# COUNTRY RISK PROFILE **TAJIKISTAN**

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 ($) |



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# Profile summary

**Tajikistan lies in the heart of Central Asia and shares borders with Uzbekistan and Kyrgyz Republic in the north and west, People's Republic of China in the east, and Afghanistan in the south. Mountains cover over 90% of Tajikistan's land area with more than half of the country sitting above an elevation of 3,000 metres. The two principal ranges, the Pamir and the Alay, give rise to many glacier-fed streams and rivers while the Tian Shan, Central Asia's other main range, skirts northern Tajikistan. Tajikistan's two main population centers are in the lowlands of the southern and northern sections of the country.**

Tajikistan lies in an active seismic belt where severe earthquakes are common. Average annual loss (AAL)due to earthquakes in Tajikistan is modelled at $63.5 million while the average annual number of people affected and number of fatalities is 70,912 and 37 respectively. The regions of Khatlon Region and Dushanbe and the Regions Under Direct Republican Jurisdiction are all expected to have over $15 million of average annual losses; the remaining areas of Tajikistan have relatively lower values exposed primarily due to lower levels of urban development.  A low frequency, high impact earthquake (1-in-100-year) in the country could cause over $885 million of loss nationally.

Flood poses a similar annual risk with the AAL modeled at $60.8 million. Nearly 80% of that is expected to be in Khatlon Region, a region which contains 36% of the country's population and major citiesincluding Bokhtar. The average annual number of people affected by floods is estimated to be 29,800in Tajikistan with fatalities averaging 45. The loss from a 100-year flood event is modelled at around $550 million.

The combined AAL across earthquake and flood is equivalent to around 0.32% of Tajikistan's gross national income, the second highest proportion for any CAREC jurisdiction.

Tajikistan is exposed to respiratory outbreaks, with a very low background risk to Crimean-Congo Haemorrhagic Fever. Respiratory pathogens present the possibility of infections and deaths, a risk which applies to many countries (COVID-19 is one example of a respiratory infectious disease outbreak). A 1-in-100-year respiratory disease event could see over 87,000 people infected.

Recent historic events illustrate the damaging nature of disaster events in Tajikistan. The country experiences multiple natural hazards such as avalanches, earthquakes, floods, mudflows, and landslides every year. In the past three decades, floods, earthquakes, and droughts combined are estimated to have affected 4.6 million people and resulted in over $1.1 billion in damage. The most devastating flood occurred in 1992 in the southwest of the country, leading to the displacement of 15% of the population and damage to 300,000 homes, critical infrastructure, flood defences, and agricultural land.

Minimum and maximum temperatures are increasing throughout the country with some areas warming faster than others. Countrywide, annual mean temperatures increased at a rate of 0.1-0.2°C per decade between 1940 and 2012, and warming rates have accelerated since the late 1970s. Annual mean temperatures are expected to continue to increase across the whole country due to climate change.





**Box 1: Key facts**

**GDP: 8,400,000,000 (2019)**

**Population: 9,314,000 (2019)**

1 IN 100 YEAR FLOOD ECONOMIC LOSS
**$550,000,000**

1 IN 100 YEAR EARTHQUAKE LOSS
**$885,600,000**

AVERAGE ANNUAL LOSS FLOOD
**$60,800,000**

AVERAGE ANNUAL LOSS EARTHQUAKE
**$63,500,000**

AVERAGE ANNUAL PEOPLE AFFECTED FLOOD
**220,000**

AVERAGE ANNUAL PEOPLE AFFECTED EARTHQUAKE
**160,314**

AVERAGE ANNUAL PEOPLE AFFECTED INFECTIOUS DISEASE
**350,516**

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

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

More intense extreme precipitation events could exacerbate flash flooding risk as well as mudflows and landslide risk in the more mountainous regions. By the 2050s, north-eastern Sughd Region and much of central to eastern Gorno-Badakhshan Autonomous Region could see annual mean precipitation increases of 10-20%. The western half of the Regions Under Direct Republican Jurisdiction, Dushanbe, and central and southern Sughd Region could experience more intense 24-hr duration extreme precipitation events by the 2050s when compared with historical extremes.

Tajikistan has been experiencing very rapid population growth over the past two decades. During the period of 2000 to 2019, the country's population grew by 49% from 6.13 million to 9.13 million people.[1] More than 70% of the increase in the country's population is associated with an increase in the population of rural areas. Agriculture, the primary sector for employment in Tajikistan, accounts for 44 percent of total employment while services and industry account for 40 percent and 16 percent, respectively.

In total, ex-ante sovereign and local government instruments provide for around $11-11.5 million in potential ex-ante funding.[2] Tajikistan has one of the smallest insurance markets in the region with an insurance penetration rate of just 0.34% in 2018. Existing risk retention mechanisms are only able to cover the costs (either total losses or emergency response costs) of the most frequent, lowest-severity flood events. Flood or earthquake events that might happen once every five years would be enough to exhaust current mechanisms which, given Tajikistan's challenging fiscal context, would almost certainly make Tajikistan dependent on support from international development partners.

[1] *Statistical Yearbooks of the Republic of Tajikistan for 2015 (data for 1995-2015).; Statistical Yearbooks of the Republic of Tajikistan for 2020. http://www.stat.tj*
[2] *World Bank (2019) Forum on Financial Protection against Natural Disasters in Central Asia – proceedings.*

CHAPTER 1

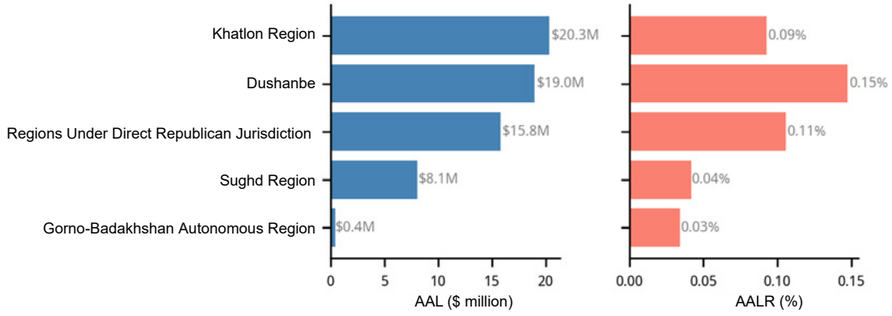
# Risk analysis

**The extent and geographic pattern of earthquake, flooding, and infectious disease across Tajikistan is revealed through probabilistic modeling. 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

Average annual loss (AAL) due to earthquakes in Tajikistan is estimated at $63.5 million. Khatlon Region has the highest AAL in the country at $20.3 million,followed by Dushanbe and the Regions Under Direct Republican Jurisdiction at $19.0 million and $15.8 million respectively. Gorno-Badakhshan Autonomous Region and Sughd Region have the lowest AAL in the country.

**Figure 1: Breakdown of earthquake average annual loss and loss ratio by region**




*Source: Global Earthquake Model*

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.

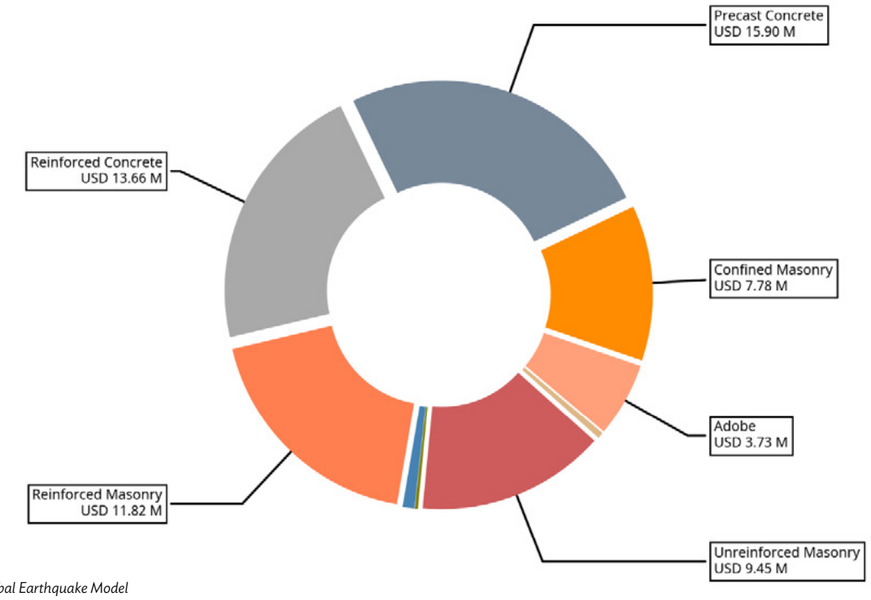
Figure 2 compares the AAL (left) and the AALR (right) for each region. The region with the highest AALR or relative risk is Dushanbe followed by the Regions Under Direct Republican Jurisdiction.

Figure 3 shows the disaggregation of the AAL due to earthquakes by primary building construction type. Precast concrete structures contribute the most to the overall average annual loss in economic terms at $15.9 million, followed by reinforced concrete structures with an aggregate AAL of $13.7 million.





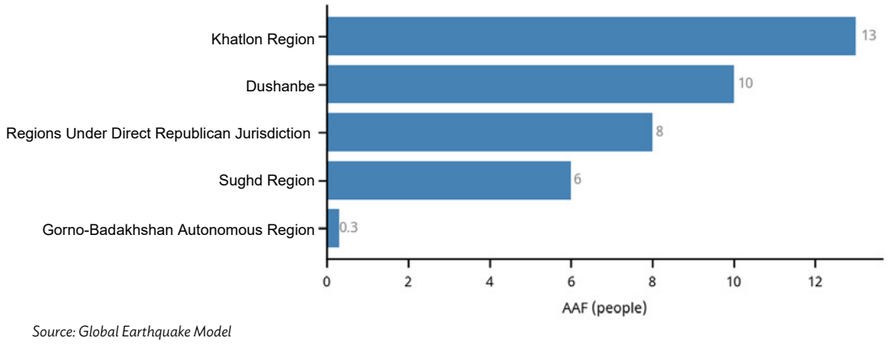
**Figure 2: Average annual loss by asset types - earthquakes**




*Source: Global Earthquake Model*

Figure 3 show average annual fatalities due to earthquakes across the regions. Average annual fatalities due to earthquakes are estimated at 37 for the whole country. Khatlon Region has the highest AAF in the country with 13 fatalities, followed by the Regions Under Direct Republican Jurisdiction and Dushanbe with 10 and 8 fatalities, respectively.

