The Disaster Riskscape across South-East Asia

KEY TAKEAWAYS FOR STAKEHOLDERS

Asia-Pacific Disaster Report 2019

PATHWAYS FOR RESILIENCE, INCLUSION AND EMPOWERMENT

UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

ESCAP APDIM
Asian and Pacific Centre for the Development of Disaster Information Management

Printed in Bangkok
ST/ESCAP/2885

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-East Asia.

Acknowledgements

The *Asia-Pacific Disaster Report* (APDR) is a biennial flagship publication of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). Its 2019 issue was prepared under the leadership and guidance of Armida Salsiah Alisjahbana, Under-Secretary-General of the United Nations and Executive Secretary of ESCAP. Kaveh Zahedi, Deputy Executive Secretary and Tiziana Bonapace, Director, ICT and Disaster Risk Reduction Division (IDD) provided direction and advice. Sanjay Srivastava, Chief, Disaster Risk Reduction Section, IDD led the core drafting team.

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An earlier draft of this publication was presented at a side event held on the margins of the 3rd South-East Asia Forum on Implementation of the Sustainable Development Goals, which was held in Bangkok, Thailand from 3 to 4 October 2019. Invaluable feedback from the participants was incorporated when finalizing this publication.

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Recommended citation

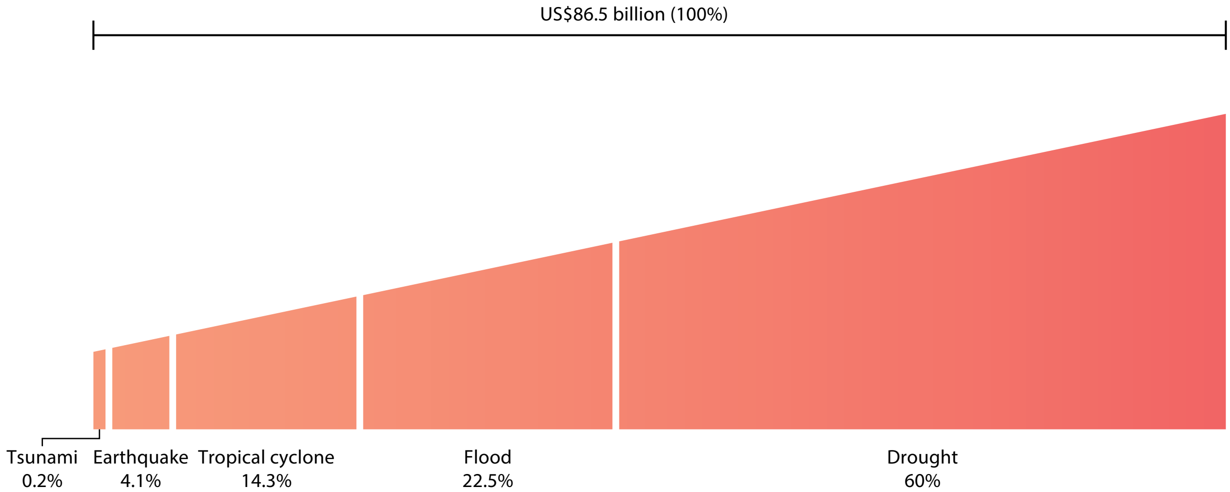
United Nations, Economic and Social Commission for Asia and the Pacific (ESCAP) (2020). *The Disaster Riskscape across South-East Asia: Key Takeaways for Stakeholders.* ST/ESCAP/2885.

Annual economic losses due to disasters in South-East Asia[1] are more than four times higher than previously estimated, at $86.5 billion.

The *Asia-Pacific Disaster Report 2019* (APDR) captured the complexity of disaster risk in the region for the first time, incorporating extensive risk, indirect losses and slow-onset disasters.[2] This report zooms into the analytical research findings of the APDR with specific reference to the South-East Asia region and comprehensively presents its sub-regional riskscape to inform policy actions. It reveals that the Average Annual Losses (AAL) are more than four times higher than the previous estimate given in the 2017 edition of the *Asia-Pacific Disaster Report 2019*,[3] reaching $86.5 billion.

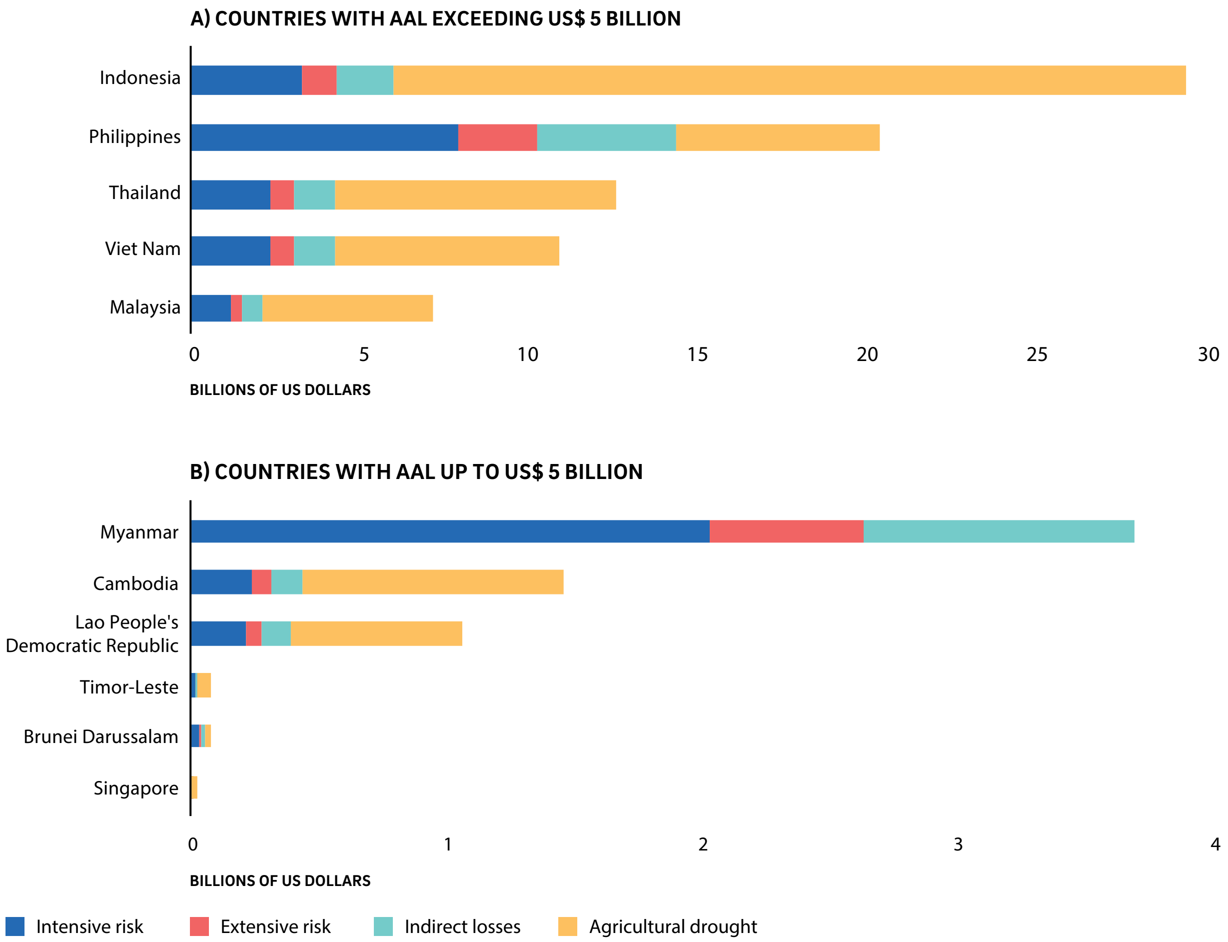
As Figure 1 demonstrates, much of this increase is due to agricultural drought losses which, at $51 billion, contribute to 60 per cent of the total AAL. The dominance of agricultural drought is consistent across all countries for which data is available (Figure 2). The agricultural losses are highest in Indonesia which, at $23.3 billion, constitute 80 per cent of the AAL. No South-East Asian country can afford to ignore agricultural drought when mitigating the economic impacts of disasters.

FIGURE 1 South-East Asia riskscape: Volumetric representation of Average Annual Losses per hazard



Source: ESCAP, based on probabilistic risk assessment.
Note: Volumetric analysis is a measurement by volume (impacted population, geographical area and economic losses).

FIGURE 2 Composition of Average Annual Loss for South-East Asian countries, billions of US dollars



Source: ESCAP, based on probabilistic risk assessment.
Note 1: Countries are shown on two separate graphs so that different scales can be used.
Note 2: Agricultural AAL data is not available for Myanmar which explains why it does not follow the pattern across the other countries.

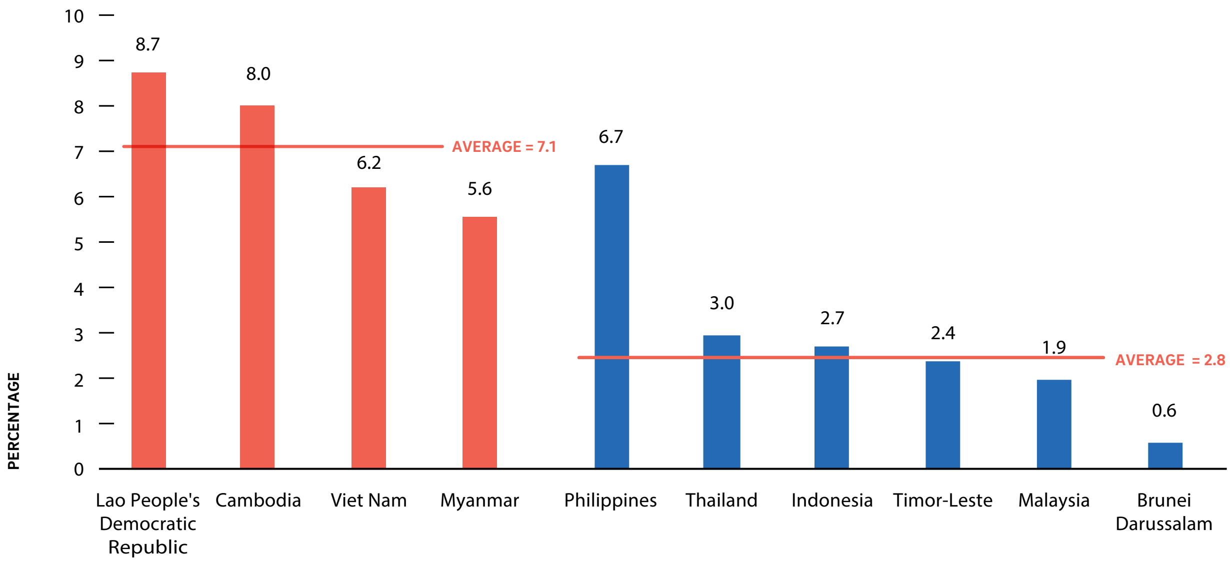
For every type of disaster risk, AAL constitutes a higher percentage of Gross Domestic Product (GDP) within South-East Asia, than does the same type of risk for the Asia-Pacific region as a whole.

SOURCE OF RISK	AAL AS PROPORTION OF GDP, FOR SOUTH-EAST ASIA	AAL AS PROPORTION OF GDP, FOR THE ASIA-PACIFIC REGION
Intensive risk	0.7%	0.5%
Extensive risk	0.2%	0.1%
Indirect losses	0.4%	0.3%
Agricultural drought	1.8%	1.4%
Total	3.1%	2.4%

Source: ESCAP, based on probabilistic risk assessment and ESCAP, 2019.
Note: Average for Asia-Pacific region refers to the total regional AAL divided by the total regional GDP. Average for South-East Asia refers to the total sub-regional AAL divided by the total sub-regional GDP.

Figure 3 displays the AAL as a percentage of GDP for individual South-East Asian countries. The results reveal significant variation between countries. The AAL as a percentage of GDP is highest in the Lao People's Democratic Republic, at 8.7 per cent, and in Cambodia, at 8 per cent. Overall, Cambodia, the Lao People's Democratic Republic, Myanmar and Viet Nam have an average AAL of 7.1 per cent compared to 2.8 per cent for the other countries in South-East Asia.

