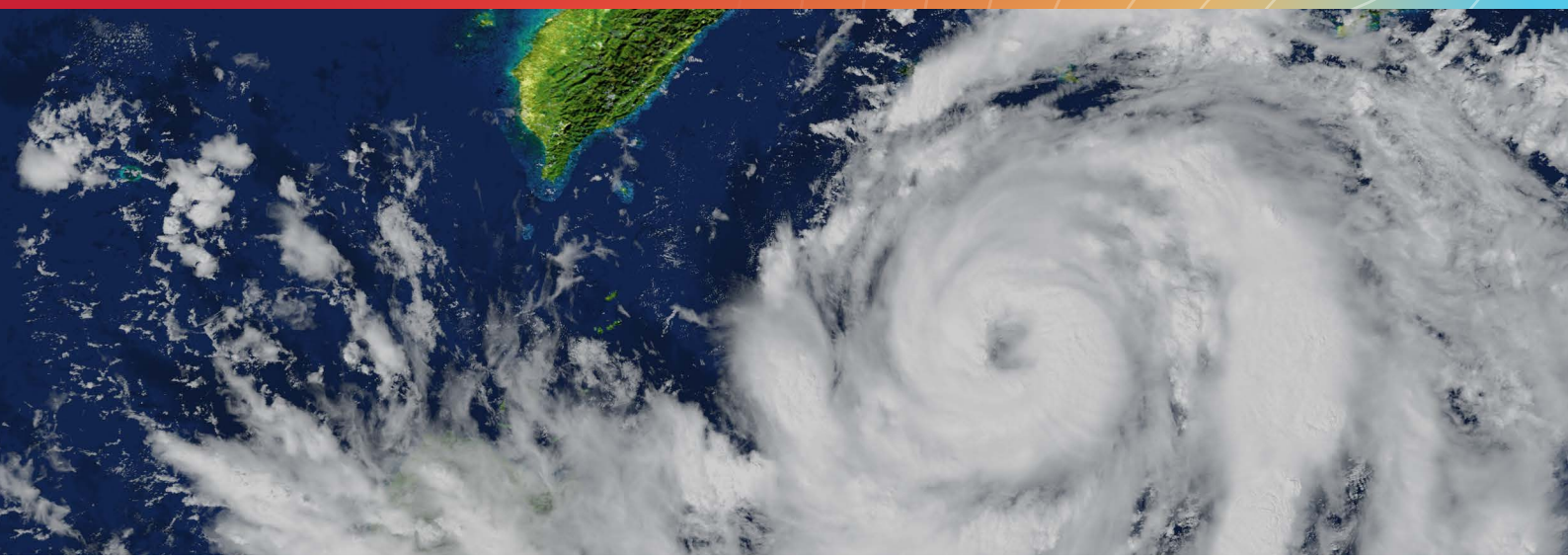
Asia-Pacific Riskscape @ 1.5°C: Subregional Pathways for Adaptation and Resilience

Asia-Pacific Disaster Report 2022 for ESCAP Subregions

SUMMARY FOR POLICYMAKERS



ESCAP 75
MOVING FORWARD TOGETHER

*The shaded areas of the map indicate ESCAP members and associate members.**

The Economic and Social Commission for Asia and the Pacific (ESCAP) is the most inclusive intergovernmental platform in the Asia-Pacific region. The Commission promotes cooperation among its 53 member States and 9 associate members in pursuit of solutions to sustainable development challenges. ESCAP is one of the five regional commissions of the United Nations.

The ESCAP secretariat supports inclusive, resilient and sustainable development in the region by generating action-oriented knowledge, and by providing technical assistance and capacity-building services in support of national development objectives, regional agreements and the implementation of the 2030 Agenda for Sustainable Development.

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Key messages for policymakers

Understand the riskscape at 1.5°C to 2°C warming in the Asia-Pacific region and its subregions

ESCAP analysis, based on the Sixth Assessment Report of the IPCC, shows that under all climate change scenarios, and in comparison to global averages, Asia and the Pacific will be most impacted by heavy precipitation, followed by agricultural drought, hot temperatures/heatwaves, and warming winds with intensifying tropical cyclones. Each subregion also has its own variation of risks to which it will have to adapt to under the warming scenarios.

Accelerate progress on the Sustainable Development Goals (SDGs) through climate action

Across the Asia-Pacific region, development challenges have increased and progress towards achieving the Sustainable Development Goals has slowed, especially those related to disaster and climate resilience. Most alarming are regressing trends on Climate action (Goal 13) across the region. Resilience pathways for climate adaptation need risk-informed development policies and investment strategies.

Utilize technology-driven solutions to enhance adaptation actions

Frontier technologies and digital innovations not only reduce the cost of implementing the policy interventions, they also have game-changing impacts on scaling up transformative adaptation through enhanced risk analytics, like impact-based forecasting, integrated multi-hazard risk assessment and early warning, surveillance, and strategic foresights, as well as efficient management of pandemics, such as COVID-19.

Finance adaptation to build resilience

ESCAP has estimated the annual cost of adaptation to natural and biological hazards under the worst-case climate-change scenario for the Asia-Pacific region and each of its subregions. The adaptation gaps are critical in vulnerable subregions which are also likely to be heavily impacted under the 1.5°C and 2°C warming scenarios. These costs are indicative of the risk-informed investments needed in the key adaptation measures and resilience pathways.

Build on regional and subregional cooperation to support ecosystem adaptation and services

It is time to capitalize on the untapped potential of regional and subregional cooperation to address the region's shared vulnerabilities and risks that are more critical at 1.5°C and 2°C warming. Subregional cooperation is key for supporting transboundary ecosystem adaptations and nature-based solutions for building the region's resilience and moving towards a climate-resilient society for all.

The regional riskscape of Asia and the Pacific under 1.5°C to 2°C warming

Global warming at 1.5°C continues to impact the frequency and intensity of disasters in Asia and the Pacific, reshaping and expanding its disaster "riskscape". The Asia-Pacific Disaster Report 2021 (APDR) provides an overview of climate risk and suggests measures that can build resilience in the Asia-Pacific region, focusing on the emerging disaster-climate-health nexus.

The 2022 subregional reports of the APDR demonstrate how each ESCAP subregion is being affected by various risk parameters under new climate models based on the Shared Socio-economic Pathways (SSPs), and where new hotspots of exposure and vulnerability to climate-induced, cascading multi-hazard scenarios are being created. Moving forward, ESCAP recommends that the subregions implement customized adaptation and resilience pathways with emphasis on risk-informed development policies and investments, technological innovations and subregional cooperation approaches. These measures can accelerate the progress of countries in achieving the Sustainable Development Goals and the targets of the Sendai Framework for Disaster Risk Reduction.

Understand the riskscape at 1.5°C to 2°C warming in the Asia-Pacific region and its subregions

The Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC)[1] finds that the difference between 1.5°C and 2°C of global warming is substantial: every fraction of a degree translates into increased risks. Using the new Coupled Model Intercomparison Project 6 models, ESCAP has downscaled the global warming trends to the Asia-Pacific region (Figure 1).

FIGURE 1 Differential impacts of climate hazards for the Asia-Pacific region

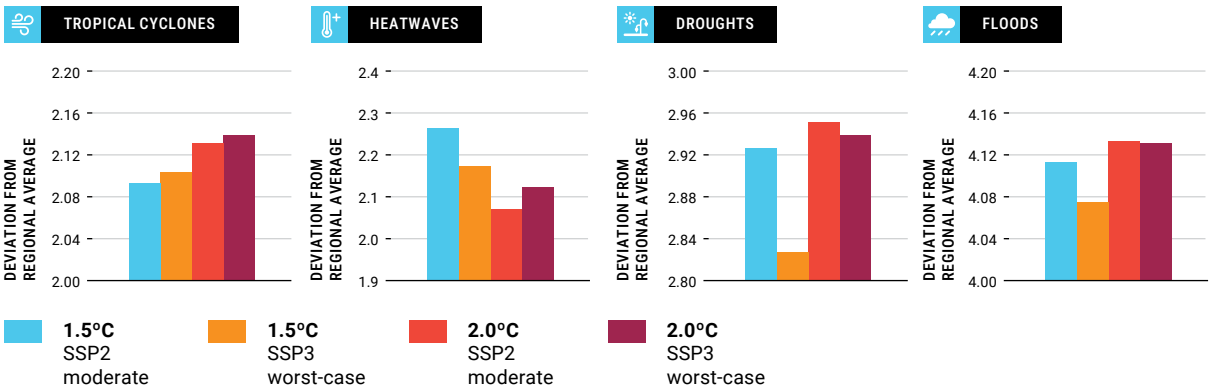


Figure 1 compares the differential impacts of four climate-related weather extremes under 1.5°C and 2°C temperature increase for two Shared Socio-economic Pathways scenarios; SSP 2 — a middle-of-the-road scenario, and SSP 3 — a rocky road scenario with high challenges for both adaptation and mitigation.

1 Intergovernmental Panel on Climate Change (IPCC), "Climate Change 2021: The Physical Science Basis, Working Group I contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change" (Cambridge University Press, 2021a).

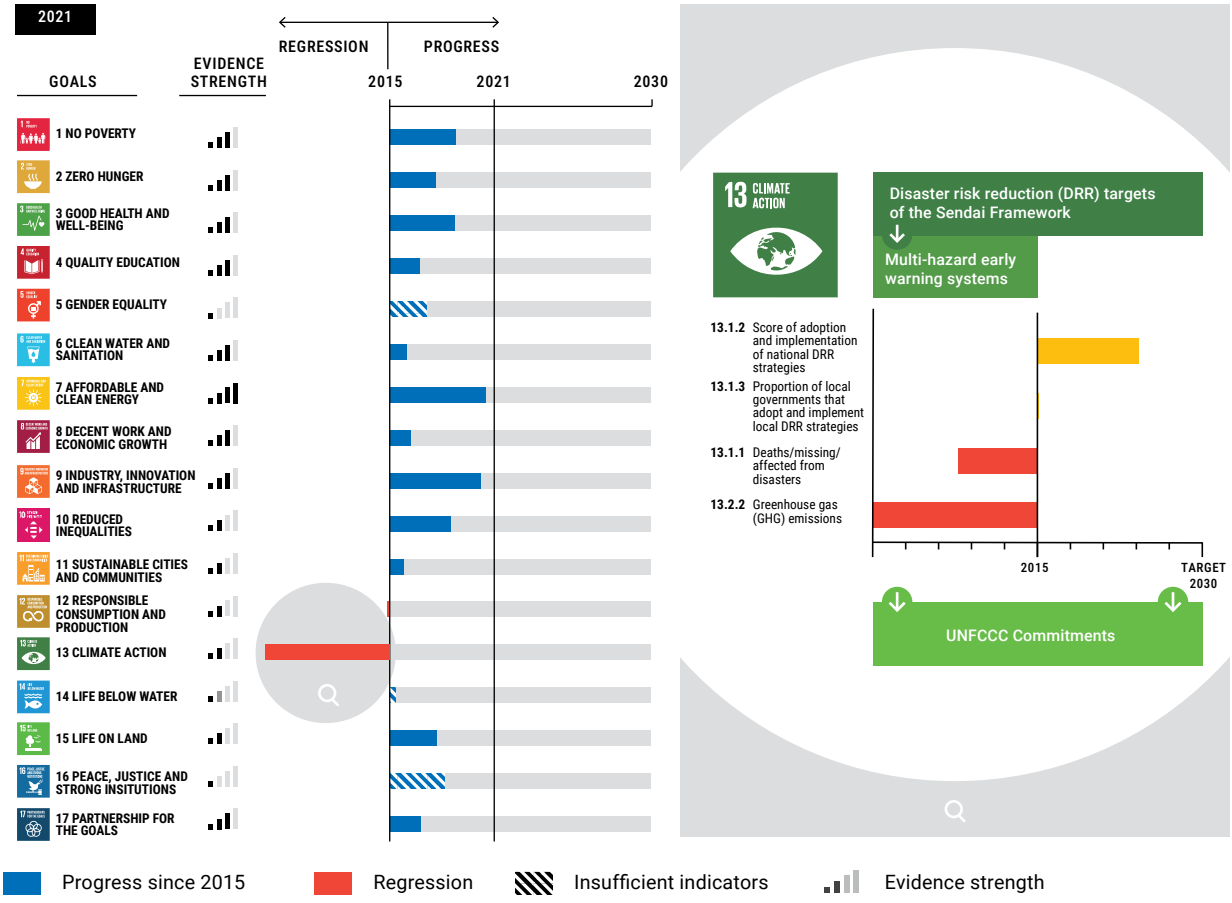
The four climate-related weather extremes include surface winds, which can lead to more frequent and intense tropical cyclones in oceans and more frequent and intense sand and dust storms over land, heavy precipitation which can result in floods, hot temperature extremes, and agriculture/ecological drought.

Under all scenarios, and compared to global averages, the region will be the highest impacted by heavy precipitation, followed by drought, heatwaves and intensifying tropical cyclones due to high surface winds. While heavy precipitation will have the highest impacts in all scenarios, drought will be slightly higher under the 2°C-SSP 3 scenario, while both surface winds and hot temperature extremes are slightly higher under the 1.5°C-SSP 2 scenario.

Accelerate progress on the SDGs through climate action

Given that the increasing extremes in climate, under 1.5°C, are already being experienced by the Asia-Pacific region, it is important to increase investments in key adaptation measures while also implementing mitigation targets. The region is regressing on Goal 13 (Climate action) (Figure 2). While there is progress in the implementation of national and local disaster risk reduction strategies, mortalities from disasters and the lack of commitments toward the United Nations Framework Convention on Climate Change (UNFCCC) are the main reason for the region's regression in achieving the goal for climate action. The trend also indicates a widening gap between climate change adaptation and mitigation in the region. A paradigm shift is needed to reduce climate impacts and build resilience which also reduces the gaps between adaptation and mitigation.

FIGURE 2 **Progress of the Sustainable Development Goals in the Asia-Pacific region, 2022**



Source: *Asia and the Pacific SDG Progress Report 2022* (United Nations publication, 2022).

The way forward for adaptation emerged from the Glasgow Climate Pact forged during the 26th annual summit of the United Nations Climate Change Conference of the Parties (COP26), which set new global targets for adaptation funding. The current aspiration is a 50:50 balance between mitigation and adaption, with a greater share of the adaption funding going to the most vulnerable countries. Current adaptation funding remains between 20–25 per cent across all financing sources.

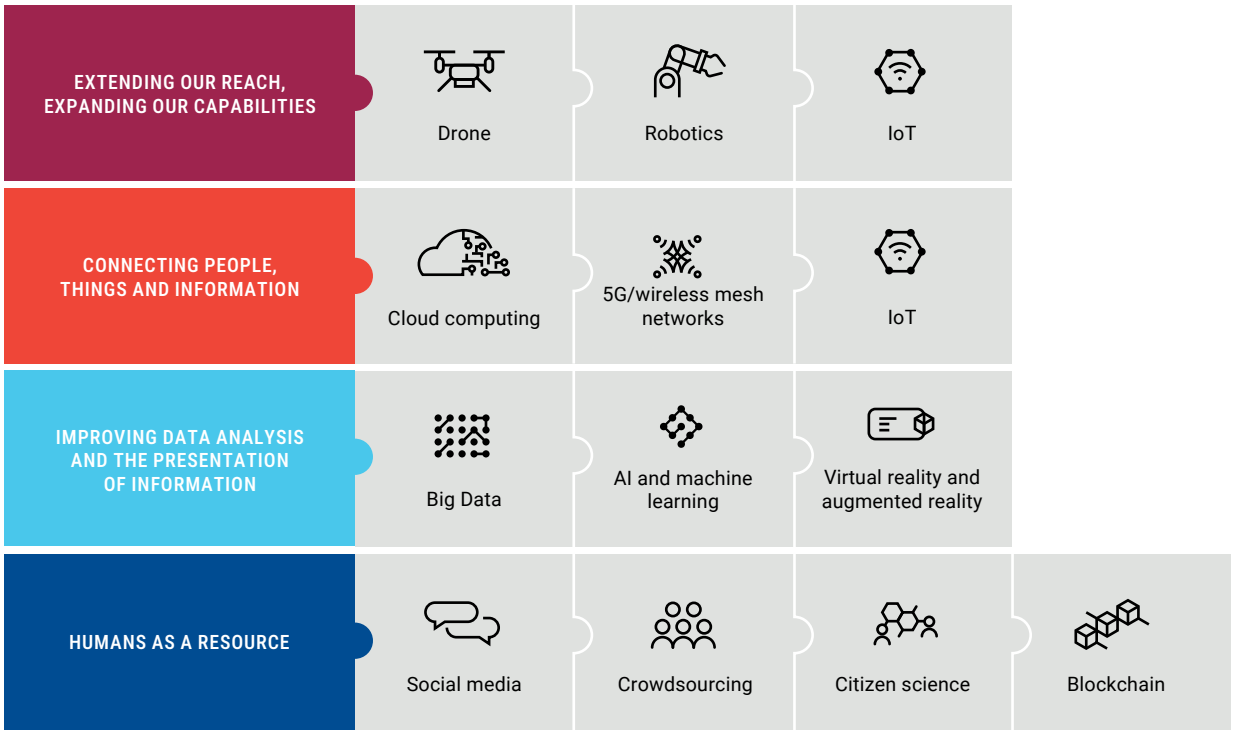
A focus on the key adaptation priorities, as noted by the Glasgow Climate Pact and the Global Commission for Adaptation, will provide the highest cost-benefit ratio to build resilience to the climate impacts of global warming under the 1.5ºC and 2ºC scenarios. The priorities which need to be factored into risk-informed development and investments are:

- Improving dryland agriculture crop production
- Making new infrastructure resilient
- Making water resources management more resilient
- Protecting mangroves
- Strengthening early warning systems

Utilize technology-driven solutions to enhance adaptation actions

Frontier technologies and digital innovations must be utilized for enhanced risk analytics like forecasting and disaster early warning, surveillance, and impact assessment, as well as efficiently managing pandemics, like COVID-19. These technologies are likely to transform disaster risk reduction and health sector management, and thus address some of the deep uncertainties in managing systemic risk. This will be done first, by extending the reach and expanding the capabilities of unmanned vehicles, robotics, remote and in-situ sensing; second, by changing how things are made and acquired, through additive manufacturing and innovative materials; and third, by connecting people, things and information, for example in cloud computing, 5G Mobile Technology, wireless mesh networks, mobile messaging, the Internet of Things, and blockchain (Figure 3).

