COUNTRY RISK PROFILE
PAKISTAN

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

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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

Pakistan is the world's 5th most populous country, with an estimated population of over 216 million in 2019, and is projected to be the fourth most populous nation in the world by 2030. It is split across a handful of economic regions and shares borders with Iran, Afghanistan, People's Republic of China, and India. The Arabian Sea, a part of the Indian Ocean, lies to the south.

Both flood and earthquake risks are significant in Pakistan. Floods are associated with an average annual loss of around $1.5 billion dollars while earthquakes lead to losses of around $614 million annually.

These are the highest absolute loss amounts of any country in the CAREC region for both perils. Direct losses amount to 0.2% of gross national income, the fourth highest losses as a percentage of national income in the region. Most of the value at risk is in the Punjab and Sindh regions given their population density; damages in those regions sum up to $938 million and $456 million per annum, respectively. Ninety three percent of the average annual losses from floods occurs in those areas.

Punjab has the highest AAL in the country at $244.8 million, followed by Khyber Pakhtunkhwa and Sindh at $145.3 million and $108.6 million respectively.

Box 1: Key facts

GDP: $278,221,910,000 (2019) **Population: 216,565,320 (2019)**

1 IN 100 YEAR FLOOD ECONOMIC LOSS	1 IN 100 YEAR EARTHQUAKE LOSS	AVERAGE ANNUAL LOSS FLOOD	AVERAGE ANNUAL LOSS EARTHQUAKE
$14,600,000,000	**$4,600,000,000**	**$1,500,000,000**	**$613,700,000**

AVERAGE ANNUAL PEOPLE AFFECTED FLOOD	AVERAGE ANNUAL PEOPLE AFFECTED EARTHQUAKE	AVERAGE ANNUAL PEOPLE AFFECTED INFECTIOUS DISEASE
2,300,000	**1,667,897**	**2,557,455**

EVENT FREQUENCY WHERE FLOOD LOSS EXCEEDS EXISTING COVER	EVENT FREQUENCY WHERE EARTHQUAKE LOSS EXCEEDS EXISTING COVER
ALL	**ALL**

For the less frequent 1 in 100-year event, direct loss could reach nearly $20 billion with a flood event modelled over $14.6 billion and an earthquake event over $4.6 billion.

Across the whole country, average annual fatalities due to earthquakes and flooding are estimated at 863 and 234, respectively. These are the second highest annual fatalities across the CAREC countries for both perils.

Since 1990, earthquake, flooding and drought in Pakistan have caused over $30 billion damage and resulted in an estimated 86,000–90,000 fatalities. On average, direct economic losses from disaster events in 2000 to 2013, including the 2010 floods and 2005 earthquake events, have amounted to 1.16% of national gross domestic product.

Pakistan has experienced numerous significant infectious diseases outbreaks since 1957. Prior to the COVID-19 outbreak, the largest event in Pakistan was the 1957 influenza pandemic which saw more than 80,000 cases. Crimean-Congo Haemorrhagic Fever (CCHF) outbreaks have occurred regularly in Pakistan albeit with relatively small numbers of people affected.

Climate change will not have uniform spatial impacts on precipitation throughout the country; there are concerns, however, that the monsoon will become more variable[1]. Analysis suggests that, on average, the monsoon might intensify for northern areas of Pakistan, plus Khyber Pakhtunkhwa and Balochistan and slightly decrease for rest of the country. These findings reflect a continuation of observed trends in the westward shift of the monsoon.

A 10-year National Disaster Management Plan (NDMP) formulated by the Government of Pakistan in 2012 lays out a strategy to holistically improve disaster management programmes, including risk assessment, capacity building, coordination, early warning systems, and human resource development. ADB analysis from 2019 suggests that the federal government has contingency funding of around $15-$20m, primarily available from the National Disaster Management Fund, to respond to national emergencies[2]. However, there is an urgent need to enhance the current disaster risk finance approach in Pakistan. Risk retention mechanisms are insufficient to cover the losses associated with even the most frequent of flood and earthquake events, while private insurance solutions for these risks have only achieved minimal market penetration.

[1] *Government of Pakistan (2016) Pakistan's Intended Nationally-Determined Contribution. Islamabad.*
[4] *ADB (2019) The Enabling Environment for Disaster Risk Financing in Pakistan: Country Diagnostic Assessment. https://www.adb.org/publications/pakistan-environment-disaster-risk-financing*

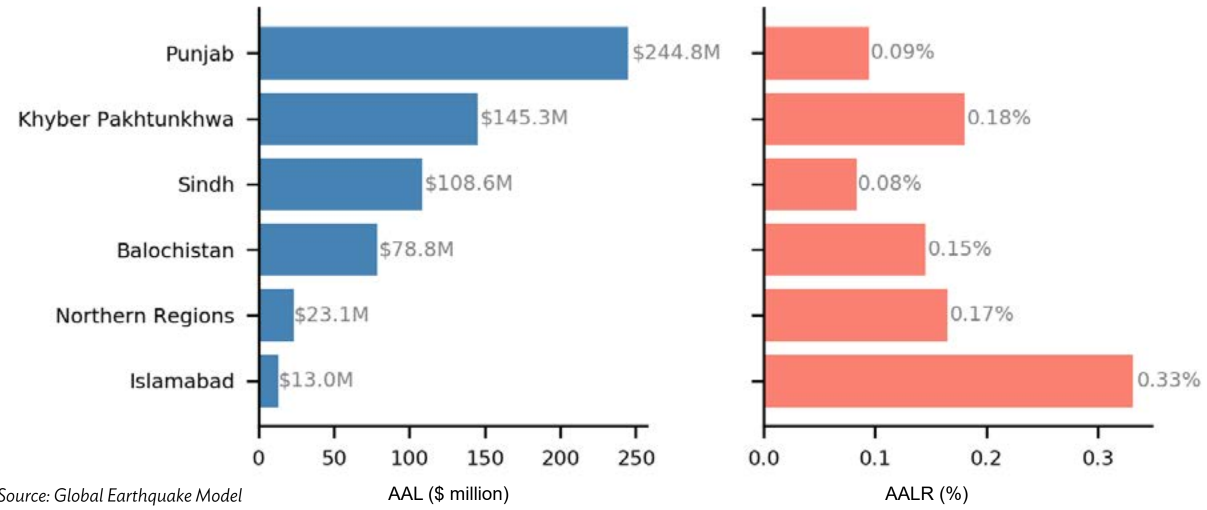
Risk analysis

The extent and geographic pattern of earthquake, flooding, and infectious disease across Pakistan 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 due to earthquakes in Pakistan is estimated at $613.7 million. Punjab has the highest AAL in the country at $244.8 million, followed by Khyber Pakhtunkhwa and Sindh at $145.3 million and $108.6 million respectively. Islamabad and Northern Regions have the lowest AAL in the country.

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

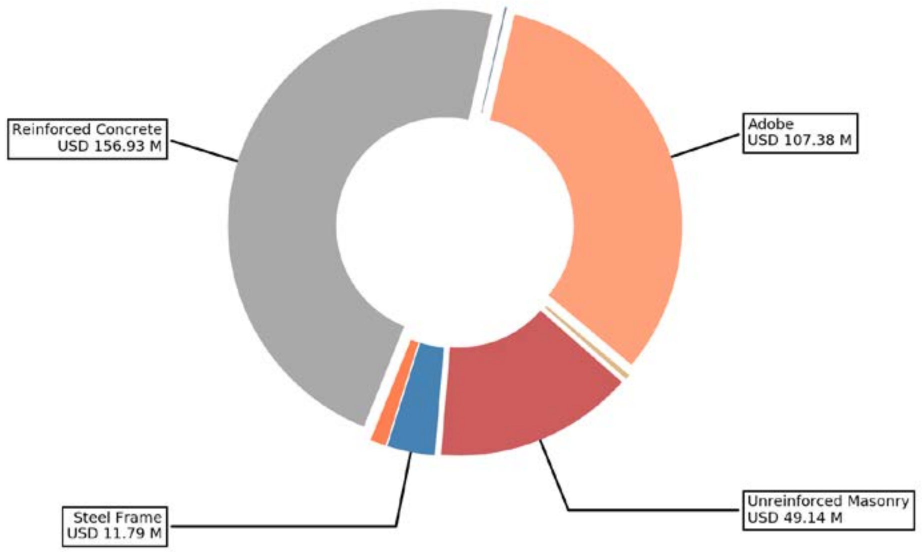


Source: Global Earthquake Model

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.

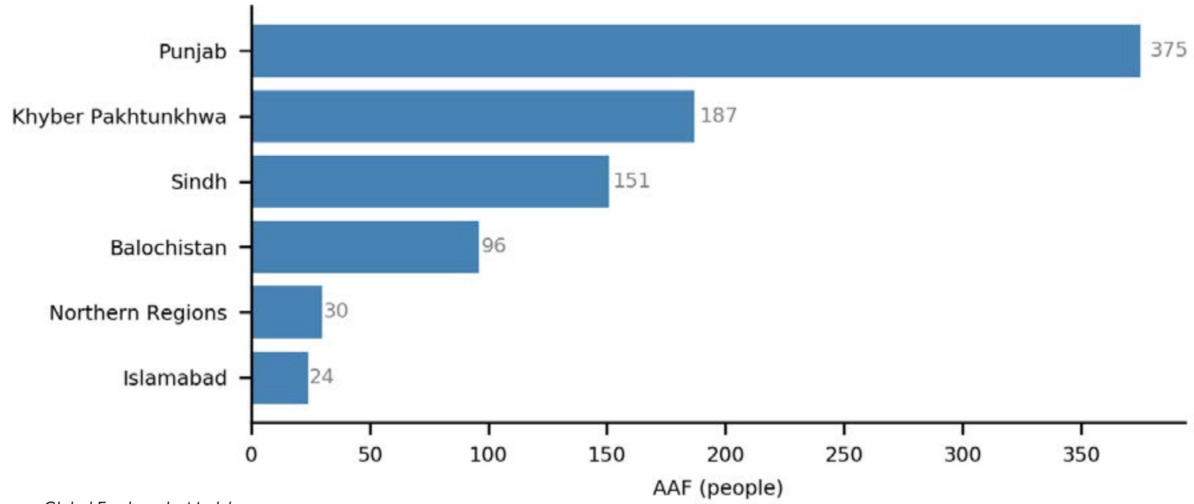
Figure 1 compares the AAL (left) and the AALR (right) for each region of Pakistan. AALR is expressed as a percentage of the total replacement value of buildings in the respective regions. Despite having the lowest absolute AAL, Islamabad is the region with the highest AALR.

