



The Disaster Riskscape across South and South-West Asia

KEY TAKEAWAYS FOR STAKEHOLDERS

Asia-Pacific Disaster Report 2019

PATHWAYS FOR RESILIENCE, INCLUSION
AND EMPOWERMENT

About the report

The Disaster Riskscape Across Asia-Pacific: Pathways for Resilience, Inclusion and Empowerment. Asia-Pacific Disaster Report 2019 (APDR 2019) captured a comprehensive picture of the complexity of disaster risk landscape ('riskscape') in the Asia-Pacific region. The full-length publication is available at <https://www.unescap.org/publications/asia-pacific-disaster-report-2019>.

Following the release of the APDR at the sixth session of the ESCAP inter-governmental Committee on Disaster Risk Reduction in August 2019, the report was customized for each of the five ESCAP sub-regions, namely East and North-East Asia, North and Central Asia, South-East Asia, South and South-West Asia and the Pacific. The current report highlights the key takeaways for South and South-West Asia.

Acknowledgements

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The Disaster Riskscape across South and South-West Asia: Key Takeaways for Stakeholders is a joint publication of the United Nations ESCAP ICT and Disaster Risk Reduction Division, SAARC Disaster Management Centre and the ESCAP Sub-regional Office for South and South-West Asia. It was prepared by Shreya Mukhopadhyay, Jiwon Seo and Madhurima Sarkar-Swaigood under the technical supervision of Sanjay Srivastava, Chief, Disaster Risk Reduction Section, ICT and Disaster Risk Reduction Division, ESCAP and with the overall guidance of Tiziana Bonapace, Director, ICT and Disaster Risk Reduction and Nagesh Kumar, Head of Office, Sub-regional Office for South and South-West Asia. Maria Bernadet K. Dewi provided significant inputs while Karanveer Singh provided research assistance. The report was enriched by comments received from Dr. PK Taneja, Director, SAARC Disaster Management Centre and Mr. Nisarg Dave, Specialist, SAARC Disaster Management Centre (IU). Anoushka Ali served as the editor. Daniel Feary provided the design and graphic services. Armita Behboodi coordinated the editing, lay-out and printing. Chonlathon Piemwongjit and Narada Kalra provided administrative assistance during the production stage.

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Annual economic losses due to disasters in South and South-West Asia are exponentially higher and more than double the previous estimates, at \$153.144 billion.

For the first time, annualized economic losses are presented, which include both losses due to intensive risk and those due to extensive risk, indirect losses and slow-onset disasters. Incorporating these additional sources of risk means that the Average Annual Losses (AAL) are exponentially higher than previous estimates, reaching \$153.144 billion.

Some South and South-West Asian countries are at risk of losing more than 5 per cent of their GDP, annually, due to disasters.

Table 1 compares the AAL for each source of risk with total Gross Domestic Product (GDP) for each country in the subregion. The results are particularly striking for Nepal, Bhutan, Pakistan and Bangladesh, for which the AAL losses amount to 7.65 per cent, 6.92 per cent, 6.77 per cent and 6.40 per cent of GDP, respectively. Furthermore, all countries, except Sri Lanka, Turkey and Maldives, have AAL that are a higher percentage of GDP than the AAL as proportion of GDP of 2.4 per cent for the Asia-Pacific region. These recurring losses represent an ongoing erosion of development assets and reduce the potential to invest the dividends of economic growth into human development.

TABLE 1 **AAL as percentage of GDP**

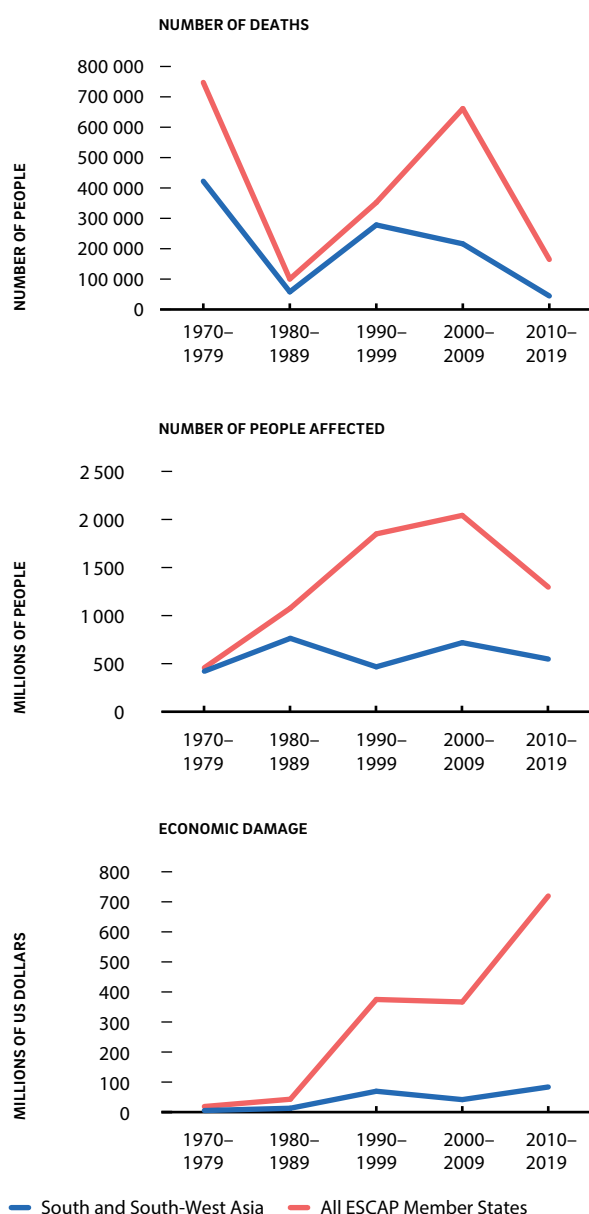
COUNTRY	TOTAL AAL (MILLIONS OF US DOLLARS)	2017 GDP (MILLIONS OF US DOLLARS)	TOTAL AAL (PERCENTAGE OF GDP)
Afghanistan	1 270.81	22 174.50	5.73
Bangladesh	11 443.90	178 788.00	6.40
Bhutan	163.95	2 368.90	6.92
India	87 617.60	2 616 860.00	3.34
Iran (Islamic Republic of)	16 465.45	565 521.00	2.91
Maldives	22.28	3 914.40	0.56
Nepal	1 663.35	21 716.80	7.65
Pakistan	16 029.40	236 748.00	6.77
Sri Lanka	1 704.01	82 547.70	2.06
Turkey	16 764.24	1 206 000.00	1.39
Total	153 144.99	4 936 639.3	3.10

Source: ESCAP calculations based on probabilistic risk assessment.

The AAL as a percentage of GDP and AAL per capita are higher for South and South-West Asia than the average for Asia and the Pacific.

While the number of deaths from disasters have decreased in the region as a result of better disaster management, prevention and early warning efforts, the trend in economic damage has been increasing. The subregion has recorded the highest economic losses in the last few years (Figure 1).

FIGURE 1 Number of deaths, people affected and economic losses from natural disasters

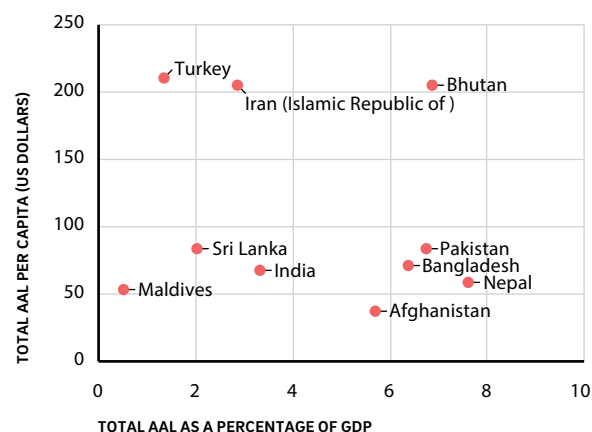


Source: Based on data from EM-DAT (Accessed on 30 May 2019).

At 3.10 per cent, the AAL, as a proportion of GDP, is higher for the South and South-West Asian countries than the AAL/GDP of 2.4 per cent for the Asia-Pacific region.

Figure 2 displays the AAL per capita and the AAL as a percentage of GDP for countries across the Asia-Pacific region. This shows that South and South-West Asian countries, such as Bhutan, have high values for both when compared with countries from other subregions.

FIGURE 2 Distribution of AAL per capita and as a percentage of GDP

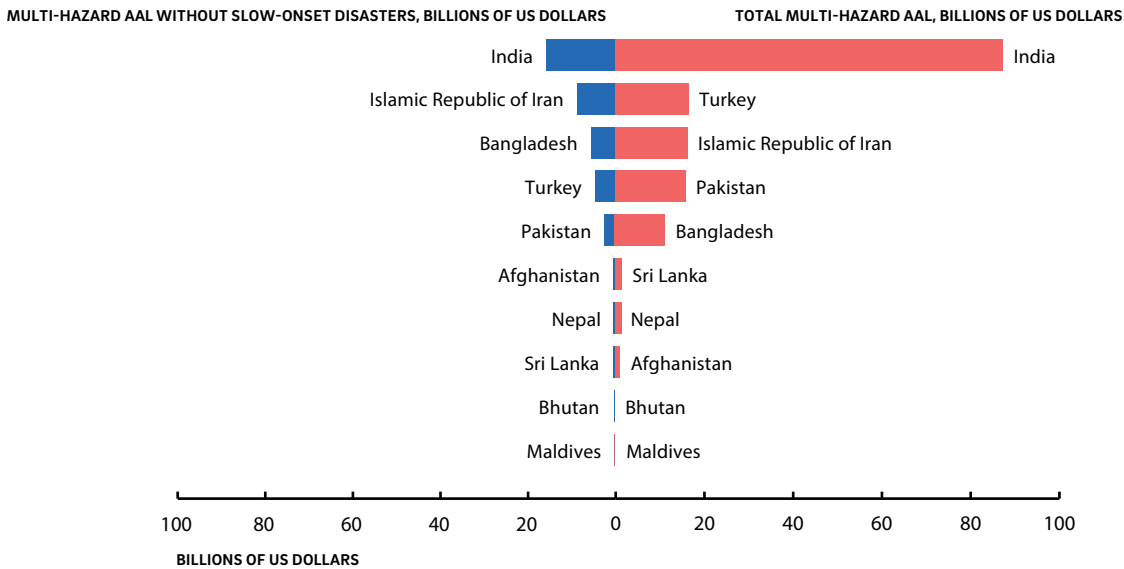


Source: ESCAP, based on probabilistic risk assessment, GDP and population data of ESCAP from 2017.

Note: Logarithmic scale is used for the Y-axis.

The five countries at greatest risk from high AAL are India, Turkey, the Islamic Republic of Iran, Pakistan and Bangladesh. The geography of risk changes slightly when slow-onset disasters are added. The new order is still led by India, followed by the Islamic Republic of Iran, Bangladesh, Turkey and Pakistan (Figure 3). Agriculture AAL represents more than 80 per cent of the total AAL in India, Pakistan and Turkey. Agriculture also remains a critical part of the total GDP and employment in Nepal and Pakistan. Hence, it is important to estimate drought risk in agriculture.

FIGURE 3 South and South-West Asia riskscape in numbers (AAL, billions of US dollars)

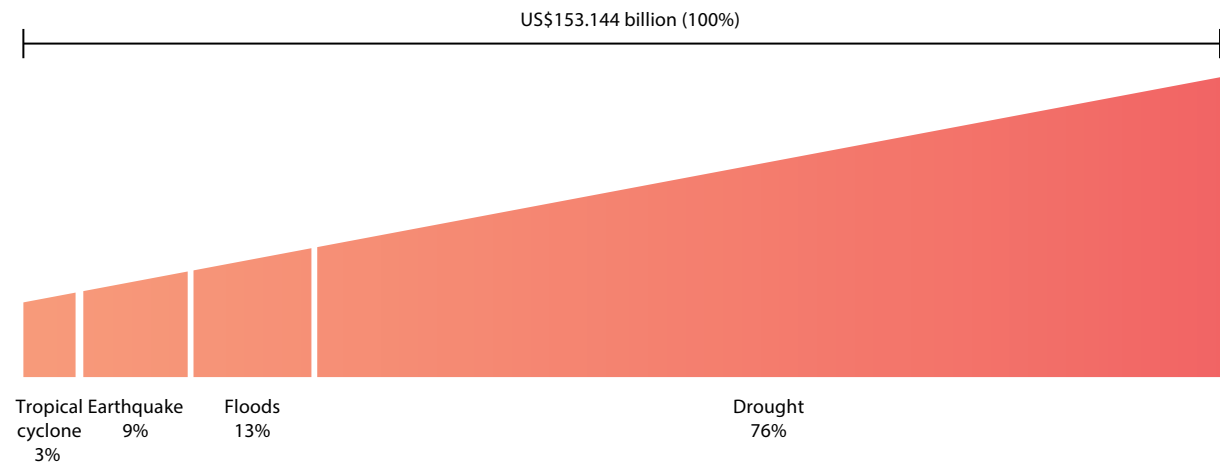


Source: ESCAP, based on probabilistic risk assessment.

Droughts and floods account for 89 per cent of the total multi-hazard AAL.

Droughts and floods are responsible for particularly high economic losses across South and South-West Asia. Figure 4 reveals that agriculture drought-related losses, which are included for the first time in calculation of AAL, contribute to 76 per cent of the total AAL, whilst floods account for 13 per cent of the total AAL. For example, 34.55 per cent of the total population in the Ganges-Brahmaputra-Meghna (GBM) basin are at the risk of exposure to floods.