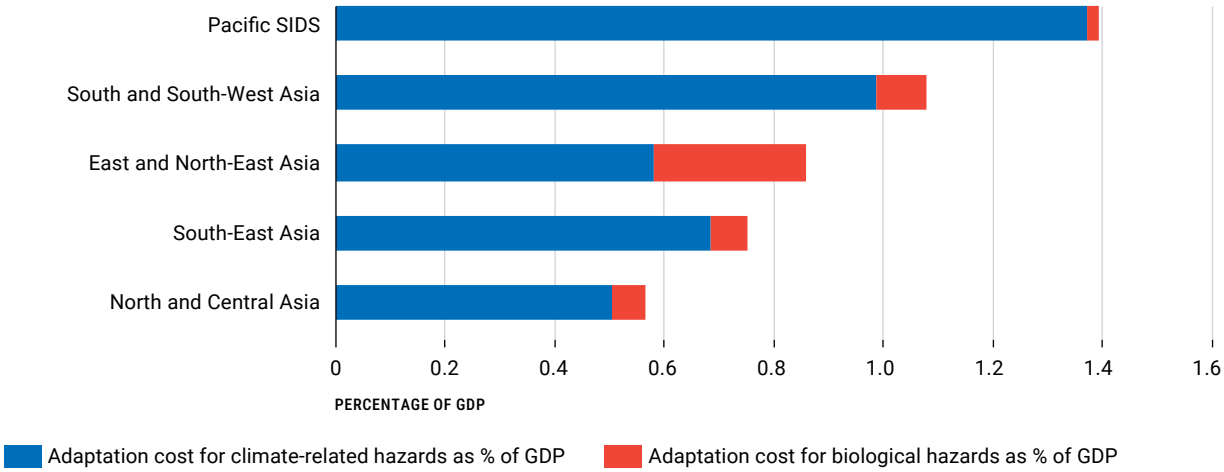
FIGURE 3 **Frontier technologies for disaster risk reduction and healthcare**



Finance adaptation to build resilience

ESCAP estimates the annual cost of adaptation to natural and biological hazards under the worst-case climate change scenario for the Asia-Pacific region and for each subregion. These costs are indicative of the necessary risk-informed investment in the key adaptation measures and resilience pathways. For Asia and the Pacific, the total adaptation cost is estimated at US$ 270 billion, of which $68 billion is required for adapting to biological hazards. As a percentage of the subregional GDP, the highest adaptation cost is estimated for the Pacific small island developing States (SIDS) (Figure 4). The following sections on each subregion highlight the respective adaptation costs.

FIGURE 4 **Subregional adaptation costs for climate-related hazards and biological hazards, as a percentage of GDP**



Source: ESCAP calculations based on the Asia-Pacific SDG Gateway. Available at https://data.unescap.org/home.
Note: Pacific SIDS = Pacific small island developing States.

Build regional and subregional cooperation to support ecosystem adaptation and services

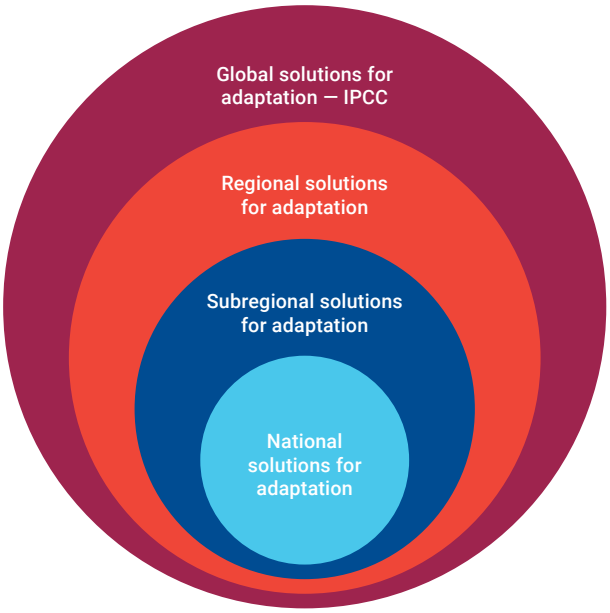
In transboundary hazards, teleconnections exist between natural resources and natural ecosystem services. Along with economic and social linkages, climate change impacts also substantially alter the nature of teleconnections. Subregional adaptation and resilience pathways do capture the teleconnections between natural resources and natural ecosystem services in the changing climate risk scenarios. Further, transboundary natural hazards and potential disruptions in ecosystem services must inform subregional cooperation on adaptation, national adaptation measures and disaster risk reduction plans, as well as sectoral development work with line ministries like agriculture, water and energy. Shared vulnerabilities and risks cut across borders and boundaries. Thus, solutions for adaptation must be translated to support regional and subregional ecosystems to reduce the risks of global warming. The taxonomy of solutions for adaptation to climate change should include solutions that go from global to national (Figure 5).

FIGURE 5 Taxonomy of solutions for climate change adaptation and disaster risk reduction

SUBREGIONAL SOLUTIONS
Joint climate change adaptation measures through regional cooperation among the Aral Sea Basin countries

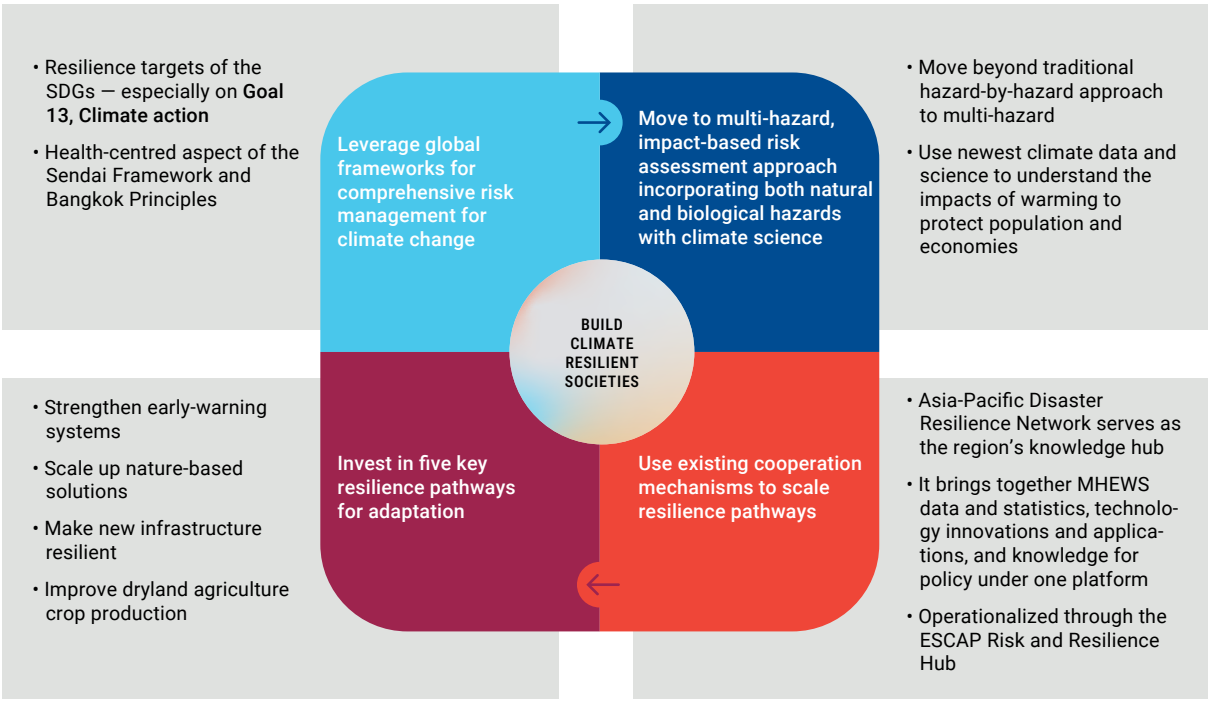
NATIONAL ADAPTATION PLAN THAT INCLUDES TRANSBOUNDARY RISKS
- National DRR strategies
- Voluntary National Review
- Nationally Determined Contributions

SECTORAL (AGRICULTURE, WATER, ENERGY ETC.)
To include transboundary risks



Several operational mechanisms already exist for regional and subregional cooperation to implement resilience pathways, protect people and move towards a climate-resilient society for all. Figure 6 demonstrates some of the operational mechanisms that can be used to implement various resilience pathways in Asia and the Pacific.

FIGURE 6 Operational mechanisms for building climate-resilient societies



- **Mechanism 1:** Countries and subregions can leverage the tenets of global frameworks to shift to a more comprehensive approach when it comes to managing and preparing for all disasters. Subregions can use existing frameworks that address the disaster-climate-health nexus including:

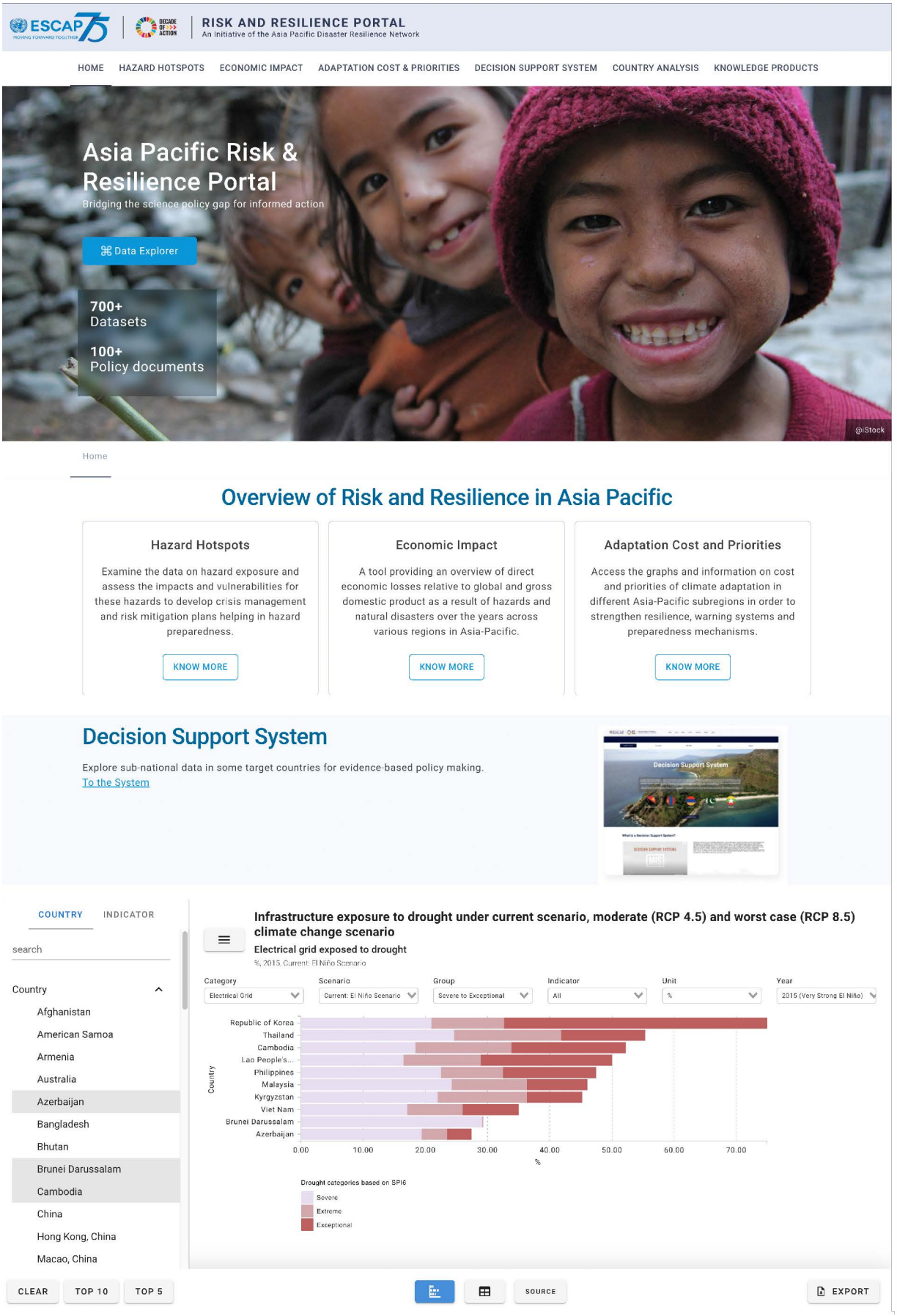
    A The health-centred aspects of the Sendai Framework for Disaster Risk Reduction (2015-2030): these call for enhanced cooperation between health authorities and stakeholders at global and regional levels to strengthen countries' capacity for disaster risk management for health, implementation of international health regulations, and to build resilient health systems. Under this, the Bangkok Principles of implementation of the health aspects of Sendai Framework can be used as a framework to integrate emergency and preparedness systems;

    B The Sustainable Development Goals: The resilience targets of the SDG goals, particular on Goal 13 (Climate action) can be used as the framework to address the disaster-climate-health nexus and the corresponding impacts on SDG progress.

- **Mechanism 2:** Governments need to adopt strategies that move beyond the traditional focus on a hazard-by-hazard approach to a multi-hazard approach. Estimating risks, vulnerabilities, and capacities from multiple hazards at the same time, is critical to pre-empt climate-related disasters. Improving common understanding of complex systems and emerging risks provides the opportunity to collectively identify solutions, reduce duplication of efforts, and allow for integrated policy actions.
- **Mechanism 3:** Investing in the five key resilience pathways noted in the subregional reports can be instrumental in building resilience and adaptive capacity. Each subregion has its own set of priorities and the costs associated with building resilience. The need for subregional cooperation is noted particularly for establishing integrated multi-hazard early warning systems.
- **Mechanism 4:** Using existing cooperation mechanisms to scale the resilience pathways, in particular, the Asia-Pacific Disaster Resilience Network which serves as the region's knowledge hub and brings together a number of workstreams related to multi-hazard early warning systems and digital and space applications for disaster risk reduction.

The knowledge hub of the Asia-Pacific Disaster Resilience Network is implemented through the ESCAP Asia-Pacific Risk and Resilience Portal, which is designed to support the monitoring and implementation of climate and disaster-related SDGs. It aims to strengthen the capacity of countries in Asia and the Pacific to identify multi-hazard risk hotspots, estimate economic losses due to cascading hazards in the present and future climate change scenarios at the country, subregional and regional levels and invest in key resilience measures for adapation (Figure 7).