Figure 2: Average annual loss by asset types – earthquakes



Source: Global Earthquake Model

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

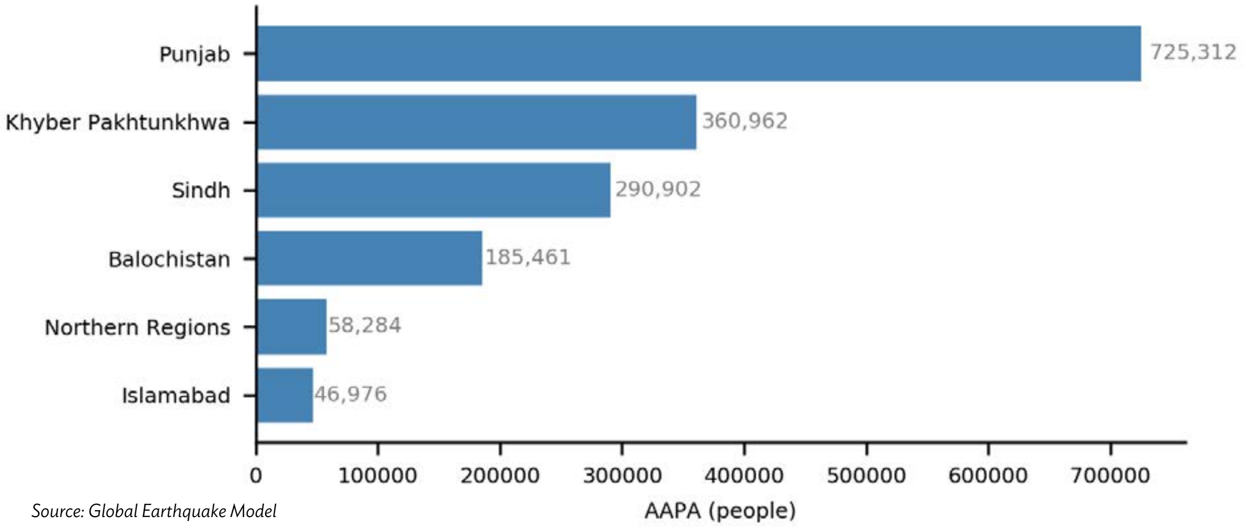


Source: Global Earthquake Model

Figure 2 shows the disaggregation of the AAL due to earthquakes by primary construction type. In terms of the total exposed value by structural type, reinforced concrete structures with an exposed value of $218.3 billion make up the largest fraction (69.9%) of the total exposed value. This is followed by adobe structures ($39.4 billion, or 12.6%) and unreinforced masonry structures ($35.0 billion, or 11.2%)

Average annual fatalities (AAF) due to earthquakes are estimated at 863 in Pakistan. As seen in Figure 3, Punjab has the highest AAF in the country at 375, followed by Khyber Pakhtunkhwa and Sindh at 187 and 151 respectively. Again, Islamabad has the highest average annual fatality ratio (1.72 per 100,000 people) despite having the lowest AAF.

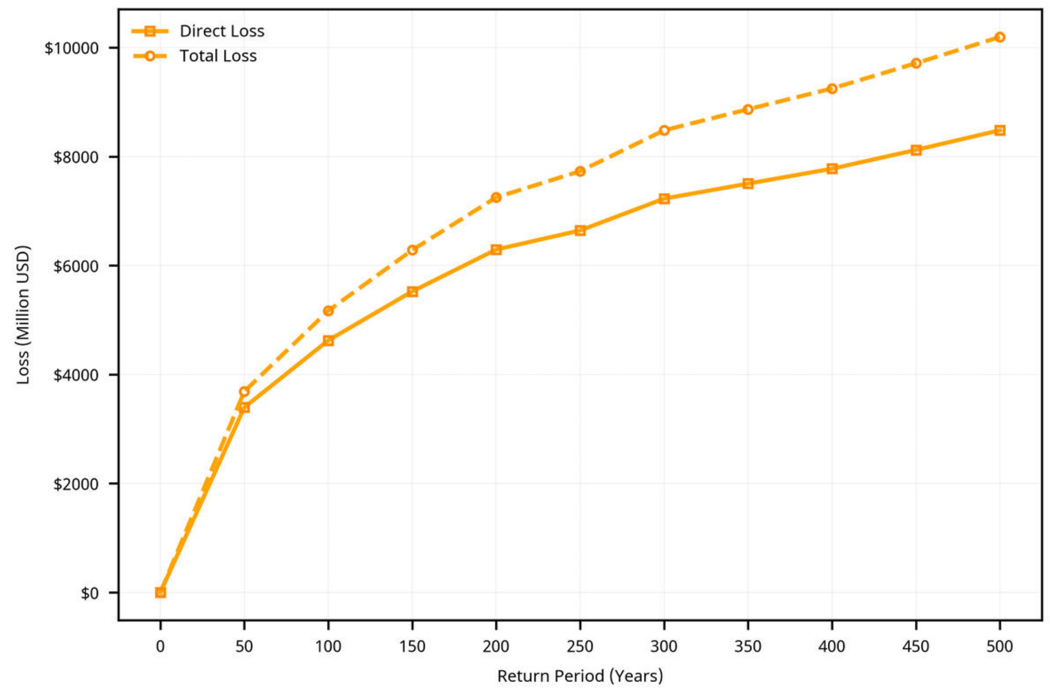
Figure 4: Breakdown of earthquake average annual number of people affected by region



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). 1,667,897 people are estimated to be affected by earthquakes on an average annual basis in Pakistan. Punjab has the highest average annual number of people affected in the country at 725,312, followed by Khyber Pakhtunkhwa and Sindh at 360,962 and 290,902 respectively. The average annual people severely affected by earthquakes is estimated at around 164,673 in Pakistan, 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 5: Exceedance probability curve – earthquake



Source: Global Earthquake Model

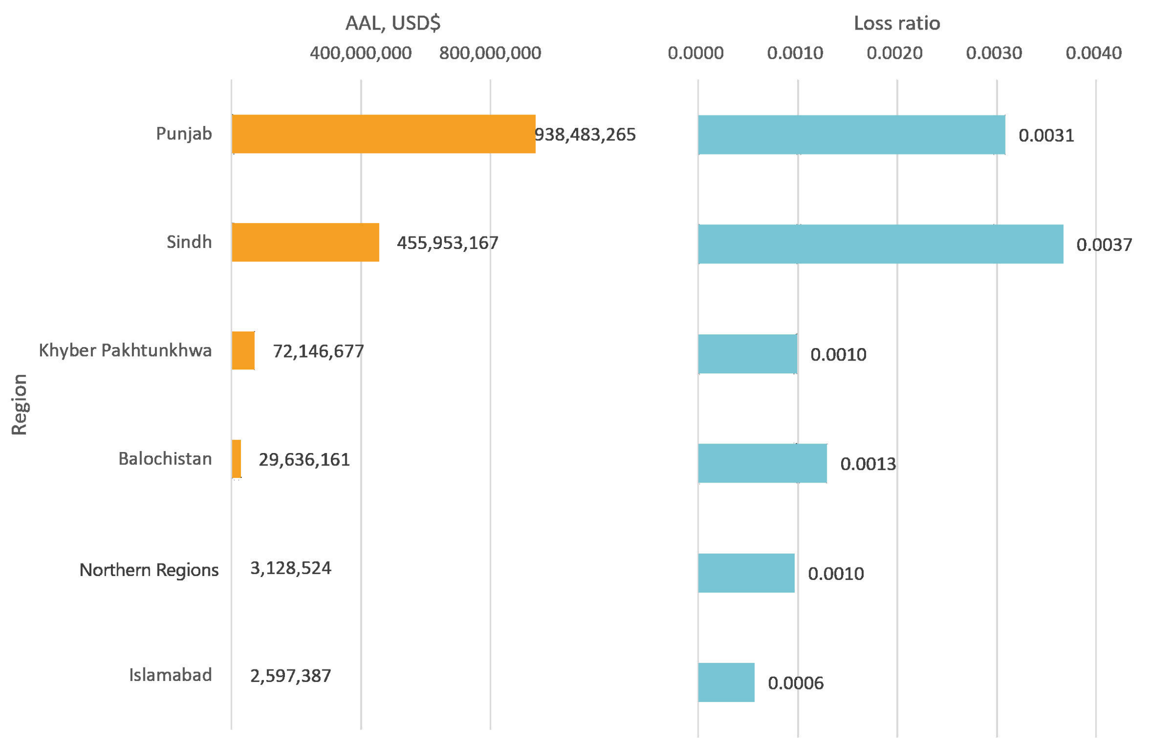
The exceedance probability (EP) curves for earthquake for Pakistan shown in Figure 5 give the direct loss and total loss from all events in any given year for the given return periods. Direct loss increases from $3.4 billion for the 50-year return period, to $8.5 billion for the 500-year return period.

The EP curve for direct loss shows that earthquake direct loss is modelled at $4.6 billion at the 100-year return period for Pakistan, which is approximately 1.51% of the country's nominal GDP. Total loss is over $5 billion on the 100-year return period and climbs to more than $10 billion for the 500-year return period.

Flood Risk

Average annual loss (AAL) from floods in Pakistan is estimated at almost $1.5 billion, which is the highest annual loss from flood across all CAREC countries. Figure 6 provides a view of AALs across Pakistan. In total, around 93% of the average annual damage from floods occurs in Punjab and Sindh provinces, where damage totals $938 million and $456 million per annum, respectively. As shown in Figure 6, these provinces also have the largest damage ratios in Pakistan and the greatest economic exposure. Flood risk is associated with the Indus River which flows northeast to southwest through Punjab, where it is joined by the Jhelum, Chenab, Ravi and Sutlej Rivers. These rivers drain the high mountains of northern Pakistan and flow through populated cities in Punjab. These rivers then merge with the Indus River which flows through the Sindh province and into the Arabian Sea.

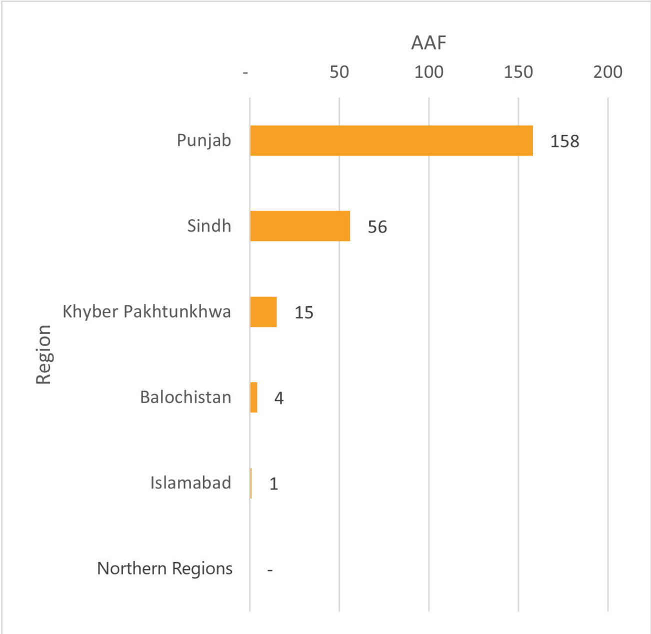
Figure 6: Breakdown of flood average annual loss and loss ratio by region



Source: JBA Risk Management

AROUND 93% OF THE AVERAGE ANNUAL LOSS FROM FLOODS OCCURS IN PUNJAB AND SINDH PROVINCES.

