2015. Heavy rainfall and hail in the eastern part of the country resulted in floods that affected 8,800 people on 7 June 2015. Flooding hit the ground level and basements of houses.

The situation exacerbated when heavy rains continued on 13 June 2015, resulting in flash floods on Vere and Mtkvari rivers and inundating the central districts of Tbilisi and surrounding villages.[5] A landslide had blocked the channel on the Vere river, resulting in a significant volume of water being held back. When torrential rain occurred on 13 June, the blockage gave way and resulted in severe flooding in Vake and Saburtalo neighborhoods – high density residential housing areas of Tbilisi city.[6] In Vake residential district on Svanidze Street, houses built next to the river about half a decade ago were completed swept away.[7]

Table 2:Total impacts from floods, earthquakes and droughts, 1990-2019

	Fatalities	Number of people affected	Total damage ($ million; constant 2019)
Flood	190	199,309	81 - 112
Earthquake	284 – 285	30,212	3,689
Drought	–	696,000	297

Source: EM-DAT; National Geophysical Data Center / World Data Service (NGDC/WDS): NCEI/WDS Global Significant Earthquake Database. NOAA National Centers for Environmental Information.

Table 3: Pandemic impacts from past events

Pathogen	Date first case reported	Total cases	Total deaths	Location of origin
2019 Novel Coronavirus	27 Feb 2020	326,441	4,699*	People's Republic of China

Source: Metabiota's infectious disease database
**As of 5/28/21*

[5] *ReliefWeb (2015) Georgia Floods – Jun 2015. Available at:* https://reliefweb.int/disaster/fl-2015-000071-geo
[6] *FloodList (2015a) 12 Killed in Tbilisi Flash Floods, Georgia. Available at:* http://floodlist.com/asia/12-killed-tbilisi-flash-floods-georgia
[7] *The Guardian (2015) The human cost of the Tbilisi floods: 'The truth is, I'd really lost all hope'* https://www.theguardian.com/cities/2015/jul/03/tbilisi-floods-georgia-capital-destroyed-zoo-wild-animals

The total losses incurred from the floods was estimated to be between $23-50 million. [8]

Eastern Georgia and the region around Tbilisi were also badly affected by flooding in 2012, with heavy rain again resulting in landslides, leading to 5 deaths, property and infrastructure damage and impacts to agriculture.[9]

Though less frequent, past earthquakes, droughts, and storms have shown the potentially detrimental impacts these individual events can have in Georgia. This is evident from the 1991 Racha earthquake, which is the most impactful earthquake event on record on Georgia's territory.

Table 4: The most impactful flood and earthquake events in Georgia, 1900 – 2019

Year	Location	Total damage ($ millions; constant 2019)	Fatalities	Number of people affected
Floods				
1995	Kvemo Kartli region; Mtkvari river	3.7	1	300
1997	Tbilisi	31.1	3	
1997	Kvemo Kartli region; Mtkvari river	15.9	4	300
2004	Mestia (Samergelo and Zemo (upper) Svaneti region)	2.9		
2011	Shida Kartli region		7	1,750
2012	Tbilisi district (Tbilisi region), Dusheti, Mtskheta districts (Mtskheta-Mtianeti region), Akhmeta, Gurjaani, Lagodekhi districts (Kakheti region)	3.3	5	100,000
2015	Vake and Saburtalo districts (Tbilisi region); Vere and Mtkvari rivers	24.8 - 55.2	40	10,320
Earthquakes				
1986	Akhalkalaki		2	
1991	Tbilisi	3,191	270	
1991	Java, Tskhinvali, Ossetia		8	3,740
2002	Java, Chiatura, Ambrolauri	497	5	

Source: EM-DAT with validation from other sources including Swiss Re, ReliefWeb, World Bank reports for floods; National Geophysical Data Center / World Data Service (NGDC/WDS): NCEI/WDS Global Significant Earthquake Database. NOAA National Centers for Environmental Information.

[8]*FloodList (2015b) Tbilisi Floods – Death Toll Rises, EU Sends Aid to Georgia* http://floodlist.com/asia/tbilisi-floods-death-toll-rises-eu-aid-georgia
[9]*ReliefWeb (2012) Georgia: Flash Floods and Landslides – May 2012* https://reliefweb.int/disaster/ff-2012-000079-geo

With a magnitude of 7, the earthquake on 29 April 1991 cost an estimated 270 lives and left 160,000 people homeless in the area.[10] Rockslides resulting from the ground shaking contributed to the destruction of homes, shops, and public buildings.[11] Damaging over 1,000 administrative buildings and 46,000 dwellings, the event caused close to $3.2 billion in damage, in 2019 prices?[12 13]

COVID-19 has had a severe impact on the Georgian economy, especially through tourism which makes up approximately 20% of the GDP.[14] Georgia relies heavily on Russian Federation for tourism, in 2019 $700 million was spent by Russian Federation tourists and 16% of all tourists coming to Georgia were from Russian Federation in 2018. Along with tourism, exports and remittances have been the areas expected to be hit hardest by the pandemic due to their high reliance on Russian Federation.[15]

[10]*Rich, V. (1991, May 11). Georgia unprepared for April earthquake. New Scientist. Accessed March 2021 at:* https://www.newscientist.com/article/mg13017682-300-georgia-unprepared-for-april-earthquake/
[11]*Parks, M. (1991, April 30). 7.0 Quake Hits Soviet Georgia, Kills at Least 30. Los Angeles Times. Accessed March 2021 at:* https://www.latimes.com/archives/la-xpm-1991-04-30-mn-971-story.html
[12]*International Institute of Seismology and Earthquake Engineering (n.d.) Largest earthquakes on the territory of Georgia. Accessed March 2021 at:* https://iisee.kenken.go.jp/net/shiva/georgia/fig2.html
[13]*National Geophysical Data Center / World Data Service (NGDC/WDS): NCEI/WDS Global Significant Earthquake Database. NOAA National Centers for Environmental Information. doi:10.7289/V5TD9V7K*
[14]*Pollakova L. (2020, June 4) 'South Caucasus States Set to Diverge Further due to COVID-19', Chatham House. Accessed March 2021 at:* https://www.chathamhouse.org/2020/06/south-caucasus-states-set-diverge-further-due-covid-19
[15]*Transparency International (2020, May 4). 'Georgia's Economic Dependence on Russia: Trends and Threats', Transparency International Georgia. Accessed March 2021 at:* https://transparency.ge/en/blog/georgias-economic-dependence-russia-trends-and-threats?fbclid=IwAROmdNvy10OnRxhlqFppSjvNl9m6SgPf4SoJ8Oby05W7iFopLvzhI-Bor6M

Hazard

Georgia is largely covered by mountains (80% of land surface), with the Greater Caucasus Mountain Range in the north and parallel Lesser Caucasus Mountains on the borders in the south. The landscape ranges from subtropical Black Sea shores and low-land marsh-forests in the west, to mountains separated by valleys and gorges in the east.