FIGURE 7 The Risk and Resilience Portal: An Initiative of the Asia-Pacific Disaster Resilience Network for subregional and regional cooperation

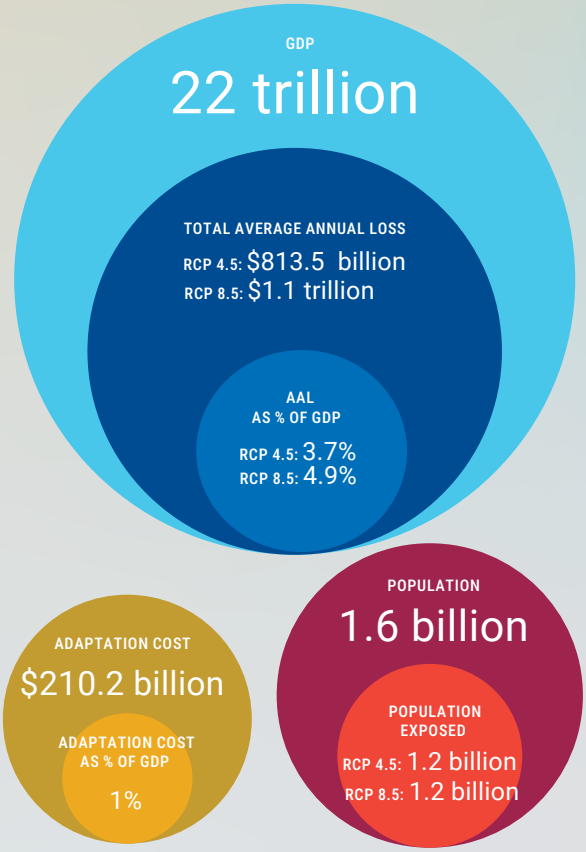


Source: ESCAP Risk and Resilience Portal. Available at: https://rrp.unescap.org.

The subregional riskscape under 1.5°C to 2°C warming scenarios

Regional analyses of warming under 1.5°C and 2°C scenarios masks subregional specificities which are important when considering the resilience of the population and the impacts on their livelihoods. Each subregion will have its own variation of risks to which it will have to adapt to in the future under both 1.5°C and 2°C scenarios.

Riskscape in East and North-East Asia



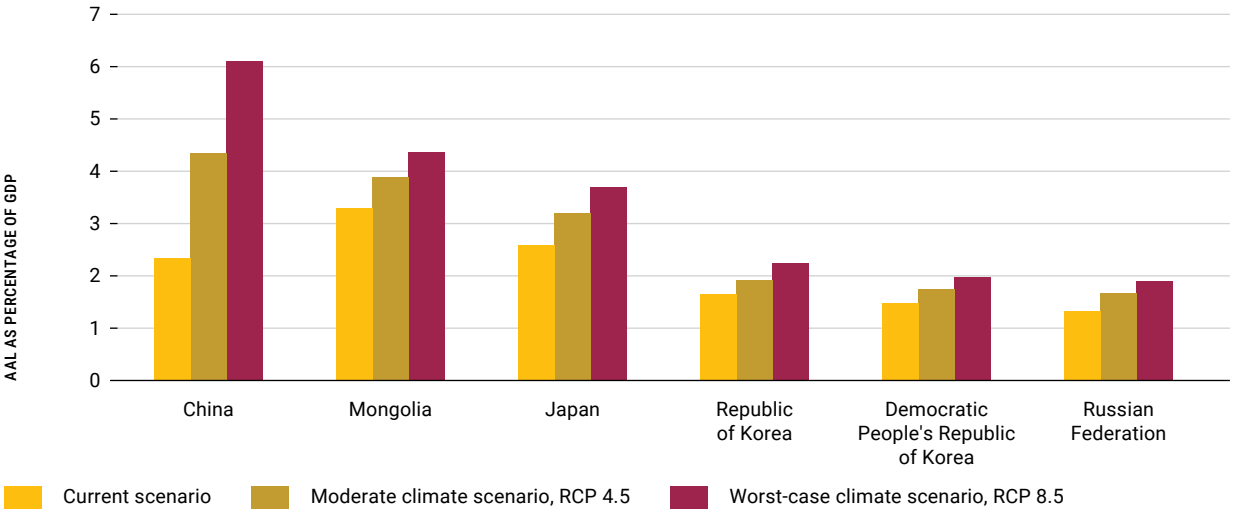
Adaptation solutions

HIGHEST–LOWEST PRIORITY

- Making new infrastructure resilient
- Strengthening early-warning systems
- Improving dryland agriculture
- Making water resource management resilient
- Protecting mangroves

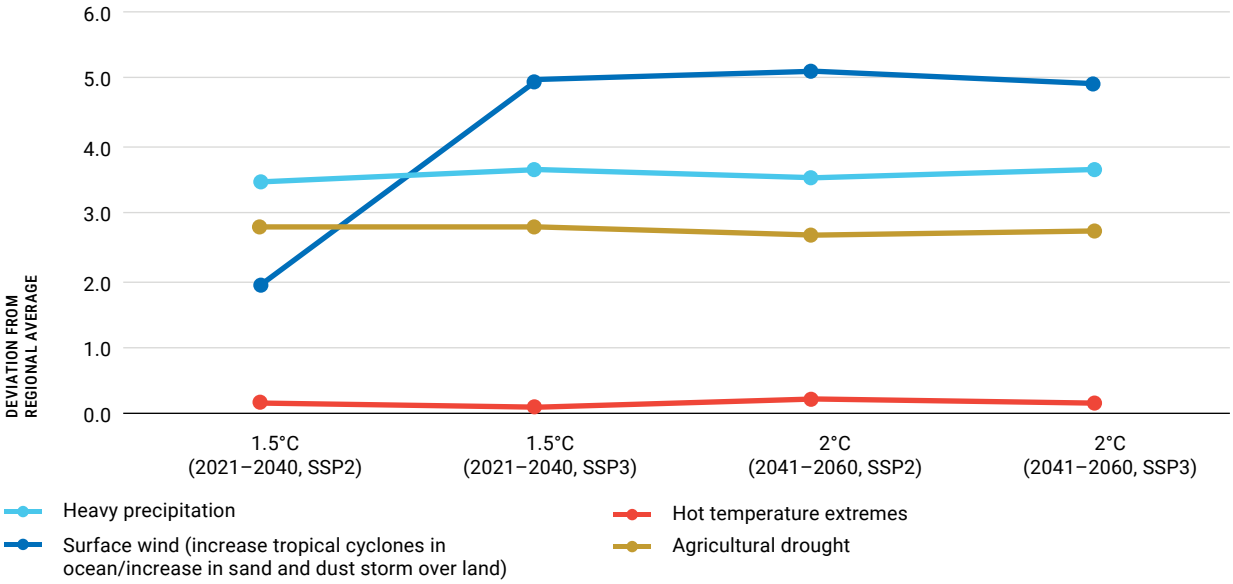
FIGURE 8 **Average Annual Losses (AAL) as a percentage of GDP from cascading risks in East and North-East Asia**

ANALYSIS China has the highest AAL with losses accounting for 6 per cent of its GDP under the worst-case scenario, followed by Mongolia at 4.4 per cent.



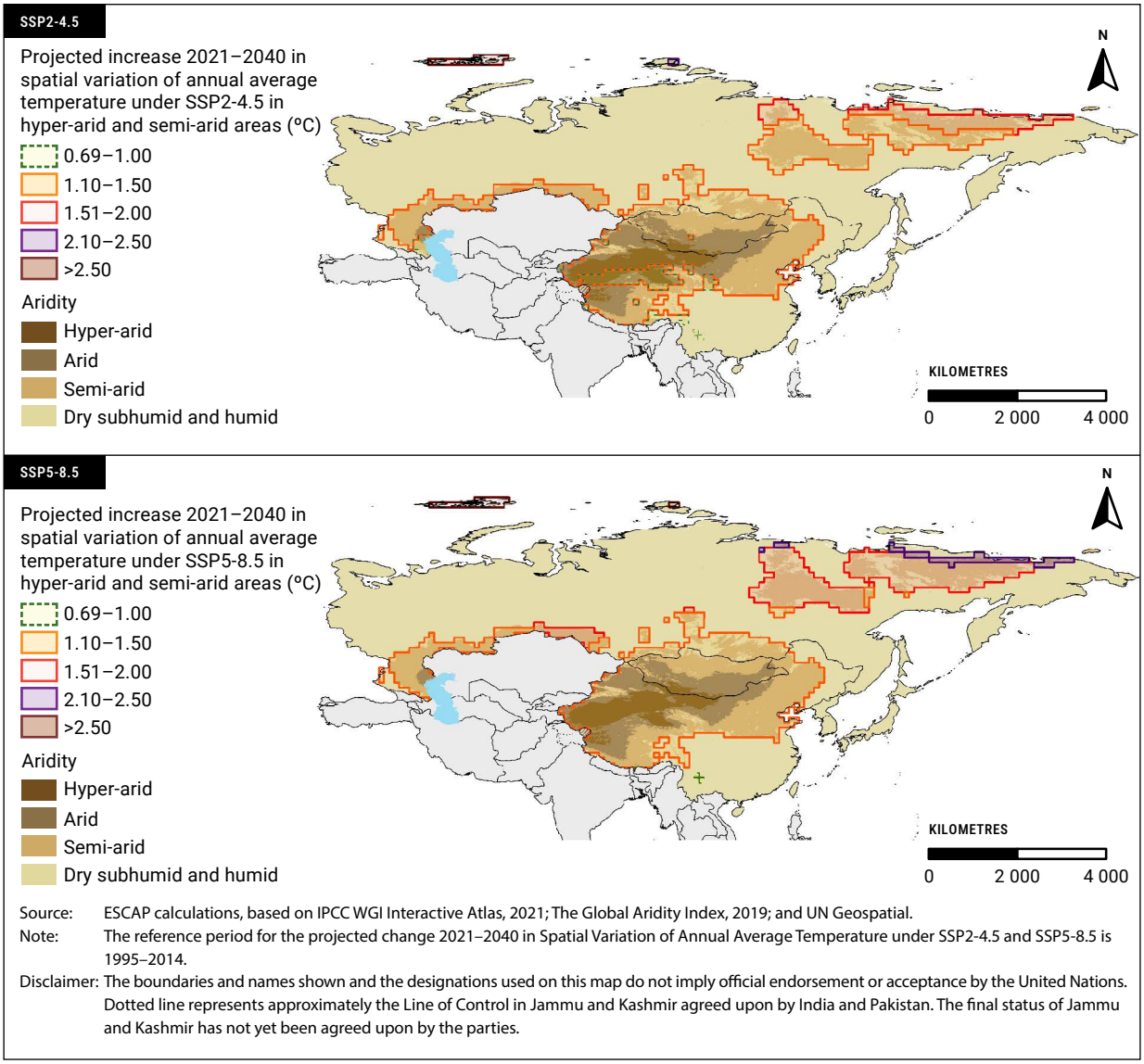
The disaster riskscape of East and North-East Asia under temperature increases of 1.5°C and 2°C comprises of extreme climate events, such as severe temperatures, and intensifying typhoons and droughts. More specifically, East and North-East Asia will experience heavy precipitation followed by agricultural drought under the moderate 1.5°C scenario (SSP2). Under the worst-case scenario (SSP3), and under both 1.5°C and 2°C, it will be heavily impacted by high surface winds that will result in more frequent and intense tropical cyclones (Figure 9).

FIGURE 9 **Relative intensity of weather extremes under 1.5°C and 2°C in East and North-East Asia**



For East and North-East Asia, the annual average temperature is expected to increase by more than 1ºC in most hyper-arid, arid, and semi-arid areas of the subregion by 2040 (Figure 10). The likely intensification of the risk of desertification and drought will impact food security, health, and critical infrastructures, among others. For example, large areas responsible for agricultural production volume in China, Mongolia and the Russian Federation are located in semi-arid areas and are susceptible to desertification and land degradation from climate drivers.

FIGURE 10 **Projected increase in annual average temperature in hyper-arid, arid, and semi-arid areas under SSP2-4.5 and SSP5-8.5, 2021–2040**



Source: ESCAP calculations, based on IPCC WGI Interactive Atlas, 2021; The Global Aridity Index, 2019; and UN Geospatial.
Note: The reference period for the projected change 2021–2040 in Spatial Variation of Annual Average Temperature under SSP2-4.5 and SSP5-8.5 is 1995–2014.
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.

Resilience pathways for accelerating progress on the SDGs

Whilst significant progress has been made towards achieving several of the Sustainable Development Goals in East and North-East Asia, gaps remain. A regression has been noted, especially, in the achievement of SDG 13 (Climate action), particularly in targets 13.1 on resilience and adaptive capacity and 13.2 on climate change policies. Investing in the following measures for adaptation and resilience-building will not only yield high returns, but also support progress on the SDGs.

For East and North-East Asia, the following are the key adaptation pathways (scores from 5-1, with 5 representing the highest priority) (Figure 11):

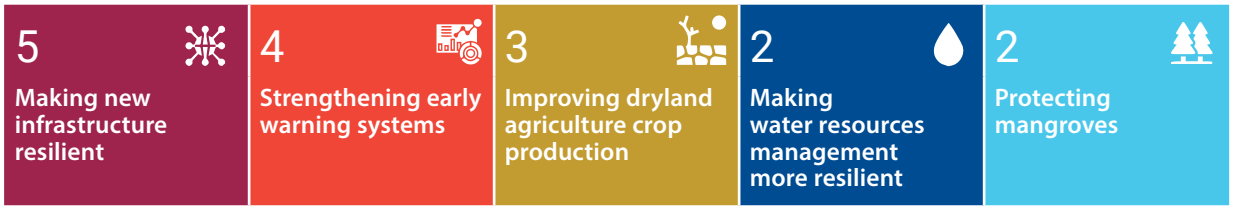
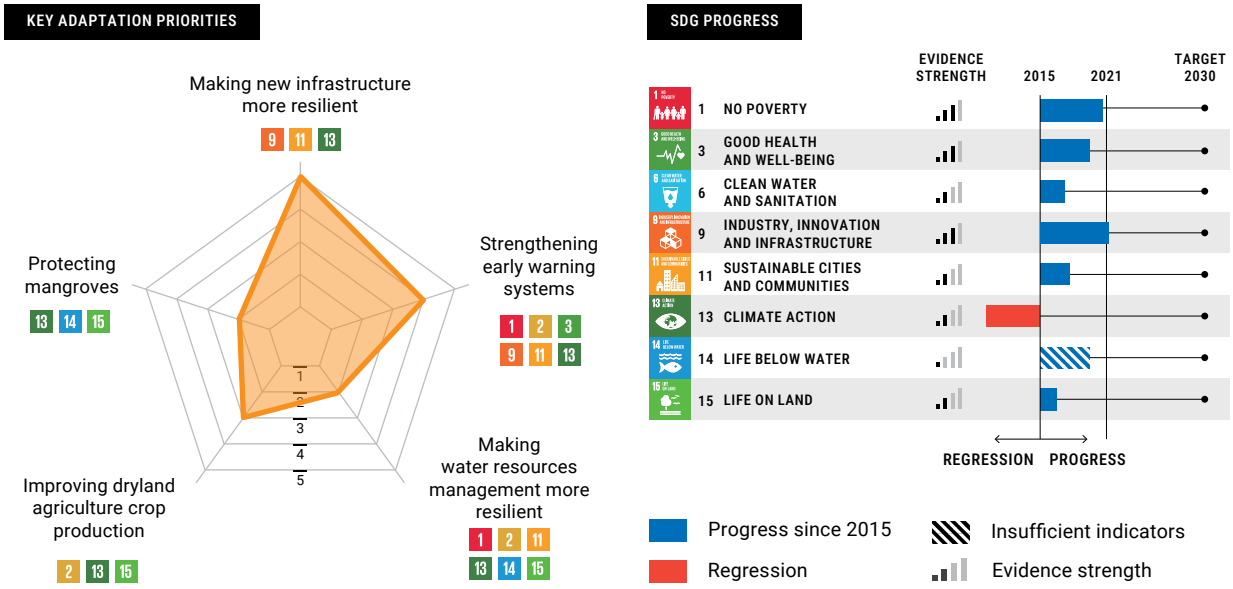


Figure 11 illustrates the SDG snapshot for the East and North-East Asia subregion together with the key adaptation priorities.