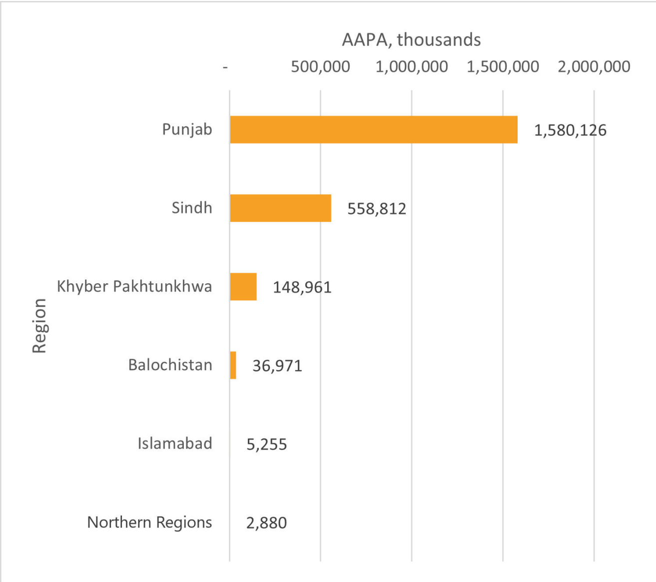
Figure 7: Breakdown of flood average annual fatalities by region



Source: JBA Risk Management

Average annual fatalities (AAF) from flooding in Pakistan are 234, the second highest number of annual fatalities across the CAREC countries. As shown in Figure 7, AAF are concentrated in Punjab and Sindh provinces, where average annual fatalities sum up to 158 and 56, respectively. These are Pakistan's most populated regions, which are home to over 77% of the country's population. Significant population centres including Lahore, Multan and Hyderabad are located along the Indus River and its tributaries in Punjab and Sindh provinces.

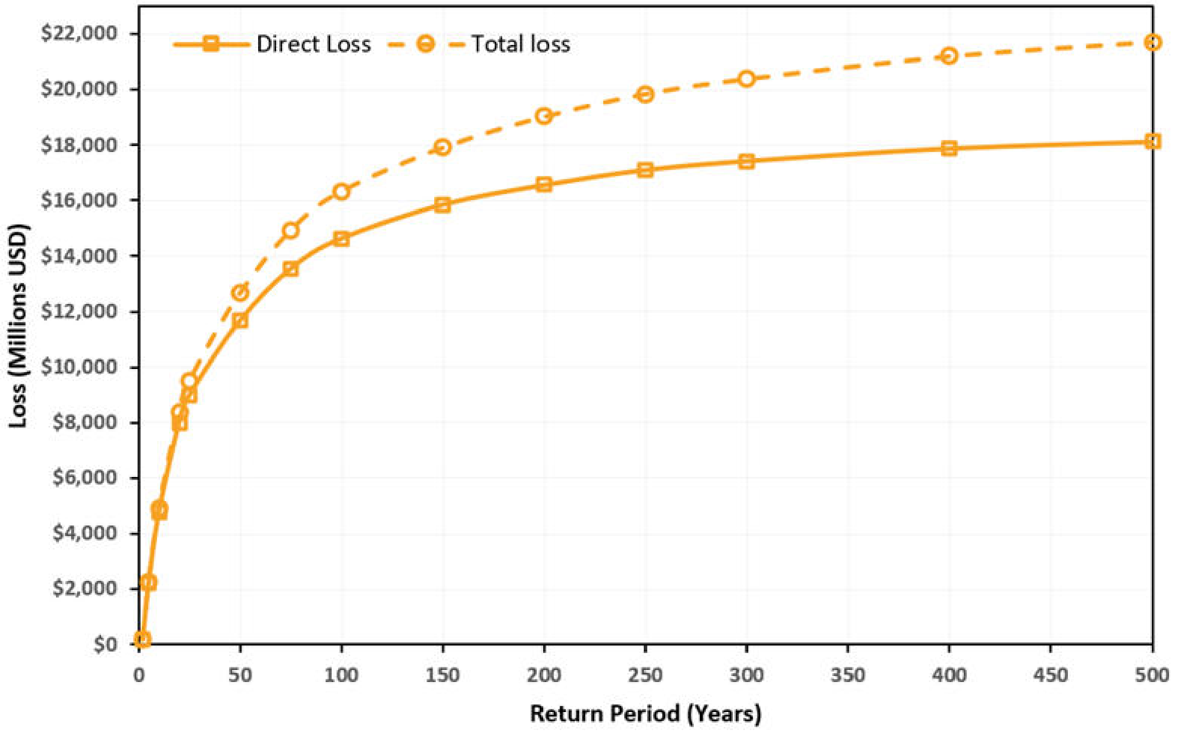
Figure 8: Breakdown of flood average annual number of people affected by region



Source: JBA Risk Management

The average annual number of people affected by flooding in Pakistan is over 2.3 million, the highest number across the CAREC countries. This is the result of Pakistan's large population and the proximity of populous cities to the Indus River system in Punjab and Sindh (average annual people affected is over 1.58 million in Punjab and over 558,000 in Sindh). The Indus River and its tributaries are also fed by higher mean annual precipitation in the north of the country, which contributes to the flood risk in Punjab and Sindh. Figure 8 provide a breakdown of people affected by region.

Figure 9: Exceedance probability curve - flood

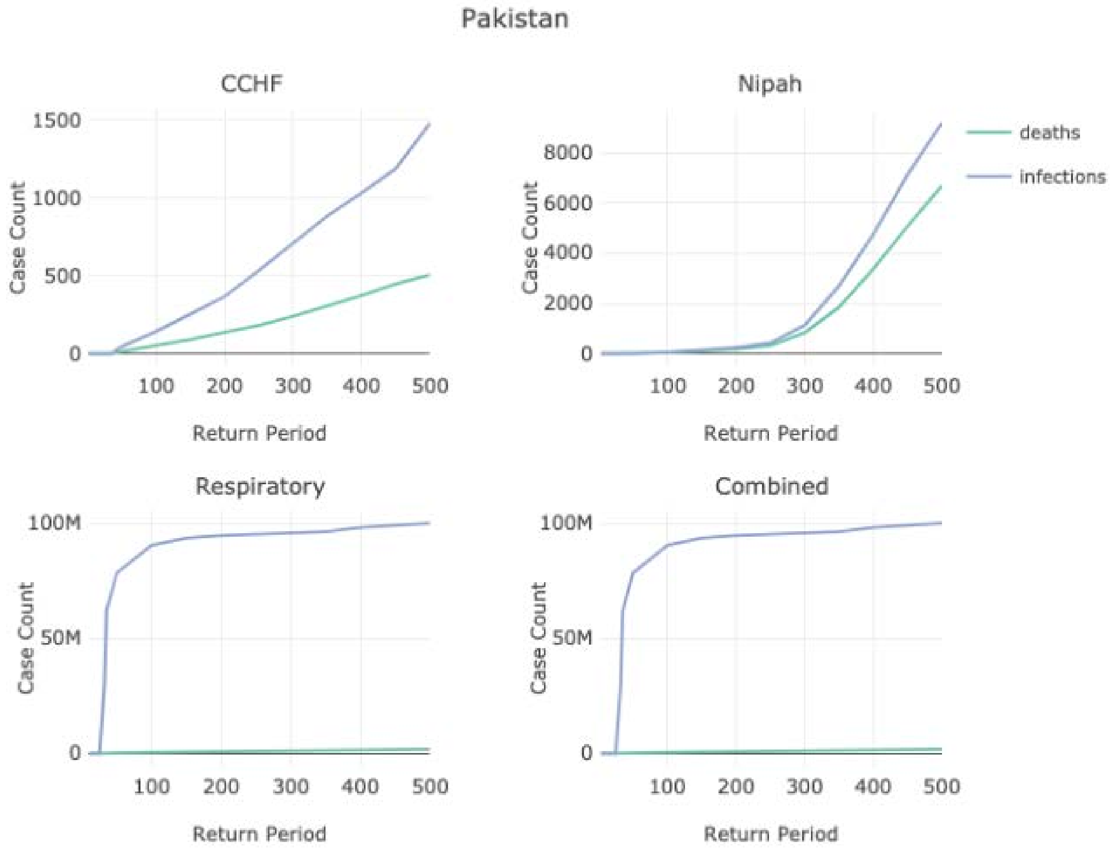


Source: JBA Risk Management

The exceedance probability curves for Pakistan in Figure 9 show the direct and total loss from all flood events in any given year for the given return periods. Direct loss increases most significantly between the 2 and 150-year return periods, which demonstrates a susceptibility to floods in this return period range. Direct loss is modelled at over $14.6 billion at the 100-year return period which is approximately 5.2% of the country's nominal GDP. Loss increases at a slower rate above the 150-year return period and reaches $18 billion at the 500-year return period. Total loss increases more significantly at the 75-year return period. At the 100-year return period total loss is modelled at over $16 billion and grows to nearly $22 billion for the 500-year return period.

Infectious disease

Figure 10: Exceedance probability curves: infectious disease outbreaks, including Crimean-Congo haemorrhagic fever, Nipah virus, respiratory viruses and combined (all pathogens)



Source: Metabiota

The modelled exceedance probability (EP) curves include only those infections and deaths which are in excess of the regularly occurring annual baseline. For the included respiratory diseases such as pandemic influenza and novel coronaviruses, this baseline will be zero. For diseases such as 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.

The pathogen EP curves for Pakistan in Figure 10 highlight that respiratory pathogens account for most of the epidemic risk. The respiratory pathogens EP curve for infections 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).

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	2,557,455	19,540
Respiratory	2,557,365	19,480
Nipah	72	53
CCHF	18	7

Source: Metabiota

CCHF outbreaks occur regularly in Pakistan. The catalogue therefore contains a higher frequency of smaller events than respiratory pathogens. Notably, larger CCHF epidemics are still much smaller than respiratory pandemics at similar return periods, reflecting CCHF's limited potential for widespread transmission.

There have been no historical outbreaks of Nipah virus reported in Pakistan, however the spill over risk maps for Nipah virus shows exposure. Additionally, Pakistan has a high degree of connectivity with India and Afghanistan where Nipah virus epidemics have occurred. Table 1 shows the average annual losses associated with these outbreaks in Pakistan.