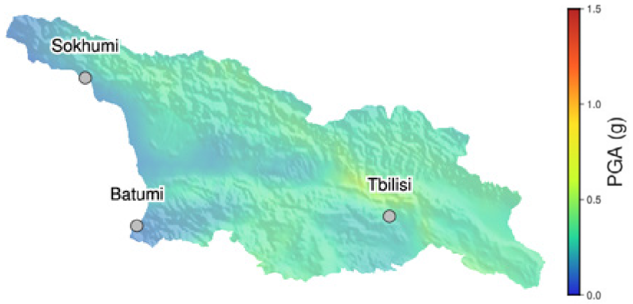
Georgia is prone to a number of hazards, particularly: earthquakes, floods, mudflows and landslides. The country has nearly 25,000 rivers, with the largest river, Mtkvari River, flows from northeast Turkey across the plains of eastern Georgia. Almost all rivers in the country are subject to surface water flooding due to sudden increases of water. The country is situated in the Alpine-Himalayan collision belt – one of the most seismically active regions.

Seismic hazard

The Lesser and the Greater Caucasus mountain chains border the territory of Georgia to the south and the north, respectively. The east-west trending Rioni depression separates the two mountain ranges and hosts the principal urban centers of the country, including the capital city Tbilisi. Seismicity in Georgia is mainly shallow and spread across the country. The rupture mechanisms are mostly reverse, in close relationship with the current geodynamic settings, dominated by the collision between the Eurasian and African-Arabian plates.

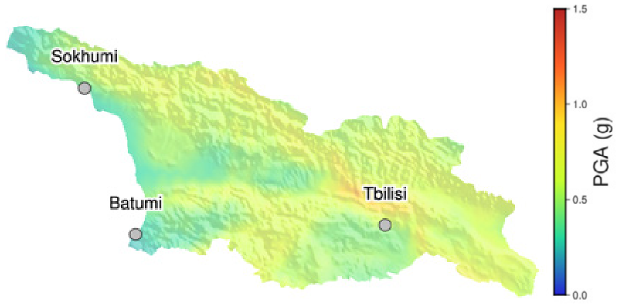
Much of the country is exposed to seismic hazard - expressed in terms of the Peak Ground Acceleration (PGA) on reference site conditions (i.e. considering a Vs30 of 800 m/s) - larger than 0.2g. The sector with the highest values is a band elongated South East-North West passing through Tbilisi. Here, the PGA10%50yr reaches values close to 0.6g.

Figure 18: Seismic hazard map PGA on rock, 10% probability of exceedance in 50 years



Source: Global Earthquake Model

Figure 19: Seismic hazard map PGA on rock, 2% probability of exceedance in 50 years

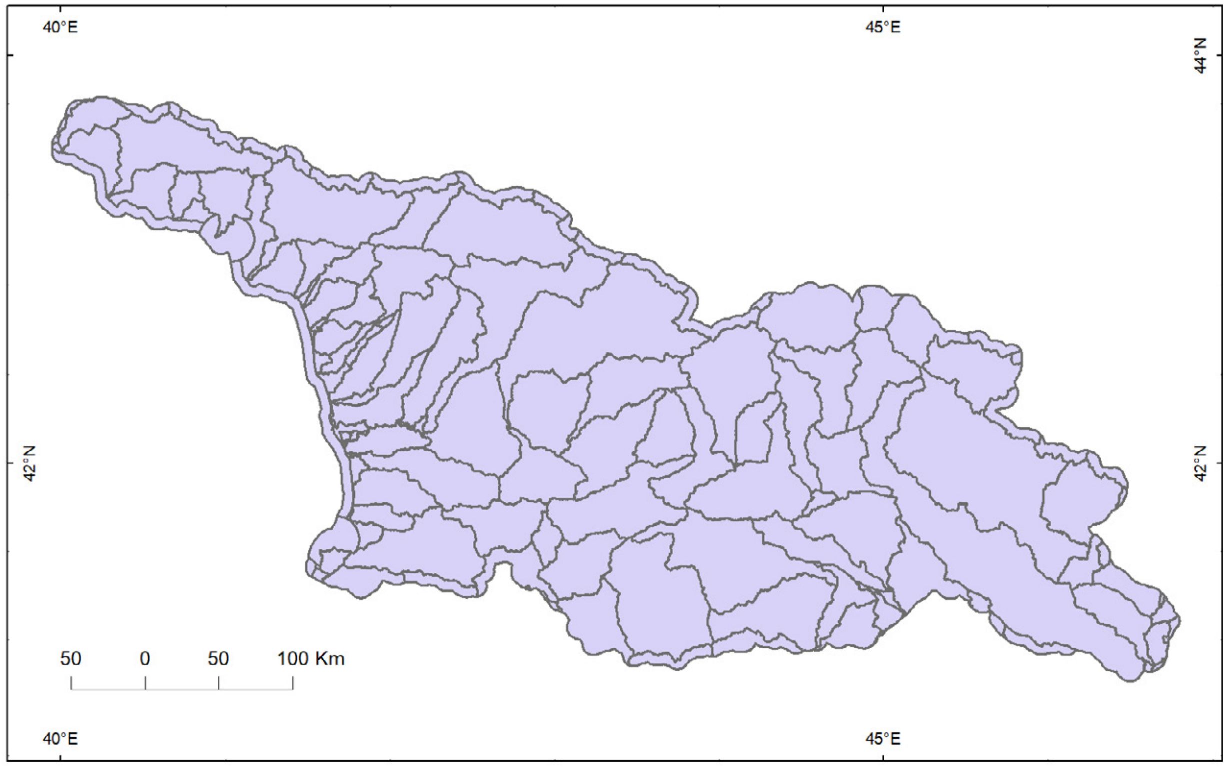


Source: Global Earthquake Model

Map of hydrological catchment areas

Exposure to flooding can be assessed via hydrological accumulation zones (HAZ). HAZ polygons represent the natural watercourse boundaries as a means of modelling the flow of water. The HAZ polygons as shown in Figure 20 for Georgia show relatively large areas across much of the country, where it might be expected that river valleys are broader. Along the Black Sea coast, the HAZ polygons are smaller, indicating that the rivers here flow a shorter distance, carry less water and present a lower risk of large-scale river flooding. This may mean that these areas are more likely to be susceptible to flooding that is of shorter duration and less extent, although it does not preclude the possibility of damaging surface water flooding from intense rainfall.

