Technological and Policy Innovations for Climate Resilient Infrastructure with lessons from the Asia-Pacific: An Overview

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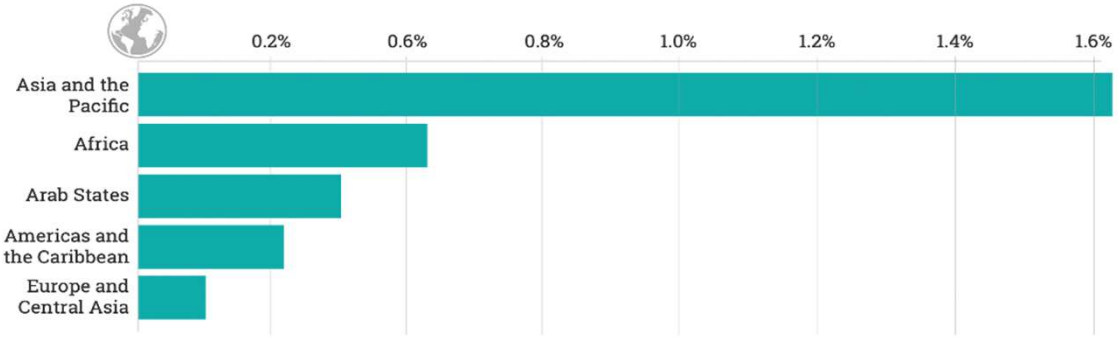
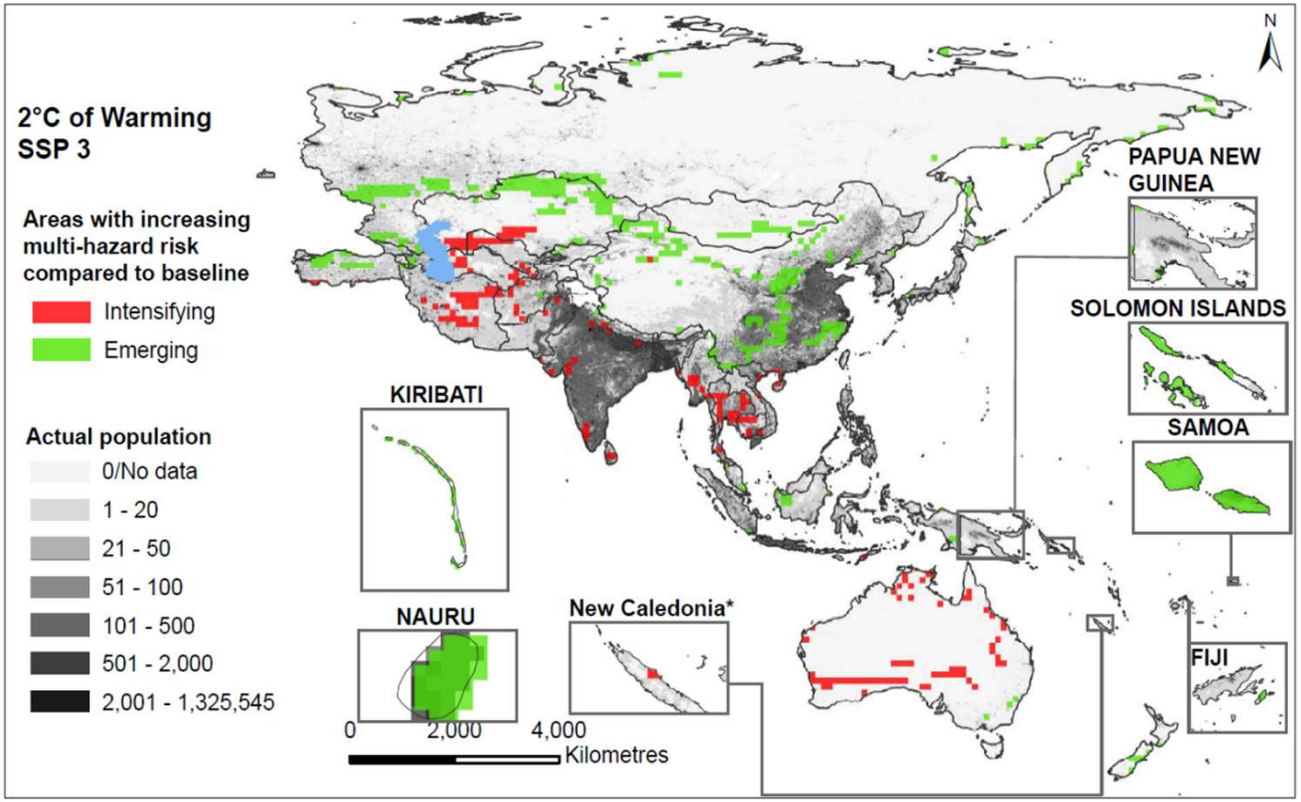
Asia-Pacific: Disaster Impact Scenario