FIGURE 3 Average Annual Loss as percentage of Gross Domestic Product, by country



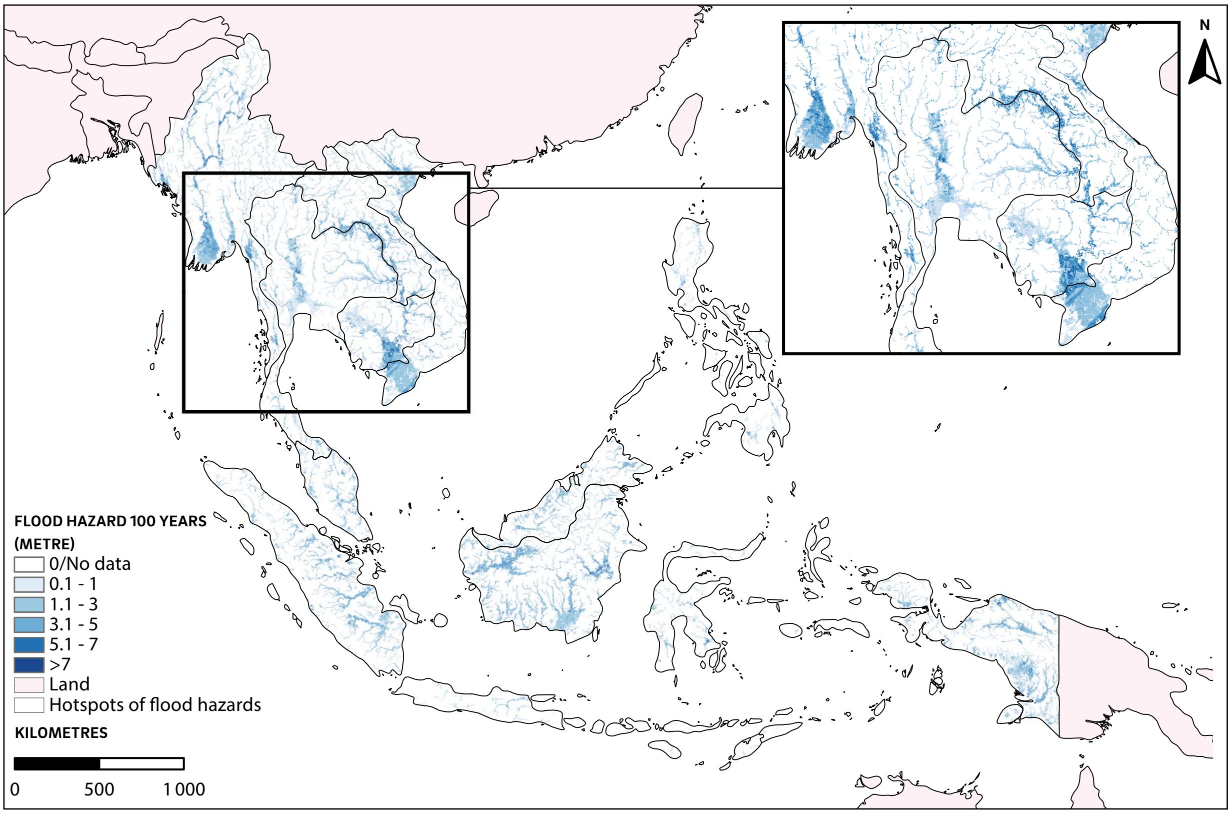
Source: ESCAP, based on probabilistic risk assessment.
Note: Singapore is not displayed as its value is below 0.5 per cent.

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

Exposure to climate-related and seismic hazards varies across South-East Asia.

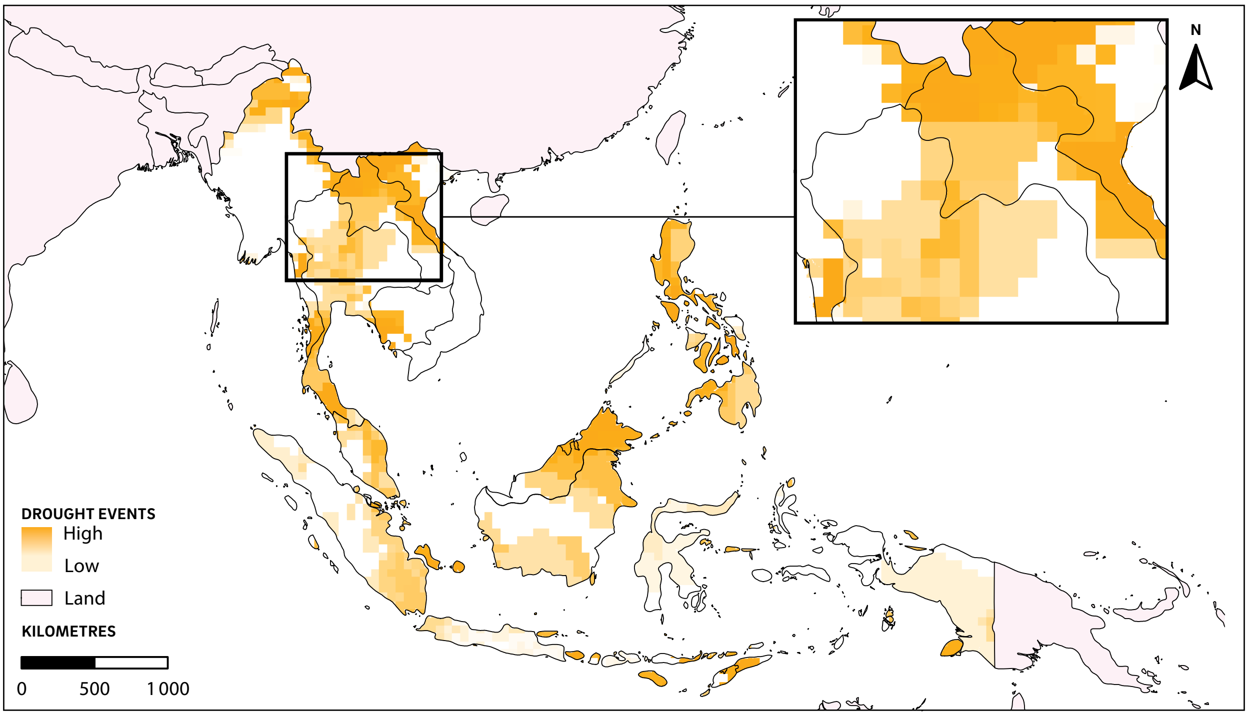
South-East Asian countries are exposed to a variety of climate-related hazards, including floods, storms, tropical cyclones, droughts and extreme temperatures. Figure 4 and Figure 5 reveal that many areas have high flood and drought hazards, particularly in transboundary river basins such as the Lower Mekong River Basin. Across South-East Asia, over 152 million people (24 per cent of the population) are living within areas experiencing flood events, and over 389 million people (62 per cent of the population) are living within areas that experience drought events.[4]

FIGURE 4 Flood hazard in South-East Asia



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

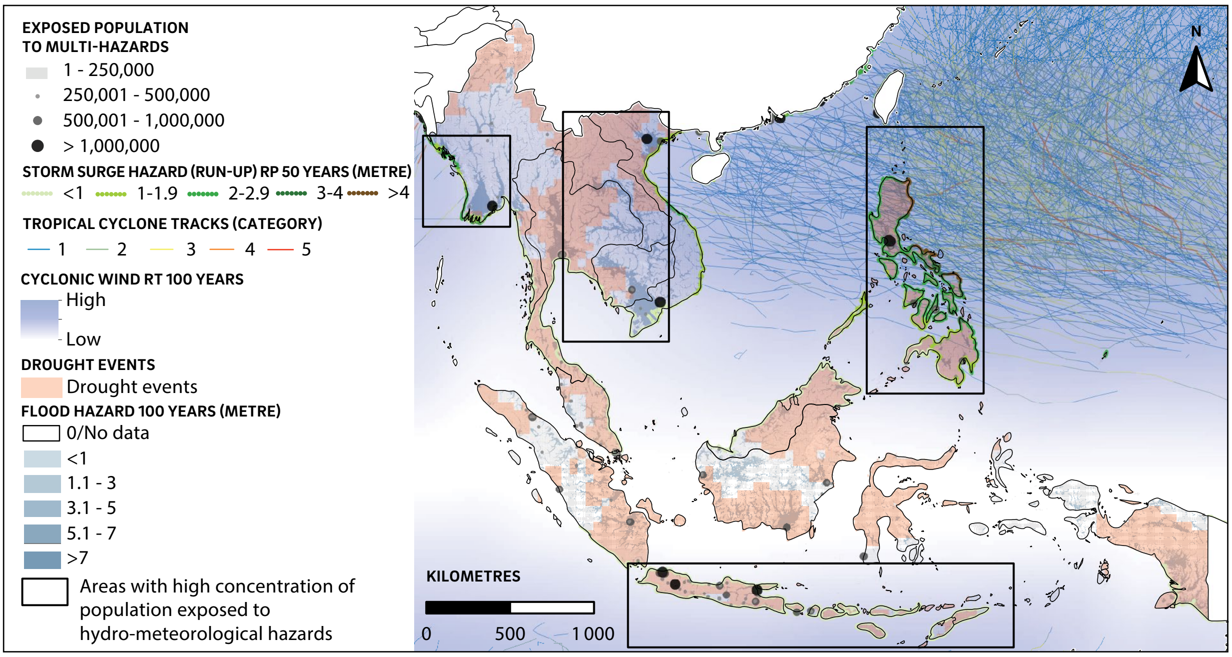
FIGURE 5 Drought hazard in South-East Asia



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.
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 climate-related hazards converge in densely populated areas, to create high population exposure. Figure 6 shows how this varies across South-East Asia, revealing four areas of high multi-hazard exposure within Myanmar, the Lower Mekong River Basin, the Philippines and Java, Indonesia.

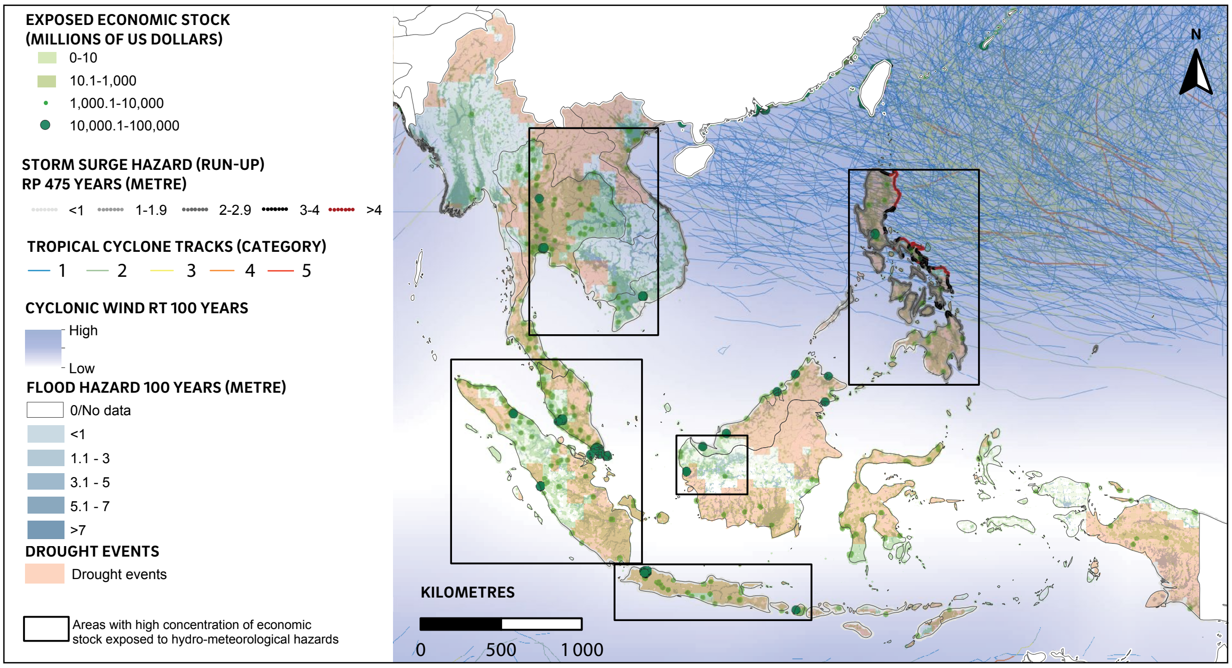
FIGURE 6 Concentration of population exposed to climate-related hazards in South-East Asia



Sources: ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015; Global Risk Data Platform, 2013.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.
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.