**Figure 3: Breakdown of earthquake average annual fatalities by region**




*Source: Global Earthquake Model*

For the purposes of this report, the number of people affected by earthquakes is defined as the population that can be expected to witness earthquake-caused ground shaking of Modified Mercalli Intensity (MMI) VI or higher (corresponding to strong shaking, capable of causing slight damage or higher). An estimated 70,912 people are affected by earthquakes on an average annual basis in Tajikistan. Figure 4 shows that Khatlon Region has the highest average annual number of people affected at 25,163, followed by the Regions Under Direct Republican Jurisdiction and Dushanbe at 19,150 and 15,428 respectively.

The average annual people severely affected by earthquakes is estimated at around 9,315 in Tajikistan, where the number of people severely affected by earthquakes is defined as the population that can be expected to witness earthquake-caused ground shaking of MMI VIII or higher (corresponding to severe ground shaking, capable of causing considerable damage including partial collapses in ordinary structures, along with slight damage to well-engineered structures).

**Figure 4: Breakdown of earthquake average annual number of people affected by region**

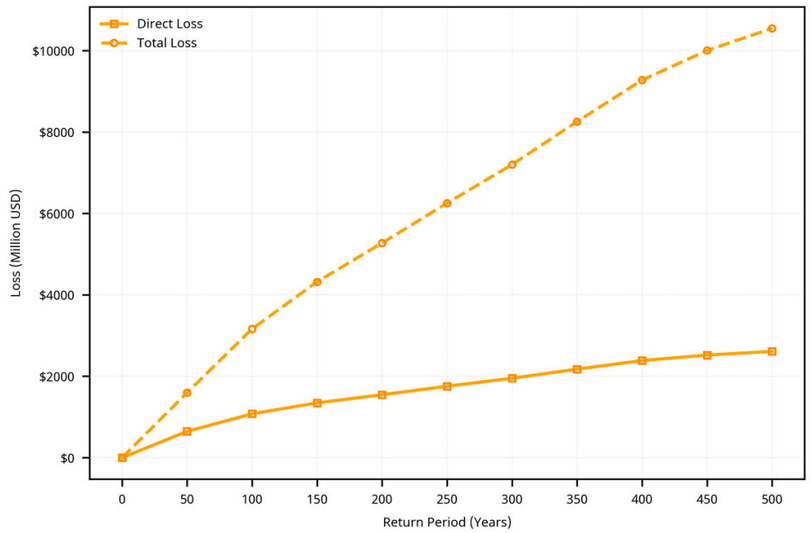



*Source: Global Earthquake Model*





**Figure 5: Exceedance probability curves – earthquakes**




*Source: Global Earthquake Model*

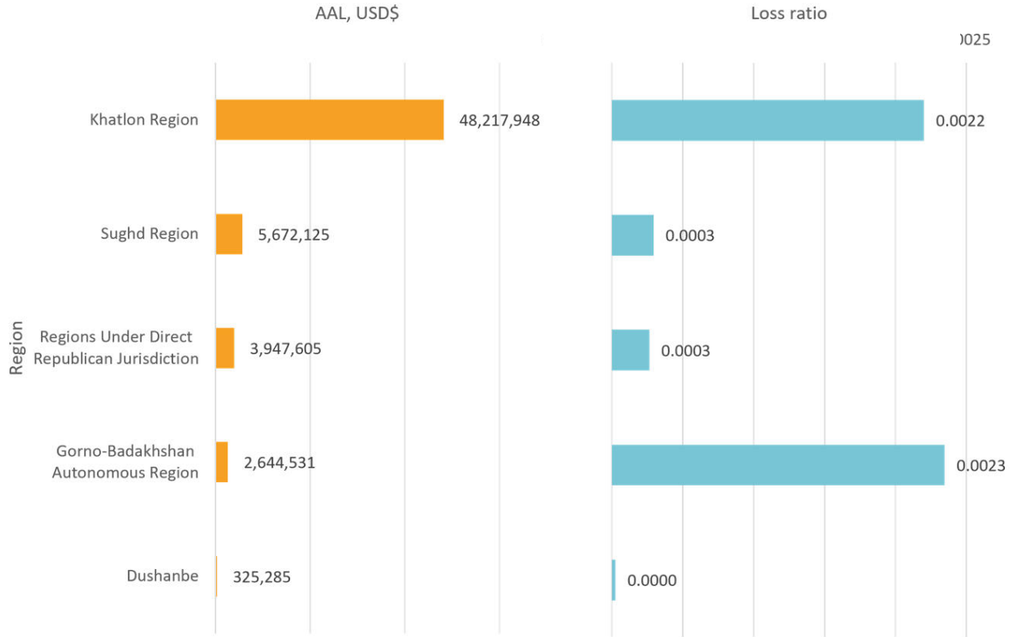
The exceedance probability (EP) curves for earthquake for Tajikistan are shown in Figure 5. The EP curve shows the total loss from all events in any given year. Curves are modeled for both direct and total loss. Direct loss displays the modeled loss to residential, industrial and commercial assets. Total loss accounts for secondary impacts from the onset of disaster events, accounting for the reconstruction time. Direct loss increases from $445.4 million for the 50-year return period to $2.6 billion for the 500-year return period. Direct loss at the 100-year return period is modelled at $885.6 million, which is approximately 11.32% of the country's nominal GDP. Total loss increases from just over $1 billion for the 50-year return period to nearly $3 billion at the 100-year return period.

## Flood Risk

Average annual loss (AAL) from floods is $60.8 million in Tajikistan. Over 79% of annual loss from floods occurs in Khatlon Region, where AAL exceeds $48 million. As seen in Figure 6, this province has the largest economic exposure and a damage ratio of 0.0022. Khatlon Region, in southwest Tajikistan, also contains the Kyzylsu, Vakhsh and Kafirnigan Rivers which join the Ama Darya River on the border with Afghanistan.These rivers drain mountainous areas of higher mean annual precipitation in central Tajikistan.

Gorno-Badakhshan Autonomous Region has a damage ratio comparable to that of Khatlon Region despite having lower AAL from floods and less than 2% of the country's total economic exposure. This may be due to the regions mountainous topography which means many settlements are located in relatively narrow river valleys that are susceptible to flash flooding.

**Figure 6: Breakdown of flood average annual loss and loss ratio by region**

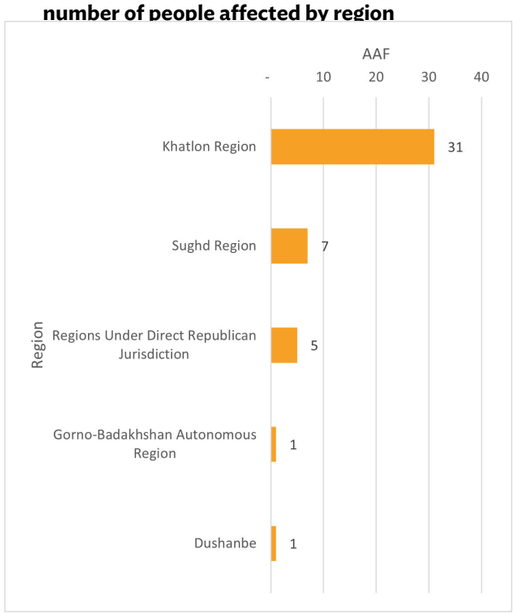



*Source: JBA Risk Management*



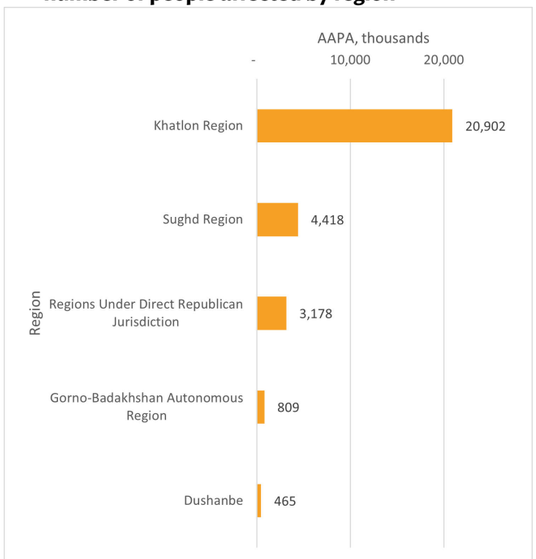


**Figure 7: Breakdown of flood average annual number of people affected by region**



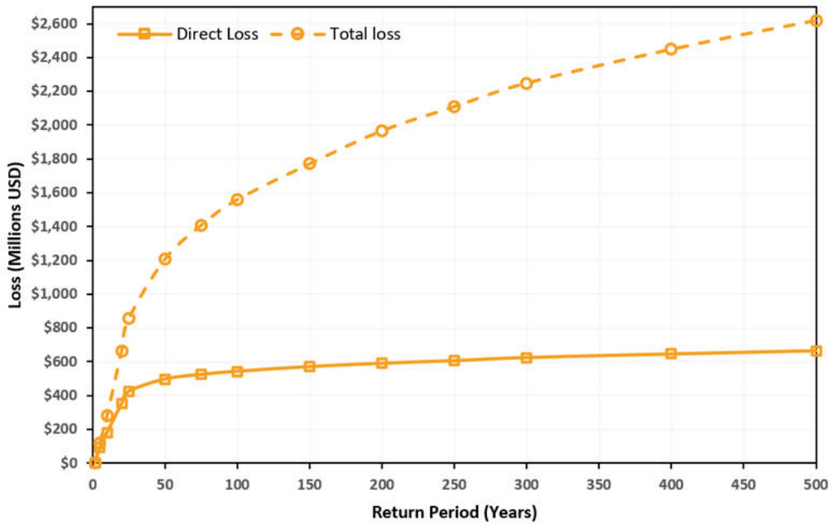

Average annual fatalities from floods total 45 in Tajikistan and are concentrated in Khatlon Region, which has 31 fatalities on average. This region contains 36% of the country's population and populous cities including Bokhtared on the Vakhsh River and Kulob on the Yakhsu River. Further north, average annual fatalities from floods are estimated at 7 in Sughd Region and 5 in the Regions Under Direct Republican Jurisdiction . In Sughd Region, the Syr Darya River flows from east to west through the country's second most populated city, Khujand. Figure 7 shows average annual fatalities for all regions.