Figure 20: Hydrological accumulation zones



Source: JBA Risk Management

Flood hazard map for pluvial and fluvial flooding

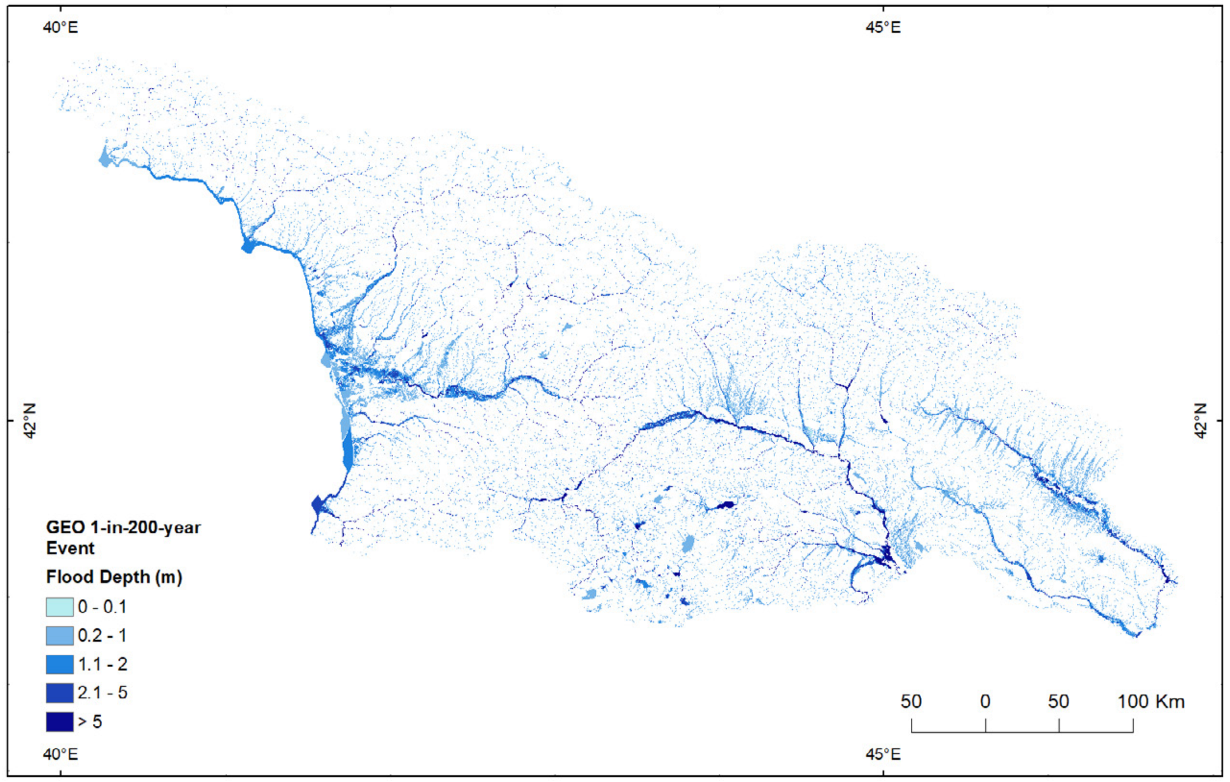
Flood modelling estimates losses on the basis of flood maps for river (fluvial) and surface water (pluvial) flooding generated at 30-meter spatial resolution. These maps use observed river and rainfall data to generate extreme rainfall and river flow volumes. Maps are generated for different return periods. The 1 in 200-year return period river flood map in Figure 21 highlights the main rivers of Georgia. This event severity is often used for planning purposes as a plausible extreme event.

The map shows the Mtkvari River that drains central Georgia to the east, through the cities of Gori and Tbilisi. Further east, the Alazani River drains the mountains of the Greater Caucasus Range along the border with Azerbaijan before meeting the Gabirri River and the Mtkvari at the Mingechevir Reservoir in Azerbaijan. In western Georgia, the main river is the Rioni, which flows south through the city of Kutaisi before joining the Kvirila and heading west to the Black Sea in a wide, flat river valley.

The flood map of Tbilisi (Figure 22) illustrates river flooding risk within a narrow strip through the city. This indicates the river is relatively well managed with some flood defenses included in the model.

Surface water flooding is possible around the city, partially a result of narrow valleys prone to flash flooding. Most of these areas however appear to be undeveloped, limiting the risk to population and assets. Almost all rivers in the country are subject to surface water flooding due to sudden increases of water

Figure 21: Map of river (fluvial) flooding (areas in blue) at the 200-year return period level



Source: JBA Risk Management

Figure 22: Map of surface water (pluvial) flooding (areas in purple) at the 200-year return period level for the Tbilisi region

Source: JBA Risk Management

Climate conditions: historic trends

The climate of the country is strongly influenced by the Greater Caucasus Mountain Range (along the northern border) and the Likhi mountain range dividing the east and west of the country. There are two main climate zones; a humid subtropical zone covers much of western region, and a continental climate zone dominates the east. As shown in Figure 23 and Figure 24, precipitation tends to be greater in the western region, with an annual precipitation between approximately 1,000 and 2,000 mm, and mean annual temperatures between 13 and 15°C. East of the Likhi, annual precipitation is less, 400 – 1,600 mm, with seasonal fluctuations. Mean annual temperatures range from 10 to 13°C at lower elevations.

Georgia is warming. Between the 1960s and 2010s, average annual maximum and annual minimum temperatures increased across much of the country, with warming trends most pronounced after 1970.[16] Temperature extremes (the number of exceptionally warm days and nights and heat waves) have increased significantly during the summer season, particularly since the 1980s.[17,18] Mean annual temperatures are projected to increase due to climate change between 2.2 and 3.8°C in the east, and 2.1 to 3.7°C in the west, by the 2080s.[19] Temperature increases during the summer could be 3 to 5°C warmer than historical means (1986-2010).

Figure 23: Georgia annual mean precipitation, 1951-2007

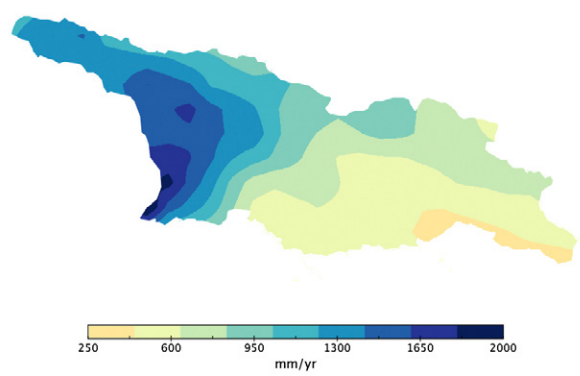
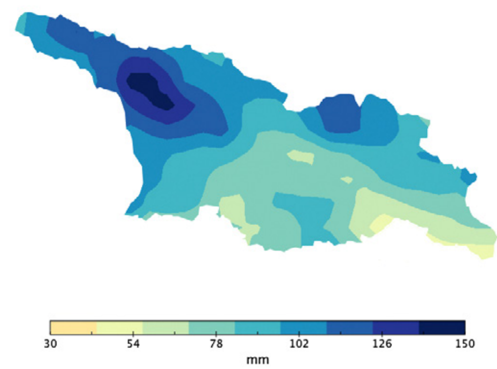


Figure 24: Georgia mean April-June precipitation, 1956-1995



Note that the precipitation scales are different for the annual mean and seasonal mean.
Source: analysis using APHRODITE7 Russia domain precipitation dataset.

[16]Keggenhoff, I., M. Elizbarashvili and L. King (2015) 'Recent changes in Georgia's temperature means and extremes: Annual and seasonal trends between 1961 and 2010'. Weather and Climate Extremes: http://dx.doi.org/10.1016/j.wace.2014.11.002
[17]Keggenhoff, I., M. Elizbarashvili and L. King (2015) 'Heat wave events over Georgia since 1961: Climatology, changes and severity'. Climate: doi:10.3390/cli3020308.
[18]Elizbarashvili, M., E. Elizbarashvili, et al. (2017) 'Climatology and historical trends in tropical nights over the Georgian Territory'. Earth Sciences: doi: 10.11648/j.earth.s.2017060501.14
[19]Government of Georgia (2015) Third National Communication of Georgia to the UNFCCC. Tbilisi.

Historic trends in precipitation are less clear.[20] Heavy rainfall associated with storms from April to July can contribute to floods, flash flooding, and landslides, with 8 major flooding events occurring since 2011. Within parts of the Egrisi Range, the number of very heavy precipitation days and extremely wet days is increasing. Though some regions of the country show overall decreases in total annual precipitation, there are indications that extreme events are starting to contribute more to annual precipitation totals than average precipitation days. This could indicate that the nature of flood hazards will change for some parts of the country.