FIGURE 11 Comparison of adaptation measures with disaster-related SDGs



> In **East and North-East Asia**, over 3 billion people affected and more than half a million fatalities from natural hazards over the past 50 years

Riskscape in North and Central Asia

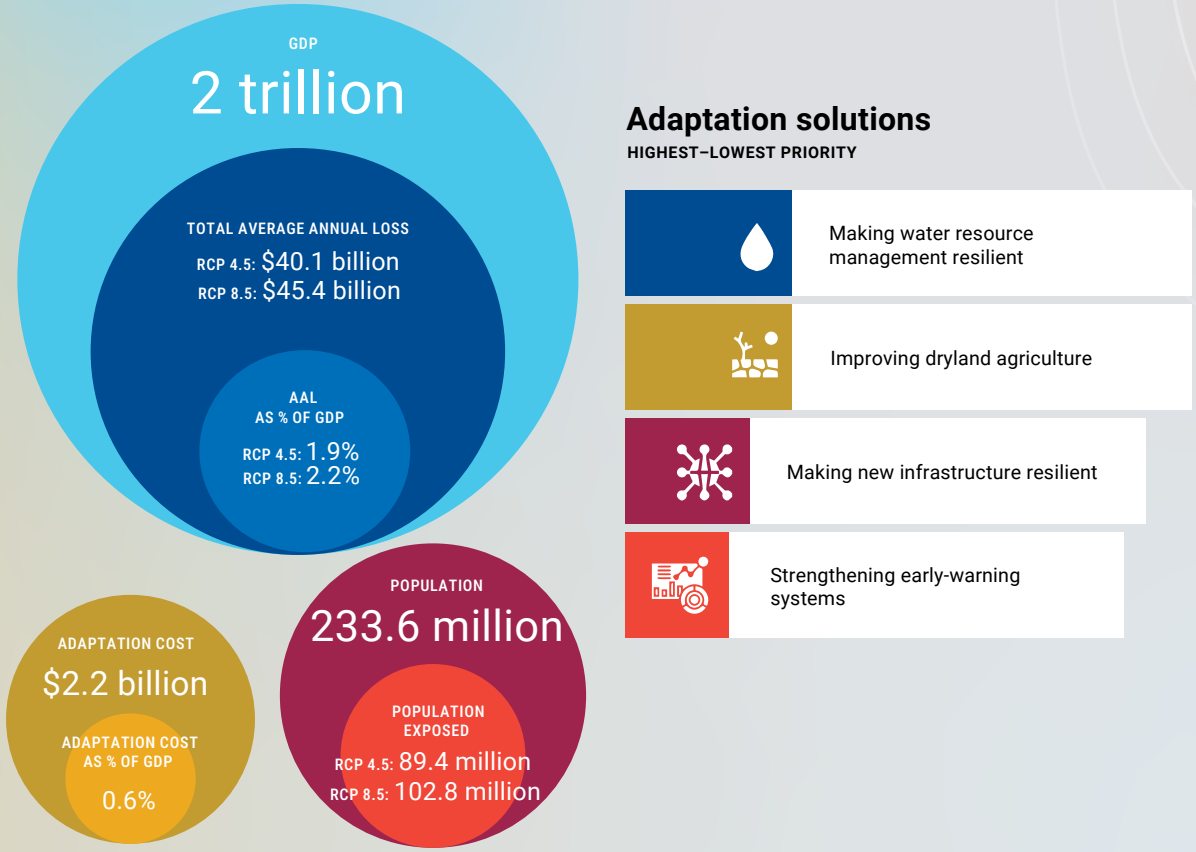
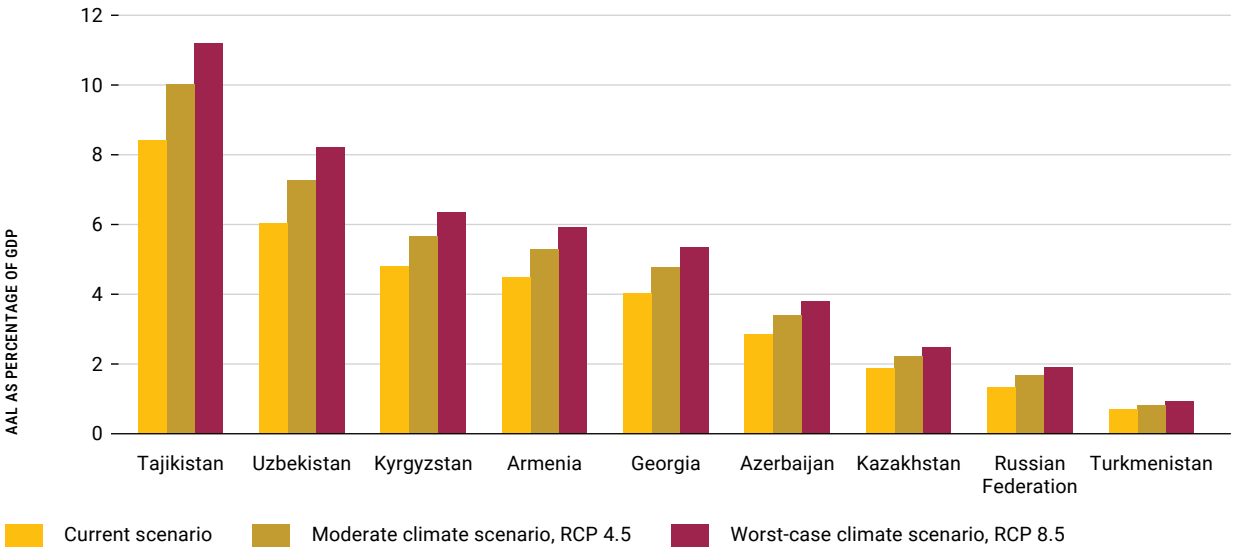


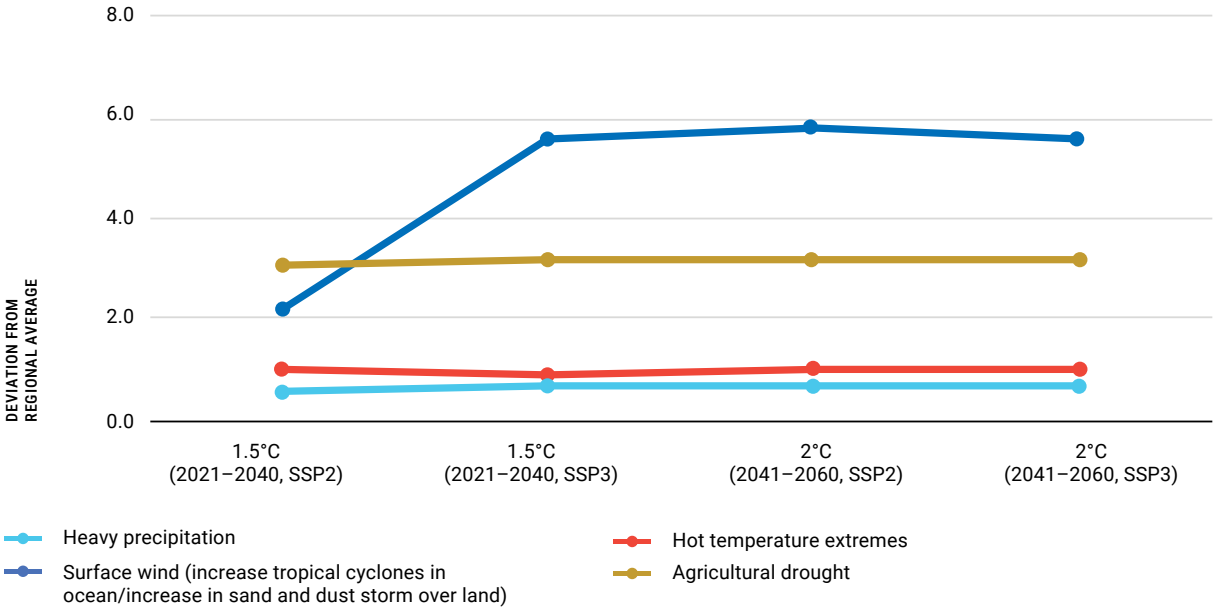
FIGURE 12 **Average Annual Losses as a percentage of GDP from cascading risks in North and Central Asia**

ANALYSIS Tajikistan will record highest AAL with losses accounting for nearly 11 per cent of the country's GDP under the worst-case scenario. This will be followed by Uzbekistan with losses accounting for nearly 8 per cent of the national GDP.



The subregion is also analysed based on temperature increases of 1.5°C and 2°C under two Shared Socio-economic Pathways (SSPs) scenarios. The analysis shows that the disaster riskscape of North and Central Asia comprises of risk hotspots of extreme temperatures, drought, desertification, aridity, and related diseases. More specifically, North and Central Asia will experience increasing surface winds over land with potentially more frequent and intense sand and dust storms. The subregion will also remain highly impacted by agricultural drought and extreme heat for all climate scenarios (Figure 13).

FIGURE 13 **Relative intensity of weather extremes under 1.5°C and 2°C in North and Central Asia**



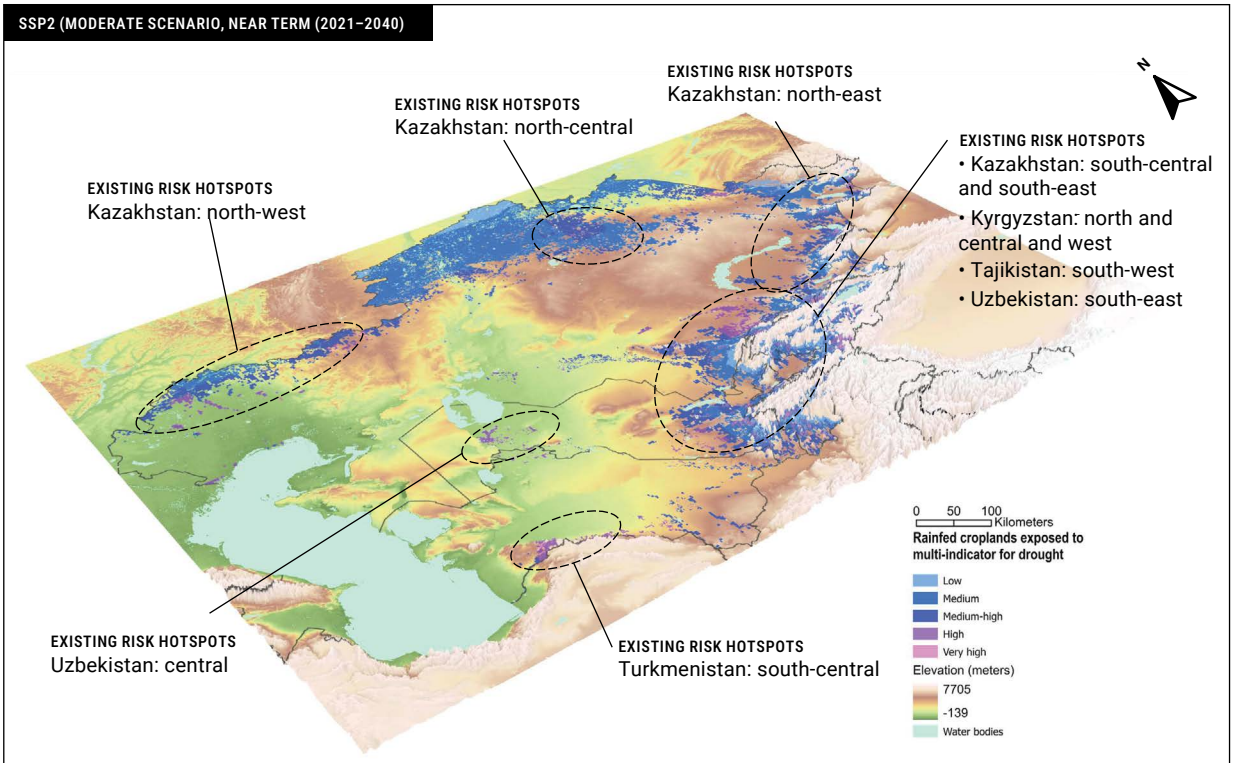
North and Central Asia is a hotspot of drought, aridity, desertification and sand and dust storms. A resurgence of severe drought events was recorded across most of Central Asia and parts of the Russian Federation, between April and July 2021. Resulting from climate change, these droughts caused severe water shortages and deaths of livestock. The Aral Sea is an example of transboundary disasters that have affected and continue to have implications on the arid and semi-arid regions of Central Asia. Future climate projections show that droughts are likely to be more frequent and lengthier in the surroundings of the Aral Sea.[2] In the SSP 2, near-term scenario, several hotspots of rainfed-agriculture exposure to droughts are likely to occur in Central Asian countries (Figure 14). A recent ESCAP study on adaptation priorities of transboundary Aral Sea hazard shows that adaptation measures like strengthening multi-hazard risk assessment and early warning systems, as well as improving dryland agriculture crop production, have the highest priority score in all five Central Asian countries in the various climate-change scenarios.[3]

> **North and Central Asia** will remain highly impacted by agricultural drought and extreme heat for **all** climate scenarios

2 Sanjay Srivastava and others, "Managing in-land water disasters in the Aral Sea: sub-regional pathways for adaptation and resilience", Working Paper Series Part II: Aral Sea, April 2022. Available at https://www.unescap.org/kp/2022/managing-land-water-disasters-aral-sea-sub-regional-pathways-adaptation-and-resilience

3 Ibid.

FIGURE 14 Rainfed agriculture exposed to drought under SSP 2 near-term scenario



Sources: ESCAP calculations based on IPCC WGI Interactive Atlas - Coupled Model Intercomparison Project Phase 6 (CMIP6)2021; the Global Aridity Index Version 2, 2019; Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global Digital Elevation Model Version 3 (GDEM003), 2018 ; Global Food Security Support Analysis Data Crop Dominance 2010 Global 1km (GFSAD1KCDv001)2017; World Water Bodies, 2021; and UN Geospatial.

Notes: 1. The multi-indicator for climate consist of a) Increase in temperature (°C) b) Percent decrease in precipitation, and c) Increase in maximum number of annual consecutive dry days.
2. The Aridity Index for arid and semi-arid regions are all values less than 0.5. The classification is based on generalized climate classification scheme for Aridity Index values (UNEP 1997).
3. Dry day is defined as day with mean precipitation less than 1 mm.

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Resilience pathways for accelerating progress on the SDGs

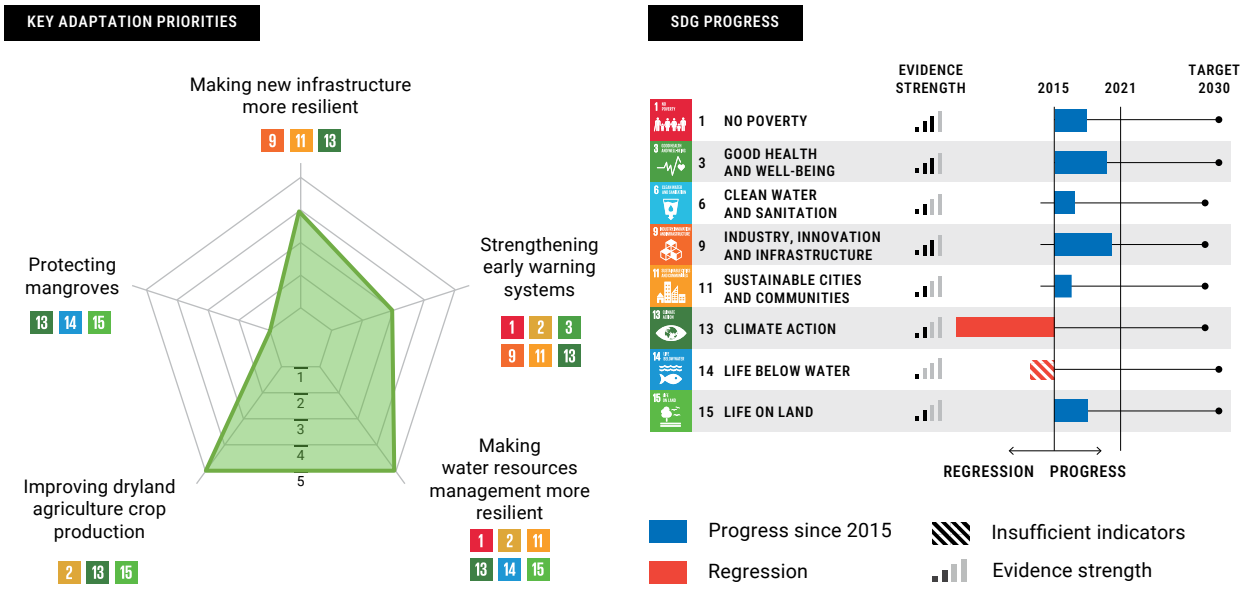
Significant progress has been made on the Sustainable Development Goals in North and Central Asia, however, some gaps remain particularly in SDG 13 (Climate action) and SDG 14 (Life below water). There is a reverse trend especially in target 13.1 on resilience and adaptive capacity and target 13.2 on climate change policies. Investing in the following measures for adaptation and resilience-building will not only yield high returns, but also support progress on the SDGs.