[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

Historical losses and impacts

Having recorded 465 major disaster events accounting for total estimated damage of over $30 billion since 1926, Pakistan is one of the most disaster-prone countries in South Asia. Pakistan is particularly affected by geophysical and climatological events.

Drought, earthquake and flooding together have caused the significant majority of losses in Pakistan since 1990 and resulted in an estimated 86,000 – 96,000 fatalities over the same period (Table 2). As evident from the statistics, disaster events have profound impact on human lives, infrastructure, and economic development. On average, direct economic losses from disaster events have amounted to 1.16% of national GDP between 2000 and 2013, which includes heavy losses from the 2010 floods and 2005 earthquake events.[5]

The northern part of Pakistan along the Himalayas and the Karakorum ranges, as well as parts of the Hindu Kush in the north of the country, are prone to earthquakes. This is evident from regular seismic activities, including the relatively recent magnitude 7.6 Kashmir Earthquake of 8 October 2005, which resulted in the loss of at least 73,338 lives and was estimated to have caused over $5 billion in damage (Table 3).

As much as 60% of the country, particularly in Balochistan, Sindh and the southern part of Punjab, is classified as semi-arid to arid.[6] These areas are vulnerable to changes in the rainfall regime, with even slight negative deviations in rainfall increasing vulnerability to drought in those provinces.

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

	Fatalities	Number of people affected	Total damage ($ million; constant 2019)
Flood	10,960 - 18,264	75,131,000 – 78,439,110	23,580 – 26,574
Earthquake	74,784 – 78,106	7,340,006	6,967 – 8,905
Drought	220	6,880,912	379.1

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

[5] *LEAD (2015). Pakistan National Briefing. Target 3: Economic losses from disasters. Islamabad: Leadership for Environment & Development (LEAD) Pakistan.* http://www.lead.org.pk/lead/attachments/briefings/LPNB3.pdf

[6] *Larsen, O., Oliver, J. and Casiles Lanuza, E. (2014). Developing a disaster risk insurance framework for vulnerable communities in Pakistan: Pakistan disaster risk profile. Report No. 16. Bonn: United Nations University Institute for Environment and Human Security (UNU-EHS).* https://collections.unu.edu/eserv/UNU:1854/pdf11810.pdf

From 1997 to 2001, rainfall was exceptionally low, resulting in the longest dry spell Pakistan had experienced in its 55-year history. Over that period, the country was estimated to have lost almost half of its livestock population, with 2.5 million livestock dying in 1999-2000 alone.[7] Between 1998 and 2001, Pakistan's GDP growth rate fell by about half as a result of the drought.[8] More than 3.3 million people were affected by the drought in the Balochistan and Sindh provinces, and thousands of people were forced to migrate.[9]

The high mountains in the north house 5,218 glaciers and 2,420 glacial lakes out of which 51 are identified as potentially dangerous glacial lakes and are prone to flash floods.[10] The EM-DAT database recorded 23 counts of major flash flood events between 1926 and 2019, resulting in over 3,500 fatalities and over $12 billion estimated worth of damage.[11] Riverine floods occur mostly in the Indus River basin along the major river systems. These are triggered by incessant rainfall and snowmelt in the upper riparian sections and cause extremely high damages on an almost annual basis.

[7] *Qureshi, A and Akhtar, M. (2004). Analysis of drought-coping strategies in Balochistan and Sindh provinces of Pakistan. Working Paper 86. Colombo, Sri Lanka: International Water Management Institute.* http://www.iwmi.cgiar.org/Publications/Working_Papers/working/WOR86.pdf

[8] *LEAD (2015). Pakistan National Briefing. Target 3: Economic losses from disasters. Islamabad: Leadership for Environment & Development (LEAD) Pakistan.* http://www.lead.org.pk/lead/attachments/briefings/LPNB3.pdf

[9] *Larsen, O., Oliver, J. and Casiles Lanuza, E. (2014). Developing a disaster risk insurance framework for vulnerable communities in Pakistan: Pakistan disaster risk profile. Report No. 16. Bonn: United Nations University Institute for Environment and Human Security (UNU-EHS).*

[10] *Climate Change Section, Ministry of Environment & National Disaster Management, Government of Pakistan and United Nations Development Programme (UNDP) (2011). Reducing Risks and Vulnerabilities from Glacier Lake Outburst Floods in Northern Pakistan. Inception Report.* http://pubdocs.worldbank.org/en/700681532123304075/46-Pakistan-Draft-GLOF-Inception-Report.pdf

[11] *Centre for Research on the Epidemiology of Disasters – CRED. EM-DAT. (*https://www.emdat.be/*)*

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

Year	Location	Total damage ($ millions; constant 2019)	Fatalities	Number of people affected
Floods				
2010	Nationwide	11,138 - 12,211	1,985 - 2,045	20,359,496
1945	Punjab, Sind	3,809 - 6,019	474	4,800,000
1945	Punjab, Sind, Northern Regions	2,269 -3,759	338	5,556,000
1945	Punjab, Northern Regions	1,822 - 3,931	1,008 -1,334	6,655,000
2011	Badin, Dadu, Ghotki, Hyderabad, Jacobabad, Karachi, Khaipur, Larkana, Malir, Mirpur Khas, Naushahro, Feroze, Nawabshah, Sanghar, Shikarpur, Sukkur, Tharparkar, Thatta, Umer Kot districts (Sindh province)	2,841	509	5,400,755
Earthquakes				
2005	Bisham Tehsil, Chakisar Tehsil areas (Shangla District), Palas Sub-Division area (Kohistan District, Khyber Pakhtunhwa province), Abbottabad District, Mansehra District, Batagram District districts, Gujranwala District, Gujrat District, Rawalpindi District districts (Punjab province), Islamabad District (Islamabad province)	6,807 - 8,745	73,338 - 76,213	5,128,309
1935	Quetta (Balochistan)	465	60,000	
1945	Makran	354	4,000	-
2013	Awaran District, Chagai District, Gwadar District, Kech District, Khuzdar District, Panjgur District districts (Balochistan province)	110	399 - 825	185,749
1991	Malakand, Chitral, Peshawar area	19	300	204,794

Source: M-DAT with validation from other sources including Swiss Re, ReliefWeb, World Bank and Government of Pakistan Annual Flood Reports for floods; National Geophysical Data Center / World Data Service (NGDC/WDS): NCEI/WDS Global Significant Earthquake Database. NOAA National Centers for Environmental Information for earthquakes.

Between 1973 and 2012, approximately 77% of the people affected by disaster events in Pakistan had been affected by floods.[12] Major floods in Pakistan are a frequent occurrence, resulting in loss of life, disruption and impacts to land and agriculture.

The 2010 flood triggered by the South Asian Summer Monsoon was one of the worst in 80 years and indicates the potential footprint of severe flooding in Pakistan. Intense monsoon rainfall was attributed to the migration of the jet stream further south than usual, interacting with the monsoon.[13] The jet stream prevented the usual movement of monsoon moisture flows, creating a blocking pattern and resulting in prolonged and intense rainfall. July rainfall in Peshawar was 772% higher than average, while August rainfall in Khanpur was 1,483% greater than average.[14] The extreme monsoon triggered flash and riverine floods in Khyber Pakhtunhwa and the northern areas along the Swat, Kabul and Indus rivers.

Along the Indus River, many irrigation channels were flooded and embankments overflowed during attempts to prevent floodwaters from reaching urban areas. Nearly one fifth of the total land area was inundated,[15] and 10% of Pakistan's population was affected, with at least 1,980 deaths reported and 1.6 million homes destroyed.[16] The floods were estimated to have affected more than 20 million people and inflicted over $ 16 billion in economic loss.[17]

Pakistan has experienced numerous significant infectious diseases outbreaks since 1957 as shown in Table 4. Prior to the COVID-19 outbreak, the largest event in Pakistan was the 1957 influenza pandemic which saw more than 80,000 cases. Crimean-Congo haemorrhagic fever virus (CCHF) outbreaks have occurred regularly in Pakistan albeit with relatively small numbers of people affected.

Table 4: Notable infectious disease outbreaks, 1957-2021

Pathogen	Date first case reported	Date last case reported	Total cases	Total deaths	Location of origin
Pandemic Influenza	02 June 1957	07 Sept 1957	81,739	NA	Hong Kong
Crimean-Congo haemorrhagic fever virus	01 Feb 1998	28 Feb 1998	4	2	Pakistan
Crimean-Congo haemorrhagic fever virus	15 Oct 2021	15 Oct 2010	26	3	Pakistan
Crimean-Congo haemorrhagic fever virus	01 Apr 2017	02 Nov 2017	149	25	Pakistan
Crimean-Congo haemorrhagic fever virus	01 May 2018	22 Feb 2019	63	11	Pakistan
Crimean-Congo haemorrhagic fever virus	01 Mar 2019	10 Jan 2020	75	9	Pakistan
2019 Novel Coronavirus (2019-nCoV)	27 Feb 2020	21 Oct 2020	324,077	6,673	PRC

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

[12] *GFDRR (2015) Fiscal Disaster Risk Assessment: Options for Consideration – Pakistan World Bank Group Report https://www.gfdrr.org/sites/default/files/publication/Fiscalodisasteoiderationo00Pakistan.pdf [accessed 19 August 2020]*
[13] *Nature News (2010) Pakistan's floods: is the worst still to come? https://www.nature.com/news/2010/100813/full/news.2010.409.html [accessed 19 August 2020]*
[14] *NASA Earth Observatory (2011) Heavy Rains and Dry Lands Don't Mix: Reflections on the 2010 Pakistan Flood. https://earthobservatory.nasa.gov/features/PakistanFloods [accessed 19 August 2020]*
[15] *ADPC and UNDRR (2019). Disaster Risk Reduction in Pakistan. Status Report 2019. Geneva: UNDRR. https://www.preventionweb.net/files/68260_682307pakistandrmstatusreport.pdf*
[16] *Asian Development Bank (2010) Pakistan Floods 2010: Preliminary Damage and Needs Assessment https://www.adb.org/projects/documents/pakistan-floods-2010-damage-and-needs-assessment [accessed 19 August 2020]*
[17] *LEAD (2015). Pakistan National Briefing. Target 3: Economic losses from disasters. Islamabad: Leadership for Environment & Development (LEAD) Pakistan. http://www.lead.org.pk/lead/attachments/briefings/LPNB3.pdf*

Hazard

Pakistan experiences several natural hazards with earthquake, flood, drought, heat waves and extreme cold all being common occurrences.

The size of Pakistan provides large, distinct geographical zones. The northern highlands of Pakistan are mountainous, spanned by the Himalayan mountains, the Karakoram Range and the Hindu Kush Range. The Balochistan plateau runs along much of the western half of Balochistan province and encompasses several shorter ranges, such as the Sulaiman Range and the Kirthar Range.