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




Average annual people affected by floods is estimated to be 29,800 in Tajikistan. Figure 8 shows that the distribution of people affected within the country is consistent with that of fatalities. At the regional level, people affected are concentrated in Khatlon Region, where over 20,000 people are affected by floods per year. More than 3,000 people are also affected in Sughd Region and the Regions Under Direct Republican Jurisdiction . These provinces are the most populated in Tajikistan and contain the largest rivers and highest mean annual precipitation in the country;these factors contribute towards the distribution of people affected in Tajikistan.

**Figure 9: Exceedance probability curves – floods**




*Source: JBA Risk Management*

The exceedance probability (EP) curves for Tajikistan in Figure 9 show the direct and total loss from all flood events in any given year for the given return periods. Loss increases most significantly between the 2 and 25-year return periods, which indicates susceptibility to floods in this return period range. Direct loss at the 100-year return period is modelled at just over $550 million, which is approximately 6.5% of the country's nominal GDP.

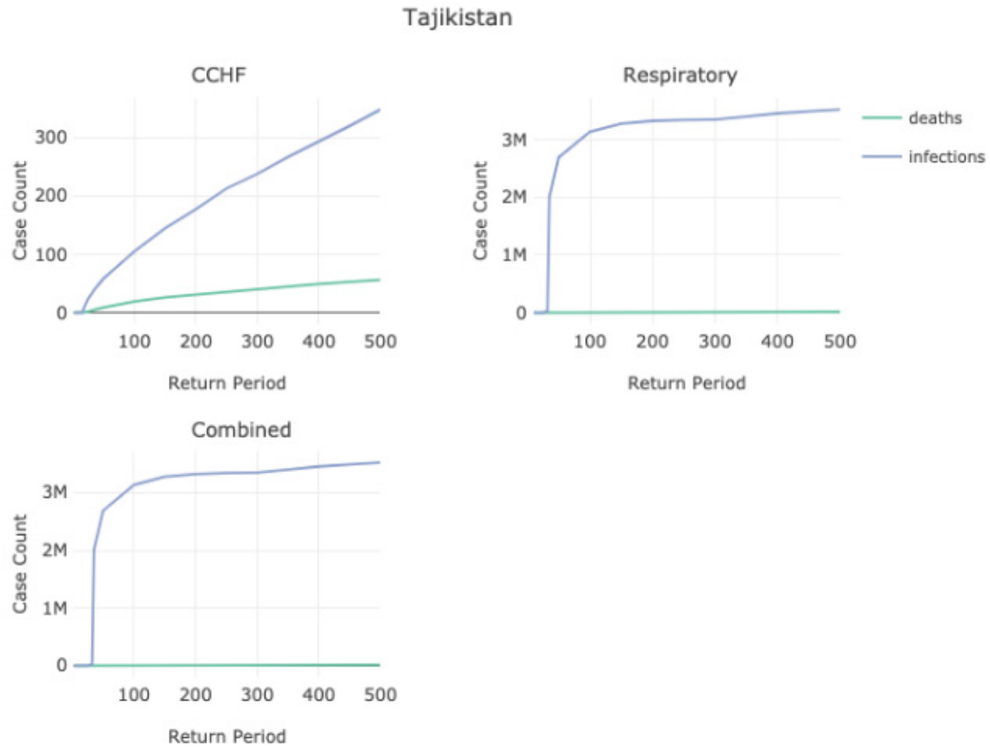
Direct loss increases at a slower rate above the 25-year return period and reaches $665 million at the 500-year return period. Total loss also increases sharply between the 2 and 25-year return period but continues to grow between the 25 and 100-year return period at nearly $1.6 billion.  Total loss then increases at a steady rate to nearly $2.6 billion at the 500-year return period.



Risk analysis

## Infectious disease

**Figure 10: Exceedance probability curves – pandemic, including Crimean-Congo haemorrhagic fever (CCHF), Nipah virus infection, respiratory viruses and combined (all pathogens)**




**Note that the graph for Nipah was omitted due to low risk in this country.*
*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 Haemorrhagic Fever (CCHF), which is endemic in some CAREC countries, the baseline will be higher than zero. Box 2 highlights the pathogens modelled as part of this analysis.





**Box 2: 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]

**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 | 87,168 | 165 |
| Respiratory | 87,162 | 164 |
| CCHF | 5 | 1 |
| Nipah | <1 | <1 |

*Source: Metabiota*

The pathogen EP curves for Tajikistan as shown in Figure 10 highlight that respiratory pathogens account for the majority of epidemic risk. The respiratory pathogens EP curve climbs rapidly and steeply. This is because respiratory pathogens tend to be highly transmissible and cause very large pandemics when they occur (COVID-19 and pandemic influenza are notable examples). CCHF has 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). There is no Nipah EP curve shown for Tajikistan as the risk is extremely low. Table 1 provides the average annual loss numbers on people impacted and fatalities.

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

# Historical losses and impacts

**Tajikistan's topography is mountainous; much of the country sits 3,000m above sea level and it has peaks over 7,000m in the Pamir and Alay ranges. The Fergana Valley to the north and the Kofarnihon and Vakhsh river valleys to the south are the lower elevation areas. This topography influences the country's hazardscape. Intense rainfall on steep terrain contributes to damaging floods and mudslides on a regular basis.[5] In the past three decades, floods, earthquakes and droughts combined are estimated to have affected 4.6 million people and resulted in over $1.1 billion in damage (Table 2).**

The Government of the Republic of Tajikistan has been documenting damage assessments by region since 1997. This includes records on damage to residential and public buildings, as well as to transport, communication and commercial infrastructure, agricultural infrastructure, and irrigation and water supply facilities.[6] The records indicate that in the past the Pyanj River Basin, including Roshtkala, Shugnan and Ishkashim districts, and the Surkhob River Basin, including Nurobad, Jirgital, Tajikabad and Rasht districts, have been heavily affected by disaster events.[7]

In recent history, the most devastating flood occurred in 1992 in the southwest of Tajikistan leading to the displacement of 15% of the population and damage to 300,000 homes and some critical infrastructure, flood defences, and agricultural land. The 2010 and 1998 floods also led to more than $100 million of damage across large parts of the country. In 2004, torrential rain caused severe floods across much of the country, including flooding of the Varzob River; these led to contamination of water supplies into Dushanbe and left 400,000 people in the capital without access to safe drinking water. The 1985 earthquake in the Sughd region is the most economically impactful seismic event, resulting in over $475 million worth of damage.

Prior to the COVID-19 outbreak, Tajikistan had no significant historic pandemic events since 1990 (Table 4).

**Table 2: Total impacts from floods, earthquakes and droughts, 1900 – 2019**

| | Fatalities | Number of people affected | Total damage ($ million; constant 2019) |
|---|---|---|---|
| **Flood** | 1,500 – 1,622 | 813,000 - 1,500,000 | 175 – 1,016.5 |
| **Earthquake** | 71 – 72 | 48,662 | 35.1 |
| **Drought** | - | 3,800,000 | 84.6 |

*Source: EM-DAT with validation from other sources including Swiss Re, ReliefWeb, World Bank for floods; National Geophysical Data Center / World Data Service (NGDC/WDS): NCEI/WDS Global Significant Earthquake Database. NOAA National Centers for Environmental Information; Department of Protection of the Population and Territory of the Committee for Emergency Situations under the Government of the Republic of Tajikistan*

[5] *Government of the Republic of Tajikistan (2019) National Strategy of the Republic of Tajikistan on Disaster Risk Reduction for 2019-2030. Dushanbe: Government of the Republic of Tajikistan; Lohr, H. (2018) Flood Disaster Risk Reduction Manual for Tajikistan. Part I: Flood Management Guideline. UNDP (https://untj.org/wp-content/uploads/2019/09/UNDP-DRMP-eng.pdf)*

[6] *Government of the Republic of Tajikistan. Statistical reporting form 1-ChS in the period from 1997 to 2008.; Samiev M.B. Analysis of damage caused by natural disasters (1997-2008) Under the general editorship of A.M. Shomakhmadov - Head of the IAC of the Committee for Emergency Situations and Civil Defense under the PRT; Archive of the Department of Protection of Population and Territory (Colonel Azizbekov Sh.) Of the Committee for Emergency Situations and Civil Defense under the Government of the Republic of Tajikistan. (1997-2008)*

[7] *Government of the Republic of Tajikistan (2019) National Strategy of the Republic of Tajikistan on Disaster Risk Reduction for 2019-2030. Dushanbe: Government of the Republic of Tajikistan*