FIGURE 4 South and South-West Asia regional riskscape (average annual losses) – volumetric analysis

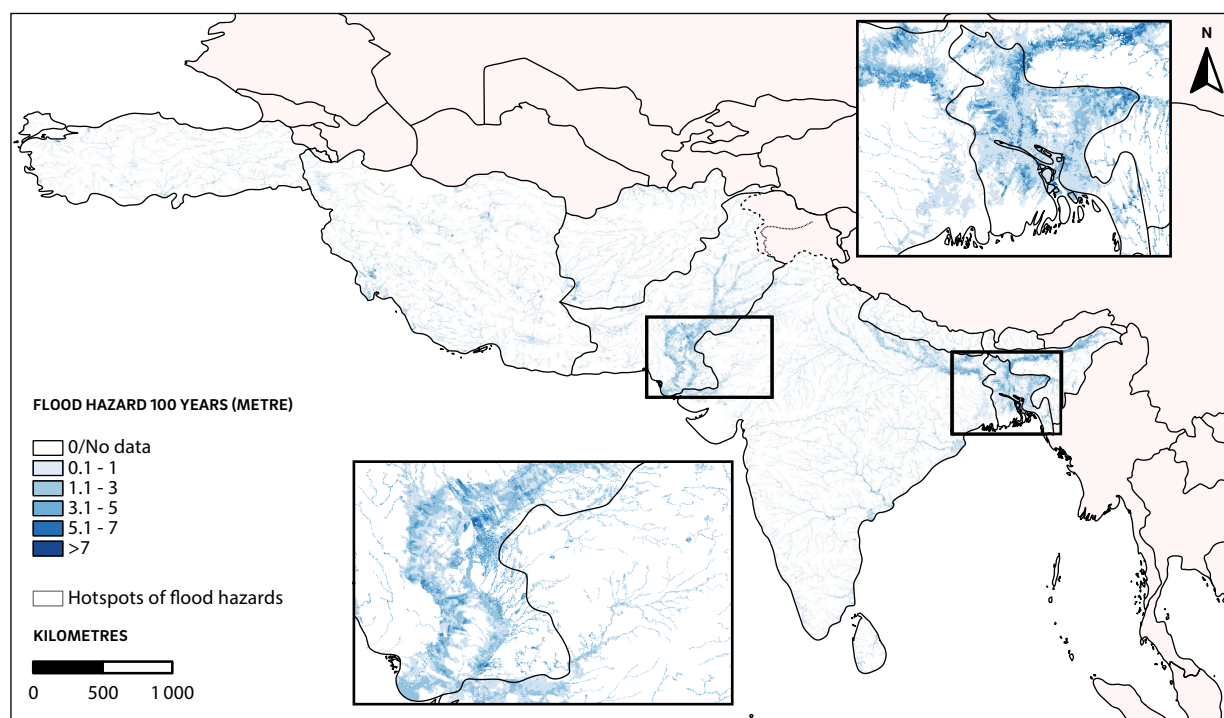


Source: ESCAP, based on probabilistic risk assessment.

Note: Volumetric analysis is a measurement by volume (impacted population, geographical area and economic losses).

The risk of drought extends to countries like Afghanistan, Bangladesh, India, Nepal and Pakistan — countries with large agricultural sectors and large rural populations with high levels of poverty. The South and South-West Asian countries fall within two risk hotspots. The first is in the floods and transboundary river basins and, the second lies in the drought hazard and sand and dust storm risk corridors (Figure 5 and Figure 6).

FIGURE 5 Hotspots of floods and transboundary river basins

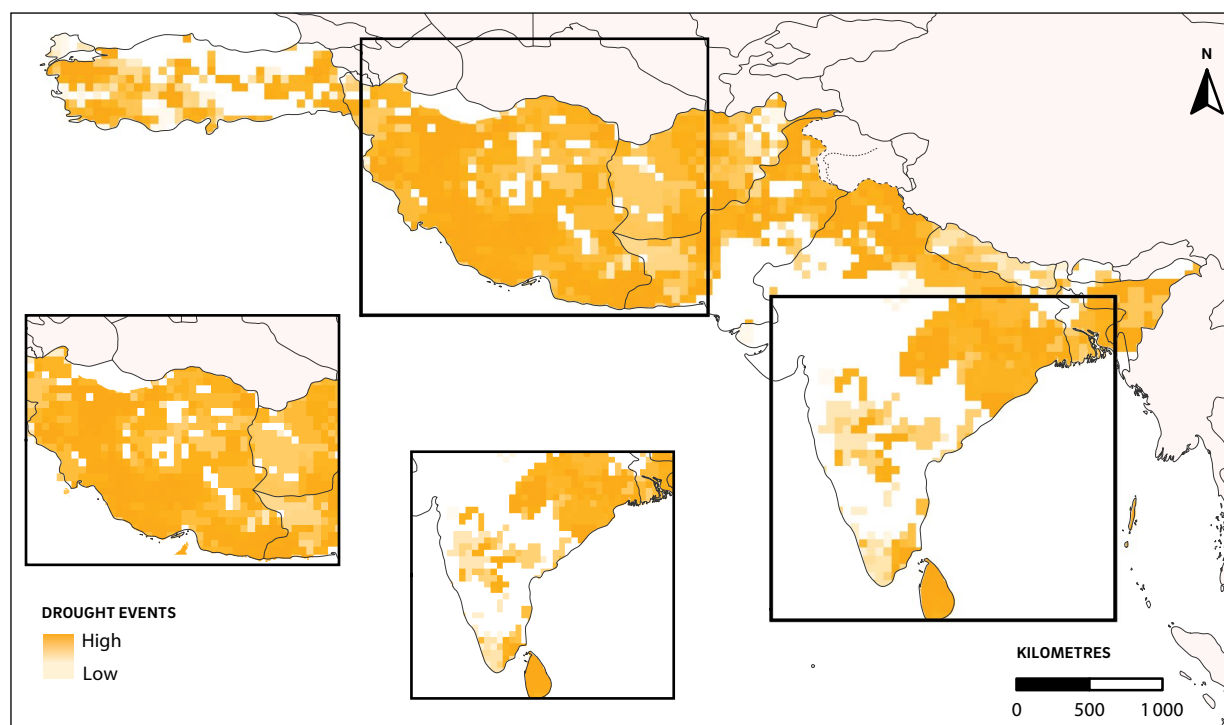


Source: ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas 2015.

Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.

Note: Flood data consist of all categories of flood hazard height with a return period of 100 years.

FIGURE 6 Hotspots of drought hazards



Source: ESCAP, based on Global Risk Data Platform 2013.

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Note: In the map, individual drought events from 1980 to 2001 are indicated by light orange polygons. Darker colours appear where multiple polygons overlap, and therefore indicate areas with a higher frequency of previous drought events, while lighter shades indicate a lower frequency. Data is unavailable for areas shown in white.

The intensification and changing geography of disaster risks are the new normal.

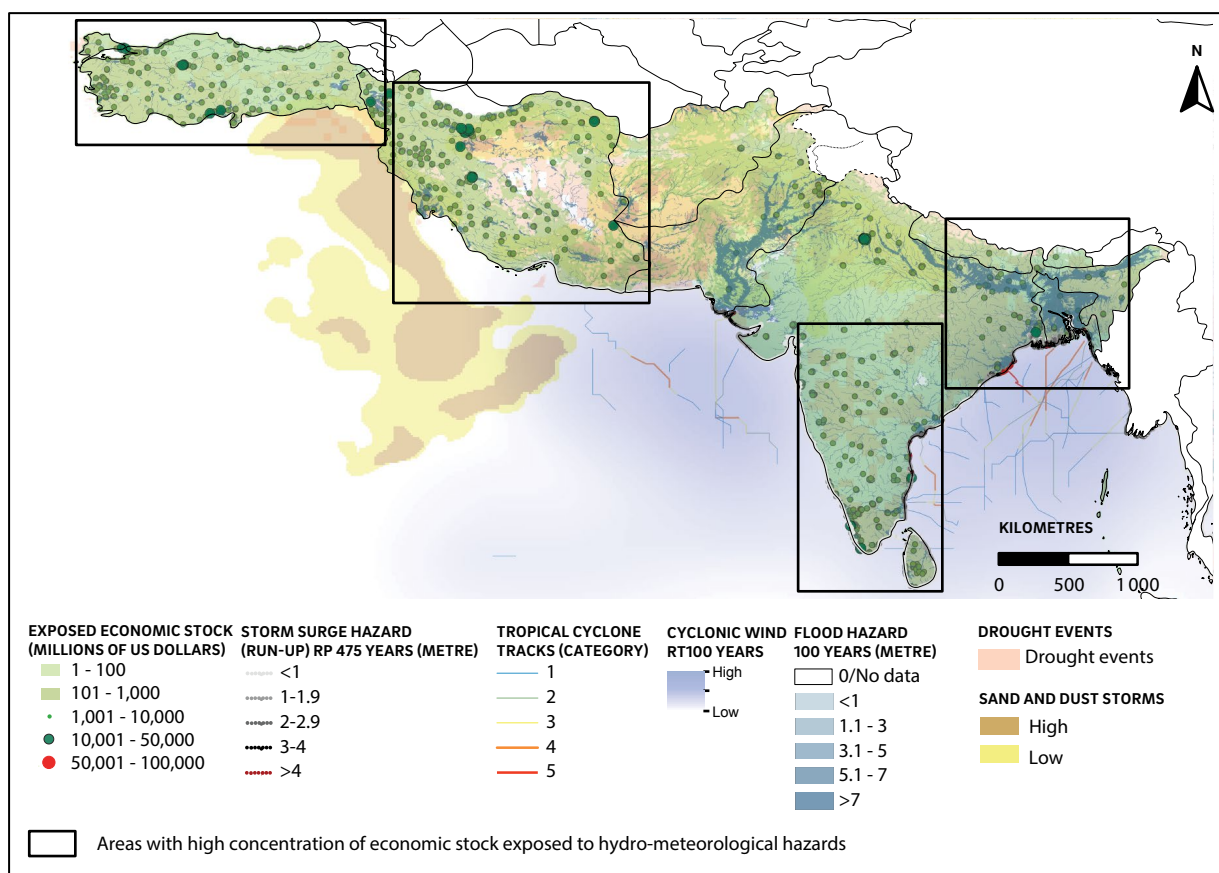
Climate change is amplifying disaster risk and thus, early warning systems need to be upgraded to keep up with the complexity of hazards.

The Intergovernmental Panel on Climate Change (IPCC) has reported that an increase in global temperature of 1.5°C above pre-industrial levels is likely between 2030 and 2052.¹ A complex sequence of climate and weather disasters such as drought, and sand and dust storms, desertification and floods are on the rise in the arid and semi-arid subregions of South-West Asia as indicated in the IPCC's 'Special Report on Global Warming of 1.5°C'. The decrease in soil moisture will increase the frequency and intensity of sand and dust storms in South and South-West Asia.² In South Asia, floods, cyclones and storm surges affect economic stock in the Ganges-Brahmaputra-Meghna basin, Southern India, and in Sri Lanka in South and South-West Asia. Risks are heightened by environmental degradation. This was demonstrated in 2018 with the floods in the state of Kerala, India. The environmental degradation combined with lack of disaster preparedness resulted in a deadly and extreme weather event.^{3, 4, 5}

Disaster risks are converging with critical socio-economic vulnerabilities making the South and South-West subregion a complex disaster hotspot.

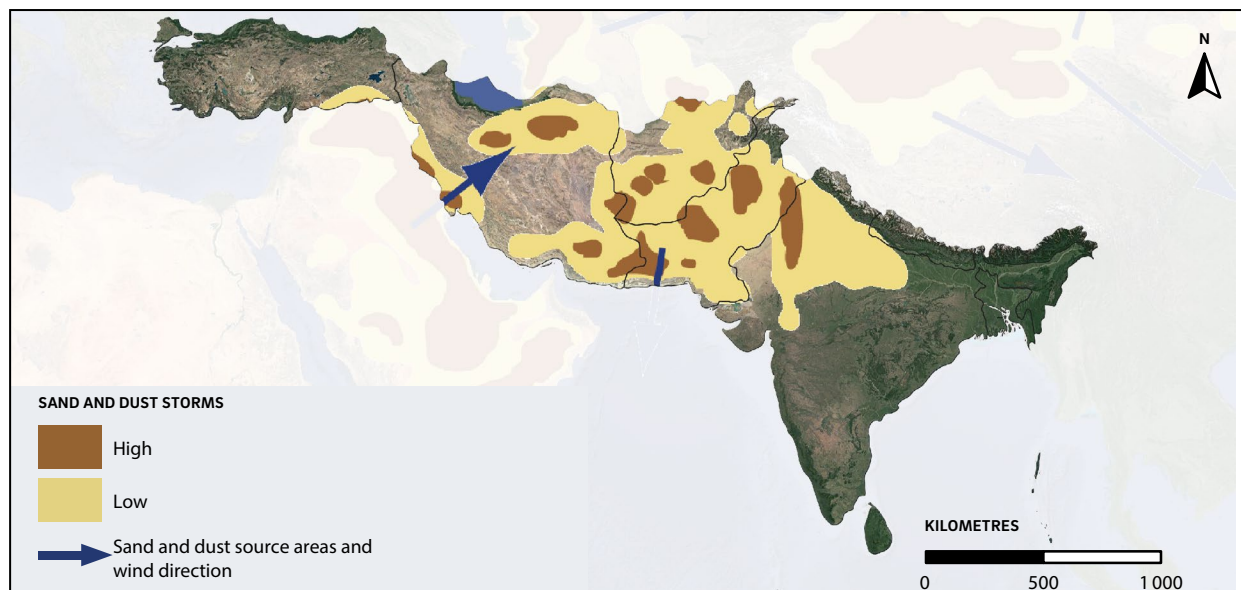
South and South-West Asia falls under two different hotspots. One lies within transboundary river basins and the other within the drought, and sand and dust storms corridors. Both are characterized by high population exposure consisting of mostly poor people as well as high economic stock exposure. Over 33 per cent of the population and over 27.2 per cent of economic stock is exposed to climate-related hazards and this will only increase with climatic changes (Figure 7 and Figure 8). Of South and South-West Asia's energy capacity, 26.1 per cent is exposed to multi-hazards, while 60 per cent of the subregion's roads are exposed to seismic hazards with a light and moderate category. This contributes to 40 per cent of the total road risk to seismic hazards with a light and moderate category in the Asia-Pacific region.