The Indus River (also called the Sindhhu) is the largest in Pakistan and a major transboundary river in Asia. With a drainage basin of about 1,140,000km2, the river leads from the Tibetan Plateau in PRC, across northern India and into northern Pakistan. There it changes direction from a north-westerly to south-westerly flow, ending at the Arabian Sea.

The Indus River has five tributaries on the eastern bank: the Beas, Chenab, Jhelum, Ravi, and Sutlej rivers. The main western bank tributaries are the Gomal, Kabul, Swat and Kurram rivers. The river is approximately 2,800km long, with 2,682km in Pakistan.

Pakistan also has four deserts, with three located to the east of the Indus River, in the Punjab and Sindh provinces, and one within the Balochistan province in the south-west.

Pakistan is in a compressional zone between the Afghan block and the Indian plate. The main seismic zones in Pakistan comprise the Makran zone in the south-west, the Kuchch zone in the south-east at the border with India, the Himalayan seismic zone in the north and, the Kirthar-Sulaiman and Chaman-Hindu Kush zones in the central part of the country.

Pakistan is a seismically active country. The pattern of instrumentally recorded seismicity follows the general trend of the mountain ranges going from the Arabian Sea to the Hindu Kush region in the north. The largest earthquake recorded in Pakistan occurred off-shore of Gwadar and Ormara in 1945 with a magnitude Mw of 8.1. This earthquake caused about 4000 casualties and extensive damage in Pakistan and neighbouring counties. Over the past hundred years, Pakistan has experienced six earthquakes with magnitudes between 6 and 7, four of them near Quetta and the other two located on the thrust fault systems in the south of the country.

The peak ground acceleration with a 10% probability of exceedance in 50 years (PGA10%50yr) on reference site conditions (i.e. considering a Vs30 of 800 m/s) exceeds 0.2g in most of the country with the exception of the zone closer to India, which includes the cities of Hyderabad, Multan and Lahore. The PGA10%50yr in Islamabad is around 0.45g and is for the most part controlled by a splay of active thrust faults.

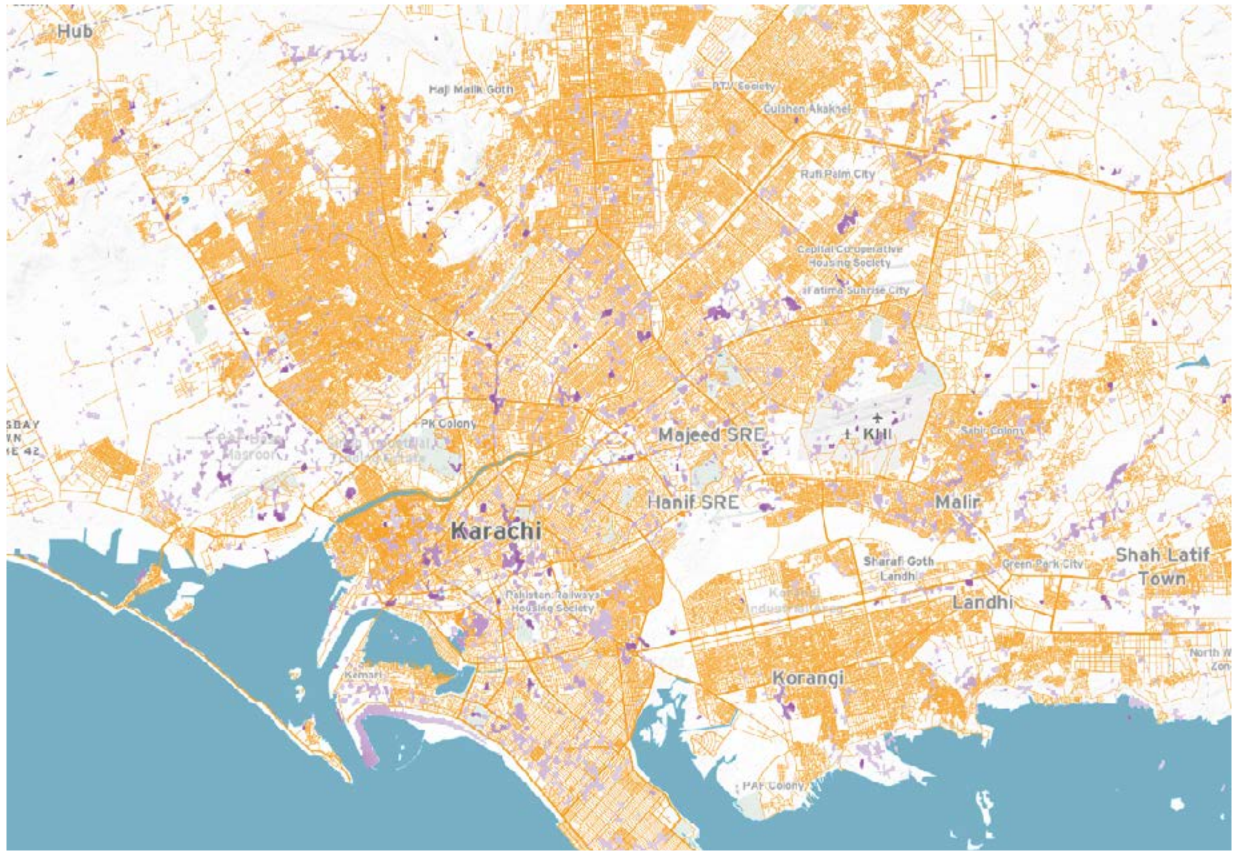
Exposure to flooding can be assessed via hydrological accumulation zones (HAZ). HAZ polygons represent the natural watercourse boundaries as a means of modelling the flow of water. The HAZ polygons for Pakistan show the course of the Indus running northeast to southwest through the centre of the country, with narrow, short river valleys draining into it. Further north, the Karakoram Himalayas and Hindu Kush drain into the tributaries of the Indus, Chenab and Jhelum Rivers. These areas are particularly susceptible to late spring and summer floods caused by rapid melting of snow, rain on snow events and higher outflow from glaciers. In the west and southwest the HAZ polygons represent dry riverbeds that only flow during the seasonal rains.

Flood hazard map for pluvial and fluvial flooding

Flood modelling estimates losses and impacts based on 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 Pakistan. This event severity is often used for planning purposes as a plausible extreme event.

The broad zone of flood risk associated with the Indus River dominates the flood map as seen in Pakistan. The river enters the Arabian Sea south of Karachi. As the river heads north, significant population centres, including Hyderabad, Larkana and Sukkur, run along the length of the broad river valley. Along this stretch, the Indus is heavily controlled by flood defences, barrages and a major network of drainage channels. South of Multan, the Chenab joins the Indus and, near Jhang, the Chenab and the Jhelum join. Whilst the Indus has a steeper, narrow valley north of this point, the other two rivers have broad valleys with large population centres along them. Multan sits on the Chenab and further north Lahore sits on the Ravi, another tributary of the river network. Both rivers remain broad into the far north of Pakistan and both rivers have similar levels of control, including barrages and drainage channels, to the lower Indus.

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



Source: JBA Risk Management

The flood map of Karachi in Figure 11 shows some significant areas through the centre of the city which are at risk of surface water flooding (shown in purple).

Some areas of significant flood depth (darker colours) may indicate areas where man-made structures (e.g. underpasses) are at risk of flooding.

Climate conditions

Pakistan can be roughly divided into four precipitation climate zones, dependent upon topography.

The first zone is in the northern highlands and parts of Khyber Pakhtunhwa. They receive much of their annual precipitation as snow during the winter months;[18] and the South Asian Monsoon is not often able to breach the higher mountain reaches. Rain events in the foothills, particularly on snow can trigger flash flooding. There are decreasing trends of flash flooding in north-eastern parts of Pakistan as the monsoon trough appears to be shifting westward since the 1950s, and due to increasing trends in monsoon precipitation over central Khyber Pakhtunkhwa.[19] The north western parts have become more prone to flash flooding with the shift. Mean annual temperatures have been increasing since 1960, with increases most significant in winter and spring.[20]

The second zone spans southern parts of Khyber Pakhtunkhwa, northern Punjab and the Islamabad Capital Region. Annual precipitation is dominated by the South Asian Monsoon during the months of June to September, with rainfall amounts typically decreasing along an east to west gradient. Since the monsoon trough is shifting westward, monsoon precipitation totals for the area from Islamabad to Peshawar have been increasing since the mid-1970s. Maximum single day rainfall amounts (an indicator of extreme rainfall) are also increasing in this region and could contribute to more incidents of flash flooding. Mean temperatures have increased during the winter season, while the number of extreme heat days (apparent temperature of 37°C or higher) has doubled from approximately 8 days a year in 1950 to 16 days a year in 2010[21].

Southern Punjab and all of Sindh province form the third zone, which has a hot, semi-arid to arid climate. Nearly 75% of this zone's precipitation falls between July to September during the South Asian Monsoon. Rainfall variability is high, though no significant trends in mean annual or monsoon precipitation over 1910-2010 have been seen in multiple studies[22], except for increases in the number of consecutive dry days in some areas. Drought indices indicate increasing drought incidence[23] largely related to significant temperature increases in mean maximums and minimums and extreme heat events.

Balochistan Province forms the fourth climate zone. It receives most of its precipitation during the winter months due to westerly disturbances and smaller amounts from the South Asian Monsoon. No trends in precipitation totals or extremes have been seen since the 1950s, although drought indices indicate worsening drought situations. The drought situations are largely temperature driven, with temperature increases noted in all seasons and faster over the interior than coastal areas[21].

[18] *Forsythe, N., D. Archer, et al. (2019). 'A Hydrological Perspective on Interpretation of Available Climate Projections for the Upper Indus Basin'. In: Indus River Basin. Water Security and Sustainability doi.org/10.1016/B978-0-12-812782-7.00008-4.*
[19] *Hanif, M., A. Khan and S. Adnan (2013) 'Latitudinal precipitation characteristics and trends in Pakistan', Journal of Hydrology, doi: 10.1016/j.jhydrol.2013.03.040*
[20] *Khan, N., S. Shahid, et al. (2018) 'Spatial distribution of unidirectional trends in temperature and temperature extremes in Pakistan'. Theoretical and Applied Climatology, https://doi.org/10.1007/s00704-018-2520-7*
[21] *Amman, C., K Ikeda and K MacClune (2014). Projecting the Likely Rise of Future Heat Impacts under Climate Change for Selected Urban Locations in South and Southeast Asia (The Sheltering Series No. 9). ISET-International: Boulder, CO.*
[22] *Abbas, F., I. Rehman, et al. (2017) 'Prevailing trends of climatic extremes across Indus-Delta of Sindh-Pakistan'. Theoretical and Applied Climatology doi:10.1007/s00704-016-2028-y.*
[23] *Ahmed, K., S. Shahid and N. Nawaz (2018) 'Impacts of climate variability and change on seasonal drought characteristics of Pakistan'. Atmospheric Research doi:10.1016/j.atmosres.2018.08.020*

Future precipitation projections

Six regional climate model-global climate model (RCM-GCM) simulations from the Coordinated Regional Climate Downscaling Experiment (CORDEX) South 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.[25] The multi-model mean information was used to examine yearly and seasonal changes under RCP4.5 and RCP8.5. Precipitation extremes from each model-RCP combination were individually used to calculate future precipitation intensities, which is relevant to estimating future flood risk.