**Table 3: The most impactful flood and earthquake events in Tajikistan, 1900 – 2019**

| Year | Location | Total damage ($ millions; constant 2019) | Fatalities | Number of people affected |
|---|---|---|---|---|
| Floods | | | | |
| **1992** | Tajikistan | 546.6 | 1,346 | 63,500 |
| **2010** | Oseysky, Muminobod, Baljuan, Shurabad, Kulyab, Yvanskiy, Jilikul, Kurgan-Tjube, Dangara, Kolhosobadskiy districts (Khatlon Region) | 239.2 | 73 | 6,708 |
| **1998** | Ragun, Ainy, Old Mastchoh, Shahrinav, Muminabad, Penjikent, Kuliyab Central, Vose, Dushanbe, Tursen-zade, Varzob, Farhor, Baljuvon, Tursunzade, Leninski, Gissar, Kanibadam, Sharristan, Kurgantube, Kafarnikhon, Khovaling | 103.5 | 51 - 100 | 40,974 |
| **2005** | Mir Sayyid Ali Hamadani area (Kulyab district, Khatlon Region), Panjrud, Shing areas (Penjikenskiy district, Sughd Region), Rushanskiy district (Gorno-Badakhshan Autonomous Region) | 65.5 | - | 1,890 |
| **2003** | Sughd Region | 27.8 | 6 | 1,755 |
| **2004** | Varzob district (Regions Under Direct Republican Jurisdiction) | 16.2 | - | 400,000 |
| Earthquakes | | | | |
| **1985** | Kaptolyuk, Kayrakkum, Gafurov | 475.3 | 29 | - |
| **2006** | Kumsangir village (Kolhosobadskiy districts, Khatlon Region), Panj Jamoat village (Piynjskiy districts, Khatlon Region) | 27.9 | 3 | 15,427 |
| **2015** | Murgabskiy, Rushanskiy, Shugnanskiy, Vanchskiy, Kalay-Humbskiy districts (Gorno-Badakhshan Autonomous Region) | 5.4 | 2 | 7,976 |
| **2010** | Uskrogh, Rogh, Payshanbeobod, Gishkhun, Dashtirogh, Rokharv, Punichuguni Jamak villages (Vanchskiy district, Gorno-Badakhshan Autonomous Region) | 1.8 | - | 7,840 |

*Source: EM-DAT with validation from other sources including Asian Disaster Reduction Center (ADRC), ReliefWeb, IFRC and UN OCHA for floods; National Geophysical Data Center / World Data Service (NGDC/WDS): NCEI/WDS Global Significant Earthquake Database. NOAA National Centers for Environmental Information.*

**Table 4: Notable infectious disease outbreaks, 1990-2021**

Prior to the COVID-19 outbreak, Tajikistan had no significant historic pandemic events since 1990

| Pathogen | Date first case reported | Date last case reported | Total cases | Total deaths | Location of origin |
|---|---|---|---|---|---|
| **2019 Novel Coronavirus (2019-nCoV)** | 5/1/20 | 10/20/20 | 10,533 | 80 | PRC |

*Source: Metabiota's infectious disease database*

CHAPTER 3

# Hazard

**In Tajikistan, at least 27 instrumentally recorded earthquakes with a magnitude larger than 6 occurred since early 1900.[8] The largest earthquake was the 1949 Khait earthquake, a magnitude 7.5 event in the central part of the country. It was presumably generated by the Vakhsh Thrust System.[9] The earthquake triggered hundreds of landslides, including one with a volume of 65 million cubic metres which occurred in the proximity of the epicentral area.**

## Seismic hazard

Analysis shows almost all the territory of Tajikistan has values of the peak ground acceleration with a 10% probability of exceedance in 50 years (PGA10%50yr) on reference site conditions (Vs30 of 800 m/s) over 0.2g. The areas with PGA10%50yr between 0.1 and 0.2g are the Fergana Valley in the north, the south-west area close to Uzbekistan, and the south-eastern area located in the Pamir Mountains.

## 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 for Tajikistan in Figure 20 show the structue of the hydrological basins across the country. Much of Tajikistan is mountainous and the HAZ polygons are of a similar size across the country, showing similar characteristics nationwide. In the northern area, where it is more arid, the HAZ polygons are smaller, reflecting short rivers draining areas during seasonal rainfall.

## Flood hazard map for pluvial and fluvial flooding

Flood modelling estimates losses and impacts on the basis of flood maps for river (fluvial) and surface water (pluvial) flooding generated at 30 metre 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 highlights the main rivers of Tajikistan. This event severity is often used for planning purposes as a plausible extreme event.

Tajikistan has 900 rivers longer than 10km. Lakes account for 2% of land by area. In the east of the country, where the terrain is particularly mountainous, the river valleys are steep and some only flow during seasonal rainfall or as a result of snowmelt. Population is sparse and the risk from flooding is mainly associated with flash floods and consequent landslides and mudflows. The duration and size of the flood event is usually dependent on the size of the catchment[10].

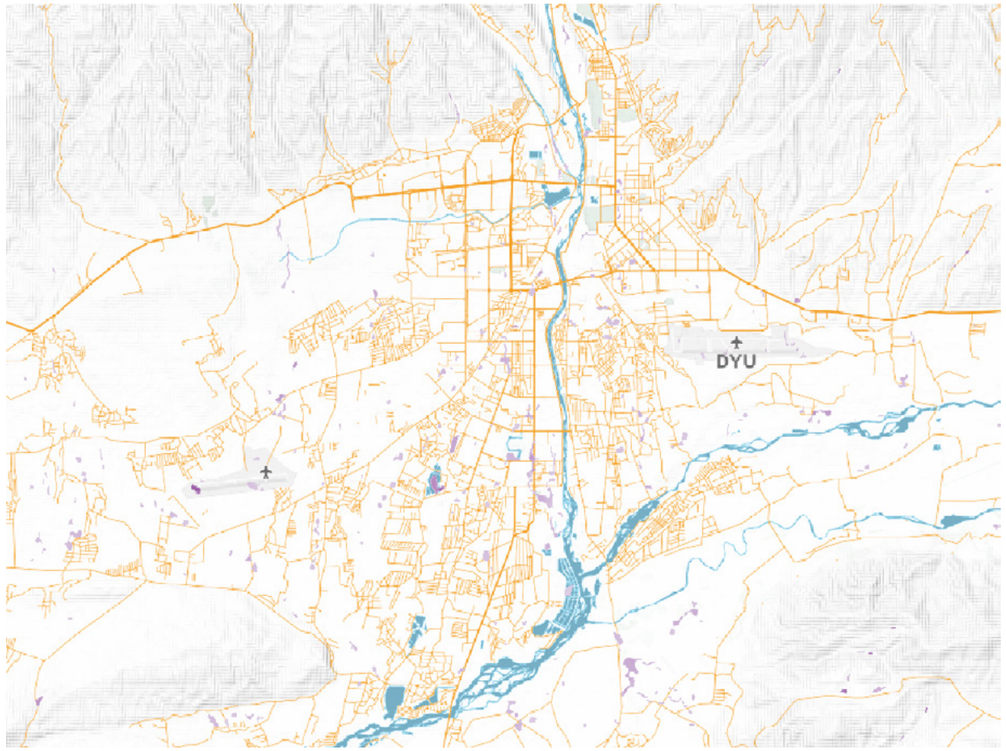
The Kyzylsu River flows through the middle of the country, from northeast to southwest, through a series of lakes created by barrages to control the flow. The river eventually joins the Amu Darya at the Afghanistan border. Sarband and Nurek/Dagana are the most significant population centres on the river, but both sit just below barrages where the river is controlled. In the west of the country, the capital Dushanbe sits on the confluence of the Varzob and Kafirnigan Rivers. In the north, Khujand sits on the Syr Darya River just below the Kairakum Reservoir.

[8] *ISC-GEM catalogue (version 7.0 - see http://www.isc.ac.uk/iscgem/)*
[9] *Schurr et al., 2014*





**Figure 11: Map of surface water (pluvial) flooding (areas in purple) at the 200-year return period level for the Dushanbe region**




*Source: JBA Risk Management*

The flood map of Dushanbe in Figure 11 shows that there is very limited risk from surface water flooding in the city. Any flood risk is likely to come from the Varzob River which runs through the centre of the city, and the Kafirnigan River, which flows through the southern suburbs.

## Climate conditions

**Historic climate**

The country's mountainous terrain creates diverse climate zones ranging from arid and semi-arid steppe to polar tundra in the high elevations. Annual mean temperatures range from -6°C in the Pamirs to 17°C in Khatlon Region.[11] Eastern areas, including much of Gorno-Badakhshan Autonomous Region and Khatlon Region, lie in the mountains' rain shadows and are very dry; daytime maximums in those areas during the hot season can exceed 40°C.Precipitation in Tajikistan mostly occurs in winterand spring with sections of the central mountains receiving between 1,000-1,800mm/yr.

Minimum and maximum temperatures are increasing throughout the country, with some areas warming faster than others. Countrywide, annual mean temperatures increased at a rate of 0.1-0.2°C per decade between 1940 and 2012, and warming rates have accelerated since the late 1970s. Winter and spring temperatures have also increased over the past three decades, with spring maximum temperatures increasing at a rate of 0.54°C/decade between 1981 and 2015.[12] Significant trends in precipitation are harder to detect, with significant inter-decadal variability potentially linked to multidecadal climate processes.

Annual mean temperatures are expected to increase across the whole country due to climate change. Warmer springs and summers will accelerate snow and glacial melt through the 2050s and 2060s and can contribute to higher peak and annual flows along rivers such as the Vakhsh and Pyanj. These factors, especially when coupled with rain-on-snow events, further increase flood risk in some areas. By the 2070s or 2080s, however, annual river flows are likely to decrease as smaller glaciers disappear.[14] Warmer temperatures will also contribute to changes in river runoff and water resource availability. The volume of river runoffs for the Aral Sea basin is already decreasing.[15]

Riverine floods tend to occur either in spring following heavy rainfalls or in summer during snowmelt; heavy rains during the snowmelt periods can further exacerbate riverine flooding. High intensity extreme rainfall events in steep terrains and narrow valleys can trigger flash flooding.[16]

[11] *Government of Tajikistan (2014) Third National Communication of the Republic of Tajikistan under the UN Framework Convention on Climate Change. Dushanbe.*
[12] *Feng, R. R. Yu, et al. (2017) 'Spatial and temporal variations in extreme temperatures in Central Asia'. International Journal of Climatology: https://doi.org/10.1002/joc.5379*
[13] *Yatagai, A. K. Kamiguchi, et al. (2012) 'APHRODITE: Constructing a long-term daily gridded precipitation dataset for Asia based on a dense network of rain gauges'. BAMS, doi:10.11.75/BAMS-D-11-00122.1*
[14] *Kure, S., S. Jang, et al. (2013) 'Hydrologic impact of regional climate change for the snowfed and glacierfed river basins in the Republic of Tajikistan: hydrological response of flow to climate change'. Hydrological Processes: https://doi.org/10.1002/hyp.9535*
[15] *Mustaeva, N., H. Wyes, et al. (2015) Tajikistan: Country Situation Assessment. Report for the Pathways to Resilience in Semi-arid Economies (PRISE). Regional Environment Center for Central Asia (CAREC).*
[16] *UNDP, 2019*





## Future precipitation projections

Six regional climate model-global climate model (RCM-GCM) simulations from the Coordinated Regional Climate Downscaling Experiment (CORDEX) Central Asia domain were used to examine climate change impacts on precipitation. Two Representative Concentration Pathways (RCP4.5 and RCP8.5) were selected; these represent a medium and high (business-as-usual) emissions pathway, respectively. The RCMs were bias corrected before precipitation projection analysis of how conditions could shift between the 2050s (2031-2070) and a historical reference period of 1956-1995.[17] The multi-model mean information was used to examine yearly and seasonal changes under RCP4.5 and RCP8.5.