For North and Central Asia, the following are the key adaptation pathways (scores from 5-1, with 5 representing the highest priority) (Figure 15):

5 Making water resources management more resilient	5 Improving dryland agriculture crop production	4 Making new infrastructure resilient	3 Strengthening early warning systems

Figure 15 illustrates the SDG snapshot for North and Central Asia together with the key resilience pathways.

FIGURE 15 Comparison adaptation measures with disaster-related SDGs



Riskscape in South-East Asia

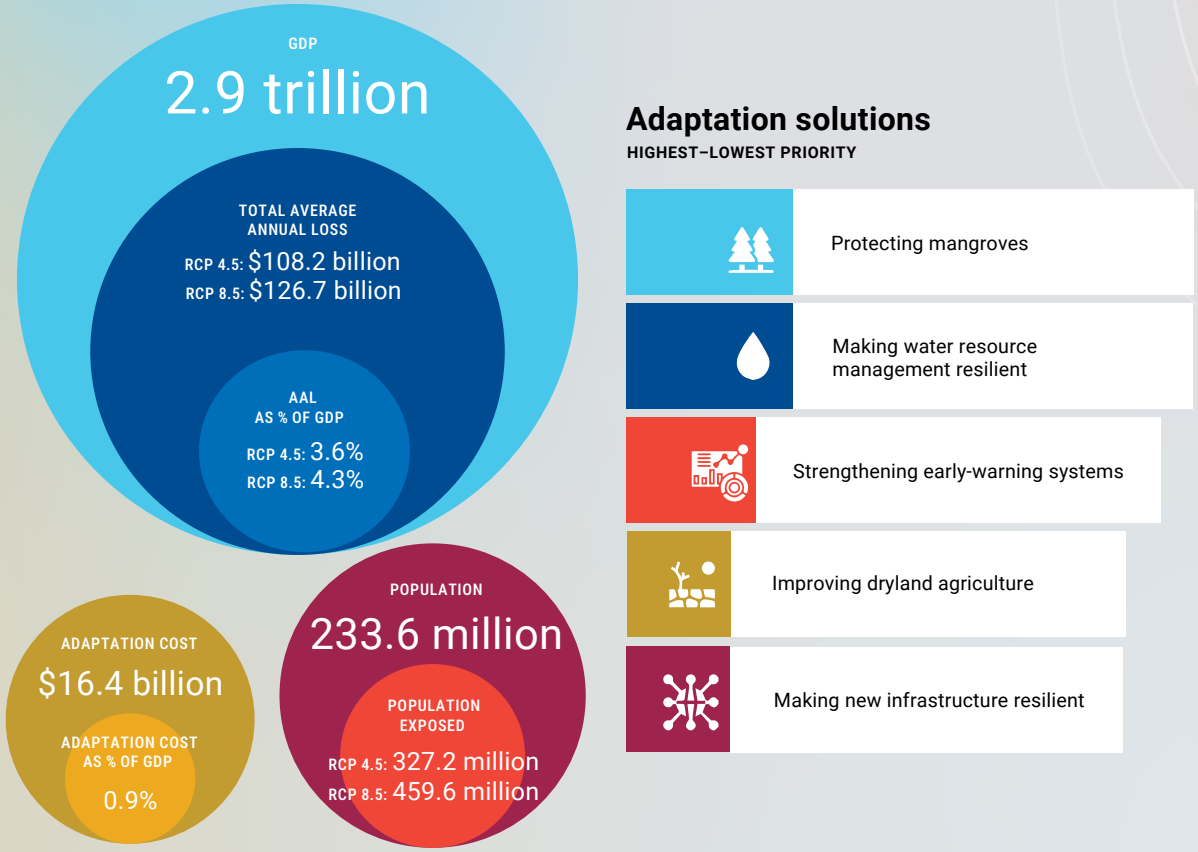
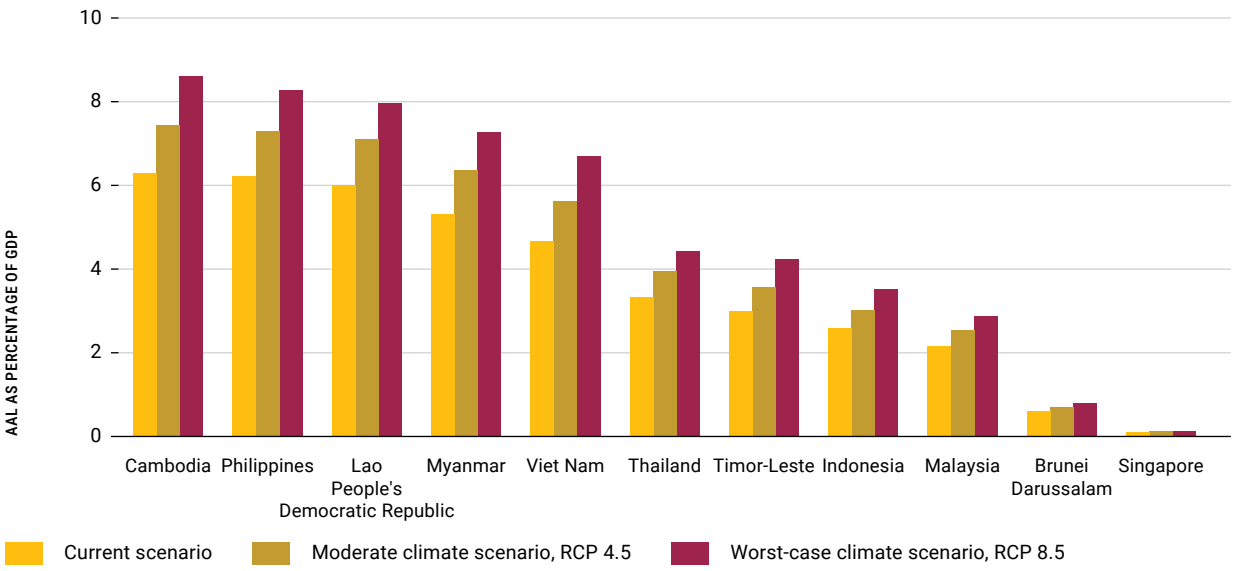


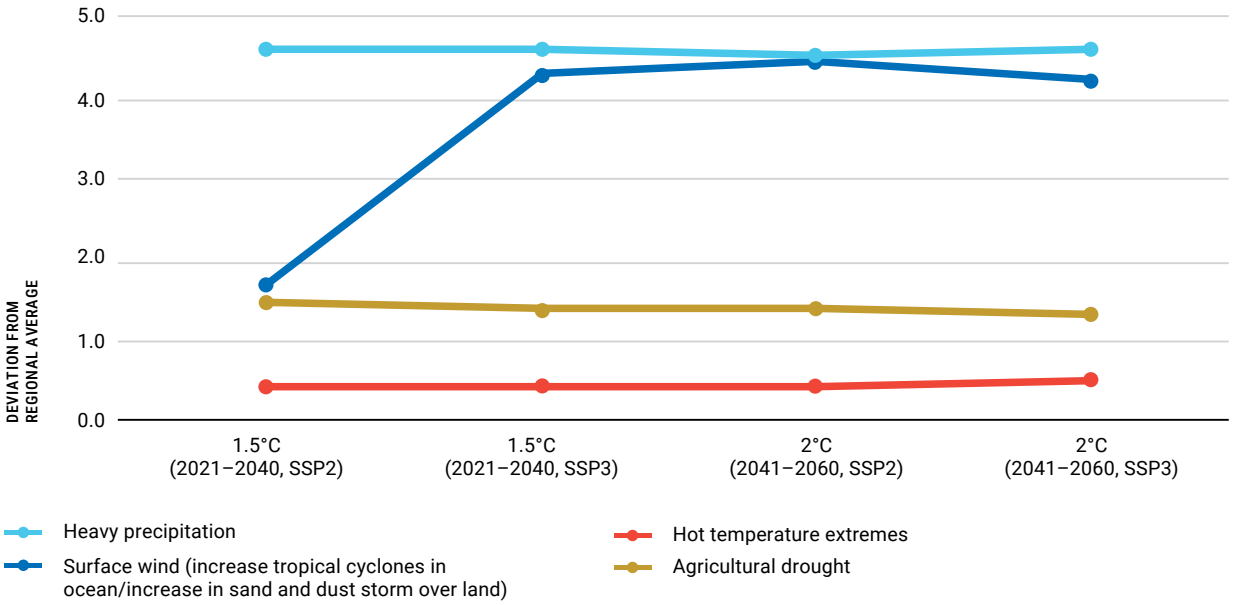
FIGURE 16 **Average Annual Losses as a percentage of GDP from cascading risks in South-East Asia**

ANALYSIS Cambodia will record the highest AAL as a percentage of GDP at 8.6 per cent. This will be followed by The Philippines at 8.2 per cent and the Lao People's Democratic Republic, at 7.9 per cent of GDP under the worst-case scenario.



The subregion is also analysed based on temperature increases of 1.5°C and 2°C under two Shared Socio-economic Pathways (SSPs) scenarios. The disaster riskscape of South-East Asia comprises of increased intensity in weather events, such as typhoons, cyclones, droughts, and floods. More specifically, South-East Asia will face a wetter climate under both the 1.5°C and 2°C climate-change scenario, with increased risks of flooding in the Mekong River Basin. The subregion will also be impacted by more frequent tropical cyclones, especially under the moderate 2°C climate scenario (SSP2) (Figure 17).

FIGURE 17 **Relative intensity of weather extremes under 1.5°C and 2°C in South-East Asia**



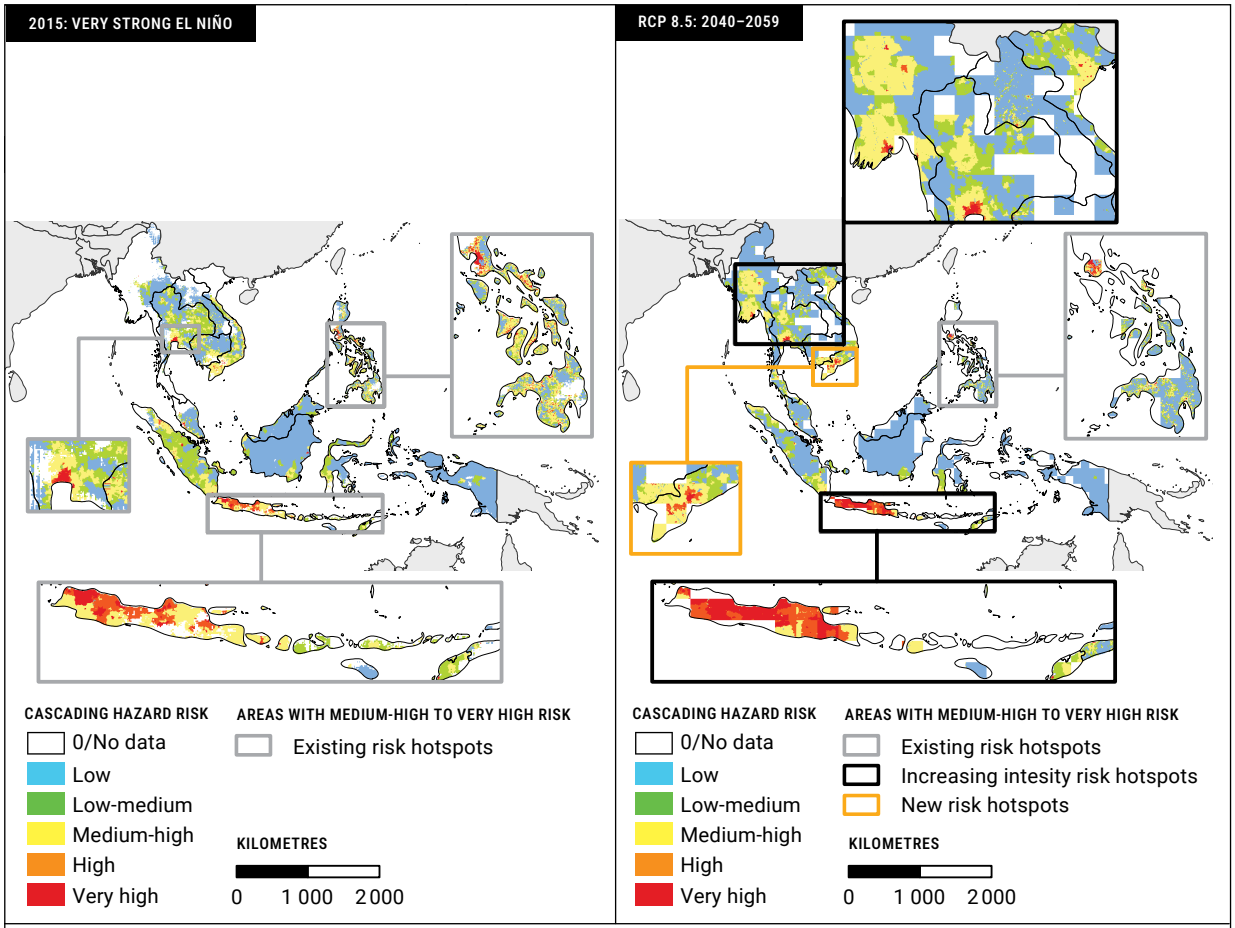
As mentioned above, in South-East Asia, currently, 65 million people live in the Mekong river basin which is a hotspot for floods and droughts. Especially during the El Niño in 2015 and 2019, the Mekong basin was a hotspot of drought. In the current climate scenario, 47.6 per cent of the population is exposed to floods, while 6.4 per cent is exposed to droughts. In terms of the economic stock exposure, 42 per cent of the economic stock in Mekong River basin is exposed to floods while 6.3 per cent is exposed to drought.[4] ESCAP analysis highlights that under the worst-case climate change scenario (RCP 8.5, 2040-2059) this hotspot of flood, drought and related biological hazards is set to intensify (Figure 18).

Indeed, droughts have continued to affect millions of people in South-East Asia, and their severity is likely to increase and shift geographically. The ASEAN Regional Plan of Action for Adaptation to Drought aims to develop policies for managing drought risk, strengthen adaptive capacity, and minimize drought vulnerability of impacted groups and sectors. The Plan of Action considers a wide range of factors, such as the region's historical and current drought situation and challenges, and proposes three parallel tracks for drought adaptation together with implementational arrangements involving key personnel, sectoral bodies, and stakeholders (Figure 19).

Cambodia, Indonesia, the Lao People's Democratic Republic, and Malaysia recorded large numbers of people affected by droughts in the most recent decade, 2011–2020.

4 *Asia-Pacific Disaster Report 2019: The Disaster Riskscape across Asia-Pacific* (United Nations publication, 2019).

FIGURE 18 Current and future risk hotspots of drought and related biological hazards in South-East Asia



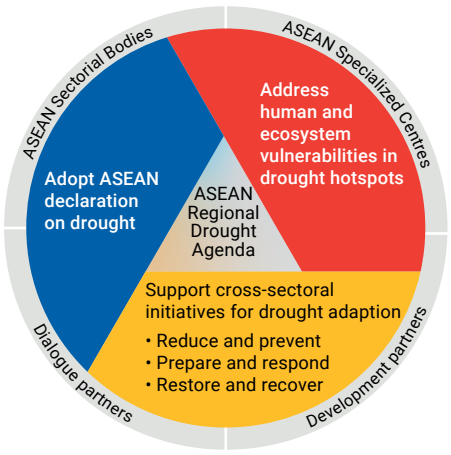
Sources: ESCAP calculations, based on 6-months Standardized Precipitation Index (SPI6) of Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS), 2015; Climate Change Knowledge Portal, 2018; UN WPP Adjusted Population Density 2020, v4.11; and Disability-Adjusted Life Years (DALYs) estimates 2000-2019; and UN Geospatial.

Note: 1. Cascading Hazard Risk is obtained from spatial variation of SPI6 for 2015 and Projected Change in Spatial Variation for Maximum Number of Consecutinve Dry Days under RCP 8.5 by Population and Disability-Adjusted Life Years (DALYs).
2. The spatial variation of SPI6 ranges from - 0.8 to the minimum value (moderate to exceptional drought) and Projected change 2020-2039 and 2040-2059 in Spatial Variation for Maximum Number of Consecutive Dry Days under RCP 8.5 ranges from 0 to maximum number of days.
3. DALY indicators for drought related diseases consist of nutritional and vitamin deficiencies.