Climate conditions: future precipitation projections

Annual mean precipitation is projected to decrease by −10 to −20% (RCP4.5) for a band across the northcentral regions and extending southward through Imereti and part of Samtskhe-Javakheti; the multi-model mean projections under RCP8.5 show declines of −10 to −20% for Imereti and Samtskhe-Javakheti, with the rest of the country experiencing little change. Wintertime (January to March) mean precipitation is projected to decrease by up to −20% across the north central of the country under both RCP4.5 and RCP8.5. Overall ensemble mean precipitation during April to June (the primary flood season) shows little change for most of the country when compared with 1956-1995; in Kakheti region, slight increases of up to 20% are projected for RCP8.5 only.

Box 2: Future climate methodology

Climate change impacts on precipitation were examined by use of Regional Climate Models. Two Representative Concentration Pathways (RCPs) were selected: RCP 4.5 as a medium emissions pathway and RCP 8.5 as a high (business-as-usual) pathway.

Multi-model projections simulated how precipitation could differ in the 2050s compared to the historical reference period of 1956-1995. Precipitation projections were made to examine how conditions could differ in the 2050s to the historical reference period of 1956-1995. This reference period accounts for two phases of the Atlantic Multidecadal Oscillation, which modulates climate over Central Asia. The 2050s were chosen as a policy relevant period where a climate change signal is detectable.

Further information on the approach is detailed in the Technical Documentation.

[20]Keggenhoff, I., M. Elizbarashvili, et al. (2014) 'Trends in daily temperature and precipitation extremes over Georgia: 1971-2010'. Weather and Climate Extremes: https://dx.doi.org/10.1016/j.wace.2014.05.001

Precipitation extremes were used to calculate future precipitation intensities, which is relevant to estimating future flood risk. Box 2 describes the method further. The area-averaged March to September annual maximum rainfalls for 24-hr duration for each province was extracted and analyzed for different return periods (2, 5, 10, 20, 50, 100, 200-, 500-, 1000-, 1500-, 5000, and 10000-year events). The spatial pattern for RCP4.5 and RCP8.5 are shown in Figure 25 and Figure 26 respectively. 24-hr extreme precipitation intensities are projected to increase fairly substantially over the west by the 2050s. In these regions, the multi-model mean projections for both RCP4.5 and RCP8.5 indicate that what was once the 500-yr 24-duration rainfall event could become the 100-yr event; the old 100-yr event is projected to become the new 50-yr event.

Extreme precipitation intensities are projected to increase for other regions as well, but the extent of potential increase lessens in a west to east gradient. While overall mean April-June precipitation totals are not projected to significantly change for most of the country, increases in extreme event intensities is indicative that more of the spring to early summer precipitation could fall as extremes with longer dry spells in between.

Table 5 shows future precipitation projections intensities in Tbilisi for the 2050s as compared to the historical record. This covers different return periods. The data presented are the median of the multi-model ensemble, with the 25th and 75th percentiles in brackets.

Figure 25: Georgia percent change: 2050 RCP4.5 April-June precipitation

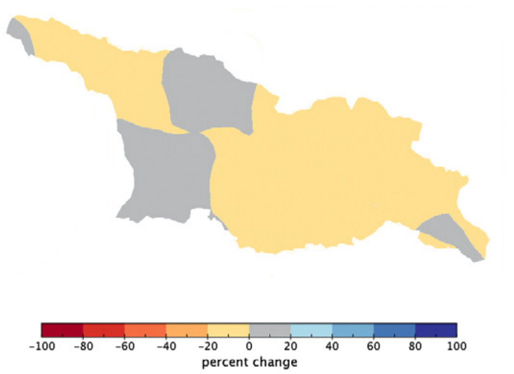
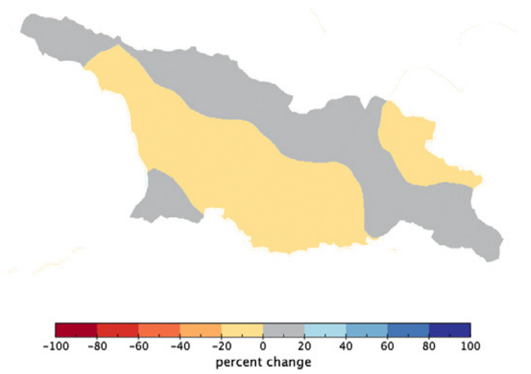


Figure 26: Georgia percent change: 2050 RCP8.5 April-June precipitation



Source: Bias corrected multi-model projections from CORDEX Central Asia domain

Table 5: Future precipitation projections

Return period	1951-2007	2050s	
	Historical	RCP4.5	RCP8.5
20-year	2.16	2.19 (2.17, 2.23)	2.28 (2.18, 2.38)
100-year	2.84	2.81 (2.77, 2.85)	2.95 (2.81, 3.1)
500-year	3.52	3.42 (3.38, 3.47)	3.62 (3.42, 3.81)

Tbilisi 24-hr duration extreme precipitation intensity (mm/hr) Projected changes in 24-hr duration extreme precipitation intensities in Tbilisi for 2031-2070 (the 2050s) as compared to historical 24-hr intensities for different return periods. The table shows the median of the multi-model ensemble and the 25th and 75th percentiles in brackets.

CHAPTER 4

Exposure

Located at the cross-roads between Asia and Europe, Georgia has a recent history of successful social and economic reforms, contributing to increased living standards. Macro-economic and social indicators attest to such progress, with the growth of private sector investment particularly notable.

GDP grew by 5.3 per cent per year between 2005 and 2019 and poverty declined from 30 per cent in 2005 to 14 per cent in 2019.[21] It is however expected that the impacts of the COVID-19 pandemic will reverse some of this progress. The economy contracted by 6.2% in 2020, with estimates indicating a 2.8% increase in poverty as a result of COVID-19. Prospects for future growth look more robust with anticipated growth of 3.5% in 2021 and 6.0% in 2022.[22]

Agriculture and services employ most of the population in Georgia (85%). Services generate 60.4 of GDP and agriculture only 6.2%.

Table 6: Population totals, distribution and trends (all data from 2019)

Population	3,720,280
Population growth date (%/year)	-0.2
Share of population living in urban areas (%)	59
Urbanisation rate (%/year)	0.5
% of population aged 0-14	20
% of population aged 15-64	65
% of population aged 65 and above	15