By the 2050s, north-eastern Sughd Region and much of central to eastern Gorno-Badakhshan Autonomous Region could see annual mean precipitation increases by 10-20%according to the multi-model mean for both RCP4.5 and RCP8.5. The rest of the country is not projected to experience significant shifts in annual means.Mean precipitation over central to eastern Gorno-Badakhshan Autonomous Region and the northern edge of the Regions Under Direct Republican Jurisdiction is also projected to increase by up to 20% during the January to March period; north-eastern Sughd Region could see increases by 20-30% under both RCPs. Overall ensemble mean precipitation during April to June, the primary flood season, could decrease by 10-20% for the western half of the Regions Under Direct Republican Jurisdiction and southern Sughd Region under RCP4.5; no change is seen over two-thirds the country under RCP8.5. Increases of 10 to 20% are possible over the eastern third and the north-eastern part of Sughd Region under both RCP4.5 and RCP8.5.

Precipitation extremes from each model and RCP were individually used to calculate future precipitation intensities, which are relevant to estimating future flood risk. The area-averaged March to September annual maximum rainfalls for 24-hr duration for each province was extracted and analysed for different return periods (2, 5, 10, 20, 50, 100, 200-, 500-, 1000-, 1500-, 5000- and 10000-year events). In all provinces, 24-hr precipitation intensities are projected to increase for all return periods by the 2050s under both RCP4.5 and RCP8.5. The western half of the Regions Under Direct Republican Jurisdiction , and central and southern Sughd Region could experience more intense 24-hr duration extreme precipitation events by the 2050s when compared with historical extremes. More intense extreme precipitation events could exacerbate flash flooding risk as well as mudflows and landslide risk in the more mountainous regions.

Projected changes in 24-hr duration extreme precipitation intensities in Dushanbe for 2031-2070 (the 2050s) as compared to historical 24-hr intensities of different return periods are shown in Table 5. The table shows the median of the multi-model ensemble and the 25th and 75th percentiles in brackets. Box 3 describes the methodology behind the future climate calculations.

[17] *The historical reference period of 1956-1995 was used over the standard 30-yr period 1961-1990 because climate over South-central Asia is modulated by the Pacific Multidecadal Oscillation and this reference period is long enough to cover two phases of the PDO, among other multidecadal climate processes. The 2050s were used for both the precipitation and flood modelling in order to be more policy relevant.*





**Table 5: Dushanbe 24-hr duration extreme precipitation intensity (mm/hr)**

| Return period | 1951-2007 | 2050s | |
|---|---|---|---|
| | Historical | RCP4.5 | RCP8.5 |
| **20-year** | 1.59 | 1.99 (1.89, 2.21) | 2.15 (1.98, 2.22) |
| **100-year** | 1.94 | 2.47 (2.34, 2.82) | 2.70 (2.43, 2.81) |
| **200-year** | 2.16 | 2.67 (2.53, 3.07) | 2.93 (2.61, 3.05) |
| **500-year** | 2.28 | 2.95 (2.78, 3.41) | 3.24 (2.86, 3.39) |

*Source: ODI*
*Projected changes in 24-hr duration extreme precipitation intensities in Dushanbe 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.*

**Box 3: 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

CHAPTER 4

# Exposure

**Tajikistan has been experiencing very rapid population growth over the past two decades. From 2000 to 2019, the country's population grew by 49% from 6.13 million to 9.13 million people.[18] The average annual population growth rate for this period was 2.2%. More than 70% of the increase in the country's population is associated with an increase in the population of rural areas. In 2019, the share of the rural population in Tajikistan was 73.7% and that of the urban population was 26.3%.[19] Table 6 provides more data on population totals, distribution and trends.**

**Table 6: Population totals, distribution and trends (data from 2019, if *from 2020)**

| | |
|---|---|
| Population (thousands) | 9,314 * |
| Population growth date (%/year) | 2.2 |
| Share of population living in urban areas (%) | 26.3 |
| Urbanisation rate (%/year) | 2.1 |
| % of total population age 0-14 | 37 |
| % of total population age 15-64 | 60 |
| % of total population ages 65 and above | 3 |

*Source: Statistical Yearbooks of the Republic of Tajikistan for 2020; World Bank Open Data*

Tajikistan's total GDP in 2019 was $8.4 billion or $840 per capita. The highest share of value added as percent of GDP comes from services, followed by industry (mechanical engineering, production of aluminum, mineral fertilizers, textile and light industry, energy and production of consumer goods) and agriculture (cotton growing, crop growing, animal husbandry). However, agriculture is the primary sector for employment in Tajikistan, accounting for 44 percent of total employment; services and industry account for 40 and 16 percent, respectively. Table 7 shows these and other key economic indicators.

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

| | |
|---|---|
| GDP (million USD, current) | 8,400* |
| GDP per capita (USD, current) | 840* |
| Country / territory economic composition | Country / territory economic composition |
| Agriculture, forestry and fishing, value added (% of GDP) | 19.2 |
| Employment in agriculture (% of total employment) (modelled ILO estimate) | 44* |
| Industry (including construction, value added (% of GDP) | 27.4 |
| Employment in industry (% of total employment) (modelled ILO estimate) | 16* |
| Services, value added (% of GDP) | 42.1 |
| Employment in services (% of total employment) (modelled ILO estimate) | 40* |

*Source: Statistical Yearbooks of the Republic of Tajikistan for 2020; World Bank Open Data*

[18] *Statistical Yearbooks of the Republic of Tajikistan for 2015 (data for 1995-2015).; Statistical Yearbooks of the Republic of Tajikistan for 2020. http://www.stat.tj*
[19] *Statistical Yearbooks of the Republic of Tajikistan for 2020. (data for 2013-2020). http://www.stat.tj*





Tajikistan's public external debt stood at $2.9 billion at the end of 2018; this is 40% of GDP which is up from 24% of GDP in 2014. According to the World Bank, real GDP growth slowed from 7.3% percent in 2018 to 6.2% in 2019 and will decline to 4.5-5.0% between 2020 and 2021, reflecting weaker economic growth in the Russian Federation and lower global commodity prices associated with COVID-19. Remittance inflows will remain slow in the medium term. Mining, manufacturing and construction will support economic activity.[20]

The average population density in Tajikistan is only at 65.6 people per km$^2$ in 2019. It also varies significantly across the country due to the geographical features of its mountainous terrain. The most densely populated regions of the country are in the lowlands of northern and southwestern Tajikistan while the sparsely populated areas are in the east.
The city with the highest population density is the capital city of Dushanbe, with 8,486 people per km$^2$. Other large cities of the country, including Khujand (population of 180,700 people), Bokhtar (109,900 people) and Kulyab (104,900 people),[25] also have high densities.

Land use in Tajikistan shows that over the past decade, no significant changes were observed in the area of agricultural land in the country.[21] As of 2020, the total area of agricultural land amounted to 3,669.4 thousand hectares, of which 18% are arable lands, 76.8% are pastures, 4.1% are perennial plantations, 0.7% are fallow lands, and 0.4% are hayfields.[22] Between 2011 and 2018, the area covered by perennial planting increased by 25% largely due to the 2015 adoption of the Program for the Development of Horticulture and Viticulture in the Republic of Tajikistan for 2016–2020. This program promoted specific measures to develop new lands and transfer vacant land to agricultural use to create orchards and vineyards.[23]

In 2018, about 70% of the total area of agricultural land was covered by dekhkan (individual or family) farms and household plots. The remaining 30% was used by agricultural enterprises, 14.4% by state farms, 1.8% being inter-farms, and 10.7% by other agricultural enterprises. The same year, there were 173,000 dekhkan farms, which is over two times more than in 2013. In 2018, on average, one dekhkan farm accounted for 15 hectares of agricultural land, including 3.1 hectares of arable land, 0.7 hectares of perennial plantations and 11 hectares of pastures. Of the total arable land in 2018, 70% was irrigated.[24]

[20] *Mirzoev, S. and Sedaghat, N. (2020) Impact of COVID-19 on lives, livelihoods and MSMEs (Assessment Report). UNDP (https://www.tj.undp.org/content/tajikistan/en/home/library/impact-of-covid-19-on-lives--livelihoods-and-micro--small-and-me.html)*
[21] *Agency for Statistics under the President of the Republic of Tajikistan (2019) Agriculture Statistics (https://www.stat.tj/ru); Land fund of the Republic of Tajikistan as of 1.01. 2020 Dushanbe, 2020.*
[22] *Statistical Yearbooks of the Republic of Tajikistan for 2020. (data for 2013-2020) (http://www.stat.tj); Agency for Statistics under the President of the Republic of Tajikistan (2019) Agriculture Statistics (https://www.stat.tj/ru); Land fund of the Republic of Tajikistan as of 1.01. 2020 Dushanbe, 2020.*
[23] *Government of the Republic of Tajikistan (2019) National strategy for adaptation to climate change of the Republic of Tajikistan for the period up to 2030*
[24] *Agency for Statistics under the President of the Republic of Tajikistan (2019) Agriculture Statistics (https://www.stat.tj/ru); Land fund of the Republic of Tajikistan as of 1.01. 2020 Dushanbe, 2020.*
[25] *Statistical Yearbooks of the Republic of Tajikistan for 2020. (data for 2013-2020). http://www.stat.tj*