- Asia-Pacific remains the most disaster impacted region. Since 1970, two million people have lost their lives, equivalent to 105 lives being lost to disasters every day.
- The LDCs/SIDS accounts for mortality five times as compared to the rest of the Asia-Pacific
- The cost of inaction is on the rise, regression on SDG 13, Sendai targets off the tracks



The highest share of economic loss by region is borne within Asia-Pacific, where countries lose on average 1.6% of GDP to disasters
Source: GAR 2021

Emerging and intensifying risk hotspots: Population exposed under 1.5 ℃ and 2 ℃ warming scenario



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Average Annual Losses in Asia-Pacific

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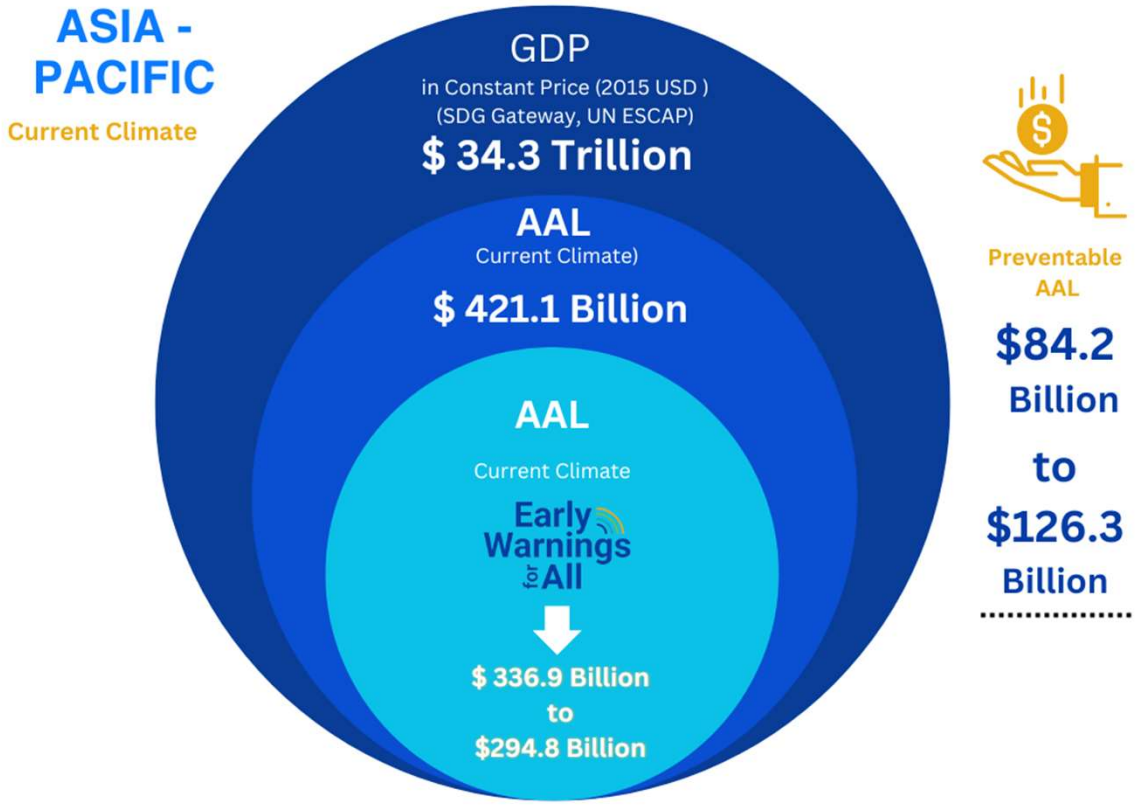


Preventable AAL

$84.2 Billion to $126.3 Billion

Studies have outlined how only a **24-hour warning** of an oncoming storm or heatwave **could reduce damages by**

30%

and how **flood warnings could alone avoid**

32.85 %

of damages

(Global Commission on Adaptation, 2019; Pappenberger and others, 2015).