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 19 ASEAN Regional Plan of Action for Adaptation to Drought

TRACK 1 REDUCE/PREVENT	TRACK 2 PREPARE/RESPOND	TRACK 3 RESTORE/RECOVER
Managing food (agriculture), water and energy	Risk assessment, monitoring and early warning	Risk financing and insurance
		Forecast-based financing
Climate-resilient water infrastructure	Climate services, data and innovations	Social safety nets



Source: ASEAN Secretariat, "ASEAN Regional Plan of Action for Adaptation to Drought 2021-2025" (Jakarta, ASEAN Secretariat, 2021).
Available at: https://asean.org/book/asean-regional-plan-of-action-for-adaptation-to-drought-2021-2025/

Resilience pathways for accelerating progress on the SDGs

Despite some progress in the achievement of the Sustainable Development Goals in South-East Asia, some gaps continue to remain. Regressions have been recorded, especially for SDG 13 (Climate action) and SDG 14 (Life below water). There is a reverse trend particularly on target 13.1 on resilience and adaptive capacity, and a need to accelerate progress on target 14.5 for conservation of coastal areas. Investing in the following measures for adaptation and resilience-building will not only yield high returns, but also support progress on the SDGs.

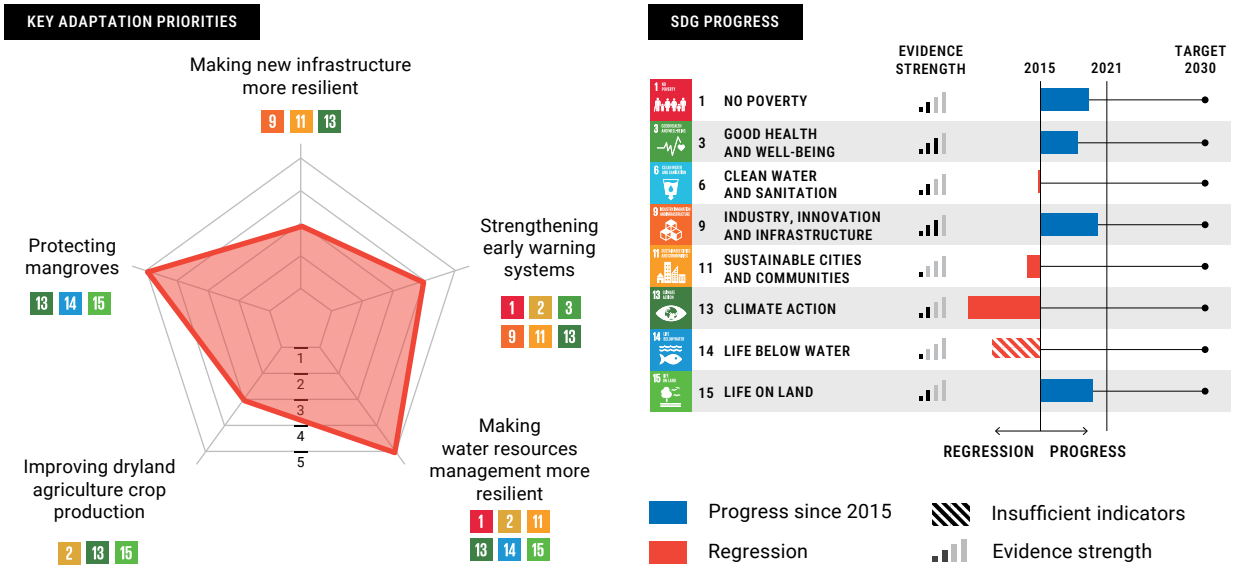
For South-East Asia, the following are the key adaptation pathways (scores from 5-1, with 5 representing the highest priority) (Figure 20):

5	5	4	3	3
Making water resources management more resilient	Protecting mangroves	Strengthening early warning systems	Making new infrastructure resilient	Improving dryland agriculture crop production

> **Mangroves** deplete with rise in sea levels, rise in atmospheric CO_2, rise in air and water temperatures as well as changes in frequency and intensity of extreme weather events

Figure 20 illustrates the SDG snapshot for the South-East Asia subregion together with the key adaptation priorities.

FIGURE 20 Comparison of adaptation measures with disaster related SDGs



Riskscape in South and South-West Asia

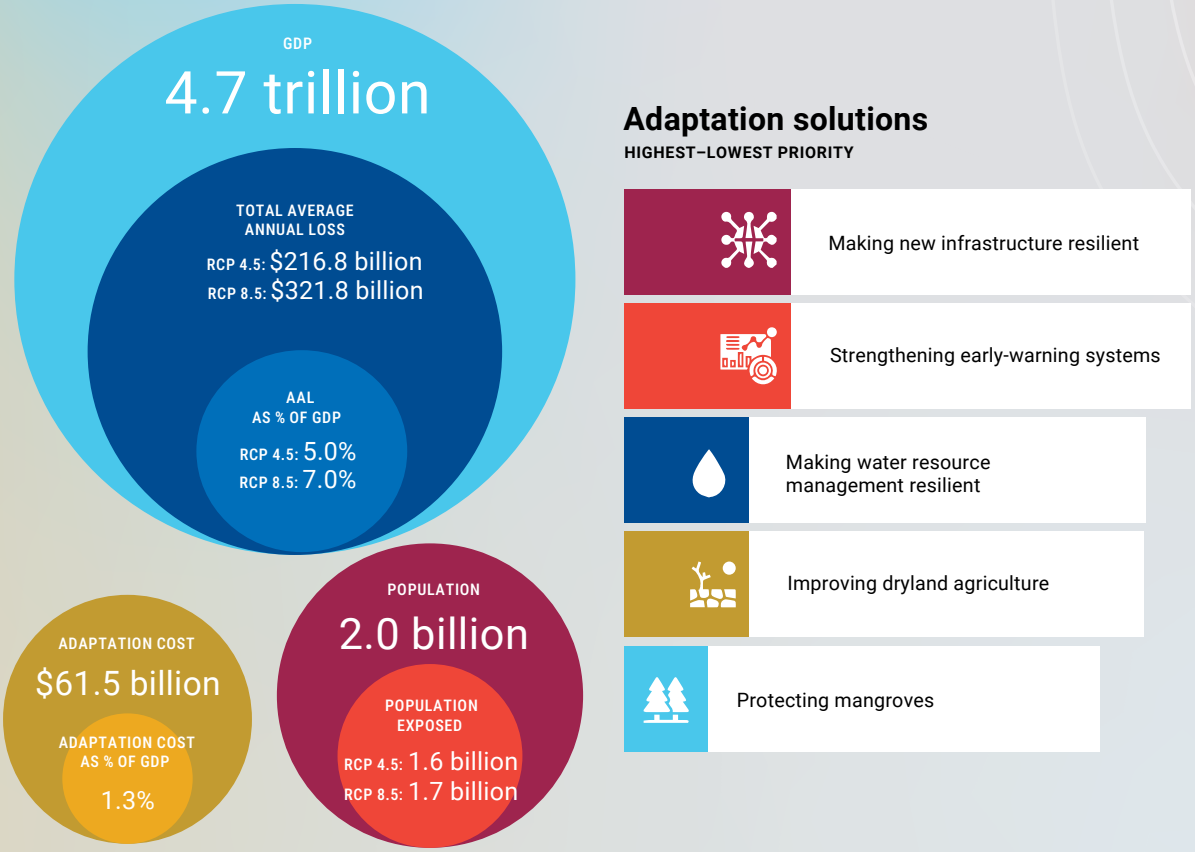
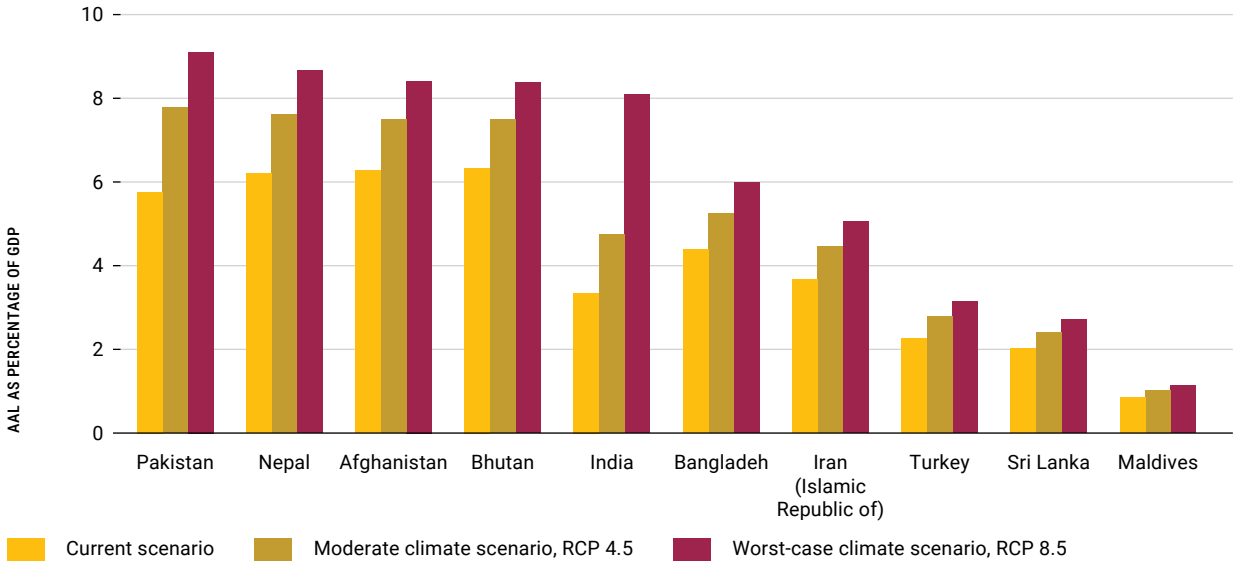


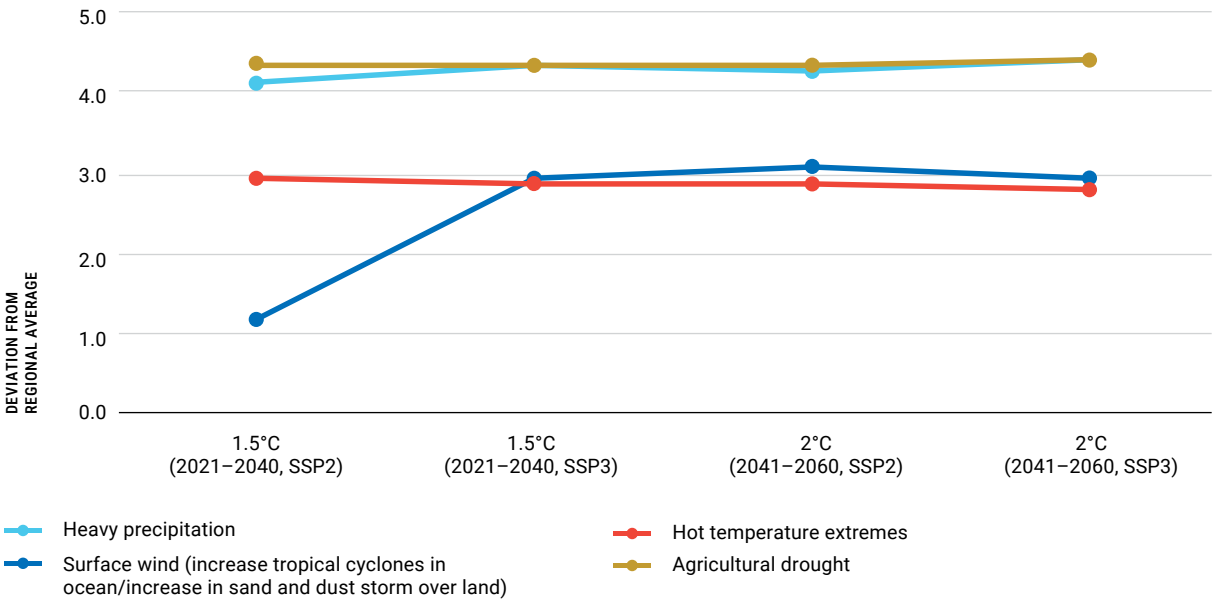
FIGURE 21 **Average Annual Losses as a percentage of GDP from cascading risks in South and South-West Asia**

ANALYSIS Pakistan is projected to record the highest AAL with losses accounting for 9.1 per cent of its GDP under the worst-case climate change scenario, followed by Nepal at 8.7 per cent.



Based on temperature increases of 1.5°C and 2°C under the two Shared Socio-economic Pathways (SSPs) scenarios, the disaster riskscape of South and South-West Asia comprises of the convergence of natural hazards, like droughts, floods, and cyclones, with vector-borne diseases, such as dengue. The subregion will be impacted by all climate extremes. For all scenarios, it will simultaneously be impacted by extremes in precipitation and dry days, which will potentially lead to more flooding and increases in the intensity of droughts. Such simultaneous and cascading disasters will effect one of the most vulnerable regions in the world — the Ganga Brahmaputra and Meghna Basin. Additionally, under the worst-case 1.5°C scenario (SSP3), the subregion will also be impacted by more frequent tropical cyclones along with hot temperature extremes (Figure 22).

FIGURE 22 **Relative intensity of weather extremes under 1.5°C and 2°C in South and South-West Asia**

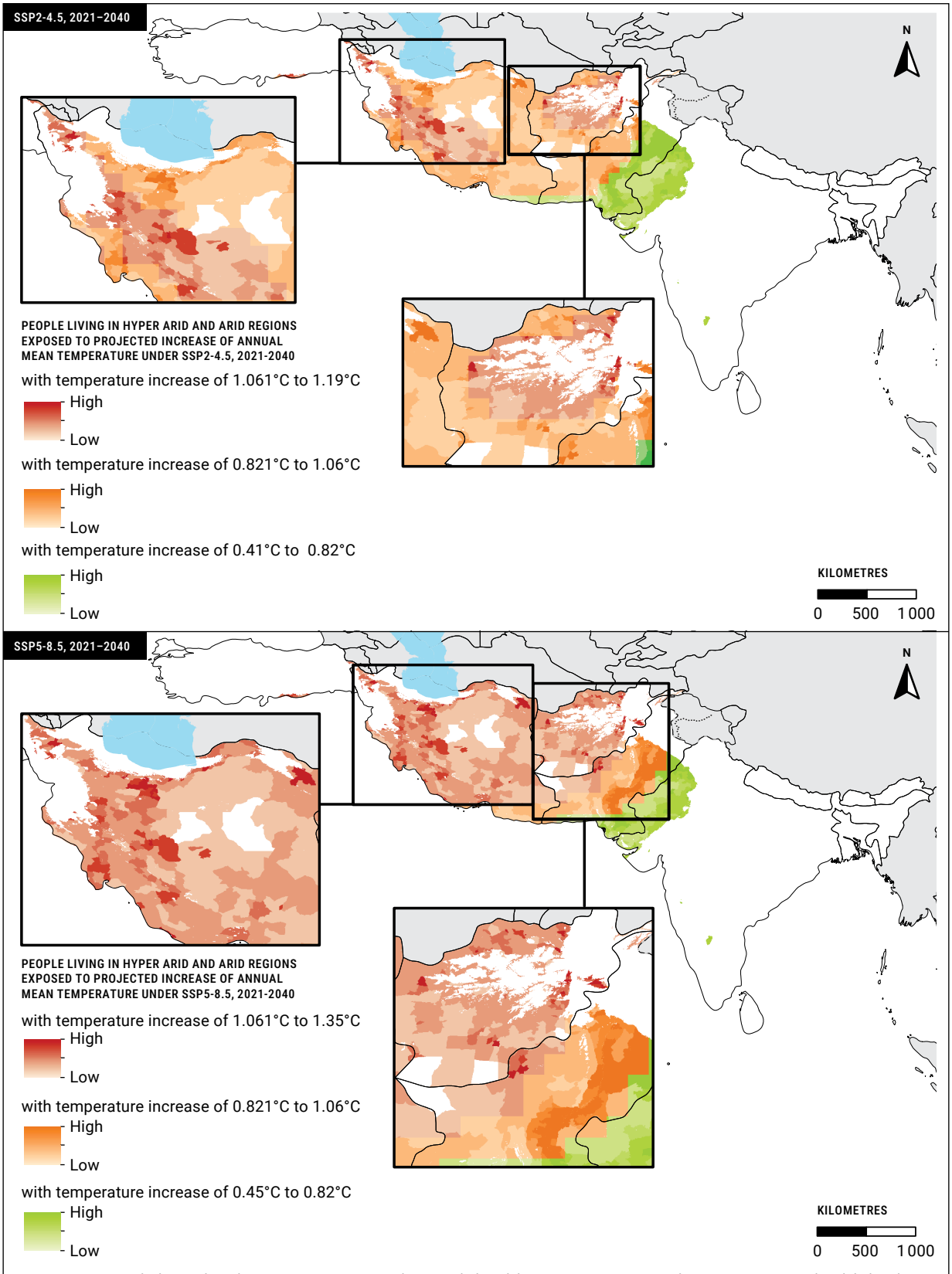


ESCAP analysis also reveals that arid and semi-arid land has been expanding and aridity has been intensifying in South and South-West Asia, particularly in Afghanistan, the Islamic Republic of Iran, Pakistan, and India. Currently, about 14.1 per cent of the total population in the subregion lives in hyper arid and arid regions. Under SSP 2, these populations will face the projected increase in temperature from 0.41°C to 1.19°C, and from 0.45°C to 1.35°C under SSP 5. This could result in an increase in droughts and sand and dust storms in the next 20 years (Figure 23).