Box 3 describes the methodology behind the future climate calculations.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).

Climate change will not have uniform spatial impacts on precipitation throughout the country; there are concerns, however, that the monsoon will become more variable.[26] The multi-model projections suggest that on average the monsoon might intensify for parts of northern regions, Khyber Pakhtunkhwa and Balochistan and result in a 10-20% increase in mean precipitation from the levels in 1956-1995. while slightly decreasing (-10 to −20%) for some areas under both RCP4.5 and RCP8.5. Annual mean precipitations are not projected to change significantly for much of the country under either RCPs, though parts of the northern provinces could see mean increases of up to 20%. This is attributable to projected increases both during winter and the monsoon season. Parts of Punjab and Sindh could also experience mean winter increases ranging from 10 to 70% according to multi-model means for both RCPs.

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.

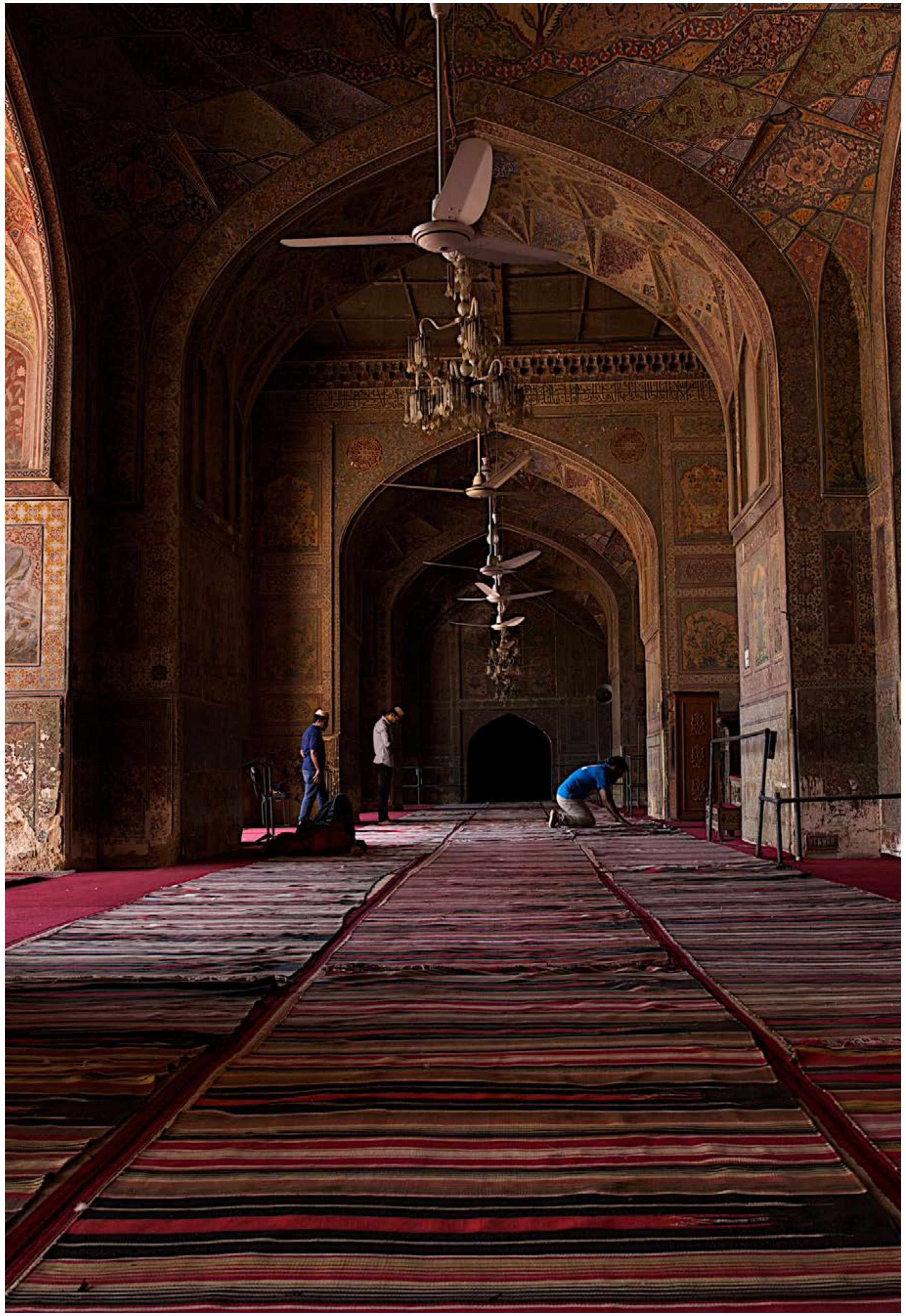
[24] *Yatagai, A. K. Kamiguchi, et al. (2012) 'APHRODITE: Constructing a long-term daily gridded precipitation dataset for Asia based on a dense network of rain gauges'. BAMS, doi:10.11.75/BAMS-D-11-00122.1*
[25] *The historical reference period of 1956-1995 was used over the standard 30-yr period 1961-1990 because climate over South 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.*
[26] *Government of Pakistan (2016) Pakistan's Intended Nationally-Determined Contribution. Islamabad.*

The intensities of 24-hr duration extreme precipitation events are likely to intensify over northern and central Khyber Pakhtunkhwa according to the multi-model projection spread for both RCPs. This could reflect a continuation of observed trends in the westward shift of the monsoon. Potential increases in 24-hr extremes are also possible for northern Punjab and for southern Sindh province (see Table 5). Extreme precipitation intensities are projected to decrease for all other areas of Pakistan, which could be due to possible increasing variability in the monsoon.

Table 5: Future precipitation projections

Return period	1951–2007	2050s	
	Historical	RCP4.5	RCP8.5
20-year	2.11	2.25 (1.99, 2.36)	2.53 (2.39, 2.73)
100-year	2.82	2.98 (2.60, 3.17)	3.32 (3.11, 3.68)
200-year	3.13	3.28 (2.75, 3.62)	3.64 (3.47, 3.95)
500-year	3.53	3.70 (3.24, 3.97)	4.10 (3.83, 4.62)

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



Exposure

Pakistan is the world's 5th most populous country, with an estimated population size of over 216 million in 2019 and is projected to be the fourth most populous nation in the world by 2030.[27]

Table 6 provides key population distributions and trends. Most of the population (63%) live in rural settlements, but rapid urbanisation is changing the demographic distribution. In the years from 1950 to 2017, the population growth rate for urban settlements has ranged from 3.1% to 4.6% annually[28] and was 2.7% in 2019. Pakistan had about 37% of people living in urban areas as of 2019.[29]

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

Population	216,565.32
Population growth date (%/year)	2
Share of population living in urban areas (%)	37
Urbanisation rate (%/year)	2.7
% of population aged 0-14	35
% of population aged 15-64	61
% of population aged 65 and above	4

Source: World Bank Open Data

The Government of Pakistan has rolled out several initiatives like the Framework for Economic Growth (FEG) in 2011, the Climate Change Policy in 2012, and the Vision2025 in 2014, to make urban centres production hubs that spur economic growth. These initiatives have entailed approaches such as the implementation of zoning regulation and an emphasis on gender equality and women empowerment as instruments for economic development.

An important characteristic of Pakistan's urban growth is its concentration in a few large urban centres.[30] According to the 2017 Housing Census, the population of the country's ten major cities has increased by 74% since 1998.[31] The population in cities in Pakistan is predicted to expand by 21.1 million people between 2015 and 2025, with the change being most pronounced (increase by 70% or 15.1 million people) in the ten largest cities. By 2025, nearly half of the country's population will be living in cities.

This rapid urbanisation without adequate focus on urban resilience, infrastructure development and the expansion of service delivery has left a major gap in both policy and practice and has resulted in unplanned urban habitat, urban poverty, and inequality. These conditions have compelled poor people to live in low-cost houses in high hazard zones, thus creating a recipe for social and ethnic tensions and the emergence of new risk hotspots. Gaps in the enforcement of building codes and risk-sensitive land use planning contribute to an increase in exposure and physical vulnerabilities. The consequences were felt during the 2005 earthquake, where several poorly built buildings were severely damaged, and thousands of people lost their lives under the collapsed buildings.[32] Pakistan, traditionally an agrarian economy, has made sustained economic progress, specifically after 2013 and marked a GDP of $278 billion in 2019. Its services sector now constitutes close to 60% of its GDP, followed by the industry (close to 20%) and agriculture (also around 20%) sectors.

[27] *Abdul, L., & Yu, T. F. (2020). Resilient Urbanization: A Systematic Review on Urban Discourse in Pakistan. Urban Science, 4(4), 76. https://res.mdpi.com/d_attachment/urbansci/urbansci-04-00076/article_deploy/urbansci-04-00076.pdf*

[28] *Alvi, M.H. (2018). Difference in the Population Size between rural and Urban Areas of Pakistan. MPRA Paper No. 90054. https://mpra.ub.uni-muenchen.de/90054/1/MPRA_paper_90054.pdf*

[29] *The World Bank (2021). World Bank Open Data. Urban population growth (annual %). Accessed March 2021 at: https://data.worldbank.org/topic/urban-development?locations=PK*

[30] *Blank, J., Clary, C., & Nichiporuk, B. (2014). Drivers of long-term insecurity and instability in Pakistan: Urbanization. Rand Corporation. https://www.jstor.org/stable/pdf/10.7249/j.ctt1287mdc.10.pdf?refreqid=excelsior%3Af0b5ff7e0779c894f4858f4016f76ade*

[31] *Government of Pakistan, Finance Division (n.d.) Chapter 12: Population, Labour Force and Employment. http://www.finance.gov.pk/survey/chapters_18/12-Population.pdf*

The economy contracted by 0.4% in 2020 due to the COVID-19 pandemic but is expected to expand again in 2021 and experience growth of 4% in 2022.[33] Other key economic indicators are outlined in Table 7.

As shown in Table 8, residential buildings are Pakistan's dominant asset type which are valued at $391.7 billion. Commercial and industrial buildings have roughly the same replacement value nationwide.