What to do for disaster loss prevention?

Residual risk

The disaster risk that remains in unmanaged form for which emergency response must be maintained

Loss and damage

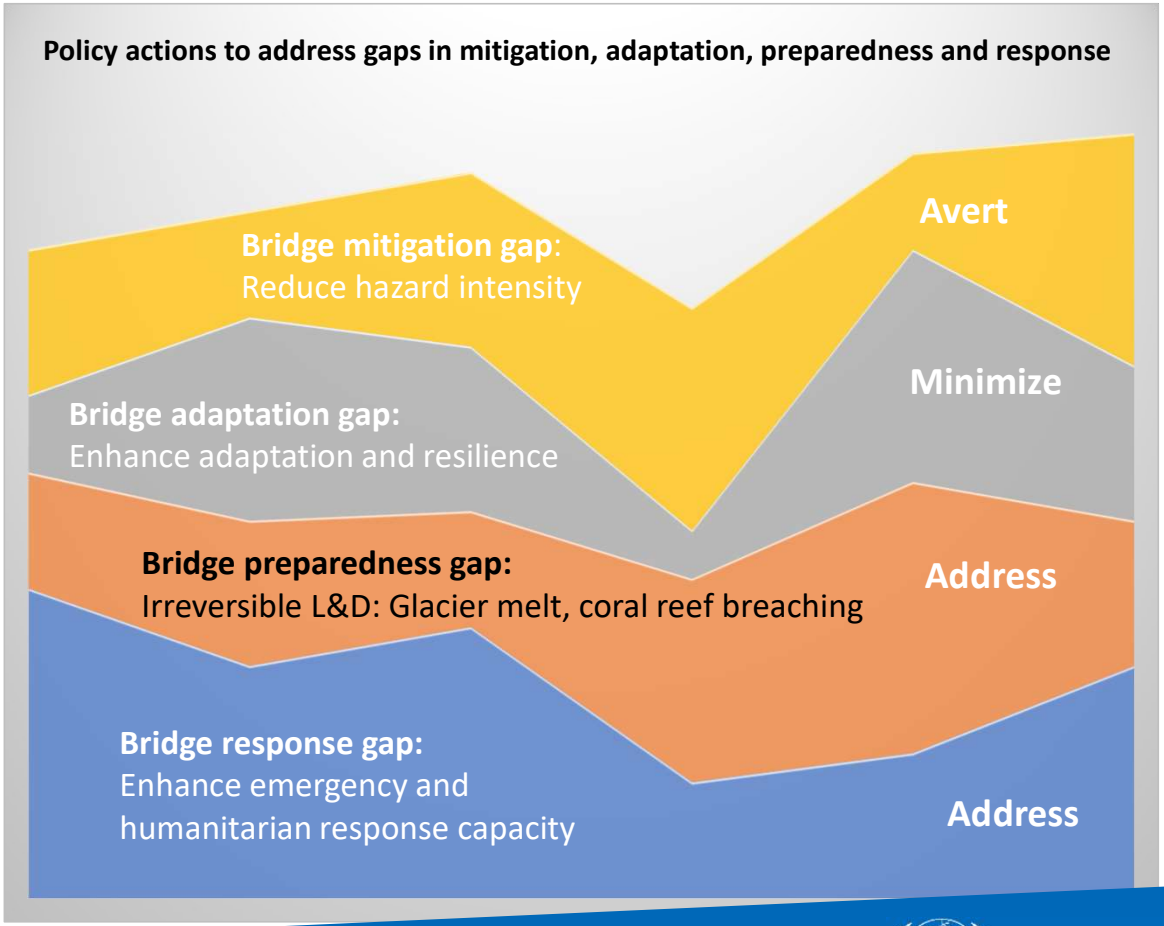
When mitigation and adaptation efforts are unsuccessful or impossible to implement

Adaptation

Investing in early warning systems, resilient food-water- energy systems, nature-based solutions..

Mitigation

“Averted” and “minimized” disaster risk by curbing greenhouse gas emissions



Data and technology ecosystems

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Disaster risk management

Adaptation technology cluster

Adaptation technologies show strong technological complementarities with mitigation given that more than 25 per cent of adaptation technologies carry mitigation benefits

Cluster II.