An increase in extreme rainfall is a danger for countries with major river basins in South and South-West Asia. A complex sequence of climate and weather disasters such as droughts, sand and dust storms, desertification and floods are on the rise in the arid and semi-arid regions of South-West Asia (Figure 8). In 2018, sand and dust storms in the Islamic Republic of Iran and neighbouring countries made fragile semi-arid and arid areas environmentally vulnerable (Figure 10). The storm swept over the eastern parts of the Islamic Republic of Iran, south-western Afghanistan and north-western Pakistan, impacting a wide geographical area resulting in the loss of hundreds of lives. In South and South-West Asia, the highest dust storm frequencies occur in the Sistan Basin in south-eastern Islamic Republic of Iran, south-western Afghanistan, north-western Baluchistan in Pakistan, the Thar Desert of Rajasthan in western India, the plains of Afghan-Turkestan and the Registan Desert.

FIGURE 7 Exposure of economic stock to hydro-meteorological hazard

Sources: ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015; Global Risk Data Platform, 2013; Muhs, and others, 2014.
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Note: Cyclone data consist of all cyclone wind categories with a return period of 100 years and an intensity of 119 km/h to more than 252 km/h.

FIGURE 8 Sand and dust storms risk corridors

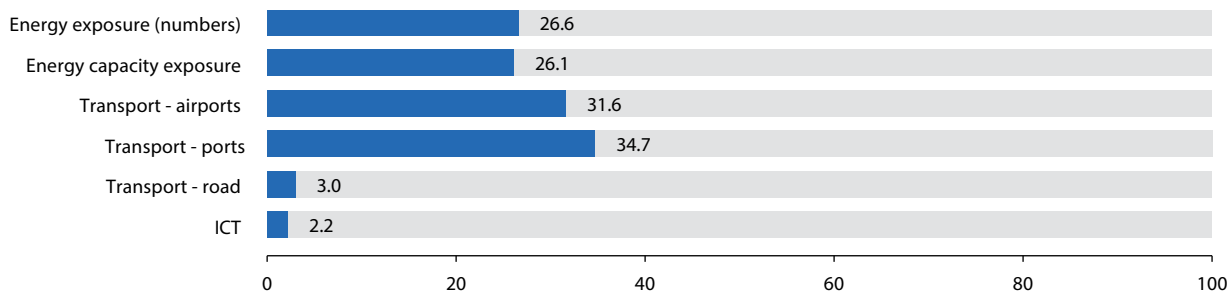
Source: ESCAP, based on Muhs, and others, 2014.

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Economic stocks are exposed to geological hazards such as earthquakes and tsunamis in India, Maldives and Sri Lanka. Areas in South-West Asia, such as the western regions of the Islamic Republic of Iran and Turkey are exposed to earthquakes. A total of 44 per cent of the economic stocks are at risk from seismic-related hazards in the subregion. In the case of climate-related hazards, residents along the coastal areas are prone to cyclones and storm surges particularly in the major cities in South Asia, such as in Bangladesh, the coastal areas of India, and Maldives. In South and South-West Asia, 54.4 per cent of airports and 51.2 per cent of ports are exposed to earthquakes, while 34.7 per cent of transports (ports) are exposed to multi-hazards in the subregion (Figure 9).

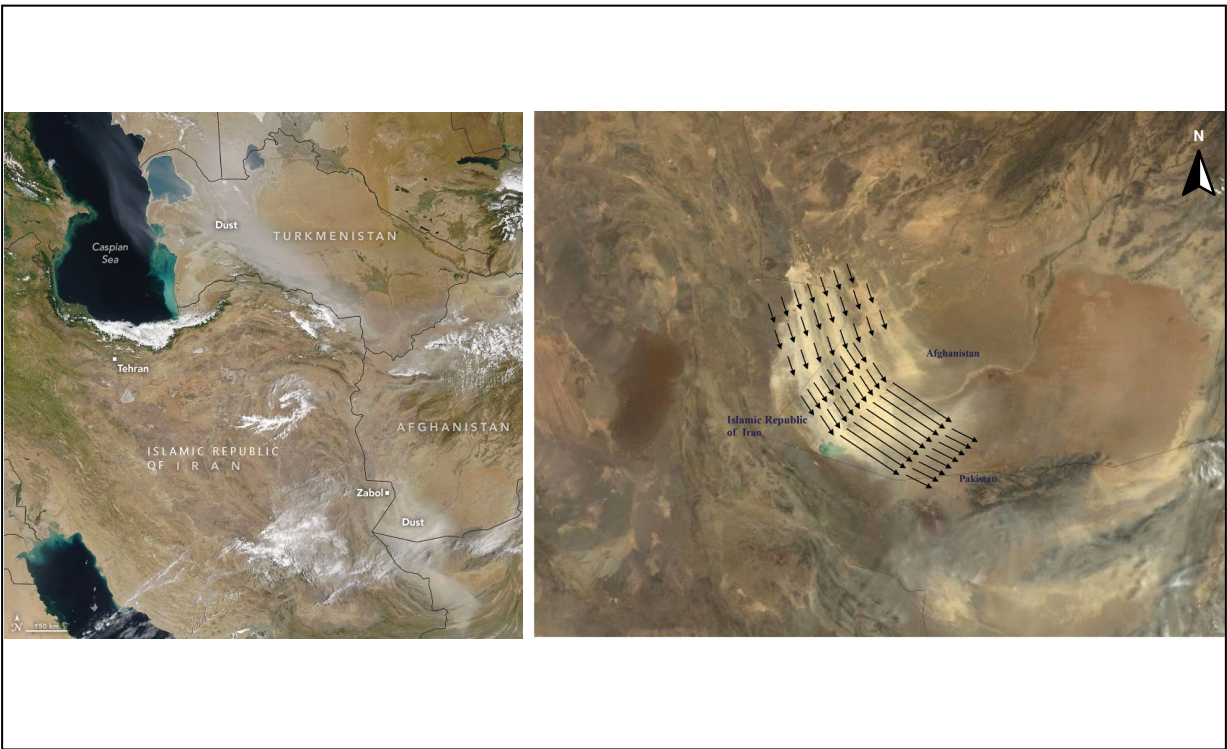
FIGURE 9 **Percentage of infrastructure at risk to multi-hazards**



Source: Global Risk Data Platform, 2013; Global Landslide Hazard Distribution v1, 2000; Muhs and others, 2014; ESCAP, Asia Information Superhighway, 2018; ESCAP Asia-Pacific Energy Portal, 2018; ESCAP Transportation Data, 2018.

Floods, cyclones and storm surges mostly affect populations in the Ganges-Brahmaputra-Meghna Basin and in South and South-West Asia. Around 40 per cent of the world’s poor live on or close to major transboundary river basins, such as the Ganges-Brahmaputra-Meghna (GBM) basin in South Asia.⁶ These risk hotspots cut across national boundaries. The GBM basin shapes social and cultural lives of around 630 million people, almost 70 per cent of whom are rural, and account for the largest concentration of poverty in the world.

FIGURE 10 **Sand and dust storm, 28 May 2018**



Source: Moderate Resolution Imaging Spectroradiometer (MODIS) image from Terra satellite (NASA), 2018 and Department of Environment of the Government of Islamic Republic of Iran, 2018.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Disaster risk is widening inequalities of opportunity and undermining poverty reduction in the subregion.

Disasters do not only result in short-term devastation, but also threaten long-term development gains. By impacting the social sectors, they exacerbate inequalities of income and opportunity, thereby leaving poor and marginalized people more vulnerable to future disasters and transmitting poverty over generations.

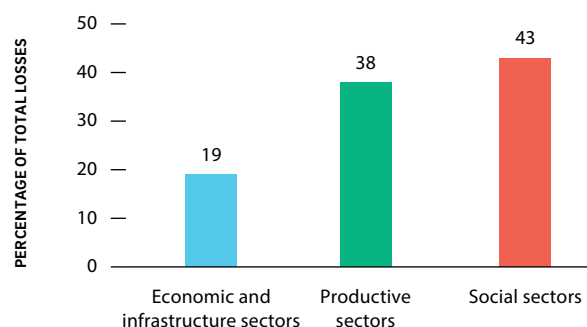
Records of major disasters in South and South-West Asia show that the social sectors suffer impacts that perpetuate inequalities of opportunity.

ESCAP analysed post-disaster needs assessment reports from six countries in the South and South-West Asia subregion and found that almost 43 per cent and 38 per cent of disaster impacts were on the social and productive sectors, respectively. Figure 11-1 demonstrates that the social and productive sectors (education, health, housing and culture) have sustained significant loss and damage due to recent disasters.

Further analysis of these impacts reveals how disruptions to the social sectors is disproportionately impacting poor and vulnerable groups, and perpetuating inequalities of opportunity.

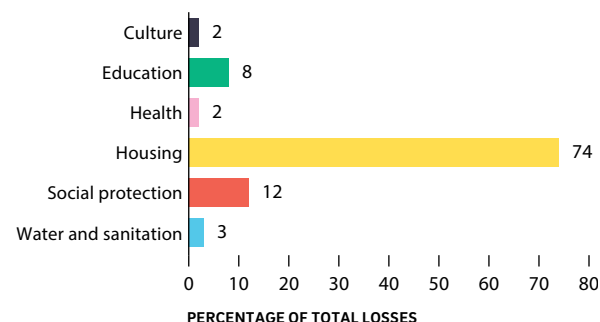
For example, the Pakistan floods in 2011 adversely effected social sectors and vulnerable population groups. Following the floods in Pakistan, the health and sanitation sector suffered the highest total socio-economic losses. People were dislocated, approximately 2.5 million children and 1.2 million women were affected and 50 per cent of the health

FIGURE 11-1 Sectoral impacts, as a percentage of total losses for selected major disasters in South and South-West Asia during the last 10 years (2009–2019)

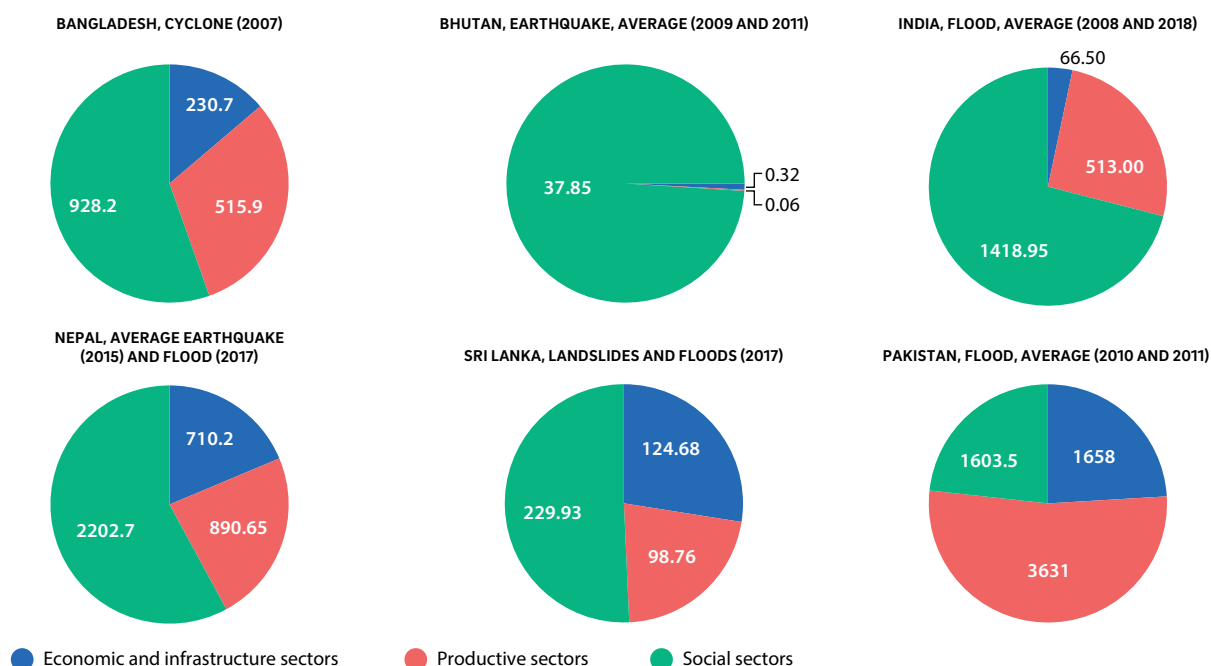


Source: ESCAP, based on GFDRR, PDNA reports.

FIGURE 11-2 Disaster impacts on social sector



Source: ESCAP, based on GFDRR, PDNA reports.