**Table 8: Asset replacement cost (billion USD) for residential, commercial and industrial buildings**

| Asset replacement cost (billion $) | |
|---|---|
| Residential buildings | 60.8 |
| Commercial buildings | 7.5 |
| Industrial buildings | 1.8 |
| **Total buildings** | 70.1 |

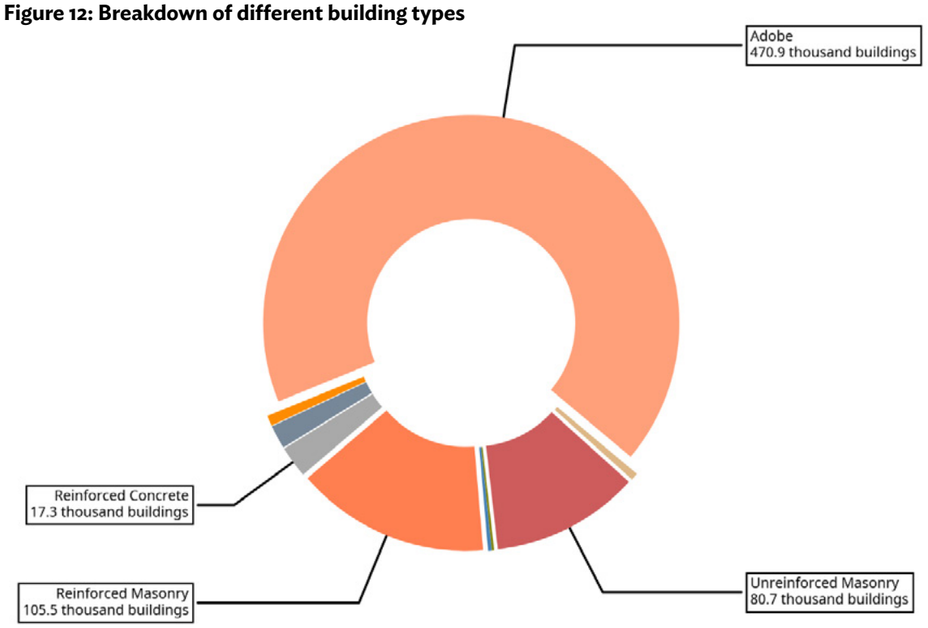
*Source: Global Earthquake Model database.*

As shown in Table 8, residential buildings are the dominant asset type in Tajikistan, with a replacement cost value at $60.8 billion. Household occupancy is split between individual family houses and multi-apartment buildings. Commercial buildings are valued at $7.5 billion and industrial buildings are just at $1.82 billion, further illustrating the agricultural nature of large parts of the Tajikistan economy.

As seen in Figure 12, adobe structures with an estimated total of 470,918 buildings make up the largest fraction (67.3%) of the total building stock. This is followed by reinforced masonry structures (105,518 buildings, or 15.1%) and unreinforced masonry structures (80,658 buildings, or 11.5%).

The concentration of value at risk is in the west of the country. This is partially reflective of the Pamir mountain range to the east and Alay mountains in the centre. Interestingly, the Khatlon Region and Sughd Region account for more exposure than the capital Dushanbe. This could be because both provinces are lower lying, allowing settlement and economic activity (e.g. agriculture).

**Figure 12: Breakdown of different building types**




*Source: Global Earthquake Model*





CHAPTER 5

# Vulnerability

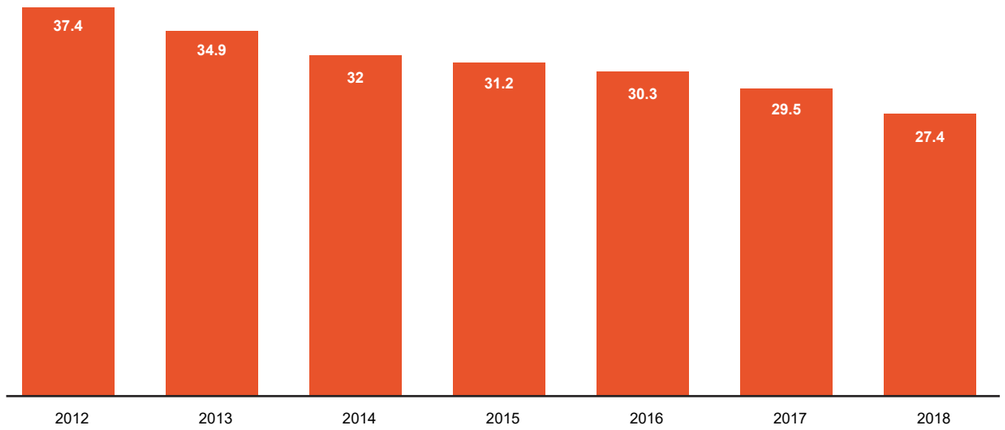
**The social impacts of hazard events are greatly affected by the structure and organization of societies and economies. Vulnerability can be thought of as one determinant of disaster risk, the other being the natural hazard event. The structure of politics, economics and livelihoods affects vulnerability 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

Tajikistan made significant progress in poverty reduction prior to the COVID-19 pandemic as seen in Figure 31. The poverty level in Tajikistan decreased 37.4% in 2012 to 27.4% in 2018. However, Figure 32 shows there is a considerable difference in poverty levels between regions of Tajikistan, with poverty being predominantly rural.

Despite the rapid pace of economic growth in Tajikistan, job creation and poverty reduction have stalled. Poverty rates declined from about 80% in 2000 to 27.5% of the population by 2019.[26] However, since 2009, the poverty rate has declined by about 1% every year, indicating a slowdown in the rate of poverty reduction. Poverty is still widespread among women and girls, especially in rural areas due to more limited access to jobs.

**Figure 13: Dynamics of the poverty level in Tajikistan for 2012-2018. (%). Data as of January 1, 2019**



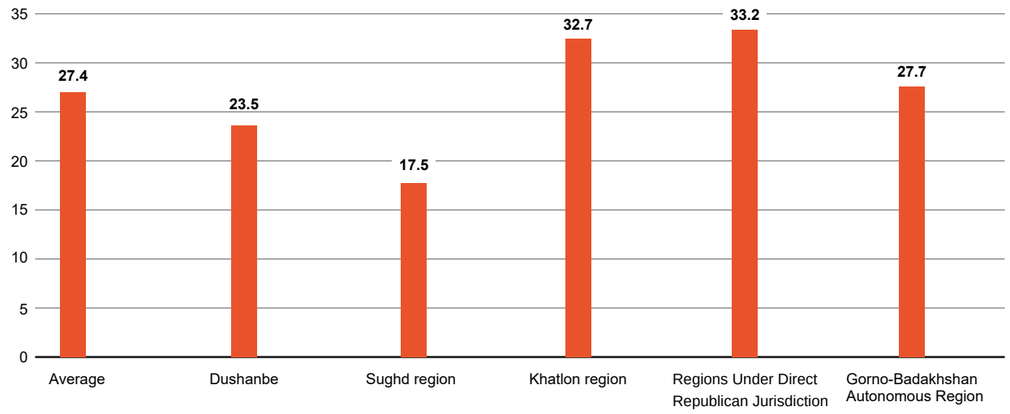

*Source: World Bank Group (2017) Tajikistan: Heightened Vulnerabilities, Despite Sustained Growth. Country Economic Update. World Bank Group (https://www.worldbank.org/en/country/tajikistan/publication/economic-update-fall-2017)*

[26] *World Bank Group (2017) Tajikistan: Heightened Vulnerabilities, Despite Sustained Growth. Country Economic Update. World Bank Group (https://www.worldbank.org/en/country/tajikistan/publication/economic-update-fall-2017)*





**Figure 14: Poverty rate in urban and rural areas and at the level of regions of the Republic of Tajikistan at the end of 2018 (%). Data as of January 1, 2019**




*Source: World Bank Group (2017) Tajikistan: Heightened Vulnerabilities, Despite Sustained Growth. Country Economic Update. World Bank Group (https://www.worldbank.org/en/country/tajikistan/publication/economic-update-fall-2017)*

Household income is mainly used for consumption, with little or no savings for these households; this reduces resilience to financial hardships and increasing vulnerability. A lack of well-paid work also forces many citizens to go into labor migration. It is highly likely that past gains in poverty reduction could be lost due to the economic impact of COVID-19.[27]

According to the Agency on Statistics, efforts to reduce poverty in 2015-2016 did not lead to the expansion of the middle class in the country. In 2016, the middle class, almost half of which live in the Sughd region, was estimated at 23% of the population and is seasonally sensitive. The same report indicates that middle-class households, on average, had fewer children, women, and the elderly.[28] Despite the lack of recent data on the proportion of the population classified as "middle class," the size of the middle class in the country's population structure is likely to shrink as a result of the COVID-19 outbreak. This may be due to income distributions that are more biased towards the upper and lower segments of the population.[29] The consequence of the shrinking middle class is the expected slowdown in both consumption and savings.

Poverty reduction and investment in the provision of public services, such as education, have increased the Human Development Index (HDI) from 0.642 in 2015 to 0.656 in 2019 which indicates steady progress in improving the quality of life and human development. However, the inequality adjusted HDI was 0.575, which is 11 percentage points below the overall HDI; this indicates a loss in human development due to inequality. The adjusted number also puts Tajikistan 125th among 189 countries globally in terms of the HDI. In addition, the average annual HDI growth in Tajikistan is slowing due to rapid population growth and economic hardship. Although it is too early to assess the dynamics of the HDI in 2020, the outbreak of COVID-19 is likely to lead to a further slowdown in HDI growth in the country.