Source: World Bank Open Data

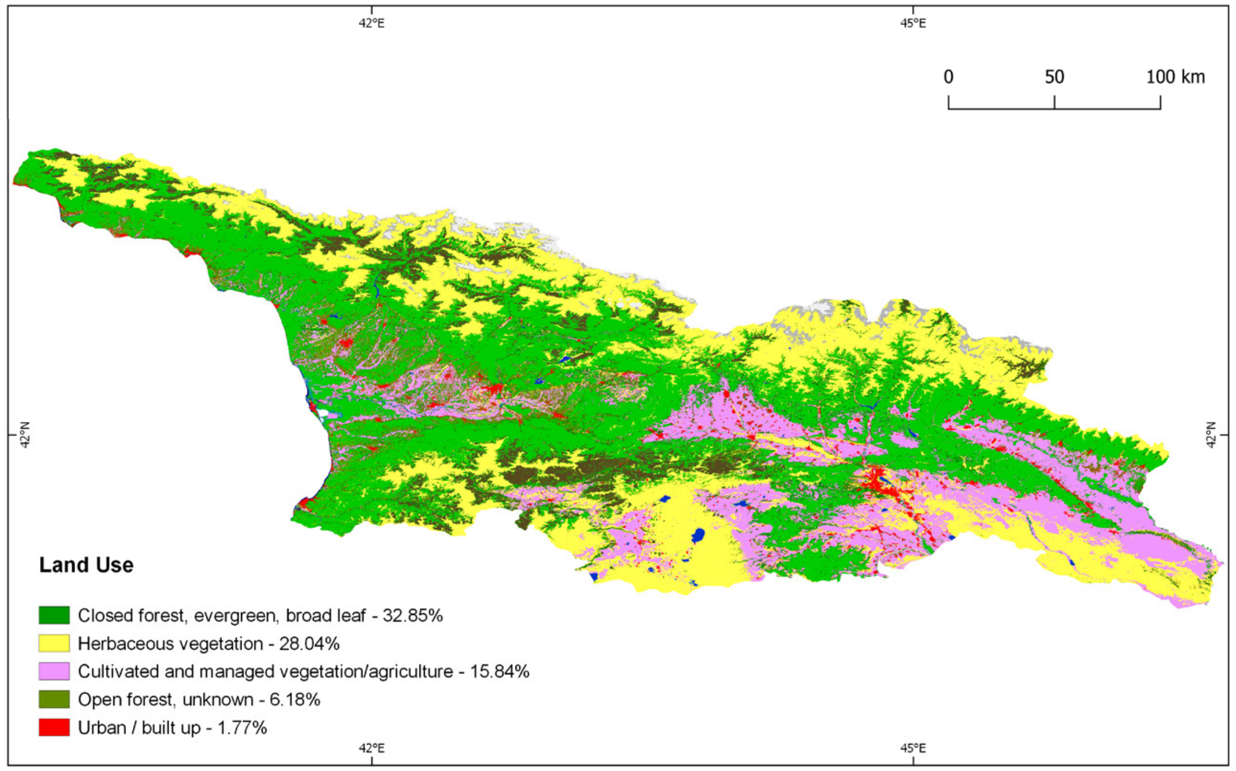
Table 7: Key economic indicators (data from 2019, if *from 2020)

GDP (million USD, current)	17743.2
GDP per capita (USD, current)	4769.2
Agriculture, forestry and fishing, value added (% of GDP)	6.2
Agriculture (% of working population employed)	41*
Industry (including construction, value added (% of GDP)	20
Industry (% of working population employed)	14*
Services, value added (% of GDP)	60.4
Services (% of working population employed)	44

Source: World Bank Open Data

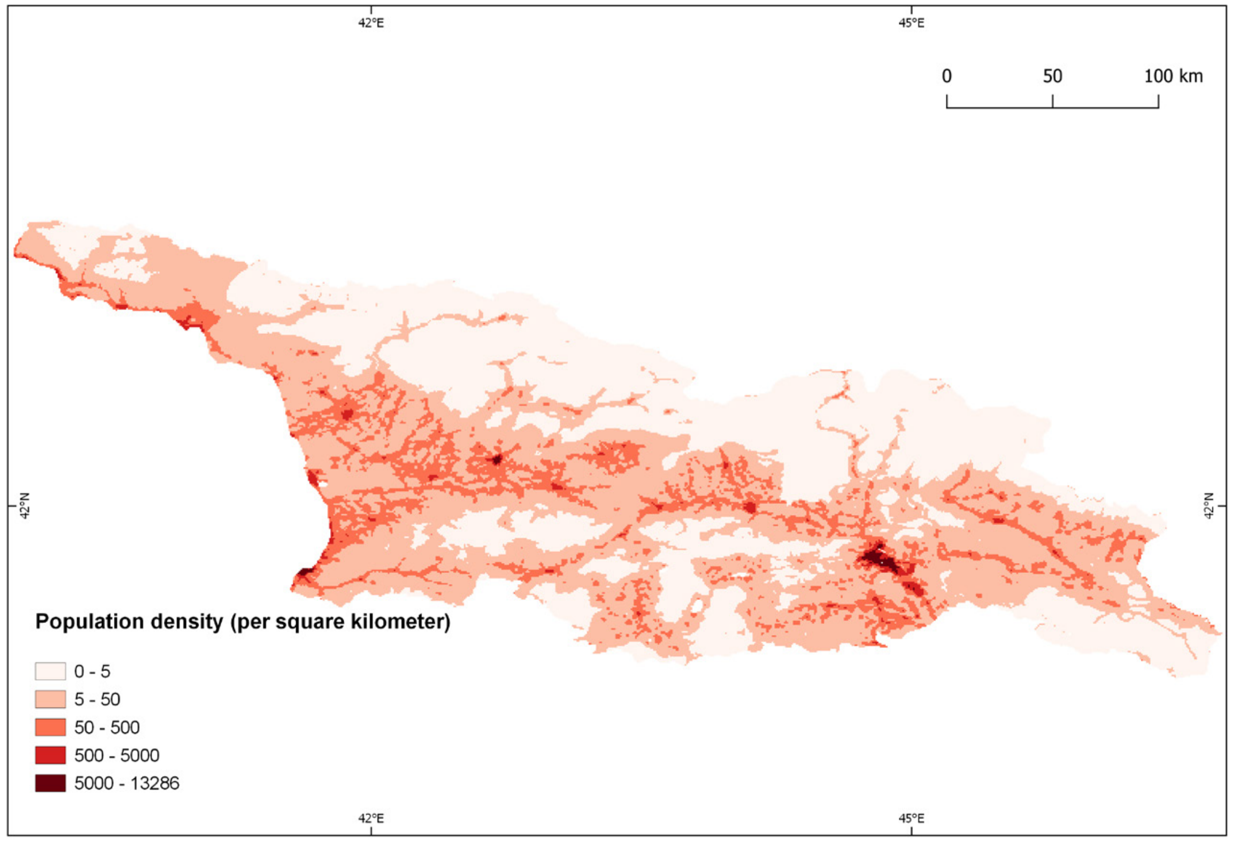
[21] https://www.worldbank.org/en/country/georgia/overview
[22] ADB 2021. Asian Development Outlook 2021: Financing a Green and Inclusive Recovery

Figure 27: Land use map



Source: FAO GlobCover

Figure 28: Population density map



Source: WorldPop

The topography of Georgia is evident in the land use and population pattern. The makeup of evergreen forest reveals mountain slopes, with herbaceous vegetation occupying higher altitudes. Untouched rural forest can be effective buffer of heavy rainfall. These zones match neatly with the population pattern, as shown in Figure 27 and Figure 28 respectively.

Cultivated land and urbanization run in bands across the country, depicted by the purple and red zones. The cultivation of land tends to increase flood risk through the compaction of soil and reduction of interceptors, increasing surface water run-off.

Much like many other CAREC countries, Georgia is characterized by select, small areas of urbanization with large parts of the country sparsely populated and/or uninhabited. The Tbilisi-Rustavi corridor is the primary area of urbanization, with the Black Sea ports of Batumi and Poti also noticeable.