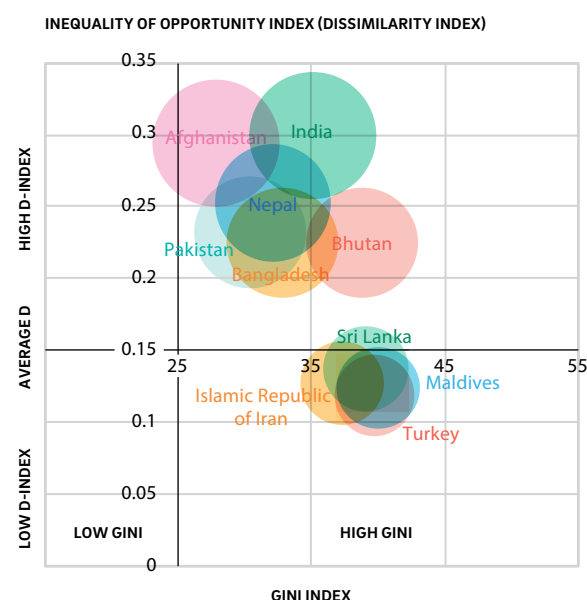
FIGURE 11-3 Sectoral impact of disasters on selected South and South-West countries (US\$ million)

Source: ESCAP, based on GFDRR, 11 PDNA reports available for last 10 years in the South and South-West.

facilities were damaged. The heavy damage and losses disrupted the educational access of men, women, boys and girls in different ways. The damage to school buildings during the floods, pushed 733,000 children out of school. Furthermore, aid was less accessible to vulnerable populations, including women, children and older persons.

Overlaps of disasters with inequalities in income and opportunities can leave people more vulnerable.

Inequality of income refers to how income generated in the production of goods and services is unequally distributed across a population. The best-known measure is the Gini coefficient.⁷ Inequality of opportunities is measured by the D-index,⁸ that measures to access of education, childhood nutrition and household access to basic services. Figure 12 shows the overlaps of inequalities of income and disaster risk. South and South-West Asian countries have higher overlaps between inequalities and disasters compared to other subregions. All the countries fall in the high-income inequality quadrant with higher extent of risks from disasters, as indicated by bubble size.

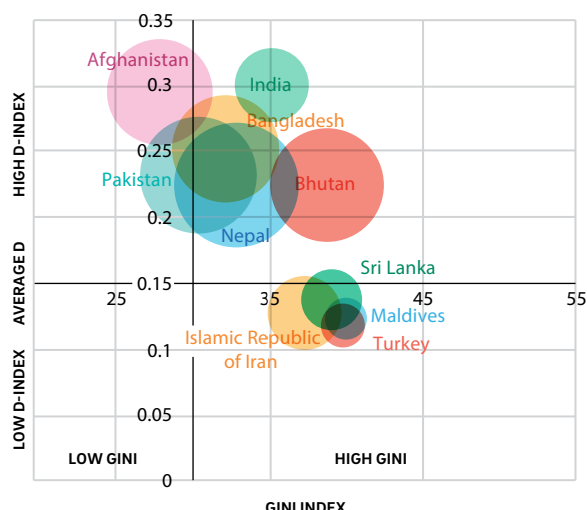
FIGURE 12 Overlaps of inequalities of income, opportunities and disaster risk for select countries

Source: ESCAP calculations for GINI, ESCAP calculations for Average annual loss, ESCAP calculations for Dissimilarity Index (D-Index) from ESCAP (2018) theme study "Inequality in Asia and the Pacific in the era of the 2030 Agenda for Sustainable Development."

Note: The size of the bubble indicates the extent of risk from multiple hazards

Figure 13 illustrates interactions between inequalities of opportunities and disaster losses. The bubble size indicates annual average losses as a proportion of GDP. Bangladesh and Bhutan are likely to continue to suffer from combined vulnerabilities.

FIGURE 13 Overlaps of inequalities of income, opportunities and disaster losses for select countries



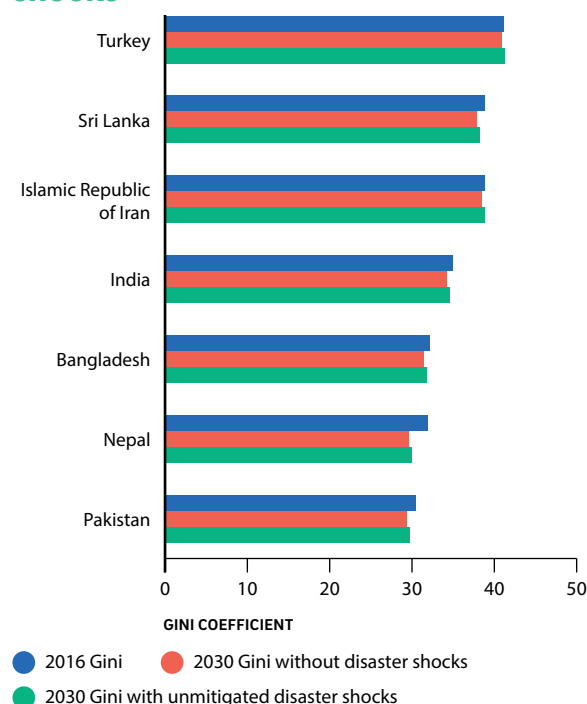
Source: ESCAP data based on DHS surveys, ESCAP calculations for GINI, Inform Index, 2019, Average annual loss (ESCAP figures).
Note: The size of the bubble indicates annual average losses as a proportion of GDP

Disasters contribute to and are drivers of income inequality and poverty in the subregion.

A comparative static computable general equilibrium model (CGE) can be used to project the impact of disaster shocks on income inequality and poverty. Figure 14 shows how the Gini coefficient is modelled to change by 2030, with and without disaster shocks. All countries can expect inequality to fall by 2030, but the decrease is lower in countries hit by disasters.

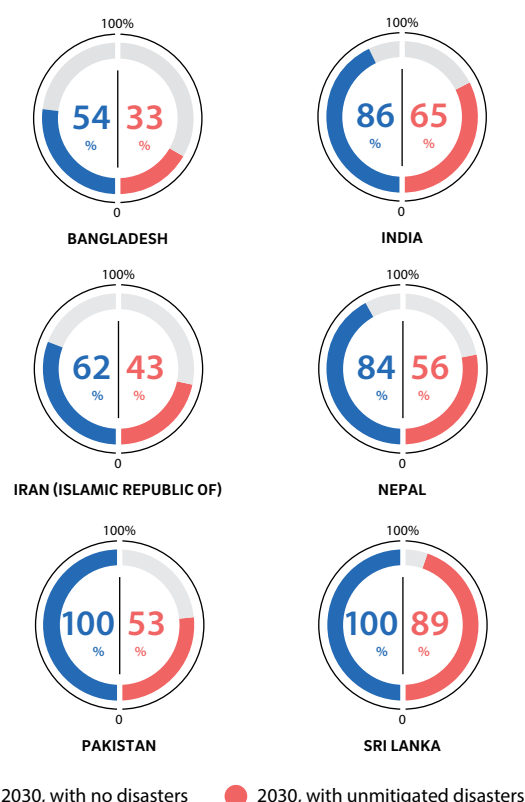
In Bangladesh, for example, the current poverty rate is 15 per cent. Without disaster shocks, the rate, in 2030, will decrease to around 7 per cent. However, with continued and unmitigated disaster shocks, the poverty rate will increase to around 10 per cent, which is lower than the current rate but higher than it would have been had the shocks been mitigated (Figure 15). Figure 15 suggests that all the countries in the subregion will have a higher rate of poverty with unmitigated disasters in 2030. Unmitigated and repeated disasters will continue to keep people in poverty or push them back into poverty.⁹

FIGURE 14 Projected Gini in 2030, with and without unmitigated disaster shocks



Source: ESCAP calculation based on CGE model.

FIGURE 15 Percentage reduction in extreme poverty rates in 2030 with and without disasters in selected countries (Baseline poverty rate=2016)



Source: ESCAP calculations based on CGE model.

Poverty, inequalities and disaster risk reinforce each other.

The South and South-West Asia subregion has a greater intersection between risks from disasters, inequalities of income, opportunity and poverty because the population is highly exposed to disaster risk. Using the latest Demographic Health Survey (DHS) data along with multiple hazard exposure data, from the 2015 Global Assessment Report, shows that disasters in countries like Afghanistan, Bangladesh, Nepal, Pakistan and Turkey can exacerbate existing inequalities of income and opportunity leaving the marginalized more vulnerable (Figure 16 and Figure 17). For example, 77.6 per cent of the population in Bangladesh live in high multi-hazard risk areas.

In addition, analysis from the DHS surveys demonstrate that wealthier individuals are better able to protect their assets and well-being because they can avoid living in areas that are likely to be hit by disasters. Poorer people, on the other hand, are more exposed and are repeatedly hit by disasters and lose wealth and assets. Figure 17 shows how the lower risks for the wealthy vary between countries. On average, the wealthiest individuals comprising the top 20 per cent of the wealth distribution are almost 70 per cent less likely to reside in high multi-hazard risk areas.

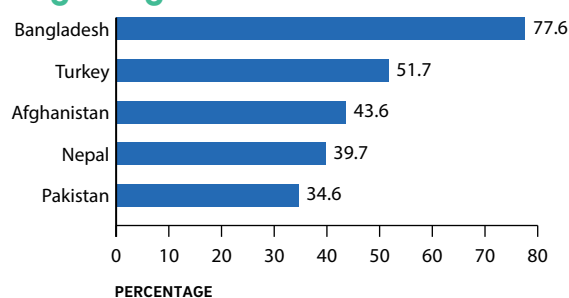
In particular, the agriculture poor in the subregion are significantly more likely to live in high multi-hazard risk areas. Analysis from within country DHS data shows that, in Bangladesh, poor households with agricultural employment are 1.9 times more likely to live in high multi-hazard risk areas; in Pakistan the poor are 1.3 times more likely and in Afghanistan 1.15 times more likely to live in high multi-hazard risk areas.

Health, healthcare and education remain the most affected social sector in South and South-West Asia due to disasters.

Analysis from DHS data shows that across countries in the Asia-Pacific including those in the South and South-West Asia subregion, health and healthcare are severely impacted from disasters. For example, for climate related hazards, a 1 percentage point increase in exposure leads to a 0.19 percentage point increase in malnutrition among children under five years of age. The harm to children can also be reflected in low birthweights. For example, in Afghanistan, children born in high multi-hazard risk areas are 1.62 times more likely to have low birthweight.

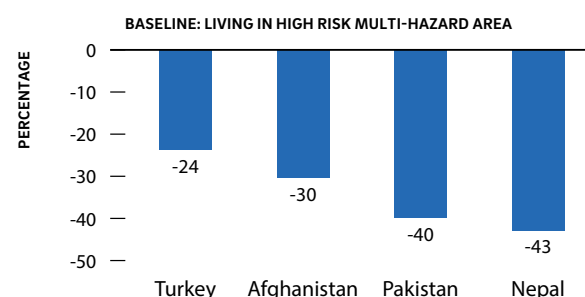
Droughts, in particular, have a significant impact on nutrition. In 2017, in Afghanistan, for example, a drought that caused scarcities of water and food exacerbated already high malnutrition rates among children, and pregnant and lactating women.¹⁰ Women living in high multi-hazard risk areas have less access to prenatal and medical care; in Nepal, for example, women living in risk prone areas are 17 per cent less likely to have access to prenatal and medical care (Figure 18).

FIGURE 16 Proportion of population living in high multi-hazard risk areas



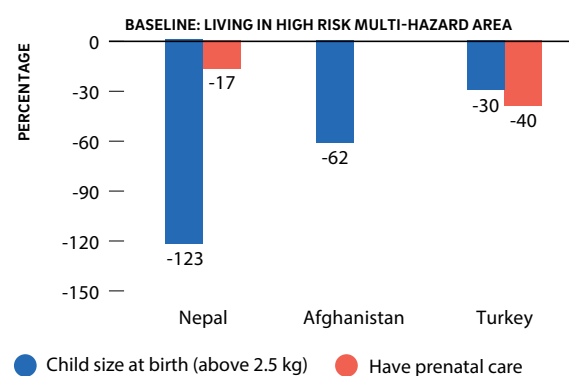
Source: ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015 and DHS Household Survey.

FIGURE 17 Odds of the wealthiest 20 per cent living in high multi-hazard risk areas



Source: ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015 and DHS Household Survey.
Note: Results are based on country-specific logistic regressions. Only countries with statistically significant coefficients and odds-ratios are shown.