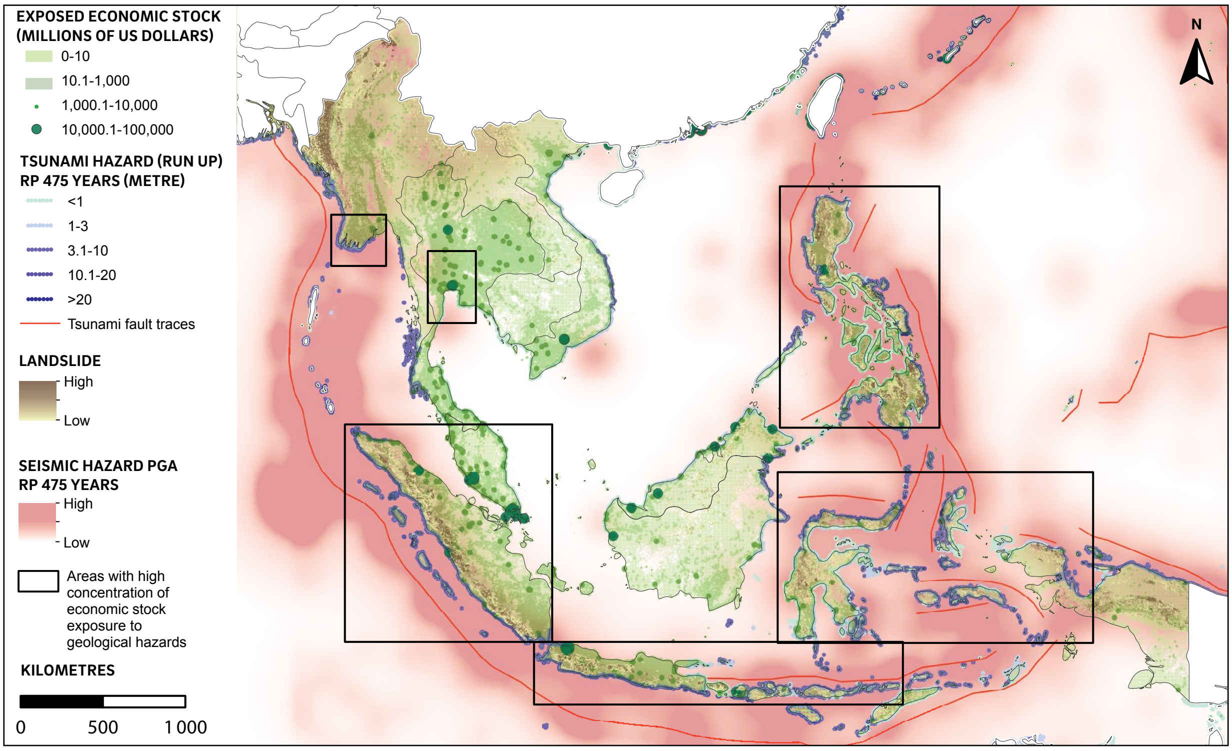
The exposure of economic stock to climate-related and seismic hazards also varies significantly across the subregion, as shown in Figure 7 and Figure 8. Comparing the two figures reveals areas with high exposure to both hazard types throughout the Philippines and Singapore, as well as in parts of Indonesia, Malaysia, and Thailand.

FIGURE 7 Exposure of economic stock to climate-related hazards



Sources: ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015; Global Risk Data Platform, 2013.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.
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 Exposure of economic stock to seismic hazards



Sources: ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015; Global Landslide Hazard Distribution v1, 2000.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.
Note 1: Peak Ground Acceleration (PGA) Return Period (RP) 475 years is the seismic hazard with a return period of 475 years expressed in peak ground acceleration. This means that a level of ground shaking is expected to occur once in 475 years. Tsunami hazard RP 475 years is a tsunami hazard run-up height with a return period of 475 years.
Note 2: The value of PGA 475 years used in this quantification is from 90 to 334 cm/s².

Multi-hazard exposure of the population, economic stock and infrastructure is projected to increase under the new climate reality.

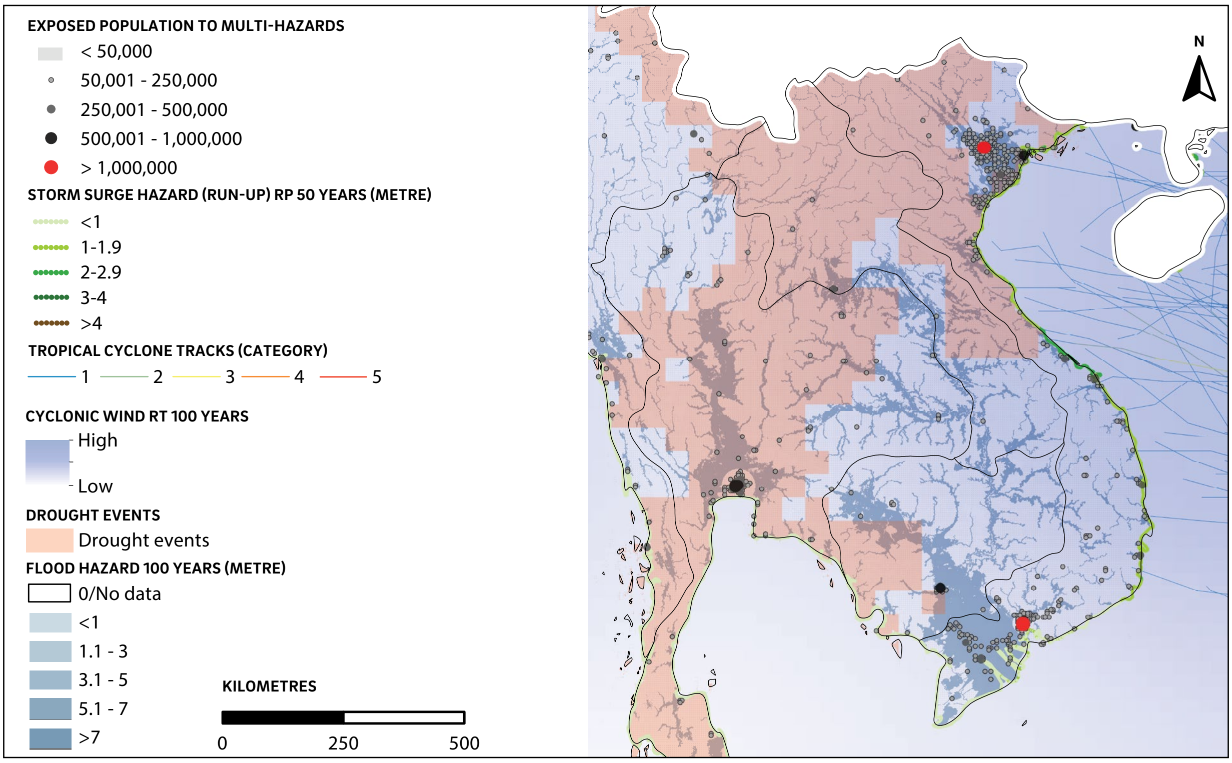
Exposure to floods, droughts, storm surges, tropical cyclones and extreme temperatures is projected to increase as climate change is causing extreme temperatures and variability in rainfall across South-East Asia. The projections are already beginning to manifest themselves. Global warming was found to increase the likelihood of the record-breaking surface air temperatures in South-East Asia, in April 2016, by 29 per cent.[5] The long-term global warming trend is also likely to have contributed to the warmer than usual temperature conditions during the first half of 2019. This resulted in a 30 per cent higher number of forest fire hotspots as compared to the same period in 2018, which included clusters in northern Cambodia, the Lao People's Democratic Republic, and eastern Myanmar.[6] The increasingly frequent and intense heatwaves and haze resulting from forest fires are causing dire public health consequences.[7]

South-East Asia contains transboundary disaster risk hotspots, where climate change and environmental degradation converge with critical socio-economic vulnerabilities.

APDR 2019 identified four transboundary disaster risk hotspots where fragile environments are converging with critical socioeconomic vulnerabilities. Two of these are within South-East Asia.

Within the transboundary Mekong river basin, poverty, hunger and under-nourishment are coupled with exposure to intensifying floods, that alternate with prolonged droughts. Figure 9 shows the population exposure to climate-related hazards across this hotspot. Currently, 48 per cent of the population, which is over 31 million people, and 42 per cent of economic stock are exposed to flood hazards.[8] Within this hotspot, projected climate changes will interact with increasing environmental fragility due to a rise in the sea level, saline intrusion, loss in biodiversity, reduced soil fertility and crop productivity.[9] This is projected to exacerbate exposure to a range of rapid and slow-onset hazards and environmental issues, including droughts, floods, water scarcity, and land degradation.

FIGURE 9 **Concentration of population exposed to climate-related hazards in Lower Mekong River Basin**



Sources: ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015; Global Risk Data Platform, 2013.
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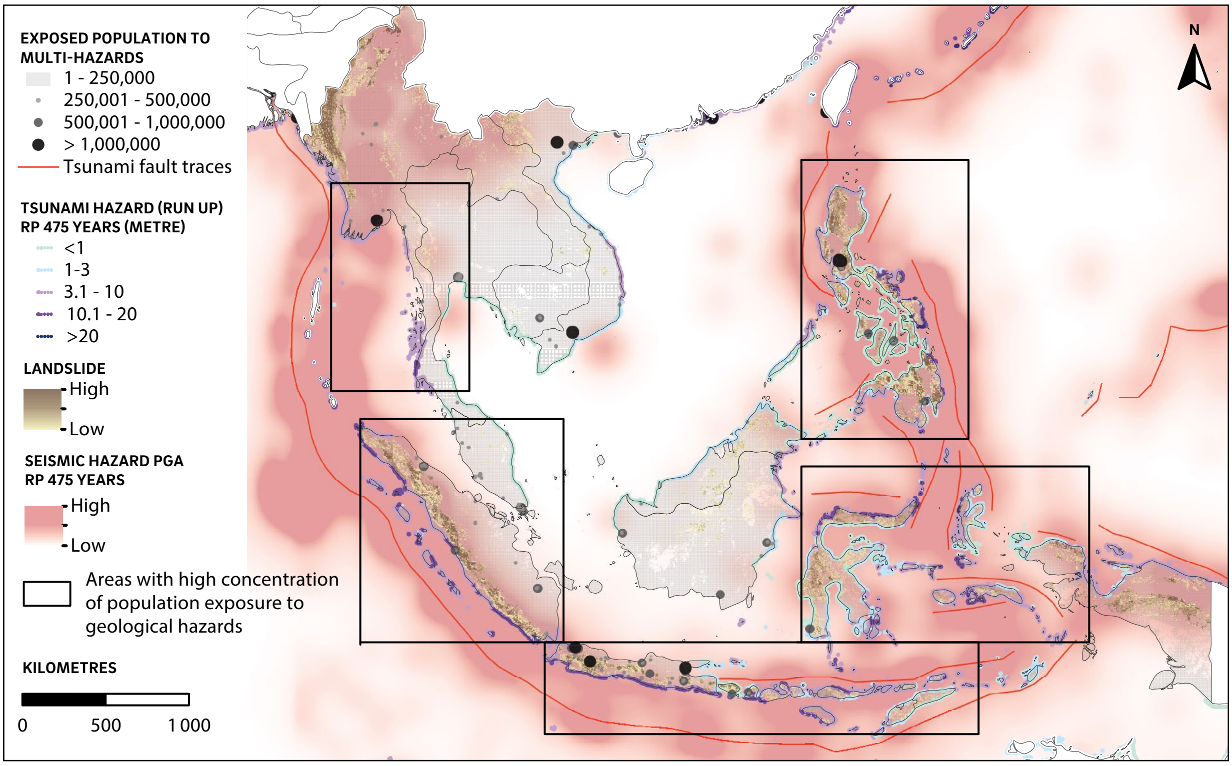
Note 1: Cyclone data consist of all cyclone wind categories with a return period of 100 years and an intensity of 119 km/h to more than 252 km/h.
Note 2: Flood data consist of all categories of flood hazard height with a return period 100 years.

Around the Pacific Ring of Fire, transport and ICT infrastructure and poor populations are exposed to seismic hazards and typhoons of increasing severity. Figure 10 shows the population exposure to seismic hazards including earthquakes, tsunamis and landslides across the hotspot. Within South-East Asia, 54 per cent of the population (334 million people), and 37 per cent of economic stock are exposed to earthquakes. There is also a high exposure of infrastructure; 43 per cent of power plants, 43 per cent of airports, 40 per cent of ICT infrastructure, and 18 per cent of roads are exposed to earthquakes.[10]

Disasters in 2018 reveal the need to step up disaster risk reduction (DRR) to cope with new extremes and uncertainty.