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

GDP (million USD, current)	278,221.91
GDP per capita (USD, current)	1,284.70
Agriculture, forestry and fishing, value added (% of GDP)	22
Agriculture (% of working population employed)	36*
Industry (including construction, value added (% of GDP)	18.3
Industry (% of working population employed)	26*
Services, value added (% of GDP)	53.9
Services (% of working population employed)	38*

Source: World Bank Open Data

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

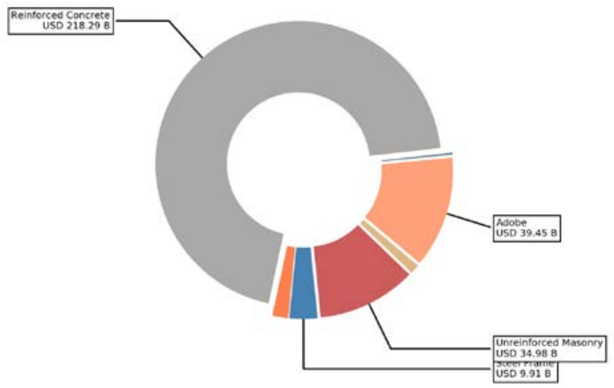
Asset replacement cost (billion $)	
Residential buildings	391.7
Commercial buildings	69.1
Industrial buildings	67.5
Total buildings	528.3

Source: Global Earthquake Model database

There are three general classes of residential buildings in the country: pukka houses, made of substantial material such as stone, brick, cement, concrete, or timber; katchi houses, made of less-durable material (e.g., mud, bamboo, reeds, or thatch); and semi-pukka houses, which are a mix between the two. Approximately 80% of the housing stock is composed of semi-pukka and katchi houses with only 20% being pukka houses. Urban areas are predominantly dominated by katchi neighbourhoods known locally as katchi abadis. Throughout the country, roughly half of all urban residents live in such areas.

As seen in Figure 12, reinforced concrete structures with an estimated total of 4,100,795 buildings make up the largest fraction (44.0%) of the total building stock. This is followed by unreinforced masonry structures (2,564,290 buildings, or 27.5%) and adobe structures (2,007,481 buildings, or 21.5%). Karachi and Lahore, the two largest cities in Pakistan, are found in the Punjab and Sindh regions, respectively, where most of the value at risk is located.
There is a much lower concentration of economic assets by value in the Balochistan and Khyber Pakhtunkhwa which are mountainous and rural areas.

Figure 12: Breakdown of different building types



Source: Global Earthquake Model

[32] *Abdul, L., & Yu, T. F. (2020). Resilient Urbanization: A Systematic Review on Urban Discourse in Pakistan. Urban Science, 4(4), 76. https://res.mdpi.com/d_attachment/urbansci/urbansci-04-00076/article_deploy/urbansci-04-00076.pdf*

[33] *Santander (2021). Pakistani Economic Outline. Accessed March 2021 at: https://santandertrade.com/en/portal/analyse-markets/pakistan/economic-outline*

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

Table 9 provides an overview of socio-economic vulnerability indicators. A large proportion (63%)[34] of the total population of Pakistan live in rural districts and are heavily dependent on agriculture, a sector that is severely impacted by deviations in rainfall. These sections of the population are vulnerable to drought and flood.

In general, women are much more vulnerable during disaster events due to pre-assigned gender roles and power relations which expose them to greater risk of violence, particularly gender-based violence (GBV).[35] In post-disaster contexts, women's access to assistance which takes into account specific needs of women is a continuous challenge in Pakistan. A Multi-sector Initial Rapid Assessment (MIRA) conducted following floods in Pakistan in September 2012 reported that the privacy and safety of women and girls were a key concern among communities affected by the floods.[36]

Women and children are also adversely affected by drought. The death of 2 million livestock during the 1998-2000 drought resulted in malnutrition and poor physical health especially among children due to reduced availability of milk products and meat. Malnutrition was worst in the rural areas of Sindh and Balochistan. The lack of water was also reported to have increased the workload of women and children, in part due to the longer distances they needed to cover to fetch water.[37]

[34] *The World Bank (2021) World Bank Open Data. Rural population (% of total population) – Pakistan. Accessed March 2021 at: https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS?locations=PK*
[35] *Inter-Agency Standing Committee (2015). Guidelines for Integrating Gender-based Violence Interventions in Humanitarian Action: Reducing risk, promoting resilience and aiding recovery. https://gbvguidelines.org/wp/wp-content/uploads/2015/09/2015-IASC-Gender-based-Violence-Guidelines_lo-res.pdf*
[36] *Pakistan National Disaster Management Authority (2012). Multi-sector Initial Rapid Assessment (MIRA) Report. Pakistan Floods 2012. https://reliefweb.int/sites/reliefweb.int/files/resources/LinkClick_33.pdf*
[37] *Qureshi, A.S. and Akhtar, M. (2004) Analysis of drought-coping strategies in Balochistan and Sindh provinces of Pakistan. Working Paper 86. Colombo, Sri Lanka: International Water Management Institute. http://www.iwmi.cgiar.org/Publications/Working_Papers/working/WOR86.pdf;* FAO (2001). *FAO / WFP crop and food supply assessment mission to Pakistan. Special Report. http://www.fao.org/3/Y1260e/Y1260e00.htm*

Table 9: Socio-economic vulnerability indicators

Poverty headcount ratio at national poverty lines (% of population)	24.3 (2015)
Human Capital Index	0.4 (2020)
GINI index	33.5 (2015)
Gender Inequality index	0.55 (2018)
Household size	6.8 (2019)
Age dependency ratio (% of working age population)	65 (2019)
Unemployment rate (modelled ILO estimate)	4.4 (2020)
General government gross debt (% of GDP)	72.077 (2018)
Under five child mortality (per 1000 live births)	67 (2019)
Life expectancy at birth (female)	68 (2018)
Life expectancy at birth (male)	66 (2018)
% of population using at least basic sanitation services	60 (2017)
% of population using at least basic drinking water services	91 (2017)

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

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. Table 10 provides key coping capacity indicators for Pakistan.

Pakistan has come a long way in improving disaster risk reduction (DRR) structures and approaches since 1958, when the National Calamity Act of Pakistan, a reactive framework regulating relief, response and reconstruction, was passed. Prior to 2005, "state response to natural disasters was carried out largely on an ad hoc basis, by a range of different institutions."[38] After the Kashmir earthquake of 2005, the National Disaster Management System was introduced, and the National Disaster Management Commission (NDMC) was established at the federal and regional level through a National Disaster Management Ordinance (NDMO) in 2006.[39]

The National Disaster Management Authority (NDMA) was established as an executive arm of NDMC at the federal level to implement policies, strategies and programs for disaster risk reduction. The establishment of NDMA is a landmark achievement and milestone for strengthening disaster risk reduction efforts, which brought about a transition from a reactive to a more proactive approach, as espoused by Hyogo Framework of Action (HFA) and the Sendai Framework for Disaster Risk Reduction. In 2007, the National Disaster Risk Management Framework (NDRMF)[40] was formulated to better integrate the disaster risk agenda into development planning in order to achieve socio-economic and environmental sustainability. This is to be achieved through properly assessing risk, empowering people through capacity building, promoting risk sensitive planning, advocating for multi-hazard early warning system, and developing post disaster capacities.

In December 2010, the NDMO was approved by the parliament and became the National Disaster Management Act (DMA), which helped establish a multi-tiered governance system to decentralise disaster risk reduction in Pakistan. The Act provided legal basis to establish Provincial Disaster Management Authorities (PDMA) and District Disaster Management Authorities (DDAM) at regional and districts levels, respectively. The NDMA, in coordination with regional chapters and with support from relevant agencies, coordinates all

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[41]

[38] *Cochrane, H. (2008). The role of the affected sate in humanitarian action: A case study on Pakistan. HPG Working Paper. London: ODI. https://www.humanitarianlibrary.org/sites/default/files/2014/02/3417.pdf*

[39] *Shaw, R. (2015). "Introduction and approaches of disaster risk reduction in Pakistan." In: Rahman, A.-U.; Khan, A. N. and Shaw, R. (Eds.) Disaster risk reduction approaches in Pakistan. Tokyo: Springer Japan (pp. 3-29).*

[40] *Government of Pakistan, National Disaster Management Authority (2007). National Disaster Risk Management Framework Pakistan. https://www.preventionweb.net/publications/view/2952*

[41] *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).*

phases of disaster management including recovery and reconstruction. The NDMA formulated the National Disaster Risk Reduction Policy (NDRRP) in 2013 to guide mainstreaming of DRR into development by providing a framework and identifying priority issues with special emphasis on prevention, mitigation, and preparedness. The Policy formed the legal foundation that paved the way for establishment of the National Disaster Risk Management Fund and the development of a Disaster Risk Financing Strategy.[42]

A 10-year National Disaster Management Plan (NDMP) formulated by the Government of Pakistan in 2012 lays out a strategy to holistically improve disaster management programmes, including risk assessment, capacity building, coordination, early warning systems, and human resource development. The Plan identifies 118 priority actions and interventions, addressing issues related to vulnerable segments of society including women, elderly and disabled. In 2015, NDMA unveiled the comprehensive National Disaster Management Plan (NDMP) Implementation Roadmap of 2016-30 with emphasis on multi-hazard risk assessment, community-based disaster risk reduction, capacity building, emergency responses exercises for government officials and volunteers, and public awareness. The plan is aligned with the objectives and targets of the Sendai Framework for Disaster Risk Reduction.[43]

Synergies between climate change, disaster risk reduction and sustainable development are well articulated. In addition to the policies and plans discussed above, the establishment of the Parliamentary SDGs Secretariat at the National Assembly and a SDGs Section housed under the federal Ministry of Planning, Development and Reform (MoPDR) demonstrates strong commitment from the government to improve approaches in tackling these important matters.[44] The Parliamentary SDGs Secretariat steers the SDGs localisation and mainstreaming process while the dedicated SDGs Section handles SDGs monitoring and national coordination.

Complementing DRR policy and programming, the role of government and non-government agencies are critical in ensuring adequate infrastructure and resources to enhance preparedness and coping capacity. Investments into critical infrastructure and services such as health, education, communication and energy are considered an engine for socio-economic growth of a country and are amongst the national level indicators for disaster preparedness and coping capacity. According to the Global Competitiveness Index (GCI), Pakistan ranks 105th out of 141 countries in terms of the quality of the overall infrastructure, compared to PRC, India, and Tajikistan, ranked 36th, 70th, and 91st, respectively, for the year 2019.[45]

Although health is a priority sector, public and private health expenditure in Pakistan has been low (2.9% of GDP in 2017). Public health expenditure has been decreasing consistently since the 1990s and has fallen behind health-related spending in many other developing countries. Pakistan's health system has been chronically under-funded.[46] A regional comparison of health-related indicators shows that despite improvements in recent years, the under-five mortality rate in Pakistan is still the highest in South Asia at 67 per 1,000 live births in 2019.[47] With 0.98 physicians per 1,000 people (2018), Pakistan is listed as one of 57 countries with critical health workforce deficiency.[48] There are notable discrepancies across provinces in terms of health care workers to population ratio.