FIGURE 18 Lower odds of average birth size among children born and access to prenatal and medical care for women in high multi-hazard risk



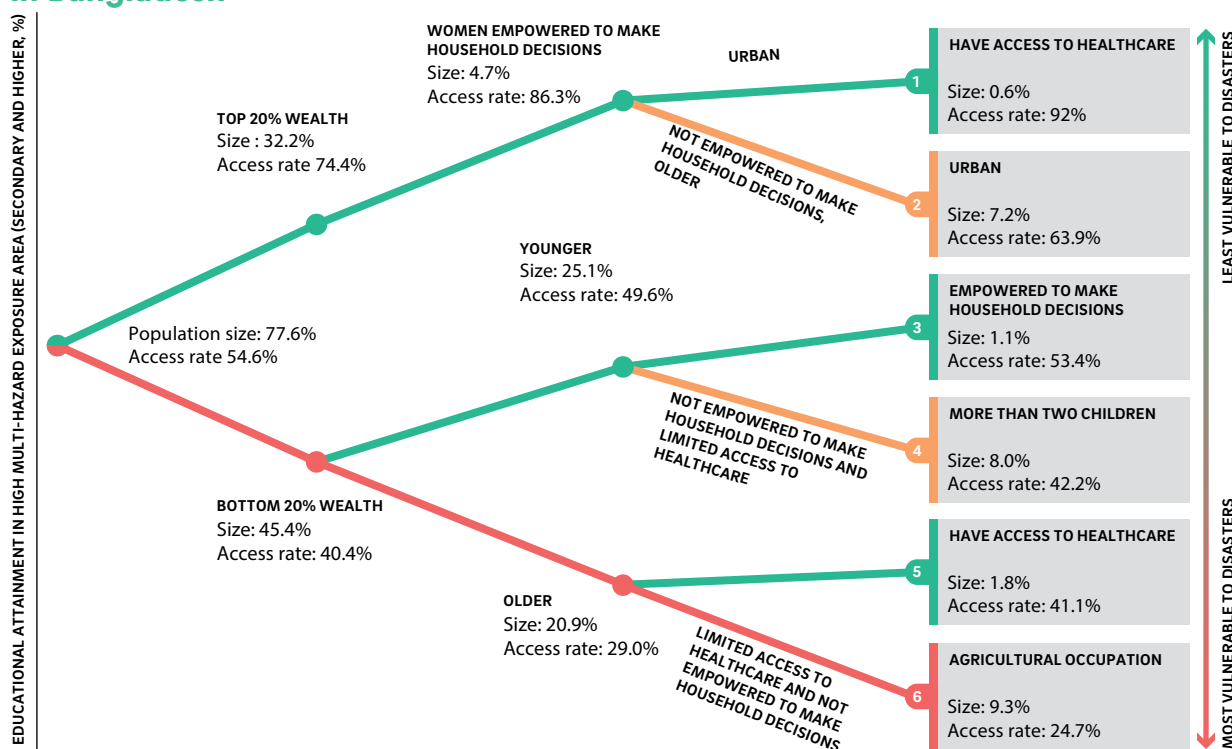
Source: ESCAP calculations based on DHS surveys from three South and South-West Asian countries for the latest years. Multi-hazard data are from the Global Assessment Report, 2015.
Note: Only countries for which there are statistically significant results are included.

Education shapes inequality in access to all opportunities, including nutrition, employment, and household-level services.¹¹ In countries such as Nepal, where earthquakes have caused large-scale disruption, many children have lost months of education.

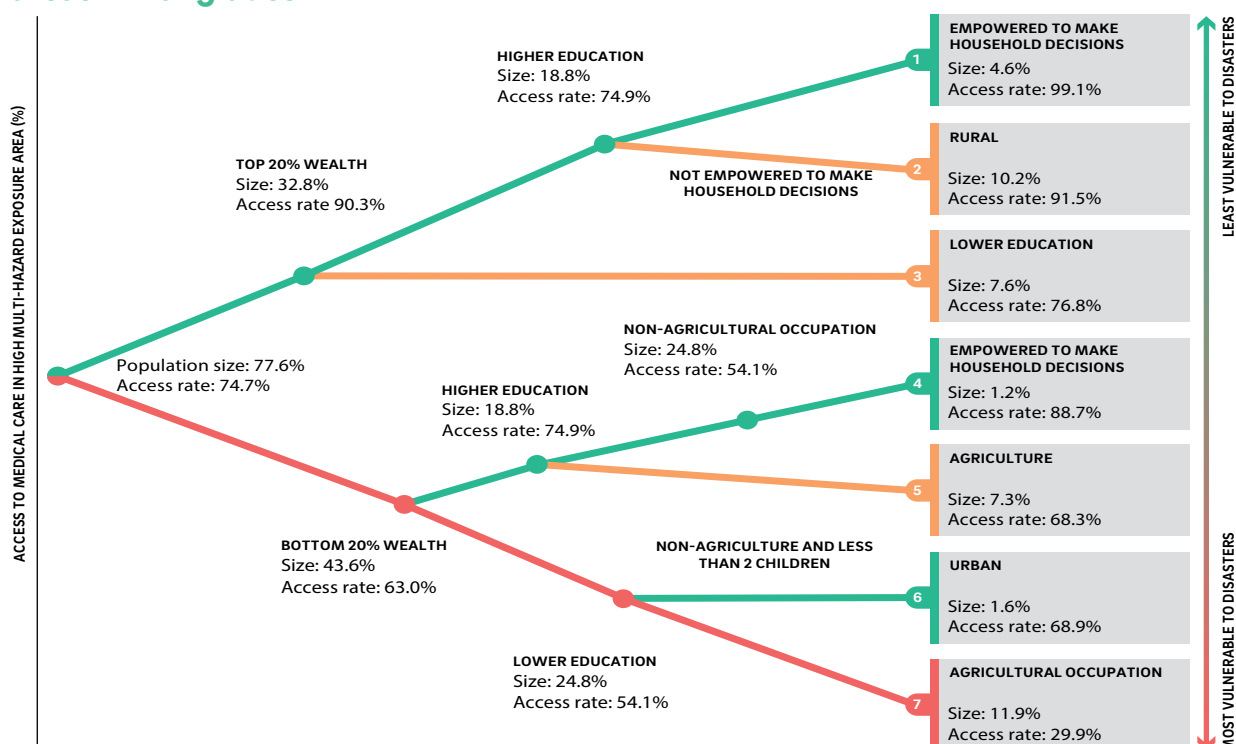
Who will be left the furthest behind when disaster hits?

It has been demonstrated that people living in high multi-hazards areas are likely to have lower nutrition, education, and access to healthcare. But they can also face discrimination based on gender, age, ethnicity, religion and other divisions. A study of these discriminations from a disaster risk perspective opens the door to a deeper exploration of the intersections between deprivations and discriminations within areas that are already exposed to high hazard risk. This will help identify the groups that are the furthest left behind and where strengthening disaster risk reduction can support social development and the building of individual resilience. Using the classification tree methodology, ESCAP illustrates people who are most at risk from the overlaps between deprivation, discrimination and hazard risk. This approach can be illustrated for Bangladesh. The classification trees, in Figure 19 and Figure 20, show which populations will be the most disadvantaged when disasters hit, specifically for education and access to healthcare. In education, as expected, the poorest, followed by older individuals, and household who work in the agriculture sector remain the most vulnerable populations.

FIGURE 19 Access to education and vulnerability in high multi-hazard risk areas in Bangladesh



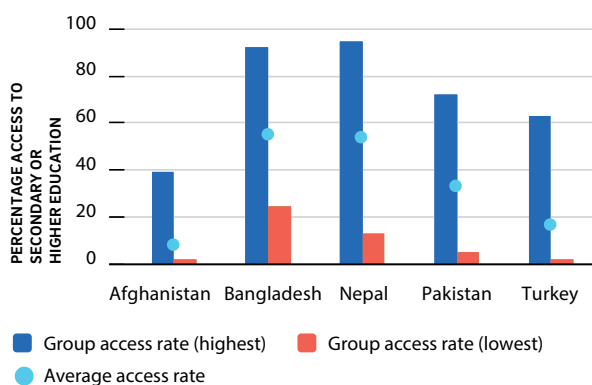
Sources: ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015, and DHS Household Survey.

FIGURE 20 Access to health care and vulnerability in high multi-hazard risk areas in Bangladesh

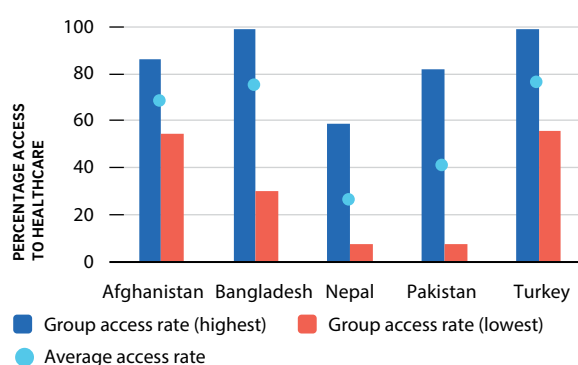
Sources: ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015, and DHS Household Survey.

The trees for education and healthcare in the South and South-West Asian countries in high multi-hazards areas are summarized in Figure 21 and Figure 22. The blue lines represent the access of the most advantaged groups; the red bars represent the access of the most disadvantaged groups; and the circles indicate the average access.

Besides being in the bottom 20 per cent of the wealth bracket, the most common shared circumstance of the most disadvantaged is employment in agriculture. Others, in declining order, are older age, living in rural areas, having more than two children, and for women, a lack of empowerment reflected through property ownership. The poor, it seems, have a multitude of circumstances that work hand in hand to keep them 'furthest behind' — generation after generation.

FIGURE 21 Inequality of access to education in high multi-hazard risk areas

Source: ESCAP calculations using data from the latest DHS surveys and GAR hazard risk data.

FIGURE 22 Inequality of access to healthcare in high multi-hazard risk areas

Source: ESCAP calculations using data from the latest DHS surveys and GAR hazard risk data.

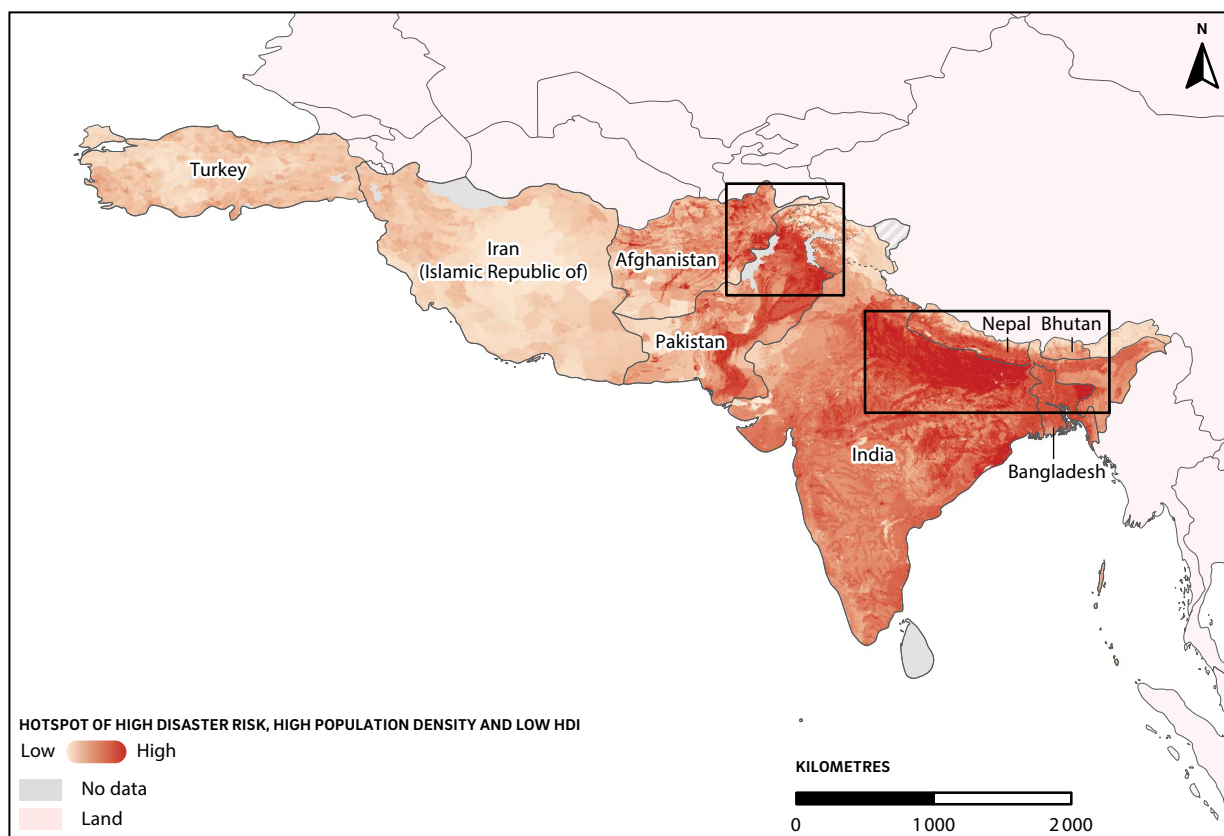
Finding the furthest behind?

The following section identifies the geographical location, where poverty, population density, low human development and disaster risk areas converge. They provide empirical, spatial evidence that support the identification of the five risk hotspots that were discussed in Chapter 1 of the *Asia-Pacific Disaster Report 2019*. This analysis uses the human development index (HDI), a composite measure of average achievements in three key dimensions of human development: a long and healthy life, education, and decent standard of living. This is combined with the GAR 2015 hazard exposure models, and data on land degradation. A novel interpolation and small area estimation method is used to locate those who live in poverty.

Figure 23 shows socioeconomic-hazard risk areas among some selected subregions. The figures amalgamate the index of high population, low HDI and high-hazard risk or high land degradation.¹² The analysis shows that, for example, within South Asia, the most vulnerable populations live in the Ganges-Brahmaputra-Meghna (GBM) basin and parts of Pakistan and Afghanistan. Within the GBM basin only 0.79 per cent of the population has a high HDI whereas 32.5 per cent fall in the low and medium HDI category.