The new climate reality is creating deep uncertainty as hazards deviate from their usual tracks. More complex disasters are also being experienced. This was evident throughout 2018, as disasters affected over 13 million people, and killed 6,681 people across South-East Asia.[11] This included four out of the ten deadliest events in the world, for that year. Two devastating events occurred within the identified transboundary hotspots, further reinforcing the urgent need to step up disaster risk reduction in these areas. Overall, the evidence presented so far makes a compelling case that the riskscape in South-East Asia is changing. The economic losses are higher than previously thought, the population exposure to multi-hazard risk is increasing, and risks are becoming more complex.

FIGURE 10 Concentration of population exposed to seismic risks



Sources: ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015; Global Landslide Hazard Distribution v1, 2000.
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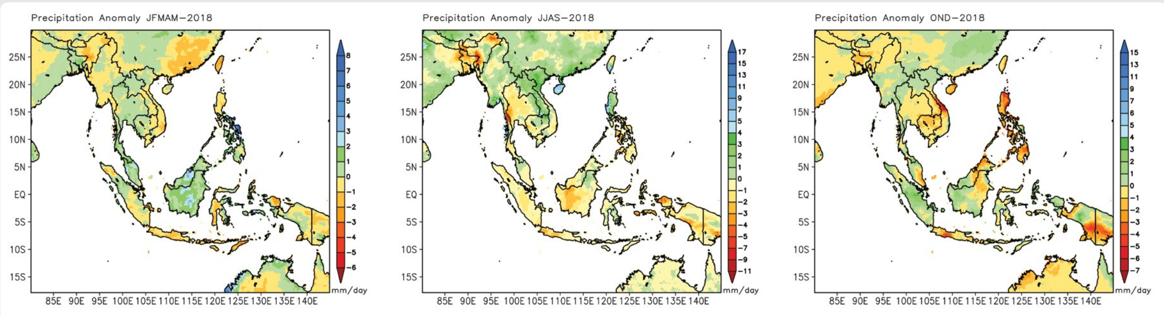
Note 2: The value of PGA 475 years used in this quantification is from 90 to 334 cm/s².

BOX 1 Recent disasters in South-East Asia

Ongoing drought

Many parts of South-East Asia have been experiencing a series of persistent droughts that have continued, from July 2018 until the time of writing (October 2019), due to weather anomalies such as below average rainfall (see below) and delayed monsoon onsets.[a] The impacts were felt across South-East Asia by the end of 2018, with water shortages in 11 provinces across Indonesia,[b] and shrinking water reservoirs in the northern region of Thailand.[c] In the first half of 2019, the impacts were exacerbated by the prevalence of the El Niño.[d] This led to a decline in the levels of major water bodies such as the Mekong River in March,[e] and in the Angat Dam, the main source of domestic water for Manila, where the hydroelectric dam reached a critically low level in early July.[f] The drought also disrupted harvests across Cambodia, prompting the Government to advise farmers, in March 2019, to refrain from planting rice crops.[g] The effects of the drought also prompted Governments to mobilize post-disaster relief mechanisms such as providing emergency food supply to the residents of the Battambang province in Cambodia,[h] and distributing aid in Thailand due to crop failure.[i]

Rainfall deficits over South-East Asia in 2018



Source: Rainfall data downloaded from Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS). Available at: https://www.chc.ucsb.edu/data.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Flash floods in the Lao People's Democratic Republic

Due to heavy rains and tropical storms, throughout July to October 2018, 55 districts were affected in the Lao People's Democratic Republic. The impacts were magnified by an unprecedented breach of the Xe Pien-Xe Nam Noy hydropower saddle dam, which inundated 55,000 hectares of land, killing 136 people and affecting 13,100 people,[j] and causing damages and losses estimated at US$ 35 million.[k] Further effects were reported in the Stung Treng Province in northern Cambodia, where over 5,600 people were evacuated,[l] and 21,400 schools and 4,100 health facilities were impacted.[m] This disaster highlighted the need to re-evaluate the resilience of critical infrastructure to worsening climate extremes.

Seismic disasters in Indonesia

A string of seismic disasters resulted in the deaths of 5,510 people.[n] This included two unprecedented events, the devastating impacts of which were due to a convergence of factors. The Sulawesi tsunami in September resulted from a strike-slip quake that typically does not generate a large tsunami; however, the narrow and deep topography amplified the waves leading to the city of Palu. The impact was also magnified by soil liquefaction, and the lead time was only 30 minutes as this was a near field tsunami. Similarly, the Sunda Strait tsunami, in December, was triggered by a volcanic eruption and submarine landslides that were not captured by early warning systems configured solely for seismic origins.

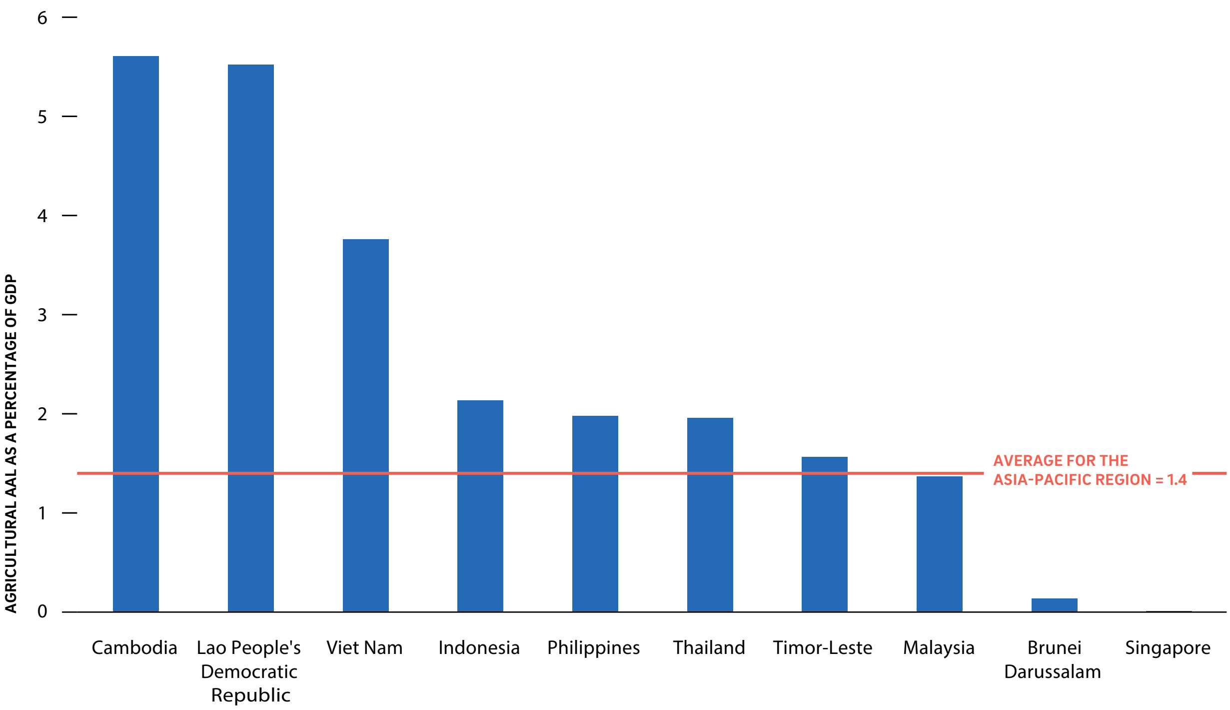
a Masayuki Yoda (2019).
b theSun Daily (2018).
c Apinya Wipatayotin (2018).
d ReliefWeb (2019c).
e ReliefWeb (2019b).
f Business World (2019).
g Husain Haider (2019).
h ReliefWeb (2019a).
i National News Bureau of Thailand (2019).
j Guha-Sapir (2019).
k Government of the Lao People's Democratic Republic (2018).
l OCHA (2018).
m ReliefWeb (2018).
n Guha-Sapir (2019).

Governments must address agricultural drought, which is resulting in large economic losses and low levels of socio-economic development.

The economic impacts of agricultural drought are higher within South-East Asian countries than across the Asia-Pacific region.

Figure 11 demonstrates that agricultural drought represents a higher proportion of GDP within seven South-East Asian countries than the average for the Asia-Pacific region. As climate change exacerbates the intensity and frequency of agricultural drought, countries can therefore expect significant economic impacts.

FIGURE 11 Agricultural Average Annual Loss as percentage of Gross Domestic Product for South-East Asian countries



Sources: ESCAP, based on probabilistic risk assessment; GDP data from ESCAP statistical database.
Note: Agricultural AAL data is not available for Myanmar. Average for Asia-Pacific region refers to the total regional agricultural AAL divided by the total regional GDP.

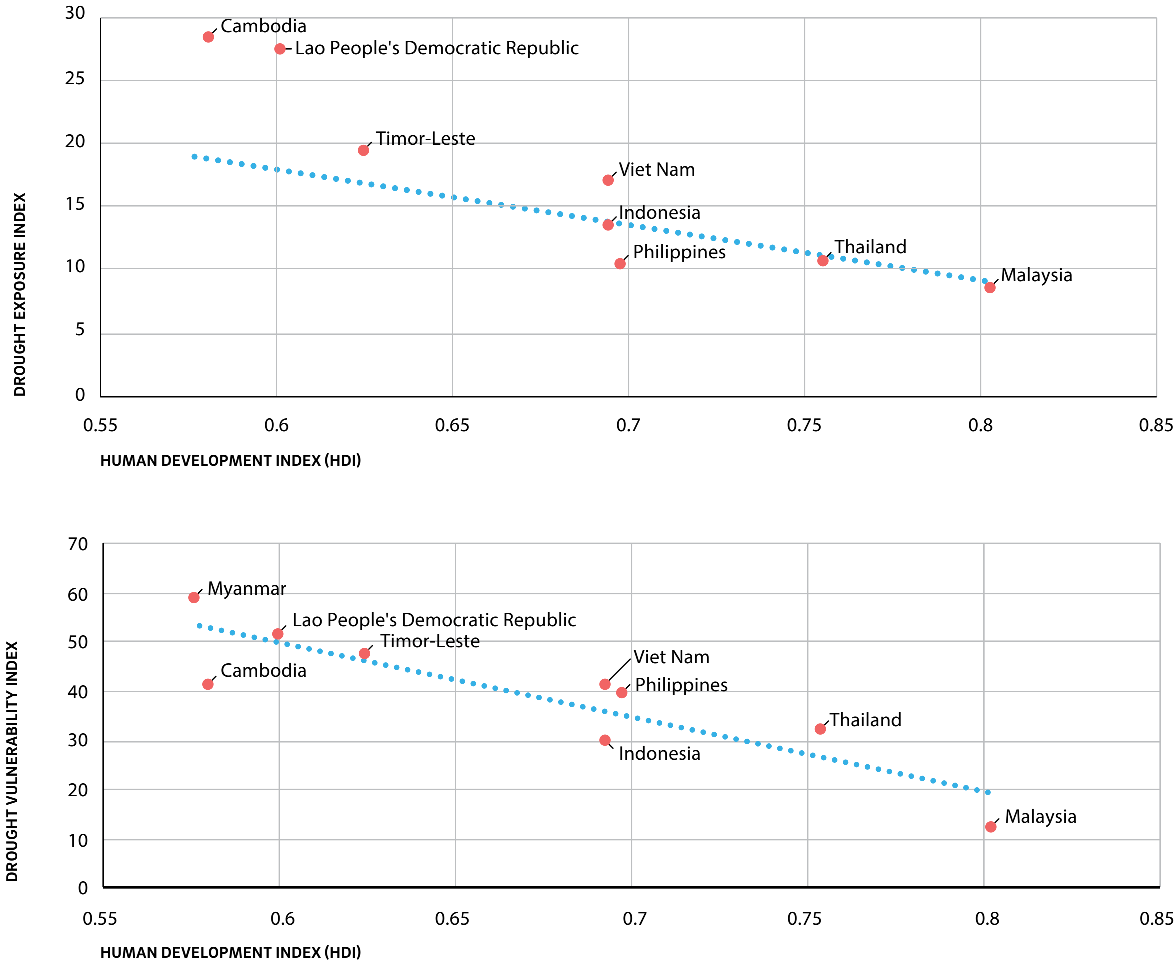
South-East Asian countries with high exposure and vulnerability to agricultural drought, also have low human development index scores.