Further, the Ganga Brahmaputra and Megna (GBM) basin is a flood hotspot in South and South-West Asia. Around 298 million people accounting for 100 per cent population of Nepal and Bhutan and 93 per cent population in Bangladesh live in this basin. In the current climate scenario, 34.8 per cent of the population living in the GBM basin is exposed to flood and related biological hazards (100-year return period). Moreover, 90 per cent of this exposed population is vulnerable as they score low and medium on the human development index (HDI). ESCAP analysis highlights that this GBM hotspot is set to intensify and expand under the worst-case climate change scenario (RCP 8.5, 2040-2059) (Figure 24).

> For all scenarios, **South and South-West Asia** will simultaneously be impacted by extremes in precipitation and dry days, which will potentially lead to more flooding and increases in the intensity of droughts

FIGURE 23 Population exposed to hyper arid and arid regions with additional exposure to projected increase of annual mean temperature under SSP 2 and SSP 5

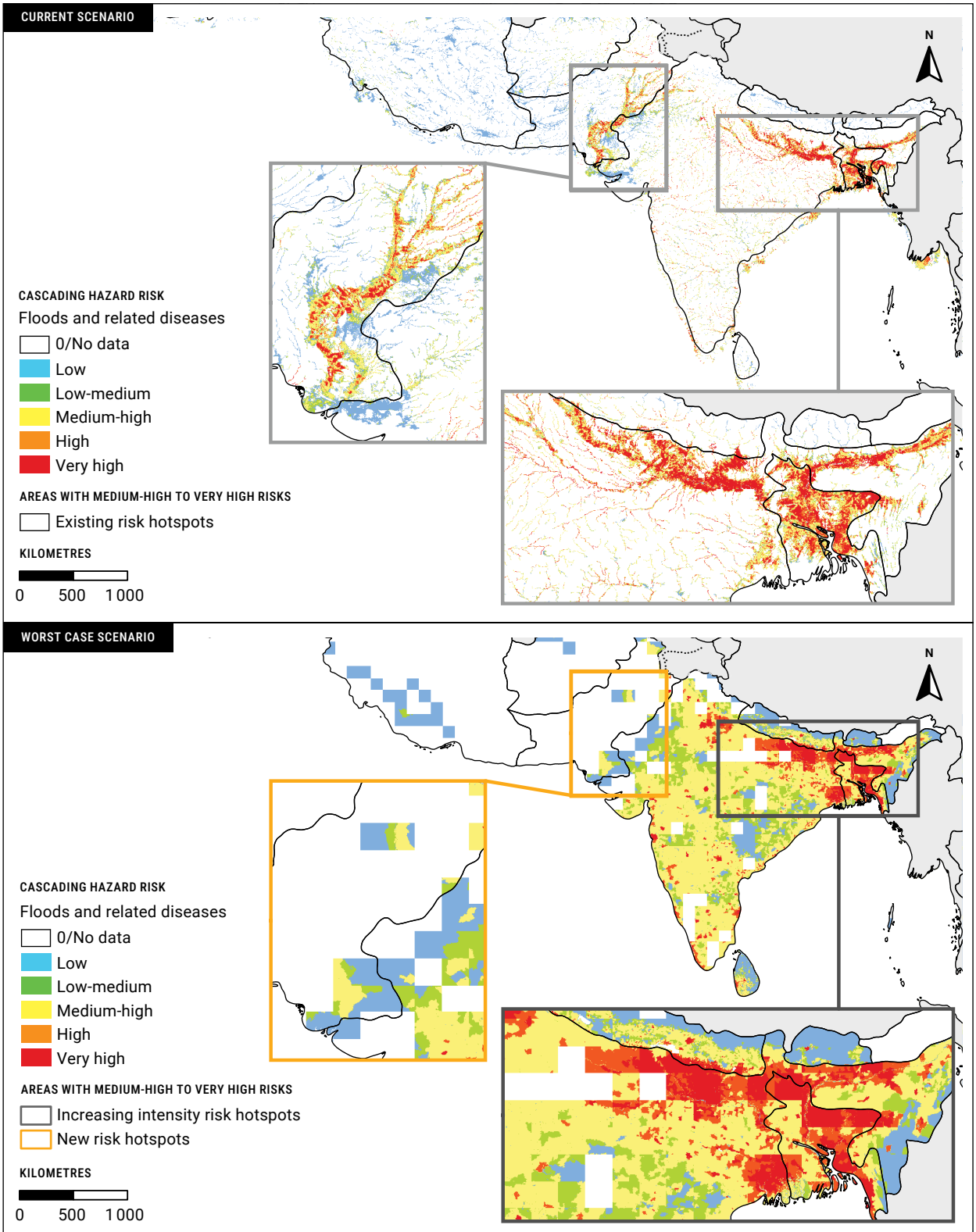


Sources: ESCAP calculations, based on IPCC WGI Interactive Atlas - Coupled Model Intercomparison Project Phase 6 (CMIP6), 2021; The Global Aridity Index, 2019; UN-WPP Adjusted Population Count 2020, v4.11; and UN Geospatial.

Notes: 1. Projected increase 2021-2040 in Annual Mean Temperature Change under SSP2-4.5 ranges from 00.41°C to 1.19°C, and from 0.45°C to 1.35°C under SSP5-8.5.
2. The reference period for the projected change 2021-2040 in Annual Mean Temperature Change is 1995 - 2014.

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.

FIGURE 24 Population exposure to floods and related diseases under current and worst-case (RCP 8.5) scenarios in South and South-West Asia



Sources: ESCAP calculations, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015; Climate Change Knowledge Portal, 2018; UN WPP-Adjusted Population Density 2020, v4.11; Disability Adjusted Life Years (DALYs) estimates 2000-2019; and UN Geospatial.

Note: 1. Cascading hazard risk for current scenario is obtained from Flood hazards 100 year return period by population and Disability-Adjusted Life Years (DALYs). 2. Cascading hazard risk for the worst case is obtained from Projected Change 2040-2059 in Spatial Variation for the 10-year return level of the maximum 5-day cumulative Precipitation under RCP 8.5 by population and Disability-Adjusted Life Years (DALYs).
3. Projected Change 2040–2059 in Spatial Variation for 10 year return level of the maximum 5-day cumulative Precipitation under RCP 8.5 ranges from 11mm to maximum precipitation amount.
4. DALY indicators for flood-related diseases consist of diarrheal diseases, measles, hepatitis A, malaria, dengue and drowning.

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 staus of Jammu and Kashmir has not yet been agreed upon by the parties.

Resilience pathways for accelerating progress on the SDGs

Significant progress has been made on the Sustainable Development Goals in South and South-West Asia, yet some gaps remain. Regressions have been recorded on several goals, particularly, Goal 11 (Sustainable cities and communities), and Goal 13 (Climate action). There is also a need to accelerate progress on targets 13.1 and 13.2 on resilience and adaptive capacity, as well as on climate change policies. Investing in the following measures for adaptation and resilience-building will not only yield high returns, but also support progress on the SDGs.

For South and South-West Asia, the following are the key adaptation pathways (scores from 5-1, with 5 representing the highest priority) (Figure 25):

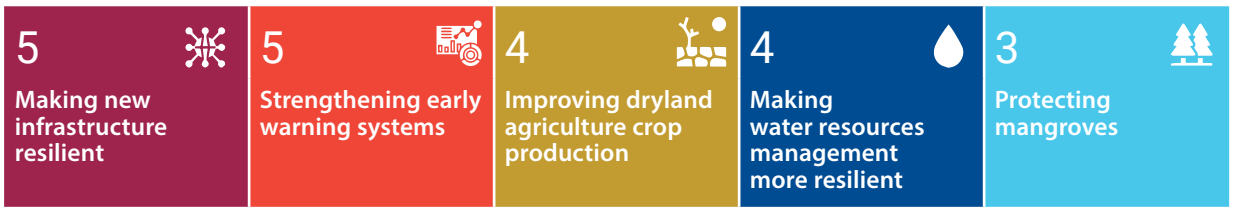
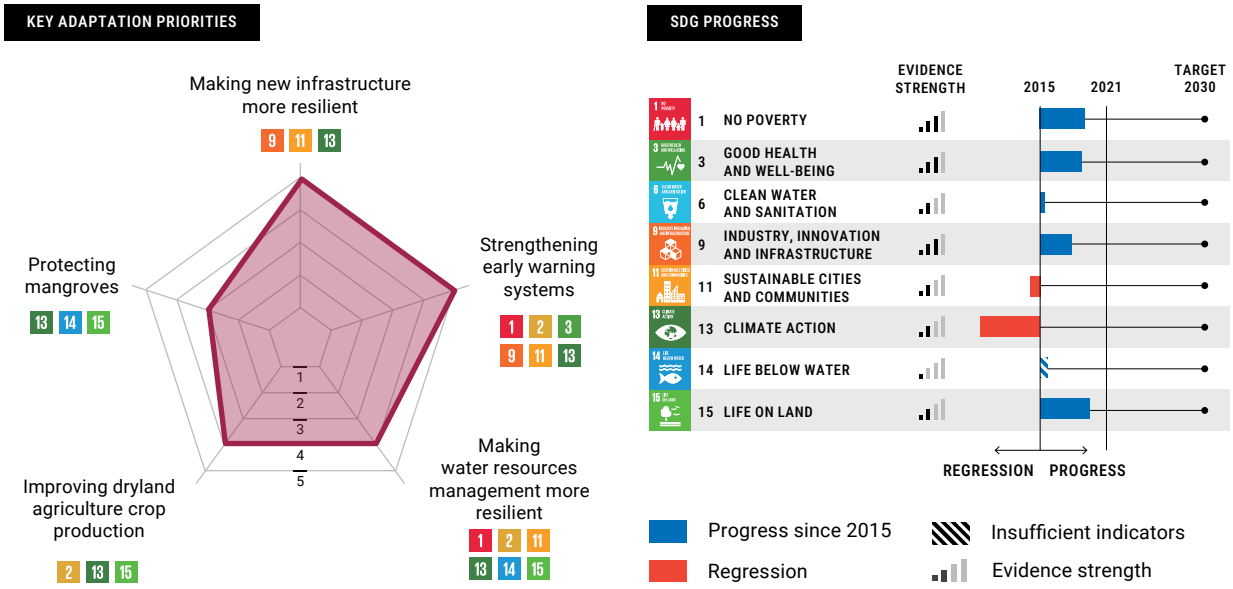


Figure 25 illustrates the SDG snapshot for the South and South-West subregion together with the key adaptation priorities.

FIGURE 25 Comparison of adaptation measures with disaster-related SDGs



Riskscape in the Pacific small island developing States (SIDS)

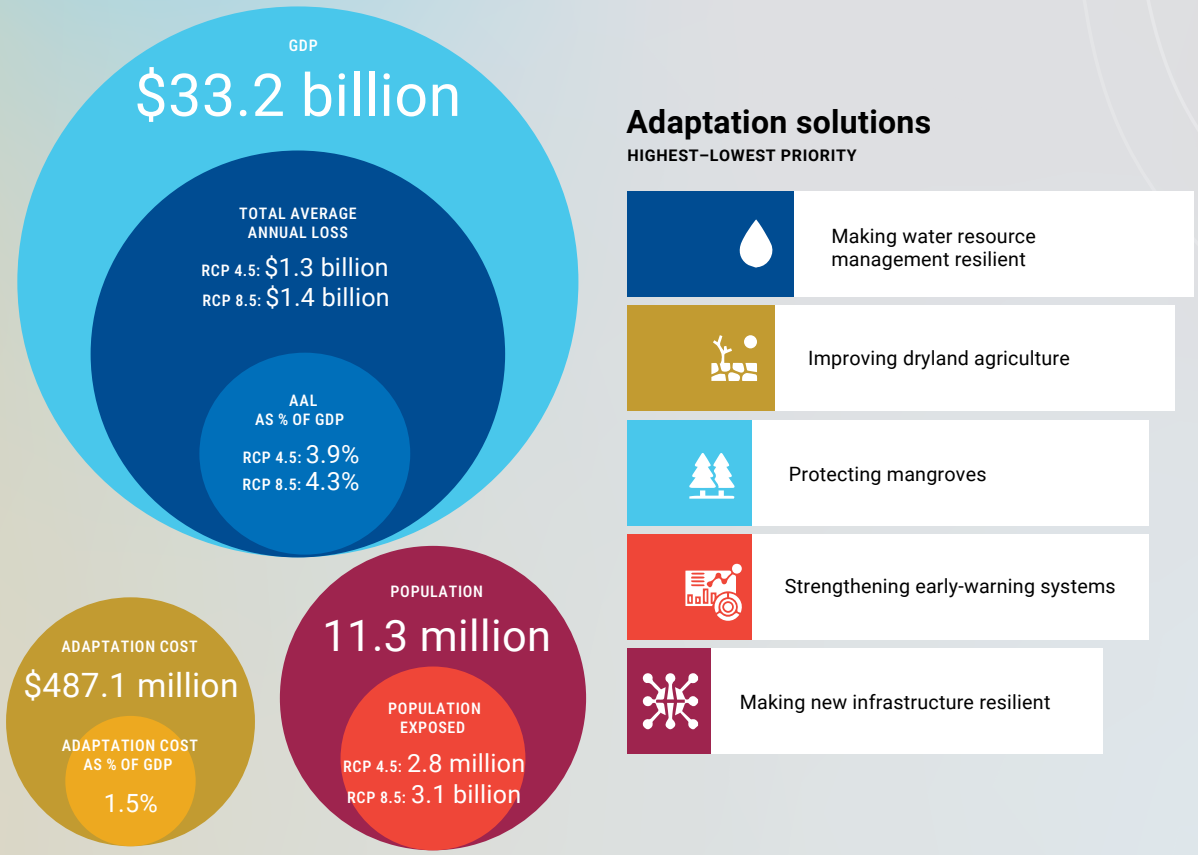
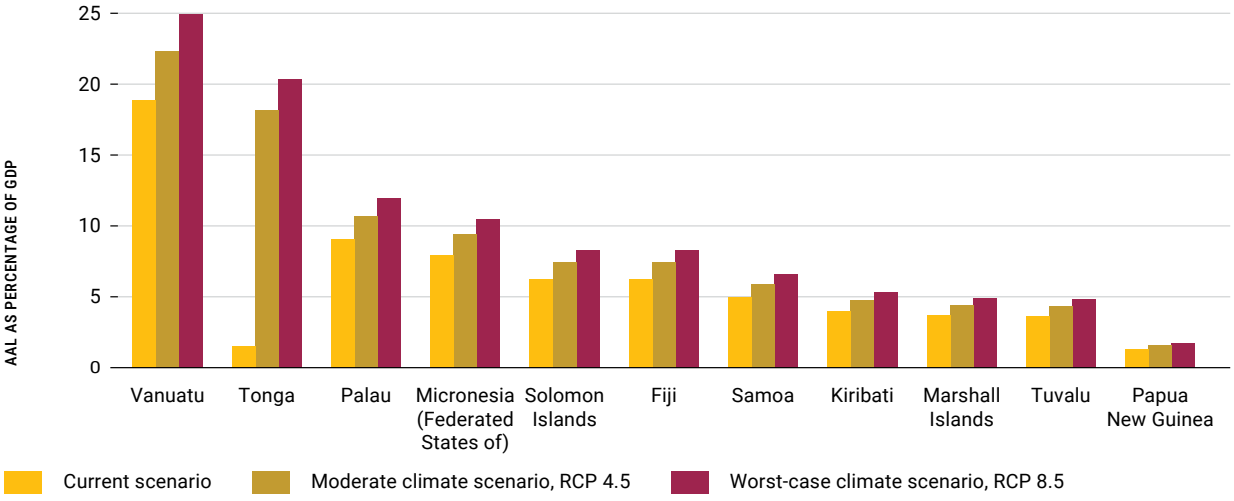


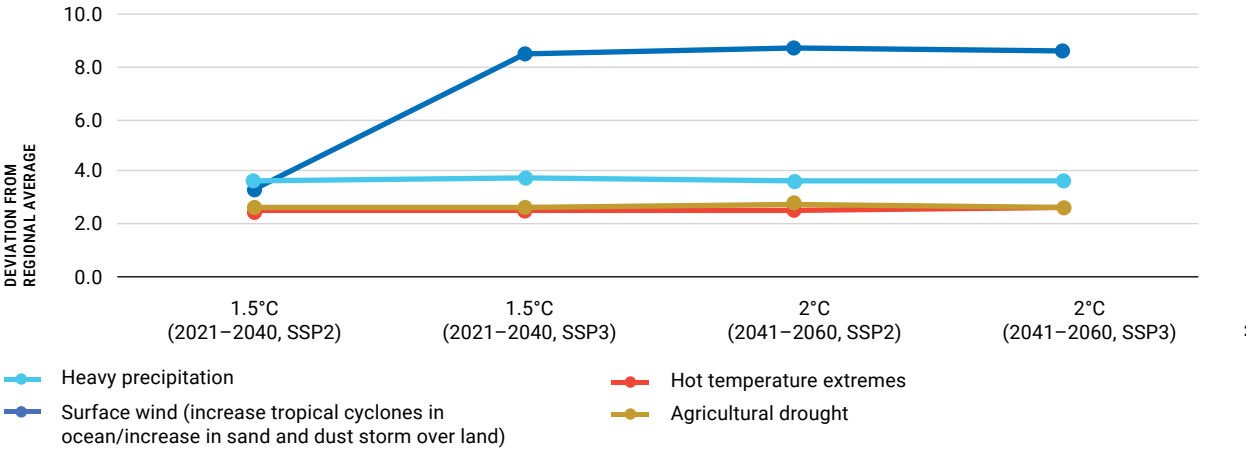
FIGURE 26 **Average Annual Losses as a percentage of GDP from cascading risks in the Pacific small island developing States**

ANALYSIS Under the worst-climate change scenario, Vanuatu faces the highest losses in the region with AAL accounting for 25 per cent of its GDP, followed by Tonga at nearly 21 per cent of the country's GDP.