These risk hotspots tend to cut across national boundaries. One of the most extensive is the Ganges–Brahmaputra–Meghna (GBM) river basin, which is the world’s largest river basin and is shared by four South Asian countries; Bangladesh, Nepal, India and Bhutan.¹³ The GBM basin shapes social and cultural lives of around 630 million people, almost 70 per cent of whom are rural, and account for the largest concentration of poverty in the world.¹⁴ Furthermore, they are also people who are at high risk from multiple hazards. Geo-locating these people and understanding their spatial distribution can provide guidance on the priority areas that should receive risk-sensitive investments.

FIGURE 23 Hotspots of low HDI, high population density, and hazard risks



Sources: Calculations by ESCAP based on (1) sub-national HDI data from UNDP, (2) Population statistics from WorldPop, (3) and hazard data from GAR, 2015. Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.

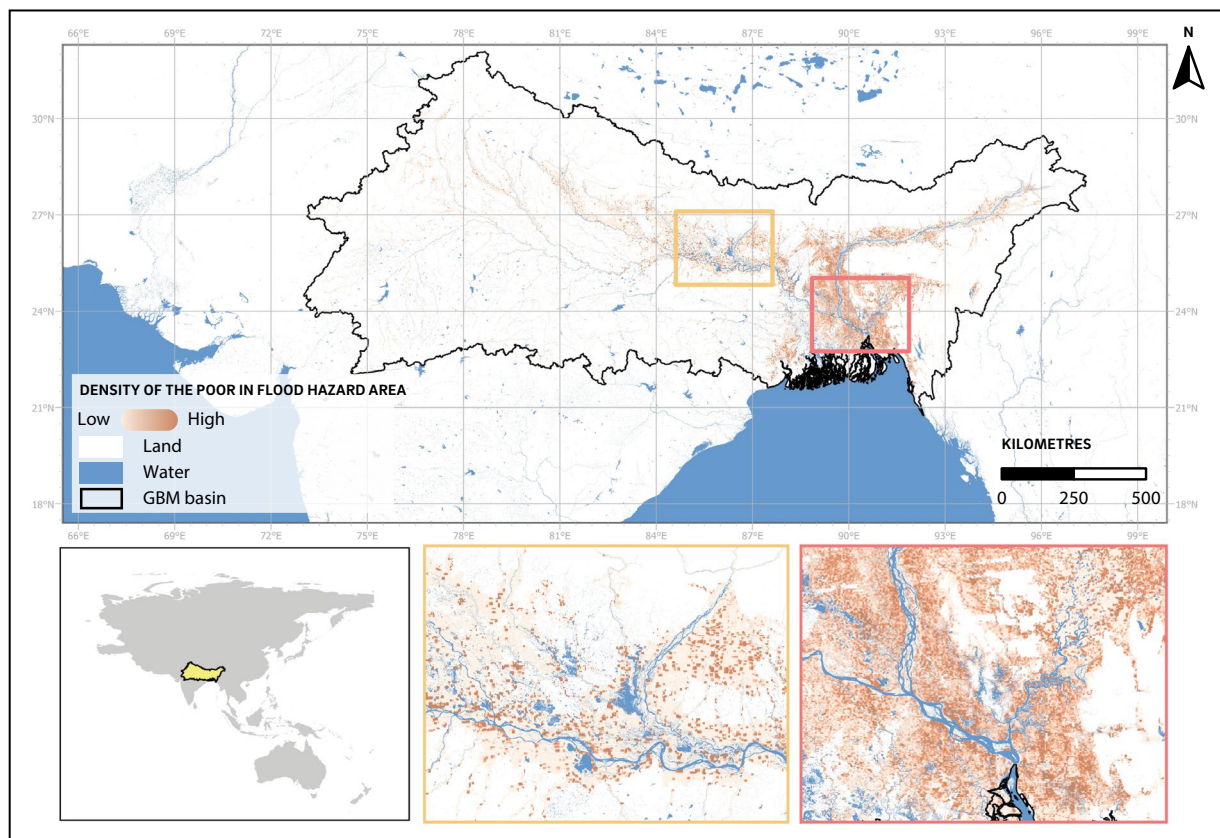
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Figure 24 uses a small area estimation methodology to estimate a probable location of the poor in the GBM basin.¹⁵ These use a range of data; urban built up area, nightlight data, as well as the DHS wealth index data. This empirically shows that poorer populations, who will be least able to cope are the ones most exposed to flooding. The box in the figure notes the locations where additional investments and policy attention can bolster the resilience of those who are the furthest behind. The map also shows that the worst-off populations are not confined to a single country so these measures should involve cooperation among the riparian countries.

While disasters are often transboundary, many strategies to reduce risk will be local, and community based.¹⁶ For this purpose, it is useful to identify the most vulnerable communities using the DHS geographic information system (GIS). Figure 25 illustrates this for Nepal showing that the concentration of risk overlap is greatest in the eastern parts of the country, particularly in Province 3, and the borders between Provinces 1 and 3. The second map overlays the country's primary care hospitals. This can be useful in identifying the critical infrastructure needed to support the most vulnerable populations. The handful of hospitals within the most at-risk areas, if built or upgraded in a resilient and risk-sensitive manner, can support the most vulnerable populations during disaster shocks.

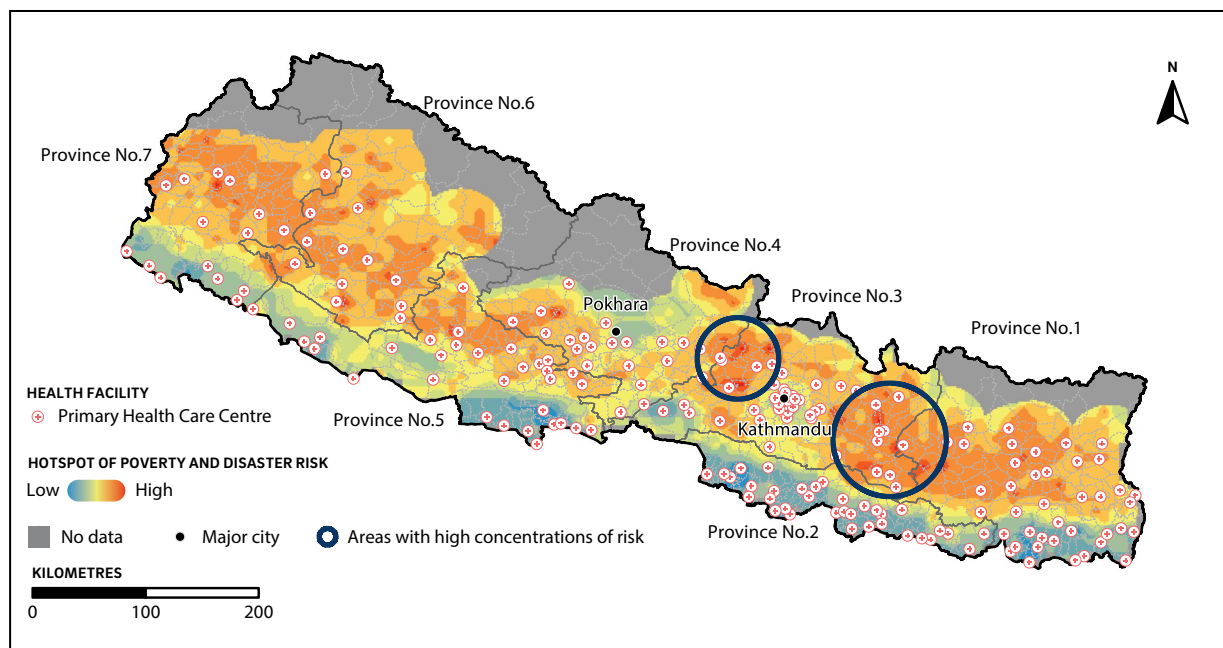
Figure 26 shows the corresponding maps for Bangladesh. This shows that the highest concentrations of socioeconomic-hazard risks are along the floodplains. The populations living there are subject to recurrent annual flooding. In addition, it also shows where critical infrastructure, like hospitals, need to be upgraded to withstand disasters and where the most resilient infrastructure needs to be built to support the most vulnerable populations.

FIGURE 24 The most vulnerable populations in the GBM basins



Source: Calculations by ESCAP based on Official population statistics from national statistics office of each of the 5 countries, (2) DHS Programme Household Survey results from Bangladesh, India and Nepal, (3) German Aerospace Centre (DLR) Global Urban Footprint, (4) Earth Observations Group at NOAA Nightlights data, (5) European Space Agency Global Climate Change Initiative (CCI) Land Cover, and (6) UNISDR GAR, 2015 Probabilistic Hazard Maps. Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

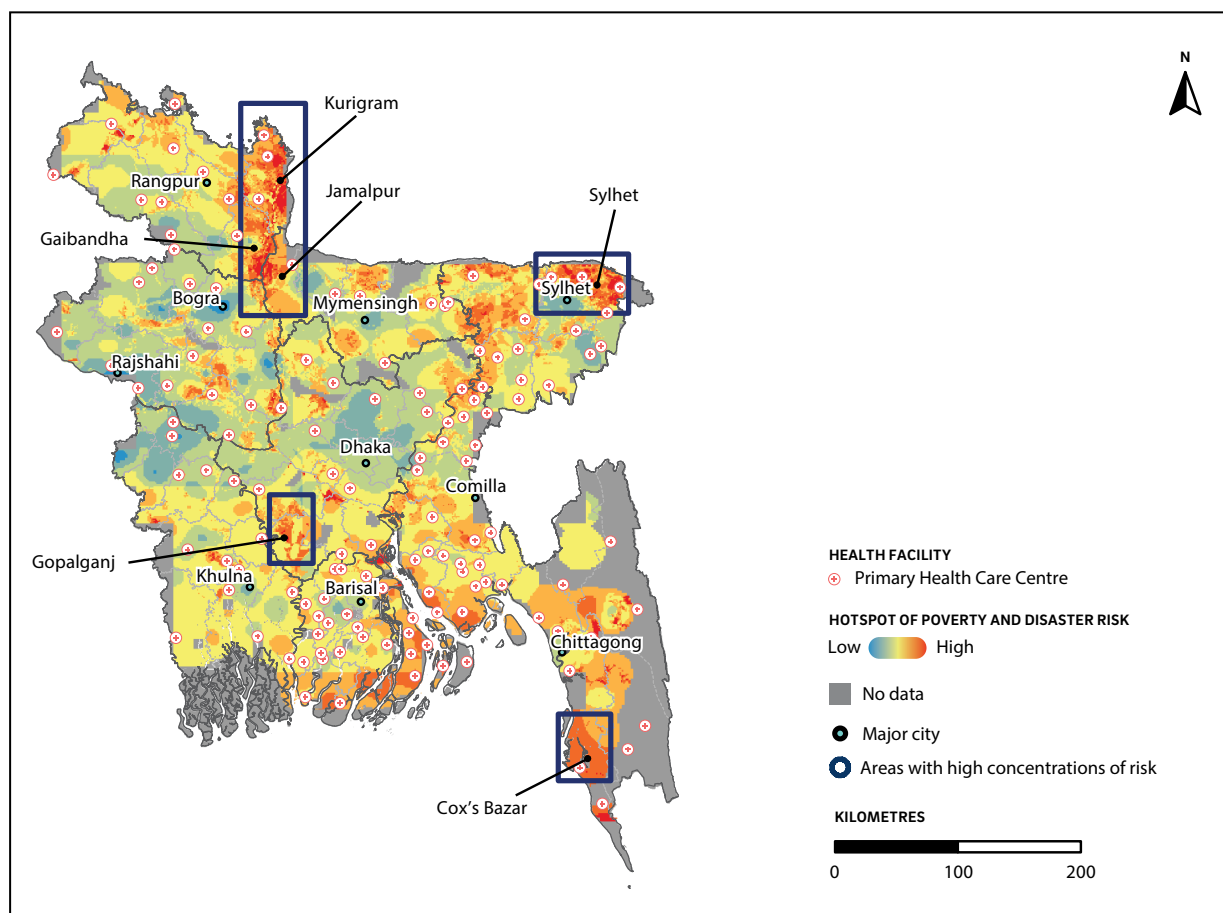
FIGURE 25 Mapping vulnerable communities and health facilities in Nepal



Sources: ESCAP, based on DHS Programme Household Survey for Nepal, and multi-hazard data from Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015.

Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

FIGURE 26 Mapping vulnerable communities and health facilities in Bangladesh



Sources: ESCAP, based on DHS Programme Household Survey and Service Provision Assessment Survey for Bangladesh, and multi-hazard data from Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015.

Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.



A range of policy options can effectively break the links between disasters, poverty and inequality.

Governments can shift their strategies from addressing only disaster impacts to addressing the fundamental drivers of vulnerability that make people susceptible to the impacts of disasters and climate change through a comprehensive portfolio of risk-informed investments and pro-poor disaster risk reduction interventions. As a result, they can prevent disaster risk from undermining poverty reduction efforts. Using CGE modelling, ESCAP quantified the percentage change of national populations living in poverty (at the \$1.90, \$3.20 and \$5.50 a day thresholds), and the Gini coefficient, using eleven different scenarios.