Economic impacts will translate into significant human impacts. Across the subregion, 104 million people, or 34 per cent of the employed population, rely on agricultural livelihoods. Within specific countries, this is even higher at 72 per cent, 55 per cent and 52 per cent in the Lao People's Democratic Republic, Cambodia and Myanmar, respectively.[12] This is reflected in a high correlation between drought exposure and drought vulnerability with levels of socio-economic development, as shown in Figure 12. Countries at the highest risk are those with high exposure and vulnerability to drought and have a low human development index, such as Cambodia, the Lao People's Democratic Republic, and Timor-Leste.

Land degradation due to human activities threaten to exacerbate agricultural drought, particularly within parts of Cambodia, Indonesia, Myanmar, and Viet Nam.

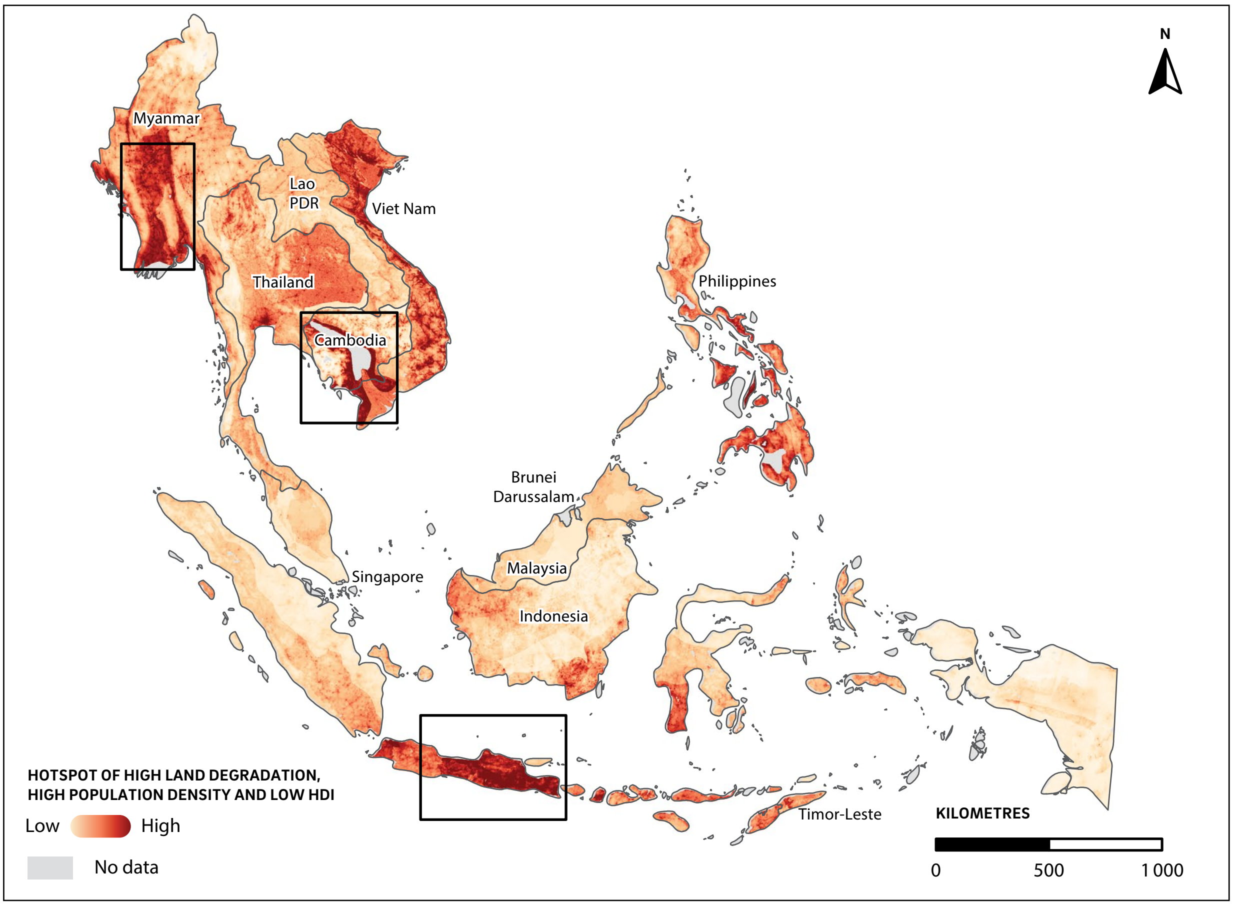
The risk of agricultural drought may be exacerbated not only by the new climate reality but also by land degradation, whereby human activities are driving soil erosion, deforestation and depletion of water resources. Furthermore, Figure 13 demonstrates that land degradation is occurring mostly in areas with low levels of socio-economic development, and high population density. The risk is high throughout much of the subregion, particularly within parts of Cambodia, Indonesia, Myanmar, and Viet Nam.

FIGURE 12 **Influence of drought exposure and vulnerability on human development index**



Sources: ESCAP, based on HDI data from UNDP and probabilistic risk assessment.
Note: Drought exposure is measured by proxy of the ratio of agricultural GDP to total GDP. Drought vulnerability index is measured by combining: Rural population as a percentage of the total population, rural poverty head count ratio at national poverty lines, and percentage of total employment in agriculture.

FIGURE 13 Hotspots of low HDI and land degradation in South-East Asia



Sources: Calculations by ESCAP based on (1) sub-national HDI data from UNDP, (2) Population statistics from WorldPop, (3) and land degradation data from the Global Assessment of human-induced soil degradation (UNEP).
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

South-East Asian countries with high levels of disaster risk and high economic losses due to disaster also have high inequalities of income and opportunity.

Disasters exacerbate inequalities of income and opportunity, thereby leaving marginalized people more vulnerable to future disasters. This transmits poverty over generations and threatens long term development gains.

Large proportions of the population are living in areas with high multi-hazard exposure, especially the poorest 20 per cent, with the least capacity to cope with disasters.

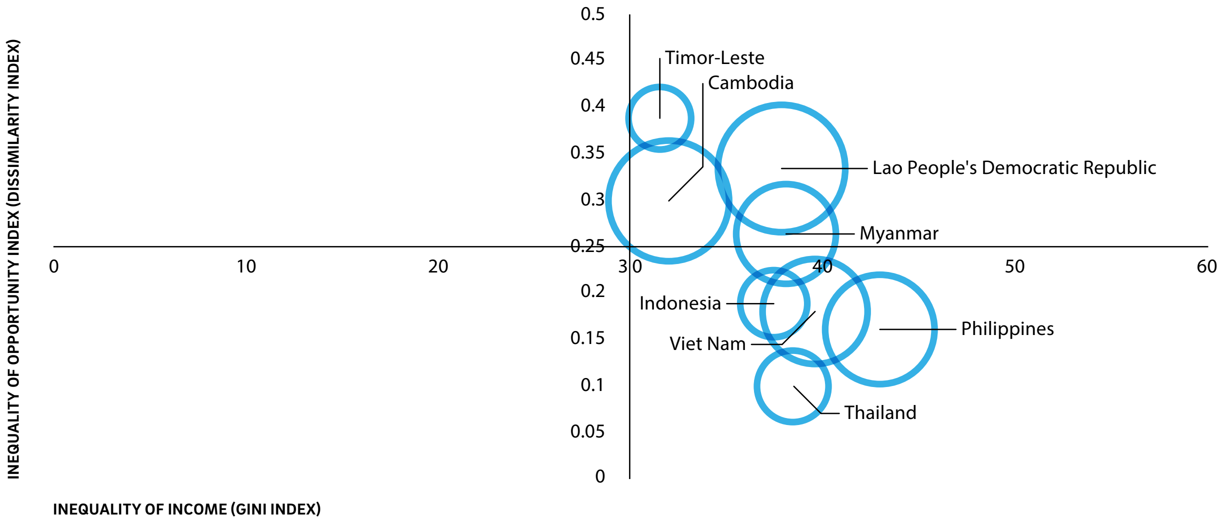
Across six countries for which Demographic Health Survey information is available, an average of 62 per cent of the population live in high multi-hazard risk areas. This is highest in Viet Nam and the Philippines, at 76 per cent, but even the lowest result of 51 per cent in Myanmar, is still high.[13] Moreover, this distribution is not even across different income groups within each country. On average, the wealthiest 20 per cent of the population are almost 49 per cent less likely to reside in high multi-hazard risk areas than the poorest 20 per cent. This disparity is most pronounced within Myanmar, where the wealthiest individuals are 73 per cent less likely to be living in areas of high multi-hazard risk, as compared to the poorest individuals. The lowest disparity is found within Timor-Leste, although this is still at 35 per cent.[14]

Furthermore, analysis of disasters within South-East Asia during the past decade reveals that significant economic losses and damages are sustained by the social sectors such as education, health, housing, social protection, water and sanitation, and productive sectors such as agriculture, livestock and fisheries, and tourism. Post-Disaster Needs Assessments, that are available for just 11 major disasters during the past 10 years, have recorded $5.4 billion losses to the social sectors, and $6.8 billion losses to the productive sectors. Ultimately this will perpetuate inequalities of opportunity that will continue to disempower at-risk people and communities over generations.[15]

Poverty, inequality and disaster risk are reinforcing each other, threatening to keep 13 million people in extreme poverty by 2030.

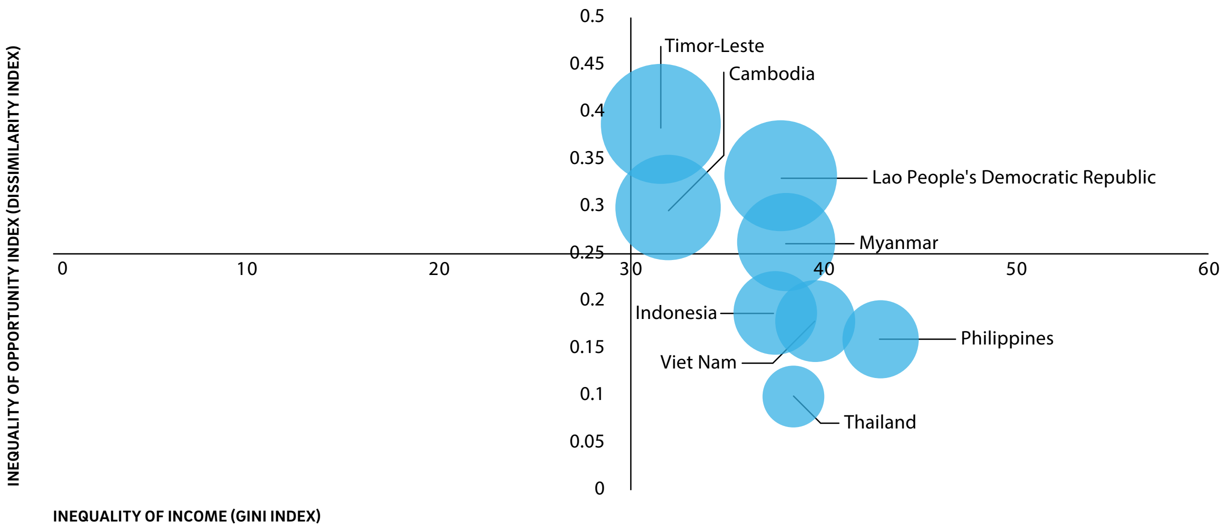
Figure 14 and Figure 15 demonstrate how income inequality and inequality of opportunity vary with levels of disaster risk and disaster losses. Inequality of opportunity refers to differences in “access to key dimensions necessary for meeting aspirations regarding quality of life”, as measured by the D-index.[16] The figures demonstrate that all South-East Asian countries with a high disaster risk index and high economic losses have either high income inequality, high inequality of opportunity, or both.

FIGURE 14 Overlaps of inequalities of income and opportunities with disaster risk for select countries



Source: ESCAP calculations for GINI and Average Annual Loss. ESCAP calculations for Dissimilarity Index (D-Index) from ESCAP (2018a), "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, captured by Inform risk index.