Table 8: Assets at risk by type: residential, commercial, industrial

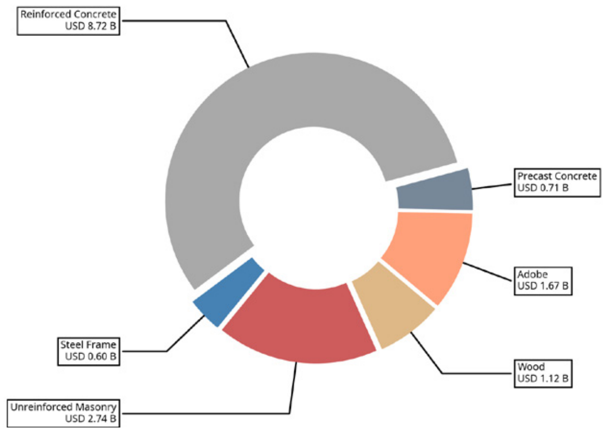
Asset replacement cost (billion $)	
Residential buildings	16.7
Commercial buildings	3.1
Industrial buildings	1.8
Total buildings	21.5

Source: Global Earthquake Model database

According to the most recent available figures, from the 2014 national population and housing census, Georgia has 1,083,795 dwellings in total, of which 632,078 are in urban areas and 451,717 are in rural areas.

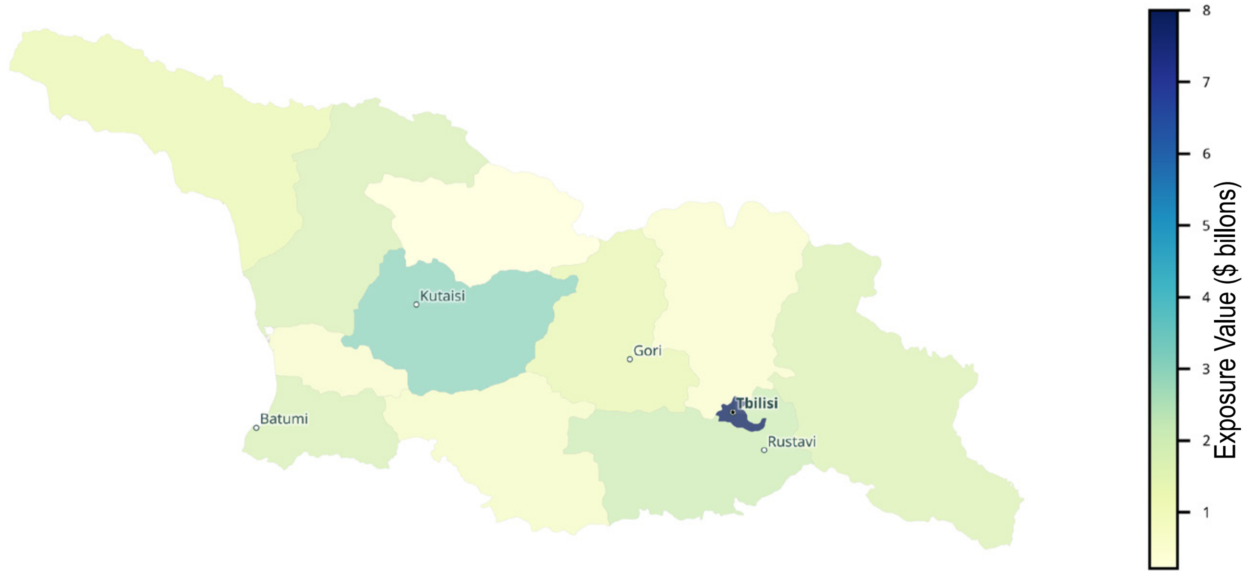
The breakdown is shown in Table 8, revealing the value of residential of buildings across the country. Over 90% of the dwellings in the rural areas are individual houses, whereas just over a quarter of the urban dwellings are individual houses. 70% of urban inhabitants live in apartment buildings. The diversity of building types is evident in Figure 29, with a large proportion of more vulnerable construction types. Around 47% of Georgia's housing stock was built before 1970, i.e., over 50 years ago. In rural areas, adobe and unreinforced masonry structures are the most commonly observed building types.

Figure 29: Breakdown of different building types



Source: Global Earthquake Model

Figure 30: Asset replacement cost (residential, commercial and industrial buildings)



Source: Global Earthquake Model

Most residential buildings in the urban areas are of Soviet-era construction, ranging from 6 to 12 floors. Commercial buildings tend to be smaller, up to 5 floors. Multi-family apartment blocks in the urban areas, constructed in the 1930-1950 period, are commonly known as "Stalin style" buildings, which are typically constructed using concrete blocks and fired clay bricks. Many of the Stalin style buildings appear to be of solid construction. Multi-family apartment blocks constructed in the succeeding era, in the 1960s, are commonly referred to as Khrushchevka housing blocks, and these are most often prefabricated concrete structures. Modern high-rise reinforced concrete structures are more common in Tbilisi and other big cities in the post-Soviet era, with a construction boom starting around the year 2000.

The spread of replacement cost across the country is illustrated in Figure 30. Tbilisi unsurprisingly accounts for the largest amount of replacement cost value. Assets at risk are broadly spread across the rest of the country. Natural resource extraction is focused in Imereti, accounting for this agglomeration of economic activity outside the capital center.

Vulnerability and coping capacity

The social impacts of hazard events are greatly affected by the structure and organization of societies and economies. Vulnerability can be thought of as one determinant of disaster risk, the other being the natural hazard event. The structure of politics, economics and livelihoods affects vulnerability to disaster events. Policy and investment choices can increase or decrease vulnerability, and so determine the overall level of disaster risk. Deliberate policies, such as for disaster risk reduction and finance, can reduce vulnerability. Other forces, such as pattern of urbanisation or decline of ecosystem services, may unintentionally increase vulnerability.

Socio-economic vulnerability

Over 40% of the population in Georgia works in agriculture, a sector that is vulnerable to deviations in rainfall, temperature, and the availability of water resources.

Hail and drought are responsible for considerable losses in Georgia's agriculture, and a recent increase in the duration and frequency of such events in the eastern part of the country is putting the sector under stress.[23] Landslides occur regularly, particularly in mountainous areas of the country, affecting local communities and destroying irrigation systems, agricultural sites, and roads.[24]
Climate change is anticipated to alter water resource availability in Georgia, with estimated yield impacts including a decrease in wheat productivity by 30-60%; a decrease in maize yields by 20-30% (in the east); and a potential decrease in vine productivity by 6-15%.[25]

Despite continued economic growth since 2010 (annual GDP growth ranging between 2.9% and 7.4%[26]) and an overall reduction in poverty in recent years, a considerable share of the Georgian population continues to live below the national poverty line,[27] especially in rural areas. Households with children in Georgia are poorer than childless households, and poverty risk increases with the number of children in a household. At the same time, children are inadequately represented in national social protection schemes.[28] Table 9 provides a breakdown of key socio-economic vulnerability indicators.