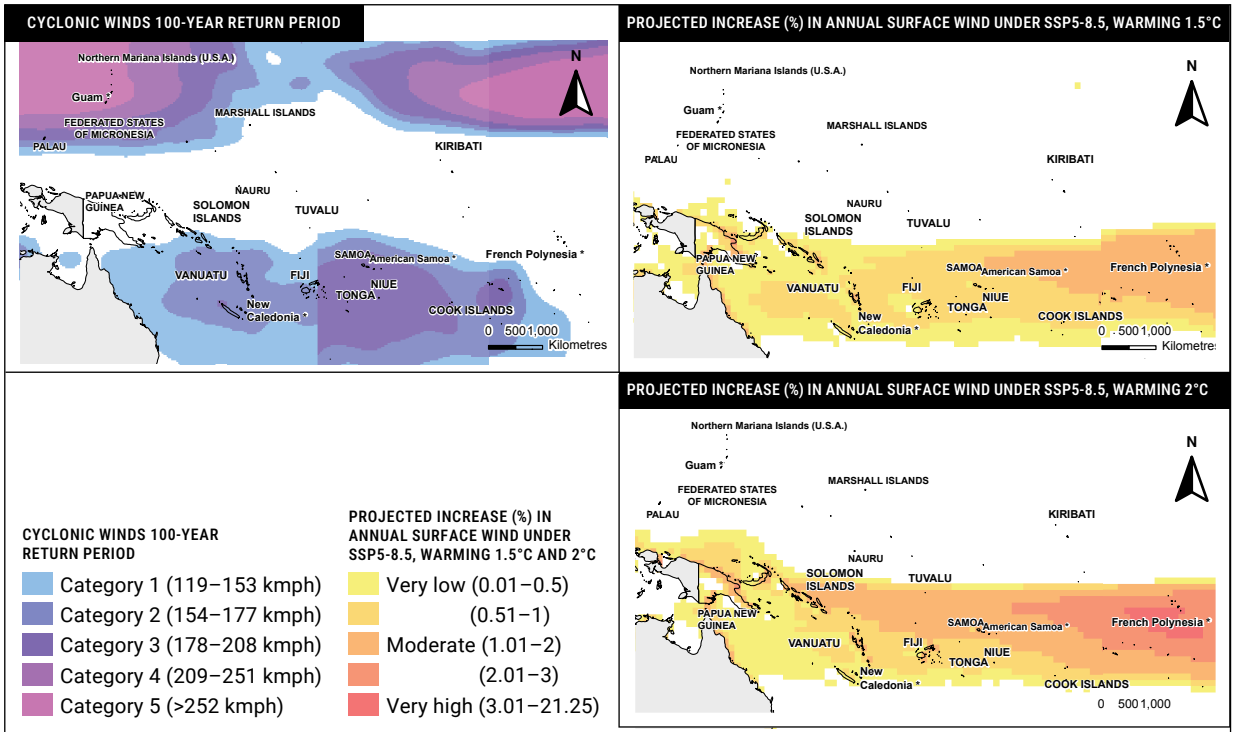
Based on temperature increases of 1.5°C and 2°C under the two Shared Socio-economic Pathways (SSPs) scenarios, the disaster riskscape of the Pacific SIDS comprises of increased risks from tropical cyclones, floods, and droughts. More specifically, the Pacific SIDS will be disproportionately impacted by high surface winds under both the 1.5°C and 2°C scenarios, leading to more frequent and more intense tropical cyclones compared to any other subregion (Figure 27).

FIGURE 27 **Relative intensity of weather extremes under 1.5°C and 2°C in the Pacific SIDS**



Every increment of a degree between 1.5°C and 2°C translates into increased risks of tropical cyclones, particularly in the Pacific SIDS. The Pacific SIDS will face increasing annual wind speeds of tropical cyclones and will be vulnerable to the associated health hazards (Figure 28).

FIGURE 28 **Projected increase in tropical cyclones and annual surface winds under SSP 5–8.5**



Sources: ESCAP based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015; IPCC WGI Interactive Atlas - Coupled Model Intercomparison Project Phase 6 (CIMP6), 2021; and UN Geospatial.

Notes: 1. Cyclone data consists of all cyclone wind categories with a return period of 100 years and an intensity of 119 to more than 252 km/h. Cyclonic wind intensity categories are based on Saffir-Simpson scale.
2. Projected increase in Annual Surface Wind Change under SSP5-8.5 ranges from 0 and above.
3. The reference period for the projected change in Annual Surface Wind Change under SSP 5-8.5 is 1995-2014.

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

> **Guam and Northern Mariana Islands** are prone to very strong category-5 cyclones; the **Federated States of Micronesia** are prone to category-4 cyclones; and **American Samoa, Fiji, New Caledonia, Palau, Samoa and Tonga** are prone to category-3 cyclones.

Resilience pathways for accelerating progress

Despite some progress in the achievement of the Sustainable Development Goals in the Pacific SIDS, some gaps remain particularly in SDG 13 (Climate action) and in all the targets related to disaster risk reduction. All disaster risk related SDGs for which there is data have either seen a reverse trend or are currently falling short of meeting the goals of the 2030 Agenda. Investing in the following measures for adaptation and resilience-building will not only yield high returns, but also support progress on the SDGs.

For the Pacific small island developing States, the following are the key adaptation pathways (scores from 5-1, with 5 representing the highest priority) (Figure 29):

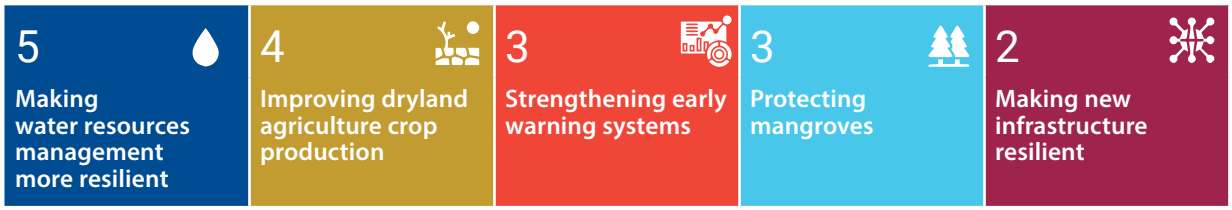
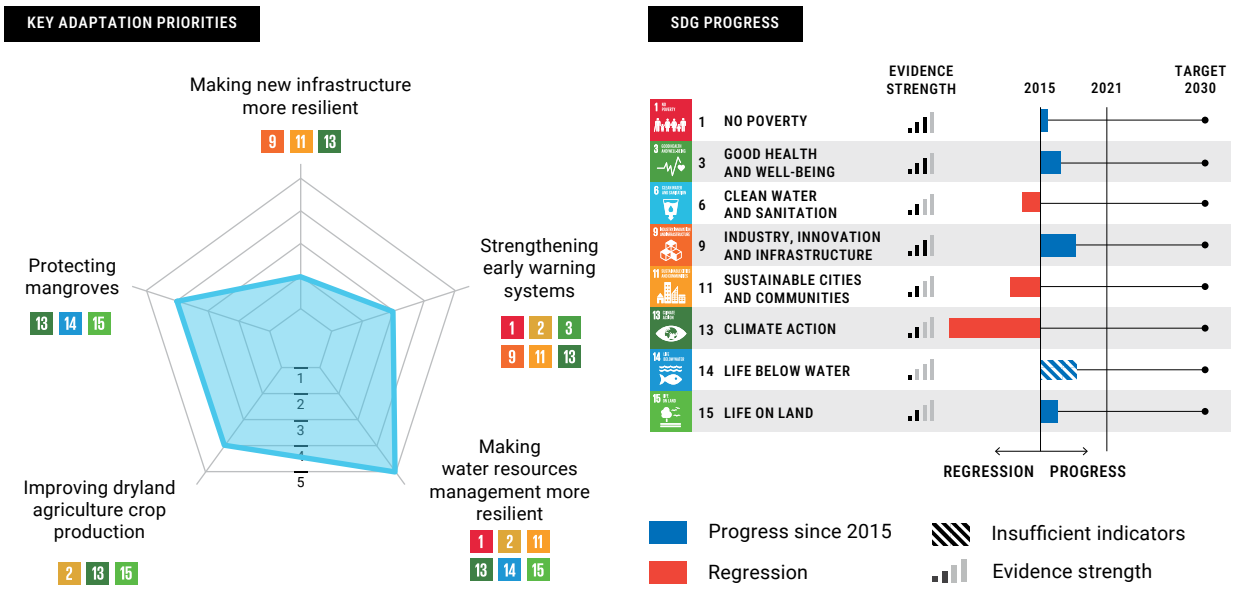


Figure 29 illustrates the SDG snapshot for the Pacific SIDS together with the key adaptation priorities.

FIGURE 29 Comparison of adaptation measures with disaster-related SDGs



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Source of data for all subregional figures on:

RELATIVE INTENSITY OF WEATHER EXTREMES UNDER 1.5°C AND 2°C:

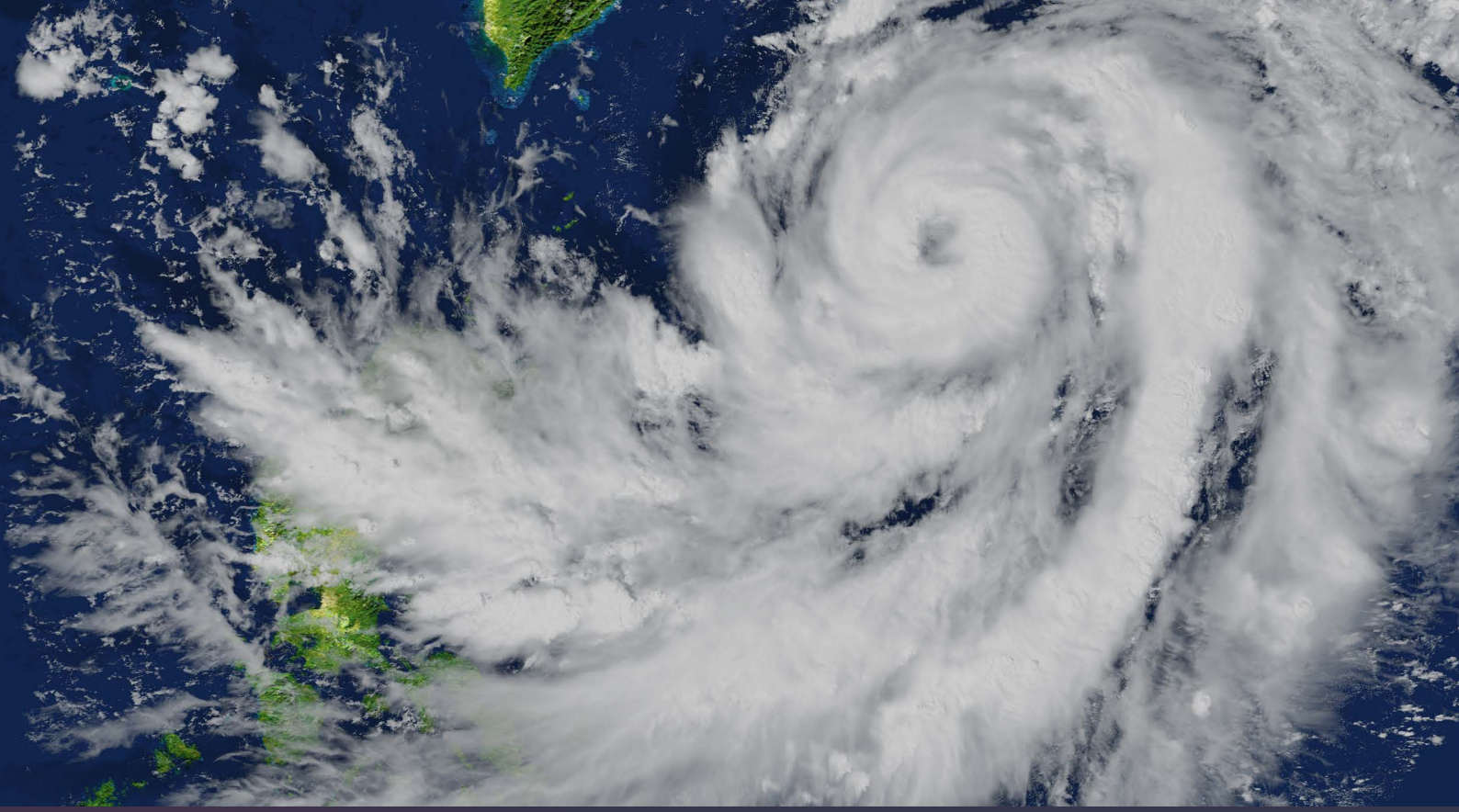
ESCAP calculations based on the Intergovernmental Panel on Climate Change (IPCC) Working Group I (WGI): Interactive Atlas – Coupled Model Intercomparison Project Phase 6 (CMIP6), 2021b. Available at https://interactive-atlas.ipcc.ch.

COMPARISON OF ADAPTION MEASURES WITH DISASTER-RELATED SDGS:

ESCAP calculations based on data from EM-DAT – The International Disaster Database. Available at https://www.emdat.be; World Bank, "World Bank Open Data". Available at https://data.worldbank.org/; Asia-Pacific SDG Gateway. Available at https://data.unescap.org/home; and Asia and the Pacific SDG Progress Report 2022 (United Nations publication, 2022).

Note for the infographic for each subregion:

GDP refers to the gross domestic product in current prices, 2018; Total Average Annual Loss (2020-2059 projections), Population Exposure (2020-2039 and 2040-2059 projections), and Adaptation Costs (2020-2059 projections) are noted for cascading multi-hazard risks from natural and biological hazards under moderate (RCP 4.5) and worst-case (RCP 8.5) climate-change scenarios. Total population and population exposure numbers are calculated based on Centre for International Earth Science Information Network (CIESEN), Gridded Population of the World (GPW), v4, 2020.



Global warming at 1.5°C continues to impact the frequency and intensity of disasters in Asia and the Pacific, reshaping and expanding its disaster "riskscape". The *Asia-Pacific Disaster Report 2021* (APDR) provides an overview of climate risk and suggests measures that can build resilience in the Asia-Pacific region, focusing on the emerging disaster-climate-health nexus.

The 2022 subregional reports of the APDR demonstrate how each ESCAP subregion is being affected by various risk parameters under new climate models based on the Shared Socio-economic Pathways (SSPs), and where new hotspots of exposure and vulnerability to climate-induced, cascading multi-hazard scenarios are being created. Moving forward, ESCAP recommends that the subregions implement customized adaptation and resilience pathways with emphasis on risk-informed development policies and investments, technological innovations and subregional cooperation approaches. These measures can accelerate the progress of countries in achieving the Sustainable Development Goals and the targets of the Sendai Framework for Disaster Risk Reduction.