FIGURE 15 Overlap of inequalities of income and opportunities with disaster losses for select countries



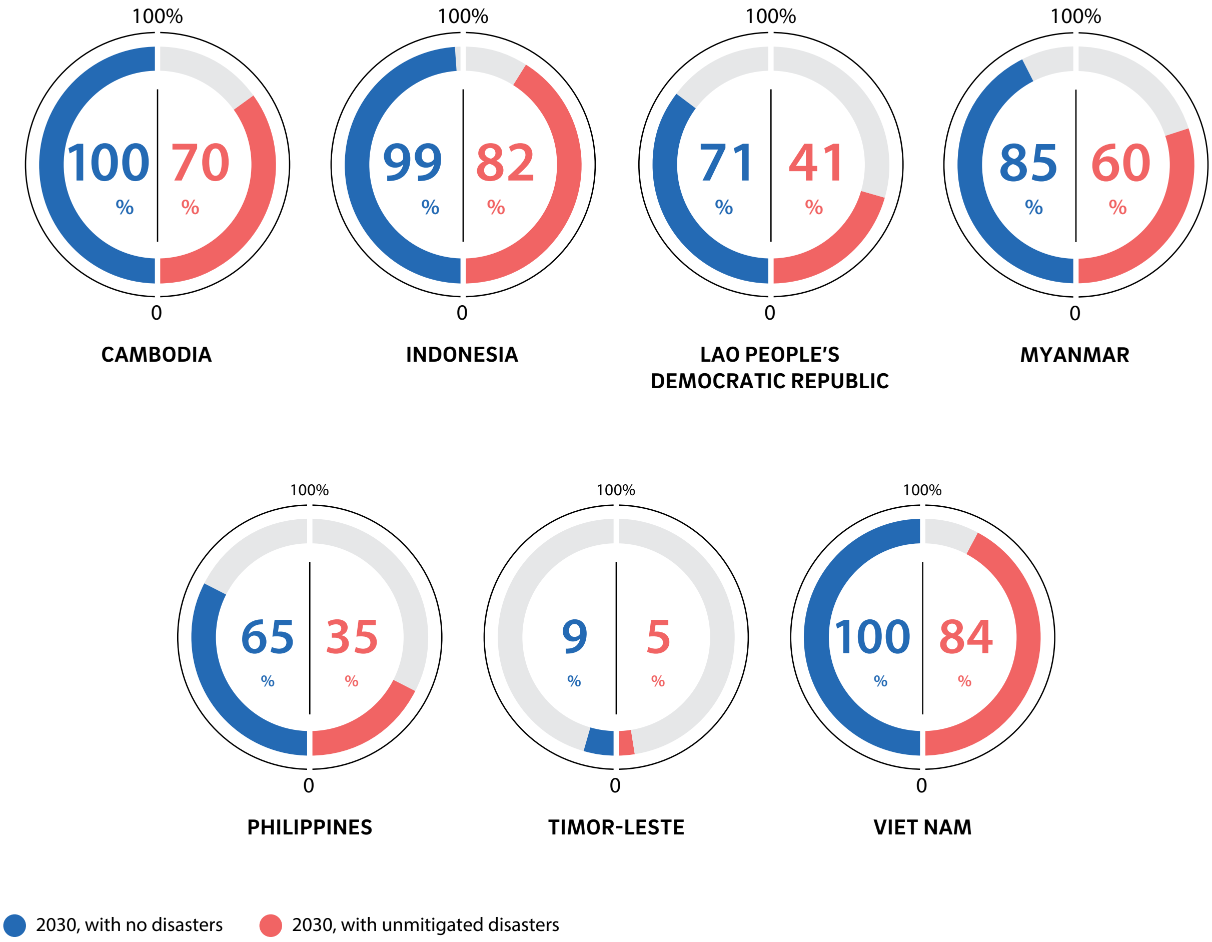
Source: ESCAP data based on DHS surveys, ESCAP calculations for GINI, Inform Index, 2019, Average Annual Loss (ESCAP figures).
Note: The size of the bubble indicates AAL as a percentage of GDP.

Computable general equilibrium modelling (CGE) is used to show how this could manifest in higher poverty rates. Modelling was conducted for nine countries which account for 99 per cent of South-East Asia's population. Within every country, economic growth is projected to deliver reductions in extreme poverty ($1.90 a day), that do not hold when disaster risk is incorporated into the model.

Figure 16 shows the reduction in the proportion of the population living in extreme poverty in 2030, as compared to 2016, when disaster risk is and is not included in the model. For every country, the reduction in poverty is greater when disaster risk is not included.

Translating the percentages into population numbers reveals that in 2016, 30 million people were living in extreme poverty. Economic growth is projected to reduce this number to 5 million people, by 2030. However, with disaster risk, 13 million people are projected to be living in extreme poverty in 2030. For example, within Myanmar, the number of people living in extreme poverty was 1.3 million in 2016, and with economic growth this is projected to fall to 470,000 people, by 2030. However, with unmitigated disaster risk, the number doubles to 940,000 people.

FIGURE 16 Percentage reduction in extreme poverty rates in 2030 with and without disasters in selected countries (Baseline poverty rate=2016)



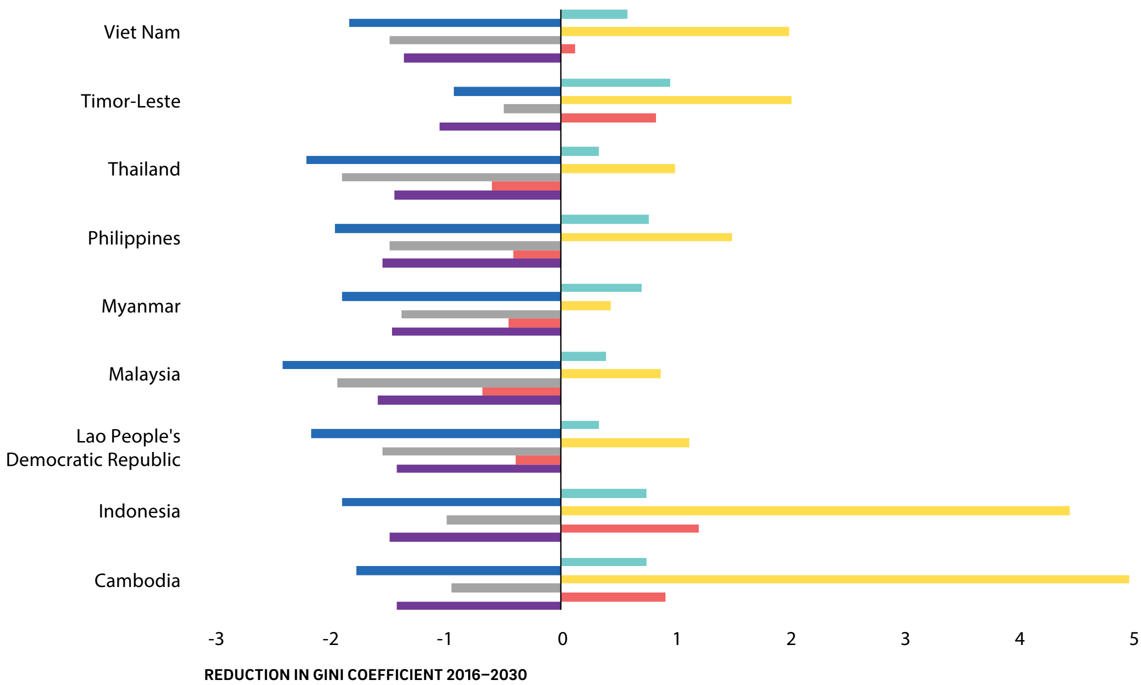
Source: ESCAP calculations based on CGE model.
Note: Results are not displayed for Malaysia and Thailand, as the poverty rate is 0 for 2016, and in 2030 regardless of whether disaster risk is included in the model.

South-East Asian Governments can lift seven million people out of extreme poverty by increasing social sector investments.

Increasing investments in social sectors and infrastructure can prevent disasters from undermining reductions in poverty and inequality.

Further CGE analysis quantifies how links between poverty, inequality and disasters could be broken by increasing investments in education, health, social protection and infrastructure to reach global average expenditure as a percentage of GDP. The methodology is outlined in Annex 3 of APDR 2019. Figure 17 shows how investments can prevent disasters from undermining reductions in the Gini coefficient.

FIGURE 17 Impact of investments on inequality, 2016–2030

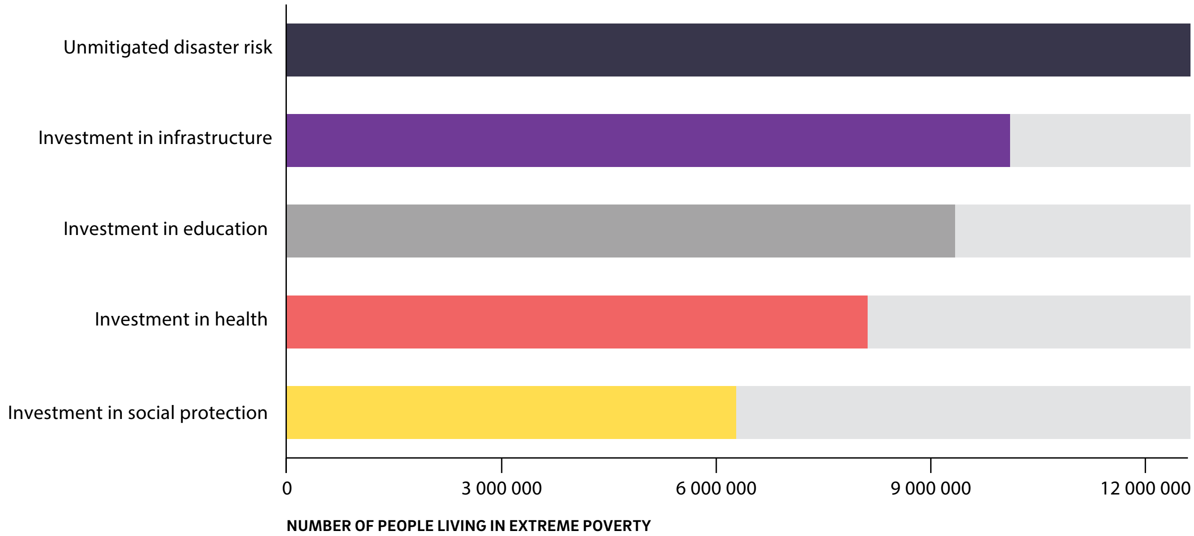


- 1. Growth
- 2. Growth + disaster risk
- 3. Growth + disaster risk + investment in social protection
- 4. Growth + disaster risk + investment in education
- 5. Growth + disaster risk + investment in health
- 6. Growth + disaster risk + investment in infrastructure

Source: ESCAP calculations based on CGE model simulation.
Note 1: A positive value corresponds to a reduction in the Gini coefficient and therefore a reduction in inequality, whereas the inverse is true for negative values.
Note 2: Data was not available for Singapore and Brunei Darussalam.

Figure 18 shows that investments in infrastructure, education, health and social protection are expected to reduce the numbers living in extreme poverty in 2030, from 13 million people, to 10 million people, 9 million people, 8 million people and 6 million people, respectively. The best results are for social protection, which could lift 7 million people out of extreme poverty.

FIGURE 18 Projected number of people living in extreme poverty in South-East Asian countries in 2030, with disaster risk



Source: ESCAP calculations based on CGE model simulation.