[42] *Rahman, A.-U., Khan, A. N. and Shaw, R. (Eds.) (2015). Disaster risk reduction approaches in Pakistan. Tokyo: Springer Japan.; Mukhtar, R. (2018). Review of national multi-hazard early warning system plan of Pakistan in context with Sendai framework for disaster risk reduction. Procedia engineering, 212, 206-213.; Government of Pakistan, Ministry of Climate Change and National Disaster Management Authority (2013). National Disaster Risk Reduction Policy. https://phkh.nhsrc.pk/sites/default/files/2019-07/National%20Disaster%20Risk%20Reduction%20Policy%202013.pdf*

[43] *Shaw, R. (2015). "Introduction and approaches of disaster risk reduction in Pakistan." In: Rahman, A.-U., Khan, A. N. and Shaw, R. (Eds.) Disaster risk reduction approaches in Pakistan. Tokyo: Springer Japan (pp. 3-29); UNDRR (2019). Disaster Risk Reduction in Pakistan. Status Report 2019. Bangkok: United Nations Office for Disaster Risk Reduction (UNDRR), Regional Office for Asia and the Pacific. https://www.preventionweb.net/files/68260_682307pakistandrmstatusreport.pdf; Lodi, S. H. Disaster Management System in Pakistan. Challenges – The way forward. Presentation.*

[44] *Shaikh, F. H. (2020, February 9) Implementing SDGs. The News International. https://www.thenews.com.pk/print/611016-implementing-sdgs*

[45] *Schwab, K. (2019). The Global Competitiveness Report 2019. Geneva: World Economic Forum. http://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf*

[46] *Khalid, F. and Ahmad, W. (2018) State of Health Sector in Pakistan. SBP Staff Notes 01/18. Karachi: State Bank of Pakistan. https://www.sbp.org.pk/publications/staff-notes/State-of-Health-Sector-in-Pakistan-(06-04-2018).pdf*

[47] *The World Bank (2021). World Bank Open Data. Mortality rate, under-5 (per 1,000 live births). https://data.worldbank.org/indicator/SH.DYN.MORT*

[48] *Rana SA, Sarfraz M, Kamran I, Jadoon H (2016) Preferences of doctors for working in rural Islamabad capital territory, Pakistan: a qualitative study. Journal of Ayub Medical College Abbottabad 28: 591-596.*

Access to information before and during emergencies can influence the disaster outcome, and the Internet plays a big role in enabling access to information. In 2019, 17.07% of people in Pakistan were using the Internet. This percentage is much lower than the global average and the rates in neighbouring developing countries (22% in Tajikistan, 21% in Nepal, and 34% in Sri Lanka in 2017).[49]

At individual and household level, access to financial services can be critical to absorb financial impacts from disaster events. Even though Pakistan adopted financial inclusion as a national policy well ahead of many other countries, progress has been quite slow compared to neighbouring countries.[50] Only 21% of Pakistani adults had access to financial services in 2017, while the rate was 45%, 50%, and 74% in Nepal, Bangladesh, and Sri Lanka, respectively. The gender gap in financial inclusivity has also increased. Women's financial inclusion was only at 7% in Pakistan in 2017. Between 2014 and 2017, there was a 13-percentage point increase in men having an account with a financial institution; the increase for women was only 2 percentage points.[51] These figures indicate the need for approaches tailored and accessible particularly to women.

The insurance industry in Pakistan is still small. Overall insurance penetration (premium to GDP) remain less than 1 percent which is one of the lowest in the South Asian Association for Regional Cooperation[52] region. The predominant means of financing healthcare costs are borne out-of-pocket (73.68%).[53] Without insurance protection, low-income household are increasingly at risk of being pushed into the poverty trap, as negative coping strategies are often adopted as a way out of the ordeal. In the recent past, there have been initiatives to promote insurance in Pakistan. In 2017, the first ever disaster risk insurance framework, which aims at providing low-income households with accessible and affordable insurance, was launched. With support from ADB, the National Disaster Risk Management Fund was established as a government owned not-for-profit association to reduce socioeconomic and fiscal vulnerability to external shocks such as natural hazards, climate variability and climate change. To extend insurance coverage to poor and vulnerable households, the InsuResilience Investment Fund acquired a significant minority stake in Lahore-based Asia Insurance in 2017.

ADB analysis from 2019 suggests that the federal government has contingency funding of around $15-$20m to respond to national emergencies[54] while a World Bank analysis in the same year reports a figure of $10.6m for the federal government.[55] This funding is primarily available from the National Disaster Management Fund. There are also similar provincial funds available across provincial governments, although the resources available in these funds is not clear. Recognising the insufficiency of these resources, the Pakistani government, through the National Disaster Risk Management Fund, has been developing a Disaster Risk Finance Strategy and considering a range of different instruments and options for implementation.[56]

More broadly, the Government of Pakistan faces a challenging fiscal position which limits its flexibility to respond to the financing needs of disaster events. Even before the impact of the COVID-19 crisis, it was suffering from both high levels of public debt and a large fiscal deficit, although the country is engaged in an IMF program to address these challenges.[57]

[49] *The World Bank (2021). World Bank Open Data. Individuals using the internet (% of population). Accessed March 2021 at: https://data.worldbank.org/indicator/IT.NET.USER.ZS*

[50] *Demirgüç-Kunt, A., Klapper, L., Singer, D., Ansar, S. and Hess, J. (2017) The Global Findex Database 2017. Measuring Financial Inclusion and the Fintech Revolution. Washington, D.C.: International Bank for Reconstruction and Development/The World Bank. https://globalfindex.worldbank.org/*

[51] *Rasmussen, S. (2018, October 30) Pakistan Enigma: Why is financial inclusion happening so slowly? CGAP Blog Series: 2017 Global Findex: What you need to know. Accessed March 2021 at: https://www.cgap.org/blog/pakistan-enigma-why-financial-inclusion-happening-so-slowly*

[52] *The World Bank (2015). Fiscal Disaster Risk Assessment Options for Considerations. Pakistan. Washington, D.C.: World Bank. https://www.gfdrr.org/sites/default/files/publication/Fiscalodisasteoideration000Pakistan.pdf*

[53] *Nishtar, S., Khalid, F., Ikram, A., Kazi, A., Abbas Mirza, Y., ul Haq Khattak, I., Javad, A., Jaffer, H., Brown, K. and Badsha, T. (2010). Protecting the poor against health impoverishment in Pakistan: proof of concept of the potential within innovative web and mobile phone technologies. World Health Report 2010. Background Paper, 55. https://www.who.int/healthsystems/topics/research/55Heartfile_HEF_POC.pdf*

[54] *ADB (2019) The Enabling Environment for Disaster Risk Financing in Pakistan: Country Diagnostic Assessment. https://www.adb.org/publications/pakistan-environment-disaster-risk-financing*

[55] *Cook, S., Tehsin, A., Skalon, T., Rashid, N., Fallesen, D. and Khalid, B. (2020). Options to Strengthen Disaster Risk Financing in Pakistan. Washington, D.C.: The World Bank.*

[56] *Cook, S., Tehsin, A., Skalon, T., Rashid, N., Fallesen, D. and Khalid, B. (2020). Options to Strengthen Disaster Risk Financing in Pakistan. Washington, D.C.: The World Bank.*

[57] *IMF (2019) Pakistan: First Review under the Extended Arrangement under the Extended Fund Facility and Request for Modification of Performance Criteria. https://www.imf.org/~/media/Files/Publications/CR/2019/1PAKEA2019002.ashx*

Vulnerability

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. By understanding the 'Protection Gap' we can better understand the current approach to disaster risk finance in Pakistan and identify opportunities to strengthen financing arrangements. Table 11 shows key protection gap indicators for Pakistan.

Table 11: Key Protection Gap indicators

AAL as % of GNI[58]	0.20%	
Un-funded AAL, ($m, %)	$2.1 billion, 97%	
Average annual human losses from flood and earthquakes	Flood	EQ
	234	863
Event frequency where direct and indirect loss and damage, less (assumed) insured losses, exceed existing ex-ante risk retention	Flood	EQ
	All	All
Event frequency where direct damage, less (assumed) insured losses, exceed existing ex-ante risk retention	Flood	EQ
	All	All
Event frequency where estimated emergency response costs exceed current risk retention mechanisms	Flood	EQ
	All	All
Macro-economic context and ability for sovereign to borrow	Weak position. High risk of debt distress and 2nd lowest credit rating in region.	
Ability of individual and households to access resources after an event	Very low rates of financial inclusion. Social protection also limited but with innovations.	

Source: Consultant team modelling

[58] *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.*

Floods are associated with an AAL of around $1.5 billion dollars and earthquakes with an AAL of around $614 million. This rises to $1.6 billion and $644 million with the inclusion of indirect costs. This is the highest absolute amount of loss of any country in the CAREC region and across the two perils direct losses amount to 0.20% of GNI, the fourth highest losses as a percentage of national income of any country in the region.

Penetration of retail insurance is low both by comparison to other CAREC countries. In 2015, reports suggest only 1.9% of the population held any form of insurance policy.[59] The non-life insurance penetration rate is estimated to be 0.3% as of 2019, and insurance density estimated at $4/person.[60] In terms of the extent to which insurance might cover losses, the analysis assumes that 1% of the losses from flood events may be covered by insurance. It is assumed a higher proportion of the losses from earthquakes might be covered by insurance on the basis of market reports that 70% of property insurance policies cover earthquakes. The base case analysis assumes that 4% of losses from earthquakes might be covered. Given the relative losses associated with flood and earthquakes, these assumptions imply that around 2% of the total losses from the two perils are covered by insurance.

The analysis also takes account of the funding available in the risk retention mechanisms which assumes that $20m might be available. Current disaster events risk finance resources in Pakistanare woefully inadequate to meet the costs that are expected to be caused by disaster events each year with analysis implying sufficient funding to only cover 3% of the AAL, leaving a residual 'unfunded' AAL of more than $2.1 billion (97%). Consistent with this, current disaster risk finance resources are insufficient to cover the total losses, the direct losses or even the emergency response costs associated with events of all frequencies.

There would appear to be a need to increase the coverage and depth of the existing risk retention instruments, for high-frequency events, through enhanced functioning of the National and provincial Disaster Management Funds. This could be complemented with the use of risk transfer instruments that might support either the emergency response cost and/or the reconstruction costs associated with lower-frequency, higher intensity events. These actions are consistent with the identified workplan of the Disaster Risk Financing Unit of the National Disaster Risk Management Fund.

[59] *Miow, J. (2015) Pakistan – Growth potential of a nascent insurance market. Available at: https://www.peak-re.com/insights/pakistan-growth-potential-of-a-nascent-insurance-market/*
[60] *Data taken from Swiss Re Sigma, https://www.swissre.com/institute/research/sigma-research/World-insurance-series.html*

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