[27] *Mirzoev, S. and Sedaghat, N. (2020) Impact of COVID-19 on lives, livelihoods and MSMEs (Assessment Report). UNDP (https://www.tj.undp.org/content/tajikistan/en/home/library/impact-of-covid-19-on-lives--livelihoods-and-micro--small-and-me.html)*
[28] *World Bank Group (2017) Tajikistan: Heightened Vulnerabilities, Despite Sustained Growth. Country Economic Update. World Bank Group (https://www.worldbank.org/en/country/tajikistan/publication/economic-update-fall-2017)*
[29] *Mirzoev, S. and Sedaghat, N. (2020) Impact of COVID-19 on lives, livelihoods and MSMEs (Assessment Report). UNDP (https://www.tj.undp.org/content/tajikistan/en/home/library/impact-of-covid-19-on-lives--livelihoods-and-micro--small-and-me.html)*

**Table 9: Socio-economic vulnerability indicators**

| | |
|---|---|
| Poverty headcount ratio at national poverty lines (% of population) | 26.3 (2019) |
| Human Capital Index | 0.5 (2020) |
| GINI index | 34 (2015) |
| Gender Inequality index | 0.38 (2018) |
| Household size | 6 (2019) |
| Age dependency ratio (% of working age population) | 67 (2019) |
| Unemployment rate | 11 (2020) |
| General government gross debt (% of GDP) | 47.819 (2018) |
| Under five child mortality (per 1000 live births) | 34 (2019) |
| Life expectancy at birth (female) | 73 (2018) |
| Life expectancy at birth (male) | 69 (2018) |
| % of population using at least basic sanitation services | 97 (2017) |
| % of population using at least basic drinking water services | 81 (2017) |

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

The 2019 UNDP Human Development Report found that Tajikistan's Gender Development Index (GDI), the ratio of female to male HDI values, was 0.799, which is significantly lower than in neighboring countries of Central Asia.[30] Table 9 shows other key socio-economic vulnerability indicators for Tajikistan.

[30] *Ministry of Economic Development and Trade of the Republic of Tajikistan (2018) National report on the implementation of the country's strategic documents in the context of the Sustainable Development Goals. Dushanbe (https://www.tj.undp.org/content/tajikistan/en/home/library/poverty/national-report-on-implementation-of-strategic-documents-of-the-.html)*





## Coping capacity

The potential for resilience to disaster risks largely depends on three factors: the country's adaptive capacity, including the effectiveness of government services, such as education and health system; the availability of a communication and early warning system; and the availability of financial resources to prepare and respond. Table 10 shows key coping capacity indicators.

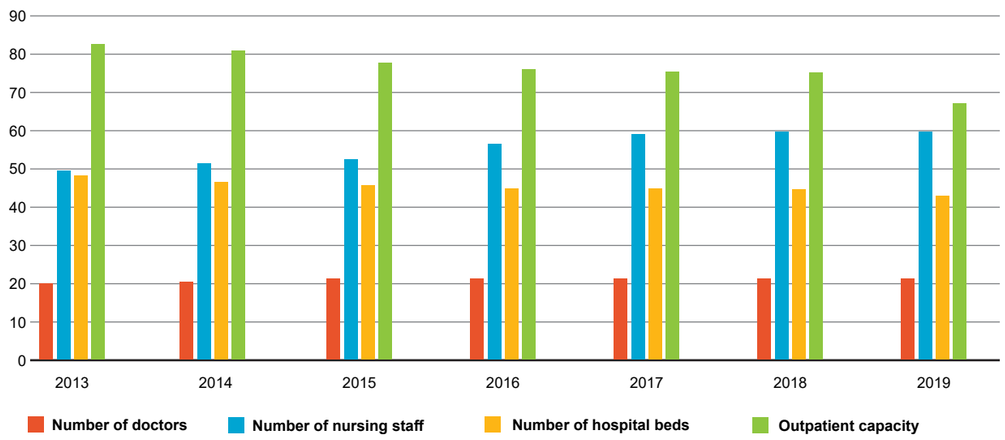
**Table 10: Key coping capacity indicators**

| | |
|---|---|
| Financial inclusion (% of population aged 15+ with access to bank account) | 47% (female pop: 42.1%) (2017) |
| Insurance coverage | 0.34% (2018)* |
| Share of population covered by public safety nets | 39% (bottom income quintile: 45.8%) (2011) |
| Internet coverage (% of population using the internet) | 22 (2017) |
| Metabiota Epidemic Preparedness Index score (100 = maximum score, 0 = minimum score) | 63 (2019) |
| Public and private health expenditure (% of GDP) | 7.23 (2017) |
| Number of physicians (per 1,000) | 2.1 (2014) |
| Number of hospital beds (per 1,000) | 4.8 (2013) |
| Government effectiveness (-2.5 to +2.5) | -1.05 (2019) |
| Corruption Perception Index | 25 (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[31]*
** Refers to total insurance penetration, rather than just the non-life segment*

[31] *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).*

**Figure 15: Dynamics of the number of doctors, nurses, hospital beds and outpatient facilities per 10,000 population in the Republic of Tajikistan for 2013-2019. Data as of January 1, 2020**




*Source: Statistical Yearbooks of the Republic of Tajikistan for 2020. (data for 2013-2020). (http://www.stat.tj)*

In order to improve the quality of human capital, the country is pursuing a policy of strengthening the health of citizens, improving the provision of medical care, and creating conditions for a healthy lifestyle. As the population grows, the need for medical personnel will grow, which must be considered in the framework of preventive measures in the education, health, and labor markets. Progress has been made in the development of the health sector as shown in trends in key health system indicators in Figure 33.

In Tajikistan, a number of legal documents have been adopted to support disaster risk reduction. The laws On protection of the population and territories from natural and man-made emergencies and On civil defense define the functions of the Committee for Emergency Situations and Civil Defense. They also outline the directions of measures to prevent natural hazard related risks, improve preparedness, and reduce disaster impact. Industrial safety, emergency preparedness, and mitigation of impacts are regulated by the Law on Industrial Safety of Hazardous Production Facilities which also provides for the creation of the State Register of Hazardous Production Facilities. The Law On Radiation Safety defines measures to protect the population and property from radiation. The Law On Insurance Activities presupposes the use of insurance to cover damage from natural-hazard related disasters, although in practice it is rarely used. The 2011 Law on Environmental Protection includes a chapter which describes the requirements for the prevention and mitigation of environmental emergencies. The 2011 Law on Environmental Monitoring defines the requirements for environmental monitoring at facilities included in the state register of hazardous production facilities.





In addition, measures to prevent and prepare for specific types of disaster events are described in sectoral legislation. For example, the amendments and additions to the 2000 Water Code adopted in 2008, 2009, and 2012 legislatively enshrined measures to prevent floods and address their consequences. The 2010 Law on the Safety of Hydraulic Structures establishes obligations in the field of ensuring the safety of dams and structures intended for flood protection. Concepts for assessing epidemiological risks and risks to animal health are contained in the 2003 Law on Ensuring the Sanitary and Epidemiological Safety of the Population. Land use and land management issues are regulated by the 2008 Law on Land Management and the 1996 Land Code. Their goal is to create conditions for sustainable land use and protection of land from water and wind erosion, drowning, waterlogging, salinization, pollution, and other negative phenomena. The 2010 Law on the Red Crescent Society of Tajikistan defines the role and rights of this organization in dealing with the consequences of emergencies.[32]

In 2007, the National Development Strategy was developed for the period up to 2015. In this strategy, disaster prevention and mitigation were considered exclusively from the point of view of environmental protection. A high risk of natural hazard-related disasters and vulnerability to the effects of climate change are identified as some of the main challenges to the country's development. The Strategy notes that natural hazards continue to cause significant damage, undermine well-being, and pose a threat to the safety of people, and that disaster risk requires a broader and more people-centered preventive approach. In the National Strategy, the main directions for reducing the risk of natural hazard-related disasters considering climate change include:

- building national institutional capacity for disaster prevention, preparedness, and mitigation;
- integration of actions to reduce the risk of natural and climate disasters into the management system of the country's economic sectors;
- development and implementation of mechanisms for reducing social vulnerability in the aftermath of disasters;
- Formation and implementation of gender-sensitive systemic information support and training of the population in proactive, protective, and restorative actions in response to disaster events;
- development of a system for the implementation of climate change issues, prevention of natural hazard-related disasters in strategic regional documents and strengthening of local capacity to manage risks of emergencies and disasters.[33]

In the end of 2018, Tajikistan adopted an updated National Strategy for Disaster Risk Reduction (DR)) for 2019-2030, building on the lessons learned from the National Strategy for Disaster Risk Reduction for 2010-2015. The updated strategy provides for the integration of measures aimed at reducing the risk of natural hazard-related disasters with the development of the economy and other spheres of activity. It has identified challenges in the following areas: insufficient funding for risk reduction and management; limited funding for local governments and increased cost of risk mitigation activities; weak governance; lack of a focal point for disaster risk management within the Government structure; poor interaction with donors; and limited awareness or understanding of disaster risk management issues among officials of the Government of Tajikistan and other stakeholders.

*[32] Government of the Republic of Tajikistan (2019) National Strategy of the Republic of Tajikistan on Disaster Risk Reduction for 2019-2030. Dushanbe.*
*[33] Government of the Republic of Tajikistan (2016) National Development Strategy of the Republic of Tajikistan until 2030. Approved by the resolution of the Majlisi Namoyandagon Majlisi Oli of the Republic of Tajikistan dated October 1, 2016, No. 392*

The updated National Strategy for DRR for 2019-2030 is based on the priorities of the Sendai Framework, the Global Agenda for Sustainable Development for the period up to 2030, and the National Development Strategy of the Republic of Tajikistan for the period up to 2030.[34] The National Strategy for DRR provides a set of legal, economic, social, educational, environmental, political, and organizational measures aimed at preventing and reducing exposure to threats and vulnerability to natural-hazard related disasters, therefore increasing the level of preparedness for response and recovery. Building on the new vision of the Sendai Framework and its guiding principles, the Strategy identifies new approaches to the role of women in disaster risk reduction and the importance of bridging gender inequality alongside disaster risk reduction, climate change and sustainable development. Special attention is also given to the importance of involving children, youth, people with disabilities, the elderly, the settled, and displaced people in transformative processes.