- A. Growth
- B. Growth + investment in social protection
- C. Growth + investment in education
- D. Growth + investment in health
- E. Growth + investment in infrastructure
- F. Growth + disaster risk
- G. Growth + disaster risk + investment in social protection
- H. Growth + disaster risk + investment in education
- I. Growth + disaster risk + investment in health
- J. Growth + disaster risk + investment in infrastructure
- K. Growth + disaster risk + investment in all four key sectors

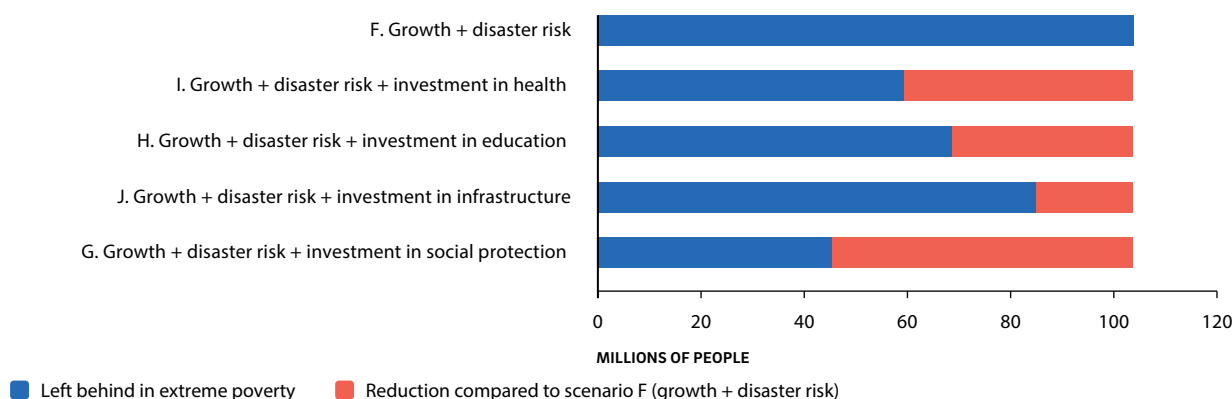
Analysis of the CGE model shown in Figure 27, depicts that the high impact countries; Bangladesh, India and Nepal, have the highest difference between scenario A and F. That is, more than 3 per cent of the people living under \$1.90 a day in 2030.

Investments in social sectors and resilient infrastructure can prevent disasters from undermining development gains.

The projected economic growth (scenario A) is expected to reduce poverty, but these reductions are lower when disaster risk is considered (scenario F). Nevertheless, investments in each sector, especially the social sector and in resilient infrastructure, can mitigate this impact of disasters, and deliver higher reductions in poverty than scenario F in the subregion. The CGE model reiterates that increasing investment in social policy will provide the opportunity to lift people out of poverty.

Using computable general equilibrium modelling (CGE) to quantify the relationship between poverty and disasters, data available for Bangladesh, India, Islamic Republic of Iran, Nepal, Pakistan, Sri Lanka and Turkey, show that investments in each of the four key sectors can mitigate the impact of disasters on poverty and inequality. Figure 27 displays the reductions in the \$1.90, \$3.20 and \$5.50 poverty rate. The highest reductions are achieved from investing in social protection, but other interventions are also effective in mitigating the disaster driven increases in poverty and inequality.

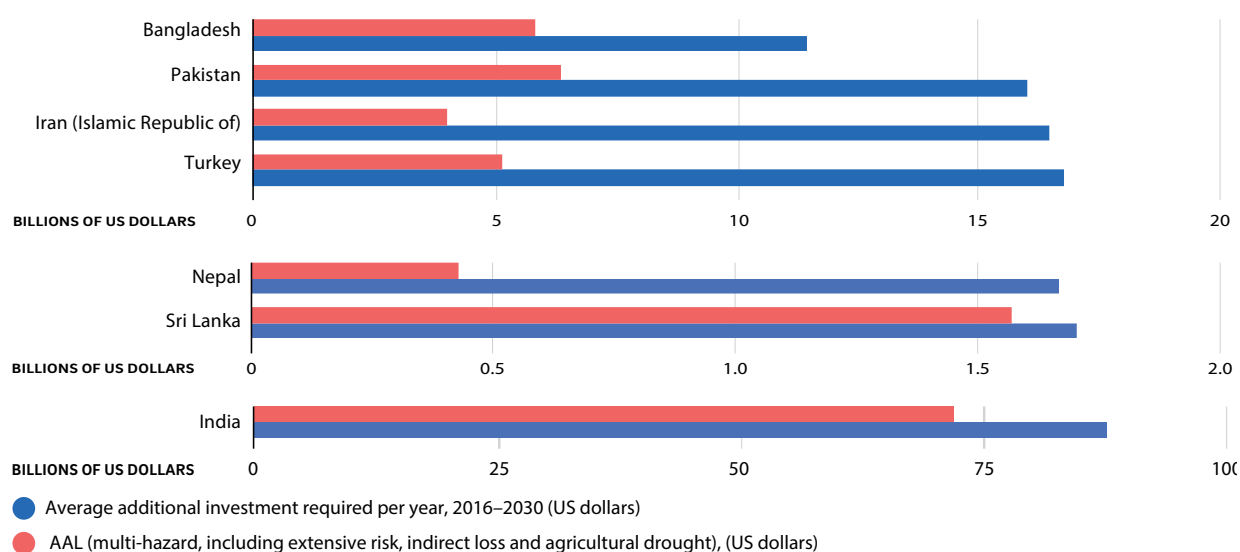
FIGURE 27 Projected number of people living in extreme poverty in 2030, with disaster risk



Translating these rates and coefficients into numbers reveals the number of people who are at risk of being left behind in extreme poverty, if disaster risk is not reduced. Within South and South-West Asia, in 2016, 232 million people were living in poverty. Economic growth is projected to reduce this number to 45 million people by 2030. However, with disaster risk, 103 million people are still projected to be living in extreme poverty in 2030. Investing in line with global averages in education, health, social protection and infrastructure will bring this number down to 68 million people, 59 million people, 45 million people and 84 million people respectively. These results hold across the various poverty thresholds in the South and South-West Asian countries of Bangladesh, India, the Islamic Republic of Iran, Nepal, Pakistan, Sri Lanka and Turkey. A clear message therefore emerges that disaster risk threatens to undermine development gains, but countries can still reduce poverty and inequality despite disaster risk, by investing in social protection, health, education and infrastructure.

Increasing investments in the social sectors and infrastructure will require additional finance but are small compared to the damage and losses already sustained by the South and South-West Asian countries due to disasters.

There are varying estimates of the total amount of investment required to meet the Sustainable Development Goals, for example, to climate-proof infrastructure. Governments can make real improvements in poverty and inequality by at least investing in line with global average expenditures in social protection, education, health, and 2 per cent of GDP in infrastructure. Figure 28 shows that the additional amounts required to meet these investments levels are small compared to the damage and losses already sustained by the South and South-West Asian countries due to disasters. For six out of the seven South and South-West Asian countries, the additional investments required per year are lower than AAL. For four out of the seven countries, the additional investment required is even less than 50 per cent of the AAL. The additional investments are also less than the damage and losses sustained in major disasters. For example, in Nepal, the average additional investment required per year is \$430 million, which is just 6 per cent of the losses incurred due to the 2015 earthquake (\$7 billion).

FIGURE 28 Average annual loss compared to annual additional investments to meet international norms

Source: ESCAP calculations based on CGE model and AAL probabilistic risk assessment.

Note: Additional investment figures refer to the difference between projected average annual investment if investment in each sector, from 2016–2030, continues at the same percentage of GDP as in 2016, and average annual investment required over 2016–2030, if investments in each sector meet international norms.

Investment in social sectors and infrastructures is essential to empower people and ensure nobody is left behind.

Increasing sectoral investments also means that Governments can be more ambitious than aiming to bounce back better after a disaster. In case of education, successful interventions have also been implemented on much larger scales in the subregion. For example, many Governments have mobilized political will after a disaster to invest in stronger school buildings. In 2001, the collapse of 11,600 schools during the Gujarat earthquake highlighted the vulnerability of Indian schools. In 2005, the Government of Uttar Pradesh passed the Disaster Management Act, mandating that all existing school buildings be made seismically safe. As a result, 6,844 new school buildings were redesigned within four months to incorporate earthquake resistance. In this case, strong governmental will at local and state levels, further strengthened by the impacts of a previous disaster, facilitated an extensive and rapid overhaul of school safety.¹⁷

Disasters reduce health care access by damaging infrastructure such as hospitals, clinics, medical equipment, and transport systems, and by affecting skilled personnel. Following the 2015 earthquake in Nepal, for example, 446 public health facilities and 16 private facilities were destroyed, whilst damages were sustained to a further 765 health facilities.¹⁸ This underlines the importance of resilient health infrastructure, including smaller health clinics which may not sustain the greatest economic costs but offer vital support for the poorest and most vulnerable people in rural areas.

In both rural and urban areas, the most vulnerable people are often those who do not have secure land tenure and are therefore unlikely to invest in disaster resilience. Empirical evidence shows that in Khulna, Bangladesh's third-largest city, unauthorized, informal owners live with the constant fear of eviction and have little incentive to improve their environment. They are unable to elevate their land to the surrounding levels with less hazard exposure, and many have constructed dwellings in risky locations, using inferior materials.¹⁹ The innovative financing mechanism of the Chars Livelihoods Programme in Bangladesh allows the programme to be shock responsive. It is first and foremost a disaster risk reduction initiative which aims to reduce vulnerability to flooding of poor households living in chars (fluvial islands). But it also has the capacity to expand and support disaster response.²⁰

TABLE 2 Benefits of insurance for poor and vulnerable groups

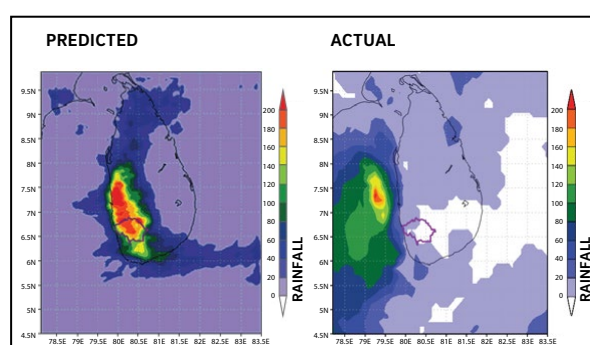
BENEFIT	EXAMPLE
ACTING AS A BUFFER AND SAFETY NET	
Prevention of negative coping strategies such as distress asset sales	Pastoralist households in Mongolia that purchased Index-Based Livestock Insurance recovered faster from the <i>dzud</i> of 2009/10, as they were less likely to resort to selling livestock early. Two years after the disaster, insured households owned between 22 and 27 per cent more livestock.
UNLOCKING OPPORTUNITIES THAT INCREASE PRODUCTIVITY	
Increase savings	Evidence from Ethiopia, Senegal and Haiti demonstrates that insurance payouts support farmers to increase their savings.
Improve creditworthiness	Banks have more confidence in herders covered by the index livestock insurance, and have offered herders loans at decreased interest rates.
Increasing investment in higher-return activities	Farmers in China with insurance are more likely to raise sows and tobacco, both risky production activities with potentially large returns. In flood-prone areas of the Sirajganj district in Bangladesh, villagers with Index Based Flood Insurance (IBFI) invest more in seeds or fertilizers to grow more crops and enhance yields.
SPURRING TRANSFORMATION IN RISK MANAGEMENT	
Incentivizing risk reduction behaviour	Modified National Agricultural Insurance Scheme in India features a discount provision if all farmers in a unit area adopt better water conservation and sustainable farming practices for better risk mitigation.

Source: Adapted from Schaefer and Waters, 2016.

Emerging technologies can be deployed to overcome the challenges posed by geography in delivering social and disaster risk reduction interventions.

Technological innovations offer unprecedented opportunities for resilience-building in South and South-West Asia. Emerging industry 4.0 innovations in robotics, analytics, artificial intelligence (AI) and cognitive technologies, nanotechnology, quantum computing, wearables, the internet of things (IoT), big data, additive manufacturing, and advanced material can be utilized to drive intelligent action for disaster resilience. By investing in these technologies, Governments can ensure that even the poorest countries and most excluded communities can be empowered.

A web-geographic information system (GIS) platform, for example, can aggregate data in space and time and build scenarios of risk and damage.²¹ The experience of ensemble prediction system (EPS) for 2018 flood forecasting for Sri Lanka was a mixed bag of success. While it captured the intensity of torrential rain two days in advance, the forecast was not precise in its exact location (Figure 29).²² The location accuracy can be improved not only with quality of downscaling ensembles but with densification of data network and putting in place an appropriate big data ecosystem.