[23] *Bogaerts V. et al (2017) 'Disaster Risk Finance Country Note: Georgia', World Bank Group.*
[24] *United Nations Development Program (UNDP) (2014). Disaster Risk Reduction Capacity Assessment Report.*
[25] *Gupta S. (2009) 'Central Asia and Caucasus Disaster Risk Management Initiative (CAC DRMI) Risk Assessment for Central Asia and Caucasus Desk Study Review', UNISDR/ The World Bank.*
[26] *The World Bank (2021). World Bank Open Data. GDP growth (annual %). Accessed March 2021 at: https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG*
[27] *United Nations Children's Fund (UNICEF) (2012). Georgia: Reducing child poverty. A discussion paper. Tbilisi: UNICEF.*
[28] *United Nations Development Program (UNDP) (2014). Disaster Risk Reduction Capacity Assessment Report.*

Table 9: Socio-economic vulnerability indicators

Poverty headcount ratio at national poverty lines (% of population)	19.5 (2019)
Human Capital Index	0.6 (2020)
GINI index	36.5 (2018)
Gender Inequality index	0.35 (2018)
Household size	3.3 (2019)
Age dependency ratio (% of working age population)	54 (2019)
Unemployment rate (modelled ILO estimate)	14.7 (2020)
General government gross debt (% of GDP)	39.952 (2018)
Under five child mortality (per 1000 live births)	10 (2019)
Life expectancy at birth (female)	78 (2018)
Life expectancy at birth (male)	69 (2018)
% of population using at least basic sanitation services	99 (2017)
% of population using at least basic drinking water services	98 (2017)

Source: World Bank Open Data; United Nations Population Division; UNDP; IMF World Economic Outlook Database

Poverty rates vary starkly across the different regions. The highest rates are in Shida-Kartli, Mtskheta-Mtianeti, Guria and Kvemo Kartli. High levels of unemployment and a large dependence of the workforce on low productivity, family-based subsistence farming remain major economic policy challenges, leaving considerable parts of the Georgian population vulnerable to the impacts of disasters and a changing climate.[29]

HIGH LEVELS OF UNEMPLOYMENT AND A LARGE DEPENDENCE ON LOW-PRODUCTIVITY, SMALL FARM SYSTEMS REMAIN MAJOR ECONOMIC POLICY CHALLENGES AND INCREASE VULNERABILITY TO FUTURE DISASTER EVENTS AND CLIMATE CHANGE

[29] *The national poverty line is the minimum level of income deemed adequate in a country. It is usually calculated by finding the total cost of all essential resources an average human adult consumes in a year. Therefore the absolute level of the poverty line varies between countries*

Some sub-groups within the Georgian population have been found to be limited in their access to basic services, are constrained in their social and political engagement, and tend to be marginalized in post-disaster assistance. In 2019, Georgia counted about 300,000 internally displaced persons (IDPs) out of a total population of about 3.7 million people.[30] IDPs in Georgia face particularly high levels of unemployment and inadequate housing conditions. Mountains occupy 65% of Georgia's territory and are home to almost 10% of the country's people,[31] but mountain populations are often marginalized and poor. They are highly dependent on natural resources for their livelihoods, which leaves them vulnerable to extreme weather events and the effects of climate change. In 2013, 73% of families living in the mountainous ranges of Georgia were classed as vulnerable.[32, 33]

Dedicated disaster response funding for the elderly is a concern. Just 1% of funds are earmarked, despite estimates suggesting the elderly could account for 10-30% of those affected.[34] Though the Georgian Social Service Agency (SSA) provides support for the disadvantaged and the elderly, disaster risk is not considered in assessments. As such, needs stemming from disasters do not attract additional support.

[30]Internal Displacement Monitoring Centre (iDMC) (2019) Georgia Country Information. Accessed April 2021 at: https://www.internal-displacement.org/countries/georgia
[31]United Nations Development Program (UNDP) (2020, December 10). Building the resilience of mountain communities in the face of crisis. On International Mountain Day, UNDP highlights the importance of highlands for people and the environment. Accessed March 2021 at: https://www.ge.undp.org/content/georgia/en/home/presscenter/pressreleases/2020/mountain-day.html
[32]Bordokoff P. A (2014) 'Perceptions of Climate Change and Vulnerability in Upper Svaneti, South Caucasus, Georgia', Graduate Student Theses, Dissertations, & Professional Papers. 4274.
[33]United Nations Development Program (UNDP) (2014, April 24). Development Solutions for Georgia's Mountains. Accessed March 2021 at: https://www.ge.undp.org/content/georgia/en/home/presscenter/pressreleases/2014/04/24/development-of-mountainous-regions/

[34]Perrin P. C. (2013) '"Drowned In Nihilism": Dignity and Health Among Older Adults Displaced by Conflict In the Republic of Georgia', Thesis (Ph. D.) Johns Hopkins University.

Coping capacity

Coping capacity is the ability of people, organizations and systems, using available skills and resources, to manage adverse conditions, risk, or disaster events. The capacity to cope requires continuing awareness, resources, and good management, both in normal times as well as during disaster events or adverse conditions. Coping capacities contribute to the reduction of disaster risks.

Georgia is transitioning to a proactive disaster risk management strategy, with greater focus on prevention. The governance structure was strengthened with the establishment of the Emergency Management Service (EMS) in 2017, directly under the Prime Minister. The EMS, works across disaster risk identification, reduction, adaptation and, transfer.[35]

Other important government agencies are:

- The Department of Spatial Planning and Construction Policy, under the Ministry of Economy and Sustainable Development, which oversees spatial, urban planning, and construction activities, including technical regulations and building codes;
- The production union "Delta" under the Ministry of Defence of Georgia which conducts artificial impact works on hail to prevent and mitigate its damages;
- The Ministry of Internally Displaced Persons from Occupied Territories, Accommodation and Refugees, mandated to develop a system for the management of migration caused by natural hazards.

The Law on Civil Safety (2014, amended in 2017) is the main legal act regulating disaster management, aimed at protecting the population and land from natural and man-made emergency situations. The Law primarily addresses civil protection and defines functions and competencies of various stages of disaster risk management cycle, introducing a common system of emergency management and centralized control of command at all levels.

Table 10: Key coping capacity indicators

Financial inclusion (% of population aged 15+ with access to bank account)	61% (female pop: 64%) (2017)
Insurance coverage	1.1% (2019)
Share of population covered by public safety nets	64% (bottom income quintile: 70.6%) (2016)
Internet coverage (% of population using the internet)	69 (2019)
Metabiota Epidemic Preparedness Index score (100 = maximum score, 0 = minimum score)	74 (2019)
Public and private health expenditure (% of GDP)	7.6 (2017)
Number of physicians (per 1,000)	7.1 (2018)
Number of hospital beds (per 1,000)	2.6 (2013)
Government effectiveness (-2.5 to +2.5)	0.83 (2019)
Corruption Perception Index	56 (2019)

Source: World Bank Open Data; Worldwide Governance Indicators (WGI) Project; Transparency International; Data relevant to national preparedness to detect and respond to epidemics and pandemics from Metabiota's Epidemic Preparedness Index[36]

[35]Oppenheim, B., Gallivan, M., Madhav, N. K., Brown, N., Serhiyenko, V., Wolfe, N. D., & Ayscue, P. (2019). Assessing global preparedness for the next pandemic: development and application of an Epidemic Preparedness Index. BMJ global health, 4(1).
[36]Third National Environmental Action Programme of Georgia, Tbilisi 2017-2021

Vulnerability and coping capacity

The Civilian Safety National Plan (2015) defines cooperation modalities among the various state stakeholders in case of emergency situations. The EU-Georgia Association Act includes provisions from the Flood Risks Management Directive (2007/60/EC). In particular, preliminary flood risk assessments and risk maps are to be conducted.

In 2017 Georgia adopted its first National Disaster Risk Reduction Strategy (2017-2020), based on the Sendai Framework. The Strategy aims to enhance disaster preparedness and response capacities at national and local levels, reduce and mitigate damage linked to natural and man-made threats, and improve response to possible threats.[37] Priority action areas include establishing disaster risk reduction systems and at the national and local levels and integrating early warning and alarm systems into the national disaster risk reduction system.[38] As of late 2020, the Government of Georgia was about to start developing a new National Strategy on Disaster Risk Reduction.[39] The Sendai Data Readiness Review (2017) suggests that a national database for collecting disaster losses, including the number of deaths, missing persons, ill or injured persons attributed to disasters should be operational in 2018. The report highlights capacity, and technology transfer as key resources needed to collect data on disaster losses.[39] While progress has been made to enhance and align methodologies for collecting data for a number of these indicators, the level of detail in the data is limited, and no consistent approach was in place to assess economic loss from disasters as of late 2020.