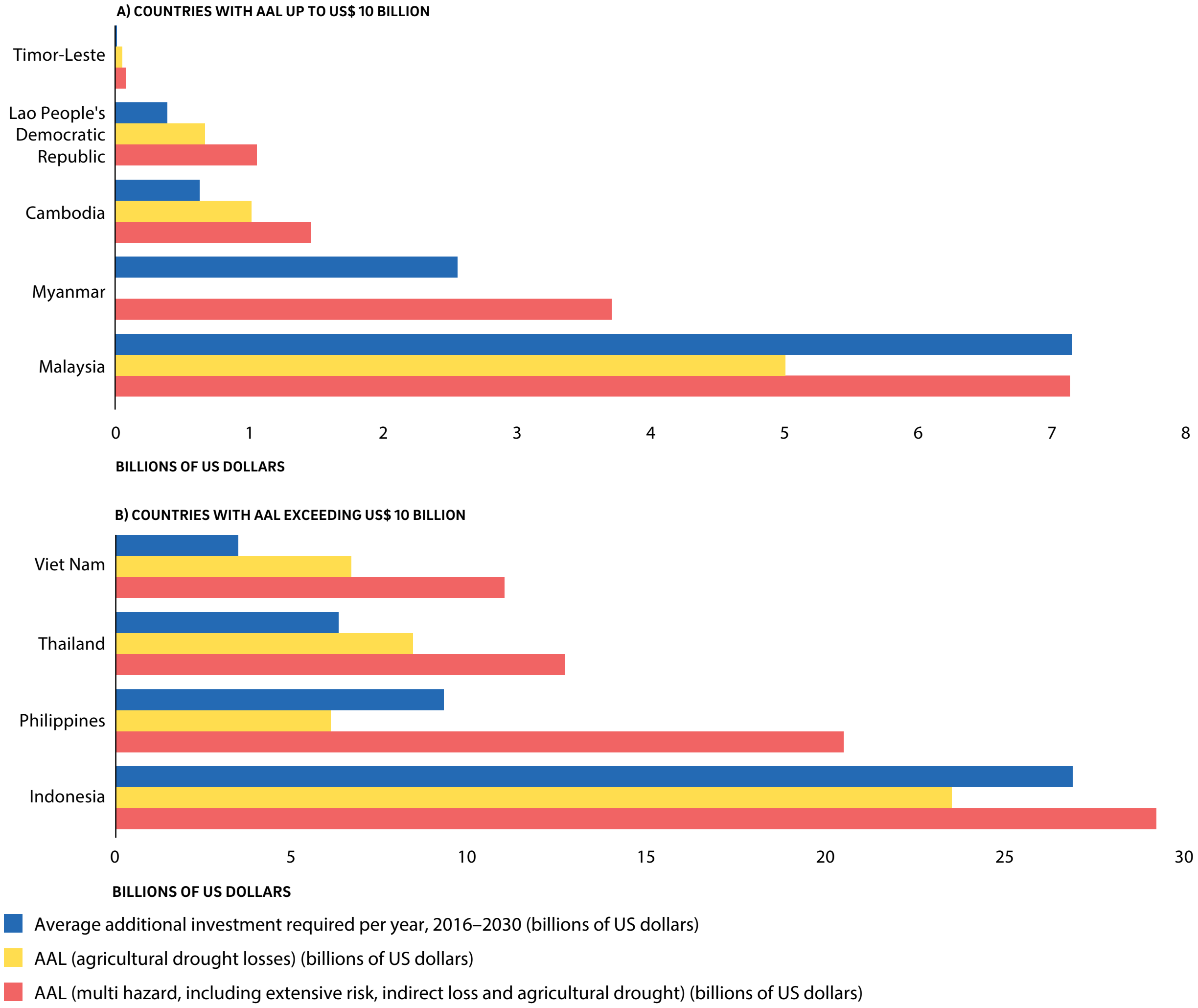
Sectoral investments have the most poverty reduction potential in specific countries, such as the Philippines.

The CGE results reveal a consistent pattern across the entire subregion, although there are specific countries in which sectoral investments could lift the most people out of extreme poverty. For example, within the Philippines, 8.1 million people were living in extreme poverty in 2016. With economic growth, this is projected to fall to 3.5 million people, by 2030. However, when disaster risk is incorporated, this number almost doubles to 6.3 million people. Investments in any sector are projected to bring the number back down, but the most impressive results are for social protection, for which the number falls to 2.2 million people. Investing in social protection in the Philippines, is therefore projected to lift 4.1 million people out of extreme poverty, compared to a scenario with unmitigated disaster risk.[17]

The additional investments required will cost less than disaster losses in most South-East Asian countries.

Increasing investments will require significant additional finance. Whilst this is a daunting challenge, Figure 19 demonstrates that the additional amounts are small compared to damage and losses due to disasters. The additional investments required per year are lower than AAL in eight countries, and even lower than 50 per cent of AAL in six countries. Moreover, the additional investments are less than the damage and losses sustained in major disasters. For example, in Thailand, the average additional investment required throughout 2016 to 2030 is $6 billion, which is just 13 per cent of losses incurred due to the 2011 floods ($47 billion).[18]

FIGURE 19 Annual additional investment to meet global averages compared to Average Annual Loss (billions of US dollars)



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 public expenditure 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 global averages.

Investments are a proactive and cost-effective approach to reducing disaster risk, and allow Governments to be more ambitious. These are 'no-regret' measures that strengthen disaster resilience, and improve public services even if no disasters occur. They also strengthen resilience to multiple hazards simultaneously, which is essential given that hazards are becoming harder to predict. This approach also means that numerous ministries can take steps to prevent disasters from exacerbating poverty and inequality. Investing in the social sectors as an entry point for reducing disaster risk is therefore a smart approach to poverty reduction.

South-East Asian countries have developed a rich body of experience in implementing innovative social policies that enhance the capacity of communities to bounce back better if a disaster occurs.

Investing in education empowers people to reduce their vulnerability to disaster and strengthen their own capacity to recover. For example, during the recovery from the 2010 drought and floods in Thailand, villages whose inhabitants had more years of schooling were better able to apply for government financial assistance than villages whose inhabitants had fewer school years.[19] Governments in South-East Asia are also recognizing that investments in education can only deliver strengthened disaster resilience if they are inclusive. Therefore, in the Philippines, off-school learning approaches are being used to reach children who are removed from schools to support household farming activities as a coping strategy following disasters.

Governments can also invest in health care, to ensure that poor and near-poor groups can access health care following a disaster without incurring expenditures that can lock them (or push them back) into poverty. Thailand has demonstrated that it is possible to rapidly introduce Universal Health Care. Launched in 2001, when the country was still recovering from the 1997 Asian financial crises, the Universal Coverage Scheme reached 47 million people within one year, including the 18 million people who were previously uninsured. Between 2004 and 2009, this prevented an estimated 292,000 households from falling into poverty.[20]

Governments must prepare not only for emergency response, but also for social protection response.

The Government of the Philippines demonstrated that a comprehensive shock-responsive social protection system can address large-scale increases in vulnerability following a disaster. Following Typhoon Haiyan, the national cash transfer programme (4Ps) was expanded; conditions for receiving cash were waived, and World Food Programme (WFP) and UNICEF used the system's existing infrastructure to give an extra 105,000 households cash transfers. This prevented erosive coping strategies such as distressed asset selling or removing children from school so they can earn an income. This social protection response was facilitated by the prior agreement that conditionality would be waivered during a state of calamity.[21]

Governments can further prepare by expanding databases to include near-poor households who may need extra support following a disaster, by ensuring that delivery systems are accessible for those in remote rural settlements or with limited technology access, or by developing communication plans for informing recipients of extra post-disaster support. ASEAN countries have adopted regional guidelines on shock-responsive social protection systems.

To strengthen disaster resilience of the most vulnerable, social policies must be inclusive, otherwise the poor and vulnerable will face double exclusion.

Limited progress has been made towards reducing inequalities in South-East Asia since 2015. To achieve SDG 10 of reduced inequalities, Governments must accelerate income growth for the poorest 40 per cent of the population, and reverse the declining social, economic and political inclusion.[22] This reinforces the need to reduce disaster risk and means that Governments must reconsider how vulnerable groups are being excluded.

Certain groups experience double exclusion; from a lack of access to education, health care and social services, to interventions for disaster risk reduction, response and recovery, due to barriers in accessing land, early warning systems, finance, and decision-making structures. Therefore, policies that work for the general population may not work for the poor, near-poor and most vulnerable groups. Governments must implement differentiated solutions that reach everybody. For example, following a disaster, wealthier households can access savings, credit and market insurance, while poorer households may rely more on the provision of social insurance and scaled-up safety nets. The expansion of Thailand's Bank for Agriculture and Agricultural Cooperatives (BAAC) crop insurance scheme has demonstrated how Governments can enhance access to insurance. As rice farmers struggled to cope with the impacts of drought and the strength of the Thai baht in 2019, government subsidies ensured that farmers can afford the insurance premiums on rice crops. The insurance coverage then ensures that when the market value falls below a threshold value, during the main harvest season, farmers will receive a fixed price for a set amount of rice produced, therefore stabilizing their incomes.[23] Governments can also reduce exclusion through pro-poor decision-making for disaster risk reduction. The Philippines and Viet Nam have recently taken steps to ensure the active participation of marginalized groups in the creation of DRR-related laws and plans.[24]

BOX 2 Financing additional investment

DRR is typically funded through dedicated funds or international assistance but receives less funding than response and recovery.[a] The solutions presented here require a substantial broadening of sources of financing. Simply raising taxation will not be sufficient, as this will increase the burden on the poor groups targeted by these investments.[b]

Governments can fund higher social sector spending through progressive tax policies,[c] or reprioritize from military expenditures and energy subsidies, as in Thailand and Indonesia.[d] Governments can also tap more funds from the private sector, by collaborating with Small and Medium Enterprises (SMEs), national companies, Multi-National Corporations (MNCs) and the investor community, including through blended finance which combines various sources of funding.[e] A statutory approach could also be undertaken, such as in Indonesia where a specialist reinsurance company called MAIPARK leads the private sector insurance providers thereby reducing the fiscal and financial restrain on the customer.[f, g]

a Jan Kellet, A. Caravani and F. Pichon (2014).
b Sandra Baquie, Columbia University, Peer review comments for APDR (April 2019).
c In general, progressive tax policies are central to fostering a fairer distribution of income and wealth. Readers are referred to Oxfam International and ESCAP (2017).
d ESCAP (2018b).
e Blended finance has been proposed as a solution for leveraging private capital for SDG related investments. OECD and UNCDF (2019) report entitled 'Blended Finance in the Least Developed Countries', provides more information about the latest research into opportunities and challenges of utilizing blended finance for development in LDCs. See report at https://www.uncdf.org/bfldcs/home
f More information available at https://www.maipark.com/en/corporate/background
g OECD (2008).

Technological innovations offer unprecedented opportunities for the inclusion of marginalized people within social policy and disaster risk reduction interventions.

Industry 4.0 innovations in robotics, analytics, artificial intelligence (AI) and cognitive technologies, nanotechnology, quantum computing, wearables, the internet of things (IoT) and big data 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, by filling gaps in information flows in pre-response and post-disaster situations.

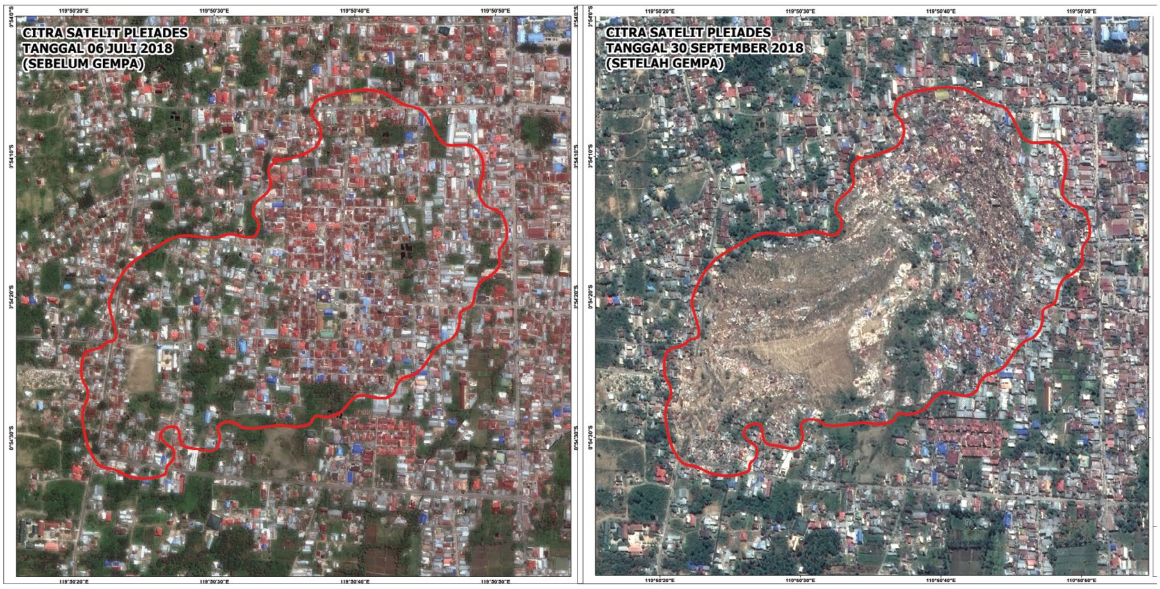
Applications of big data are already being used within South-East Asian countries to increase delivery time of information for disaster response, recovery and preparedness.

Big data offers an opportunity to fill gaps in information flows before, during and after a disaster, by supporting four types of analytics: descriptive, predictive, prescriptive and discursive.