One of the objectives of the updated Strategy is to conduct a risk assessment with a focus not only on threats, but also on determining the vulnerability of the population to risk. The vulnerability assessment considers gender and age factors and available resources for management, and also focuses on reducing vulnerability, by identifying priority threats, risk factors, areas and most vulnerable populations for risk reduction measures.

The Strategy notes that predicted changes in climate and weather conditions will lead to more frequent occurrence of mudflows and, paradoxically, droughts as well as periods of abnormally hot weather and unfavorable weather conditions (e.g. strong hail that can destroy crops). To successfully tackle these conditions, it is necessary to improve early warning systems and existing risk management structures (e.g. for mudflows and droughts), as well as develop new mitigation and adaptation approaches, especially for hot weather and droughts.

The National Platform for Disaster Risk Reduction, established in 2013 as a cross-sectoral structure, plays a key role in the coordination and implementation of the Strategy and oversees issues related to the development of risk reduction policies in the development process. Currently, the Platform has become one of the main government coordination structures of the country for disaster risk reduction. In accordance with the National Strategy of the Republic of Tajikistan on Disaster Risk Reduction for 2019-2030 and the Medium-Term Development Program of the Republic of Tajikistan for 2021-2025, one of the tasks of the National Platform includes the adoption of adaptation measures to reduce the impact of climate change.[35]

In 2013, the Ministry of Economic Development and Trade approved the procedure for the development and implementation of regional and district/city programs for social and economic development. These programs cover environmental protection, climate change, and disaster management (a separate chapter is devoted to disaster risk reduction and preparedness for response). As of 2015, disaster risks were included in 43 out of 65 socio-economic development programs in Tajikistan.

These legal instruments, strategies, and government programmes are complex in nature and feature some gaps and overlaps. Some of these shortcomings may be addressed through the implementation of the Unified State System of the Republic of Tajikistan for the prevention and elimination of emergencies. The process of determining the nature of state assistance for restoration is within the competence of the State Commission of the Government of the Republic of Tajikistan. These responsibilities can be delegated

[34] *Government of the Republic of Tajikistan (2019) National Strategy of the Republic of Tajikistan on Disaster Risk Reduction for 2019-2030. Dushanbe.*
[35] *Government of the Republic of Tajikistan (2019) National Strategy of the Republic of Tajikistan on Disaster Risk Reduction for 2019-2030. Dushanbe.*





to various divisions in the structure of the apparatus or to subordinate Commissions at the regional or district level.

Currently, no government agency is directly responsible for managing risk mitigation activities. Until now, the Government lacks specific regulations and procedures to ensure that gender, age, and the needs of people with disabilities are taken into account in the context of disaster risk management (however, the possibility of integrating these issues into disaster risk management is being discussed). In developing sectoral plans and strategies, particularly for water resources management and agricultural reform, aspects of disaster risk and adaptation to climate change are still not systematically addressed. Until now, there is no detailed regulation on the responsibilities of ministries and other government agencies in such situations or any information about the structure or content of such plans.[36]

Discussions are under way for Tajikistan to join the Central Asian Center for Emergency Response and Disaster Risk Reduction, which was established by Kazakhstan and Kyrgyz Republic in 2012 and inaugurated in 2016. Tajikistan is not a member of the International Search and Rescue Advisory Group (INSARAG) and is not a member of the United Nations Disaster Assessment and Coordination Group (UNDC). However, the country took part in the INSARAG Global Meeting in 2015. Tajikistan also has bilateral agreements and arrangements on preparedness measures with several countries, among which key partners are Afghanistan, Belarus, Kazakhstan, PRC, Kyrgyz Republic, the Russian Federation and Switzerland.

In 2003, the United Nations Development Program in Tajikistan established the Disaster Risk Management Program (DRMP) to support the government of the Republic of Tajikistan in the area of disaster risk management. Since its inception, DRMP's activities have focused on strengthening the capacity of the Committee for Emergency Situations and Civil Defense and other relevant agencies in responding to natural hazard-related disasters. For more than ten years, this Program, in close cooperation with the Government of the Republic of Tajikistan, has been assisting vulnerable groups in the country to mitigate the risk of natural hazard related disasters and to address their impacts. Over the past decade, the Program has implemented more than 20 projects aimed at disaster risk reduction in most regions of the republic. Through joint efforts of the UNDP DRPR and the Government of the Republic of Tajikistan, the Information and Analytical Center was created under the Committee for Emergency Situations, which is able to conduct disaster risk analysis, develop risk maps, and identify the risks of floods, landslides, avalanches, mudflows and other disasters inherent in separate areas of the country. In addition, the DRMP has developed numerous training materials and civil defense training programs, which are now being applied in daily practice by the Committee for Emergency Situations and Civil Defense and its regional organizations, local and international non-governmental organizations, local authorities, and various communities.

The Risk Monitoring and Early Warning System created under the Ministry of Economic Development and Trade of the Republic of Tajikistan is one of the main achievements of the DRMP. Over the past four years, the Program has been assisting the Ministry in building and strengthening internal capacity to monitor and prevent major disaster risks in the economic, health, and social sectors. Currently, the system operates continuously and independently under the Ministry of Economic Development and Trade of the Republic of Tajikistan and issues monthly bulletins. For the fourth year now, users both within the country and abroad have received data through a mailing list which they use to plan and implement their projects.

[36] *Government of the Republic of Tajikistan (2019) National Strategy of the Republic of Tajikistan on Disaster Risk Reduction for 2019-2030. Dushanbe.*

## 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 disaster. This is important for the design of risk management and arrangement of risk financing: identifying the protection gap informs on where financing is most needed. Table 11 provides the details underpinning this assessment for Tajikistan.

**Table 11: Key Protection Gap indicators**

| | | |
|---|---|---|
| AAL as % of GNI[37] | 0.32% | |
| Un-funded AAL, ($m, %) | $107m, 86% | |
| Average annual human losses from flood and earthquakes | Flood | EQ |
| | 45 | 37 |
| Event frequency where direct & indirect loss and damage, less (assumed) insured losses, exceed existing ex-ante risk retention | Flood | EQ |
| | 1 in 5 | 1 in 5 |
| Event frequency where direct damage, less (assumed) insured losses, exceed existing ex-ante risk retention | Flood | EQ |
| | 1 in 5 | 1 in 5 |
| Event frequency where estimated emergency response costs exceed current risk retention mechanisms | Flood | EQ |
| | 1 in 5 | 1 in 10 |
| Macro-economic context and ability for sovereign to borrow | Weak position. High risk of debt distress and 3rd lowest credit rating. | |
| Ability of individual and households to access resources after an event | Growing financial inclusion but still lower than many other countries in region. Low and poorly targeted social protection. | |

*Source: Consultant team modelling*

*[35] GNI data (in current international $) used to take account of the importance of remittances in many parts of the CAREC region. GNI data taken from World Development Indicators. GDP used for Inner Mongolia and Xinjiang where province level GNI data is not available drawing from press reports.*





Tajikistan faces significant flood and earthquake risk with annual average loss (AAL) from floods estimated to be around $61 million and from earthquakes at around $63 million. The combined direct AAL is equivalent to around 0.32% of Tajikistan's GNI, the second highest proportion for any CAREC jurisdiction.

The government of Tajikistan has identified the importance of developing an explicit disaster risk financing strategy. As of now, the country has three main sources of ex-ante risk retention mechanisms that, as of 2016, were able to collectively provide up to $11-$11.5 million in financial resources of disaster risk financing each year.[38] First, both national and local governments include budget lines that provide compensation for people affected by disaster events. From 2009 to 2010, around $1-$1.5 million has been allocated to this line item. In addition, the Contingent Fund, capped at 0.5% of budget revenues and typically averaged at around $8 million, can be used for a range of different contingencies including disaster response and rehabilitation. Finally, local reserve funds also provide resources, with $1.2 million allocated to these in 2017.[39]

Tajikistan has one of the smallest insurance markets in the region with an insurance penetration rate of just 0.34% in 2018.[40] Compulsory property insurance is restricted to perils such as fire and earthquake and has no coverage for floods. For earthquake risk, it is assumed that around 8% of losses might be covered by insurance. This is based on property insurance, including earthquake cover, being nominally compulsory and observing that property insurance premiums as a percentage of flood and earthquake AAL is 18%, higher than many other countries in the CAREC region. The combined effect of these assumptions is that just 3% of the AAL from flood and earthquakes are assumed to be covered by insurance leaving unfunded residual AAL of $107 million.

The IMF forecasts a fiscal deficit of 7.7% of GDP in 2020 and public sector debt to rise above 50% of GDP. The IMF has defined Tajikistan's overall risk of debt distress as 'high' and its debt carrying capacity as 'medium'.[41]

There are important opportunities to improve arrangements for disaster risk finance in Tajikistan, especially in relation to flood events and more severe earthquakes. As highlighted, insurance penetration is low and existing risk retention mechanisms are only able to cover the costs (either total losses or emergency response costs) of the most frequent, lowest-severity flood events. Flood events that might happen once every five years would be enough to exhaust current mechanism. Tajikistan's fiscal position does not allow significant reliance in ex-post funding alternatives which would almost certainly make Tajikistan dependent on support from international development partners.

*[38] World Bank (2019) Forum on Financial Protection against Natural Disasters in Central Asia: proceedings. http://documents1.worldbank.org/curated/en/820381574227673469/pdf/Forum-on-Financial-Protection-Against-Natural-Disasters-in-Central-Asia-Proceedings.pdf*
*[39] World Bank (2019) Disaster Risk Finance Country Note: Tajikistan. http://documents1.worldbank.org/curated/en/407701574229572325/pdf/Disaster-Risk-Finance-Country-Note-Tajikistan.pdf*
*[40] Data taken from Swiss Re Sigma, https://www.swissre.com/institute/research/sigma-research/World-insurance-series.html*
*[41] IMF (2020) Republic of Tajikistan. IMF Country Report No. 20/151. https://www.imf.org/~/media/Files/Publications/CR/2020/English/1TJKEA2020001.ashx*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