FIGURE 29 Predicted and actual rainfall in Sri Lanka, 24 May 2019

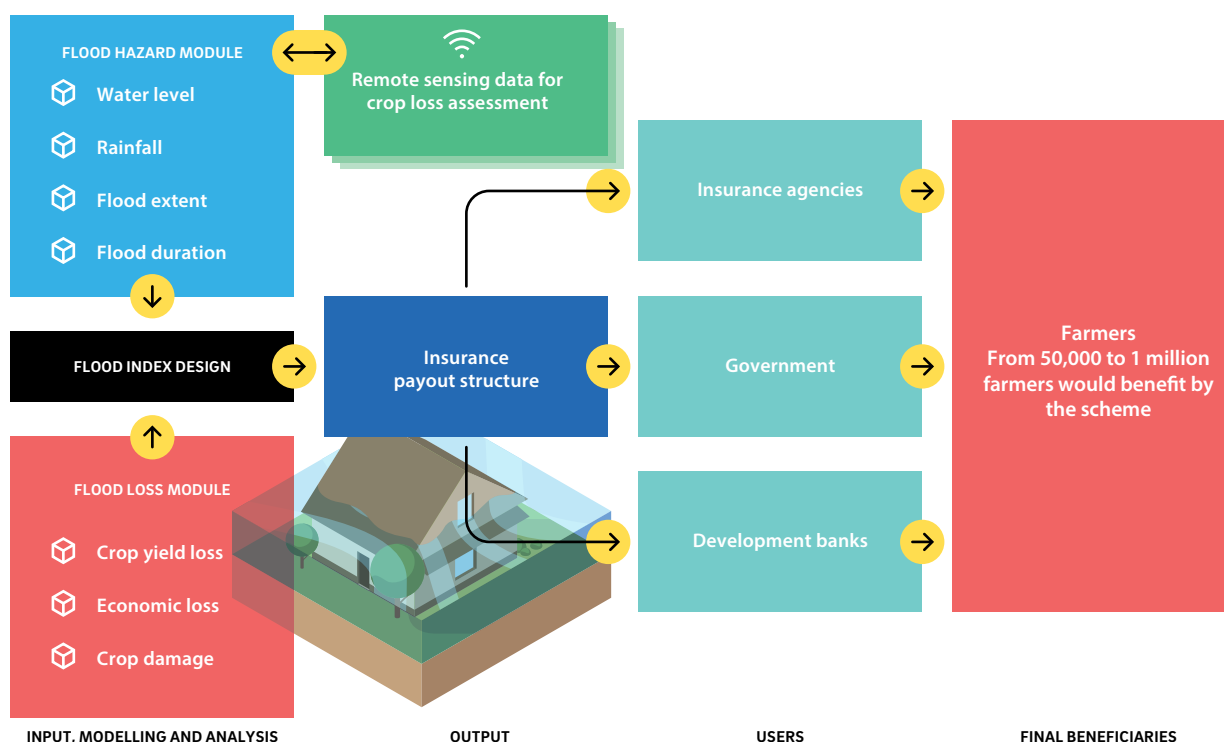
Source: Tomoki Ushiyama, ICHARM, 2019.

Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

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Prescriptive use of big data can be seen for index-based flood insurance (IBFI). In South Asia, IBFI systems use satellite data and computer-based flood models to assess the location, depth and duration of flooding and indicate when and where flooding reaches the threshold at which damage is severe enough to warrant compensation.²³ This simplifies decision-making and speeds up the delivery of insurance payouts which has helped alleviate the asymmetric impacts on poor farmers (Figure 30). IBFI has successfully been piloted in 2017/2018 in Bihar, India.²⁴

FIGURE 30 Index-based flood insurance



Source: Amarnath, 2017.

Identifying the excluded and digitally empowering them

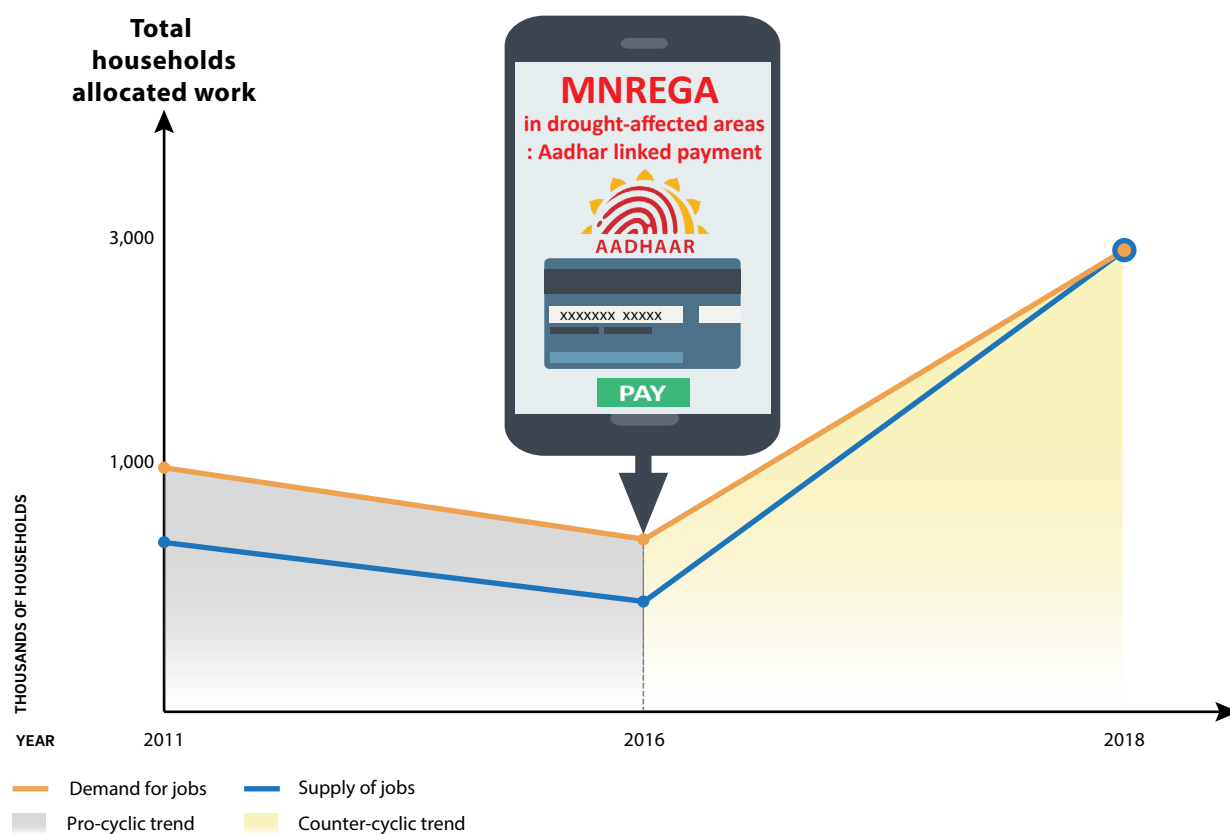
Around 2.4 billion people around the world, typically the poorest and most vulnerable lack formal identification records such as identity document (ID) cards or birth certificates.²⁵ They may then find it more difficult to access vital services and entitlements which can transmit exclusion over generations.

In Bangladesh, for example, the Government is partnering with the World Bank on the Identification System for Enhancing Access to Services project. This system includes a unique identifying number and biometrics-based smart national ID cards for citizens, including those in high-risk areas, and the socially vulnerable and marginalized.

India, for example, has one of the world's largest public workfare programmes; the Mahatma Gandhi National Rural Employee Guarantee Act (MNREGA),²⁶ however, the programme suffered from leakages and delays in wage payment. This issue has been addressed through direct payments using a biometric-enabled national identity number, named Aadhar, for identifying MNREGA beneficiaries with numbers which were linked to their bank accounts.²⁷ The use of Aadhar-linked digital identity bank accounts for a variety of subsidy and social protection schemes saves an estimated \$11 billion per year (Figure 31).²⁸



FIGURE 31 Job demand and supply in selected drought-affected areas in India, 2011–2017



Sources: ESCAP based on data from Prasad, Parijat Shradhey, and others, 2018.

A way forward: opportunities for action.

The *Asia-Pacific Disaster Report 2019* illustrates the immense challenges for South and South-West Asia, but also the range of policy options to strengthen resilience vis-à-vis the new riskscape. Responses at the national, regional and global levels need to be upgraded across three broad areas.

Implement risk-informed policies and investments.

Multiple policies must be deployed depending on local circumstances. It will be important to guarantee risk-informed social protection, education and health services along with more disaster and climate resilient agriculture and infrastructure. The report shows that investments in resilient infrastructure, health and education, all offer an entry point for mitigating disaster-driven increases in poverty and inequality.

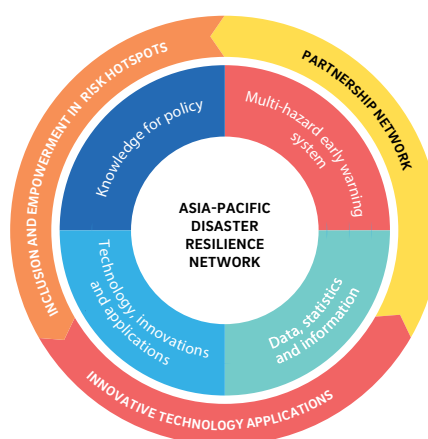
Capitalize on new technologies.

Disaster risk reduction should be grounded in a seamlessly integrated system that comprises big data, digital identity, risk analytics and geospatial data. New technologies can be deployed to overcome some of the critical challenges posed by the geography of South and South-West Asia, for delivering disaster risk reduction, preparedness and response actions, particularly in reaching vulnerable communities.

Unlock the potential of regional cooperation.

South and South-West Asia contains some of the world's most extensive transboundary disaster hotspots. With climate change these are likely to expand still further, creating deep uncertainties. Addressing these will require strategies at the regional and sub-regional levels. Asia-Pacific Disaster Resilience Network (APDRN), with an emphasis on partnerships and innovation, comprises four inter-related streams: (i) *multi-hazard early warning system platform*; (ii) *data, statistics and information management*, which also includes big data from emerging technological platforms and sources; and (iii) *knowledge for policy* (Figure 32).

FIGURE 32 Structure of Asia-Pacific Disaster Resilience Network



Regional multi-hazard early warning systems.

The advances in industry 4.0 technologies enable more effective, risk-informed and end-to-end multi-hazard early warning systems. The benefits can be scaled up through regional cooperation. The longer forecasting and warning lead times enabled through smart technologies go beyond saving lives to ensuring livelihood support. For small farmers in Bangladesh, for example, a flood-warning lead time of one day results in a reduction of losses of up to 33 per cent for fish aquaculture. A lead time of seven days reduces household damage by up to 90 per cent. For the moderate 2007 floods of Bangladesh, a forecasting and early warning system could have reduced damages by an estimated \$208 million. Estimated benefits over a decade of typical flooding would be about \$1,700 million—more than 500 times the cost of a hypothetical forecasting and warning system.²⁹

Tropical Cyclones – In 2018, the Panel on Tropical Cyclones in its 45th session recognized the intensification of tropical cyclones and laid out plans to address their complex risk patterns in South and South-West Asia. With inclusion of new Members, including the Islamic Republic of Iran, the Panel membership increased from 9 to 13.

Tsunamis – The ESCAP and UNESCO-IOC partnership supports effective end-to-end tsunami early warning systems in the Indian Ocean basins.

Floods and droughts – Forecasting transboundary floods and slow-onset disasters, especially droughts remains difficult. Efforts to strengthen regional cooperation for early warning for river basin floods and drought are underway and require scaling up of regional cooperation.

Data, statistics and information.

In support of strengthening big data ecosystems, APDRN has three initiatives.

The Asia-Pacific Disaster Risk Atlas – The atlas is the online data and information platform of ESCAP's regional institute, the Asian and Pacific Centre for the Development of Disaster Information Management (APDIM).³⁰ It serves as a decision support tool for risk-informed infrastructure investment and development policy decisions.

The Disaster-related Statistics Framework – The Disaster-related Statistics Framework (DRSF) covers the core concepts and indicators defined in the Sendai Framework and the SDGs. For risk assessment and post-disaster impact assessments, the DRSF also analyses data on population, society, and economy from censuses and surveys.

Data-and information-driven regional cooperation – Earth observation satellite and surface-based observations are used to capture transboundary impacts and origins of disasters. Sand and dust storms, for example, are frequently transboundary in nature. Risk-informed policy interventions therefore require dialogue and cooperation among the related countries.³¹ APDIM is currently establishing a regional slow-onset hazards network and sand and dust storms alert system. ESCAP has also joined a United Nations Coalition on Combating Sand and Dust Storms to deepen regional cooperation in South and South-West Asia, Central Asia and North and North-East Asia.

Knowledge for policy.

ESCAP has put in place a knowledge and innovation platform and develops its analytical research products to promote risk-informed policies. This, for example, has been produced on a biennial basis and the report findings are discussed at the respective sessions of the Committee on Disaster Risk Reduction. The report also contributes to the High-Level Political Forum for Sustainable Development and its regional preparatory process, the Asia-Pacific Forum on Sustainable Development.

The South and South-West Asia subregion has had considerable experience with reducing disaster risk. But with climate change and expanding disaster hotspots, the region is entering an increasingly uncertain future. Countries in the subregion will need to consider how every aspect of development can face up to disaster risk. All ministries and departments should consider how they can work together in a more integrated way, so that they are able to identify the people in danger of being left behind and empower them to protect themselves and build sustainable and resilient livelihoods.

Endnotes

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The Asia-Pacific region faces a daunting spectrum of natural hazards. Indeed, many countries could be reaching a tipping point beyond which disaster risk, fuelled by climate change, exceeds their capacity to respond.

The *Asia-Pacific Disaster Report 2019* shows how these disasters are closely linked to inequality and poverty, each feeding on the other and leading to a vicious downward cycle. It assesses the scale of losses across the disaster 'risky landscape' and estimates the amounts that countries would need to invest to outpace the growth of disaster risk. It shows the negative effects of disasters on economies in the region and where investments are more likely to make the biggest difference.

While this will require significant additional finance, the report shows the amounts are small compared to the amounts that countries in the region are currently losing due to disasters. The report demonstrates how countries can maximize the impacts of their investments by implementing a comprehensive portfolio of sectoral investments and policies that jointly address poverty, inequality and disaster risk. It showcases examples from the region of innovative pro-poor disaster risk reduction measures and risk-informed social policies that are breaking the links between poverty, inequality and disasters. Similarly, it explores how emerging technologies such as big data and digital identities can be used to ensure the poorest and most vulnerable groups are included in these policy interventions.

The Disaster Risk Landscape across South and South-West Asia: Key Takeaways for Stakeholders, provides analysis from the APDR 2019 with specific reference to the South and South-West Asia subregion and comprehensively presents its sub-regional risk landscape to inform policy actions.