Descriptive analytics use historical data to describe what has occurred. For example, following the earthquake in Sulawesi, Indonesia, big data was used to ensure that a damage assessment could be undertaken rapidly, over a large geographic area, that was inaccessible in many places by using satellite and remote sensing imagery from a variety of sources (Figure 19). The World Bank response started with a rapid assessment of the damage-affected areas using the Global Rapid Post-disaster Damage Estimation methodology. For this disaster, this was the first report to produce sector-based preliminary economic loss estimates, based on scientific, economic and engineering data and analysis. Other inputs were information from early assessments, as well as social media data for a calibration of results. Spatial characteristics developed for tsunami events included inundation extent and ground deformation analysis. This approach meant that within 10 to 14 days of an event, stakeholders could assess loss estimates and the spatial distribution of damage. The World Bank used this to design its support programme for recovery and reconstruction for the disaster-affected areas of Lombok and Sulawesi.[25]

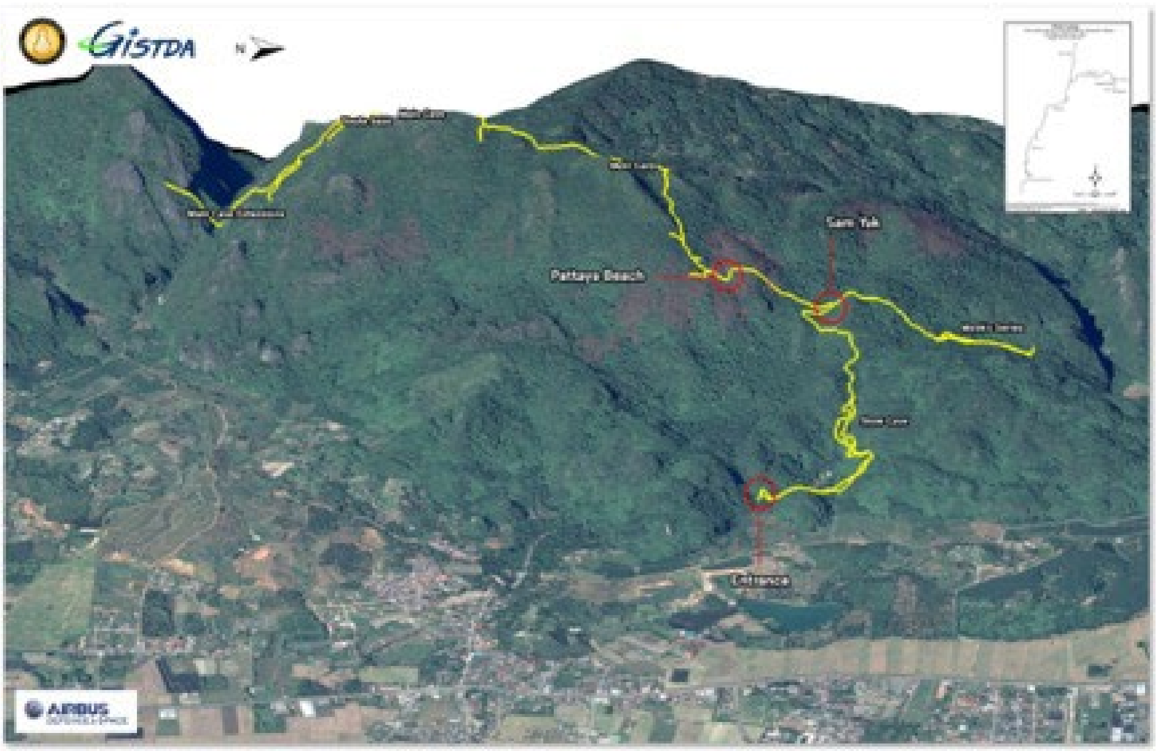
Big data was also instrumental in the successful rescue of a team of 12 boys and their coach, from a cave in Thailand, in July 2018. A variety of image data products and contextual collateral information from multiple platforms were used to obtain a better visualization and understanding of the risk scenarios, evaluation differences, and topographic features of the area. 3D high-resolution satellite images were particularly important for providing real-time images that revealed alternative access sites, openings to drop off survival boxes, and sinkholes for managing the water flowing into the cave system (Figure 20).

FIGURE 19 Pre- and post-tsunami images in Sulawesi 2018



Source: International Disaster Charter, 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.

FIGURE 20 3D-Satellite Image Map of Tham Luang, Khun Nam Nang Non-Forest Park, Chiang Rai, Thailand



Source: Geo-Informatics and Technology Development Agency (GISTDA), 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.

South-East Asian countries are also applying big data to improve disaster preparedness. For example, data can inform predictive analytics, which determine probabilities and trends, such as in impact-based flood and typhoon forecasts. Big data also supports prescriptive analytics, which can inform disaster risk reduction policy. This is essential for providing decision makers with information about dynamic risks, that is localized and relevant to particular sectors. The Specialized Expert System for Agro-Meteorological Early Warning for Climate Resilient Agriculture (SESAME) is an agricultural advisory tool that is addressing this challenge through integrating forecasts for precipitation, temperature, humidity, and evapotranspiration with crop information, to generate risk advisories and early warnings for farmers. The system functions as a data sharing platform, in which data from the Department of Meteorology and Hydrology is complemented by user-generated and crowd-sourced information, from the farmers, regarding crop information, local soil, and other geographic characteristics. This is collected using a web platform and mobile app called DMH SESAME, while feedback is collected through notice boards and SMS. As a result, SESAME has supported agriculture planning at the farm level for more than 30 townships in the Central Dry Zone of Myanmar.

Despite these advances, there is a need for further technological innovation that can capture risks of increasing complexity and uncertainty. The potential consequences when existing technologies are not able to capture the full complexity of the risk were demonstrated during the tsunamis in Indonesia, in 2018.

Emerging technologies can be used to ensure that social policy and disaster risk reduction interventions are inclusive.

A lack of baseline data disaggregated by gender, age, and disabilities, particularly for the most vulnerable people who are hardest to reach, currently presents a significant challenge to implementing such policies. This is exacerbated by errors in traditional statistical sampling, which means that vulnerable people may not be accounted for within census records. Advances in geo-statistical interpolation techniques can address these issues, which can integrate disaggregated geospatial data into gridded population areas taken from satellite imagery, to more accurately determine the circumstances of people living within defined areas. These new approaches have already been used in the urban slums of Hanoi, as well as in Kathmandu and Dhaka in South Asia, and have been found to reduce the problem of undercounting.

South-East Asia wide actions need to be scaled up to tackle the challenges posed by the new riskscape.

Individually and collectively, under the ASEAN, Governments have pioneered innovative approaches across all phases of disaster management. Yet, it will be difficult to stay ahead of the curve as the riskscape becomes increasingly complex. Countries therefore need to forge stronger commitments and actively seek regional cooperation, to reduce the risk of transboundary disasters, and to share best practices for more resilient development. Action on four areas is particularly urgent:

Adopt a region-wide strategy on building resilience to drought and other slow-onset disasters.

The dominance of slow-onset, agricultural drought means that existing strategies, focusing on rapid-onset disasters are not sufficient. Following the release of the UN-ASEAN joint study, titled *Ready for the Dry Years* (2019), which was developed under the purview of the ASEAN Committee on Disaster Management, many countries expressed interest in developing a region-wide strategy for building resilience to drought. The momentum needs to be sustained for developing a strategy that strengthens drought monitoring and early warning services, fosters drought and financial markets, and enhances adaptive capacity to drought.

Leverage new technologies to seamlessly integrate disaster risk and early warning information across all timescales into decision-making.

Within the past 20 years, South-East Asia has shown significant progress in generating and applying risk and early warning information, particularly for the more established timescales of weather and seasonal climate. The volume of data and information across all timescales, particularly hazard data, as well as the ICT-powered applications that allow user-friendly access to data, have also increased. South-East Asian countries must build on these achievements by strengthening their capacities to integrate information from past, current and future timescales and apply them into decision-making. The successful establishment of the Monsoon Forum in many countries in South-East Asia is one example.

Make fiscal frameworks fit for purpose to tackle the nexus of poverty, inequality and disaster risks.

More intense hazards and frequent surprises impose a considerable fiscal burden on countries at all administrative levels. Governments must therefore make fiscal frameworks fit for fostering risk-informed, sustainable development, by allocating resources across all sectors including social protection, education, health, agriculture, infrastructure, and disaster risk reduction. The launch of the second phase of the ASEAN Disaster Risk Finance and Insurance Programme, which aims to strengthen the financial resilience by improving risk management and risk transfer capabilities of the countries in the subregion, is a step in the right direction. Collective thinking on how to diversify finance and deploy differentiated fiscal solutions is also needed, if Governments are to break the link between poverty, disasters and inequality through sectoral investments and pro-poor disaster risk reduction.

Strengthen regional cooperation.

Capitalize on the Asia-Pacific Disaster Resilience Network (APDRN) to address shared vulnerabilities across South-East Asian countries, particularly within the multi-hazard disaster risk hotspots. In 2019, the ESCAP inter-governmental Committee on Disaster Risk Reduction endorsed the operationalization of the APDRN to mobilize expertise and resources of existing networks and partnerships and deploy them towards developing practical resilience solutions. It focuses on four inter-related streams: (i) multi-hazard early warning system platform; (ii) data, statistics and information management; (iii) technology, innovations and applications; and (iv) knowledge for policy.

Existing institutions, such as the Mekong River Commission and the Asian Development Bank (ADB), both created under the auspices of ESCAP, as well the landmark ASEAN Agreement on Disaster Management and Emergency Response, demonstrate the ability of Member States to initiate large-scale collaboration to tackle challenges. South-East Asian countries also cooperate with other countries from across the Asia-Pacific region through institutions such as the ESCAP/WMO Typhoon Committee, and the ESCAP Trust Fund for Tsunami, Disaster and Climate Preparedness, to tackle rapid-onset disasters. South-East Asian countries should now summon the same spirit of cooperation to strengthen resilience to the new disaster riskscape, particularly for slow-onset disasters.

Endnotes

1 Countries covered are the ten ASEAN countries namely Brunei Darussalam, Cambodia, Indonesia, the Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, and Singapore, Thailand and Viet Nam, as well as Timor-Leste.
2 The regional riskscape was calculated using a probabilistic risk model that estimated the risk of a range of hazards including earthquakes, tsunamis, floods, tropical cyclones and storm surges, and drought. The model incorporated intensive risk due to high-severity, mid to low-frequency disasters, as well as extensive risk due to low-severity but high frequency disasters, both direct and indirect losses, as well as agricultural drought, a slow-onset disaster. This was calculated based on a proxy estimate that incorporated exposure of the agricultural sector to drought (ratio of agricultural GDP to total GDP) and vulnerability (proportion of the population in rural areas, the extent of rural poverty and proportion of employment in the agricultural sector).
3 ESCAP calculations based on Global Assessment Report 2015.
4 ESCAP calculations based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015; Global Risk Data Platform, 2013; and WorldPop Dataset. All accessed in May 2019.
5 K. Thirumalai, and others (2017).
6 ASMC (2019).
7 ESCAP, ASMC and RIMES (2019).
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9 IPCC (2018).
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11 Guha-Sapir (2019). EM-DAT (Accessed on 30 May 2019).
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13 ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015 and DHS Household Survey.
14 ESCAP calculations based on DHS surveys, latest data and multi-hazard data from Global Assessment Report, 2015.
15 ESCAP, based on GFDRR, 11 Post Disaster Needs Assessments reports available for the last 10 years in South-East Asia.
16 The D-index shows how all population groups fare in terms of access to opportunities such as attainment of education, childhood nutrition, and household access to basic services.
17 ESCAP calculations based on CGE model simulation.
18 ESCAP calculations based on Post Disaster Needs Assessments; World Bank (2012).
19 A. Garbero, and R. Muttarak (2013).
20 Health Insurance System Research Office (2012).
21 Smith, Gabrielle, and others (2017).
22 ESCAP (2019).
23 Ploen Angwatanakul (2019).
24 International Federation of the Red Cross (2018).
25 World Bank (2018).

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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 'riskscape' 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 Riskscape across South-East Asia: Key Takeaways for Stakeholders presents a comprehensive analysis of the subregion's riskscape to inform policy actions. Governments in South-East Asia have pioneered innovative approaches. Yet, it will be difficult to stay ahead of the curve as the riskscape becomes increasingly complex. Countries therefore need to forge stronger commitments and actively seek regional cooperation to strengthen resilience, particularly for slow-onset disasters.