Further steps can be taken to deeply integrate and implement the strategy. Georgia's spatial planning, architectural, and construction activities code does not reference the Framework but establishes basic requirements for earthquake resistance of structural elements of buildings and structures. For instance, the code stipulates that when it comes to structural strength, stability, and reliability of buildings and structures, load bearing structures and engineering systems of buildings and structures should be reliable during the entire period of their operation, especially during seismic impact, and should meet the requirements established by the relevant technical regulations.

Disaster risk finance in Georgia

There is no formal disaster risk finance policy or strategy. Instead, public authorities utilize a mix of national and regional funds. National arrangements include the 'Fund for Projects Implemented in the Regions of Georgia (RegFund)', the Reserve Fund of the President, and the Reserve Fund of the Government. In 2020, $113m, $1.6 million and $16.2 million were allocated to these funds, respectively (although RegFund has multiple spending priorities).[40] However, only a small amount tends to be used for disaster response: after the 2015 Tbilisi floods, only 4% and 2.9% of the President and Government's Funds were used, respectively, despite these floods being associated with a funding gap of $36m.[41]

Municipalities and regions can allocate up to 2% of their annual budget into a reserve fund for unforeseen expenditure, including disaster response. This, however, is similarly not earmarked for disaster events" and can be depleted for a range of other needs. Prior to the impact of the COVID-19 pandemic, the broader fiscal position of Georgia was increasingly robust, but 2020 is expected to see a spike in public debt and the fiscal deficit widening to 8.5% of GDP.

[37]The threats include floods, flash floods, landslides, mudflows, biological hazards, earthquakes, hails, avalanches, strong winds, forest and valley fires, chemical threats, soil erosion by water, draught, hydrodynamic accidents etc.

[38]Other priority areas of action include: reduction of natural and man-made disaster risks identified in the "National Threat Assessment Document 2015-2018"; establishment of disaster risk reduction system at national level; establishment of the disaster risk reduction system at local level; development/ implementation of methodology/ approach for post-disaster damages and recovery needs assessment and calculation of economic losses; integration of early warning and alarm systems into the national disaster risk reduction system; international cooperation in the area of disaster risk reduction; enhancement of role of media within the disaster risk reduction system; enhancement of cooperation with academic and scientific community within the disaster risk reduction system; Implementation of Disaster Risk Reduction model into the Education System; Enhancement of the Role of Private Sector within the Disaster Risk Reduction System; Development of Geospatial Data Infrastructure for DRR; Gender Equality in the Disaster Risk Reduction Policy and Increasing the Role of Persons with Disabilities within the Disaster Risk Reduction Policy

[39]Government of Georgia and United Nations Georgia (2020). United Nations Sustainable Development Cooperation Framework. Georgia 2021-2025. (https://unsdg.un.org/sites/default/files/2020-11/Georgia_UNSDCF_%202021%20to%202025_0.pdf)

[40]Ministry of Finance of Georgia (2019) Citizen's Guide Law on State Budget. https://mof.ge/images/File/guides/Citizens%20Guide%20-%202020%20kanoni%20ENG%20LAST-04.pdf

[41]Government of Georgia (2017) Georgia: Sendai Framework data readiness review report (https://www.preventionweb.net/files/53190_georgiageo.pdf)

Protection Gap

The protection gap is traditionally defined as the proportion of losses from disaster events that are not insured. Identifying the level of risk which has not been reduced (through risk reduction investment) or transferred (through risk financing) is to identify the contingent liability that will need to be met in the event of a natural hazard. This is used as a fundamental input into the design of risk management and arrangement of risk financing. By understanding the 'Protection Gap' we can better understand the current approach to disaster risk finance in Georgia and identify opportunities to strengthen financing arrangements.

Table 11: Key Protection Gap indicators

AAL as % of GNI[1]	0.08%	
Un-funded AAL, ($m, %)	AAL covered	
Average annual human losses from flood and earthquakes	Flood	EQ
	165	11
Event frequency where direct and indirect loss and damage, less (assumed) insured losses, exceed existing ex-ante risk retention	Flood	EQ
	1 in 5	1 in 20
Event frequency where direct damage, less (assumed) insured losses, exceed existing ex-ante risk retention	Flood	EQ
	1 in 5	1 in 25
Event frequency where estimated emergency response costs exceed current risk retention mechanisms	Flood	EQ
	1 in 200	1 in 200
Macro-economic context and ability for sovereign to borrow	Moderate. Improving before COVID-19 crisis. Credit rating higher than most others in region	
Ability of individual and households to access resources after an event	High rates of financial inclusion and generous social protection. Inequalities by region and age group.	

Source: Consultant team modelling

Based on the modelling undertaken in this assessment, average annual losses associated with earthquakes and floods are estimated to be over $46 million per annum. The combined AAL as a percentage of GNI is 0.08%, one of the lowest in the CAREC region. The results of this analysis are summarized in Table 11.

While Georgia does not currently have an explicit strategy or policy in place for managing the financial impact of disaster events, it does have a range of different financial options that it can draw upon. Municipalities can allocate up to 2% of the annual budget allocation into a reserve fund and if these are exhausted, national level financing arrangements can be drawn upon, in particular through the Ministry of Finance 'Fund for Projects Implemented in the Regions of Georgia'. Georgia's non-life insurance penetration rate is 1.1%, the third highest in the region. Health, property, and motor insurance compose the majority of premium payments, of which property insurance represents roughly 16% of the market. Earthquake insurance is concentrated in Tbilisi and either included as standard with property insurance, or may be offered as an add-on. It is not offered as a stand-alone policy. Market reports suggest that around 5% of domestic properties in Tbilisi are insured, and it is likely that earthquake insurance is equally broad in its coverage.[42] Outside of Tbilisi, very little property or earthquake cover exists. Flood insurance is offered as an extension to property insurance, but coverage is limited. Insured losses only covered 5% of the $86 million damage caused in the 2015 landslides and flooding in the Tbilisi region.[43] The analysis assumes that 12% of the losses associated with either peril in Tbilisi might be covered by insurance. Outside Tbilisi, the analysis assumes that insurance penetration rates are 50% lower, i.e., 6% of losses might be covered by insurance.

Georgia is in a stronger place to manage the financial impacts of disaster events than many other countries in the CAREC region. Its reserve funds are currently large enough to cope with the average annual losses that might arise from these events, or to cover the emergency response costs associated with a 1 in 200-year earthquake or flood event. This is buttressed by a relatively benign macroeconomic and levels of financial inclusion and social assistance that will provide resilience, at least to high-frequency, low severity events. However, there are obvious gaps. Most notably, the current risk retention mechanisms would be exhausted by the direct damage caused by floods with a return period of 1 in 5 years. While the costs of retaining reserves for more severe events would likely be prohibitively high, it does create a potential financing gap, especially outside of Tbilisi where the penetration of private insurance markets remains weak.

[42] Axco 2021. Insurance Market Report: Georgia
[43] Katsia, I and Deisadze, S. (2019) How can you be sure? On Georgian Agricultural Insurance, Georgia Today.

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