Engineering-based technologies (Critical infrastructure, water, energy, transport, digital/ICT)

Cluster I

Science-intensive technologies (climate, agriculture, health, and indirect adaptation), modelling and simulations

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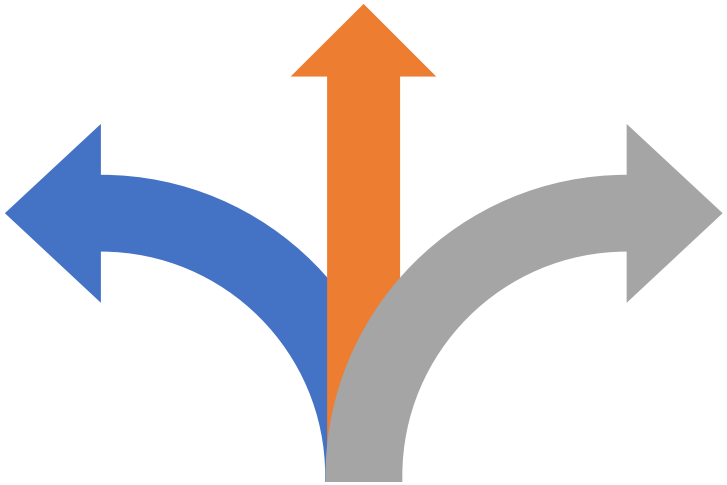


Cluster III.

Data science and geospatial technology, Earth observations, risk analytics, early warning systems.

Adaptation technology clusters

Technology to enable a resilient society

People to appreciate the imminent threat of climate emergency: nearing the point of no return but all is not lost.	AWARENESS
There is no substitute for swift mitigation of GHG emissions, adaptation gaps to be narrowed down with 'just' transition approach	RECOGNITION
By leveraging the best of technology, we can pave the way for innovative, collaborative solutions to just transitions.	CAPACITY
Data-driven and digital technologies provide a unique set of capabilities particularly well-suited to support adaptation	OPPORTUNITIES
To be effective at scale, adaptation technologies need to become more standardized, transparent and equitable.	PATHWAYS

Source: World Economic Forum 2024

Averted story of fatal landslides

Effectively predicted landslides and saved countless lives

Source: averteddisasteraward.org

1

People's centered landslide EWS: Co-designed by scientists and @risk communities

The Amrita Center deployed the world's first wireless sensor network for landslide monitoring and early warning in Munnar, Western Ghats, and Sikkim, Himalayas

2

AI-enabled Internet of Things (IoT): Amrita-LEWS

An innovative system consisting of more than 150 sensors strategically placed underground, ranging from the surface level to bedrock.

3

What sets Amrita-LEWS apart: Multi-scale warnings for different types of landslides

By seamlessly integrating meteorological, geological, and hydrological data through an IoT framework, the system delivers timely and reliable early warnings

4

Two striking examples highlight Amrita-LEWS's effectiveness:

In August 2020 and August 2022, regional warnings were issued for devastating landslides occurred within a mere 20 kilometers of the deployment sites that triggered successful response actions. Disasters averted.

Tool 1: UNESCAP's Asia Pacific Risk and Resilience Portal

Asia Pacific Risk and Resilience Portal leverages CDRI data to strengthen risk-information, enhance decision-making, and promote subregional and regional cooperation. This initiative is part of the Asia Pacific Disaster Resilience Network, offering a one-stop solution for disaster preparedness and resilience.

url: Rrp.unecap.org

Open source data

SDGs — Support Global Frameworks

EW4ALL

Sendai Framework — Support country adaptation plans

NAPs

VNR

Chat-AI — User friendly interface built on AI

Automated IbF

Adaptation Tool — Automated risk analysis with Machine Learning

Satellite Data

Spatial Analysis

Statistical Analysis — Modelling & Risk Analysis methodologies

Biological

DALY

Health Care Access

Social

Population

Male, Female, Elderly

SHDI

Economic

Critical Sector

Agriculture, Energy, Infrastructure, Water

Environment

Land Degradation

Elevation Model

Mangroves

Desertification

Soil Moisture

Soil Texture

Vegetation Health — Exposure & Vulnerability Data

Climate Scenarios

Existing Climate

SSP 126

SSP 585

Flood

Drought

Heatwave

Cyclones

Glacial Lake Outburst

Landslide

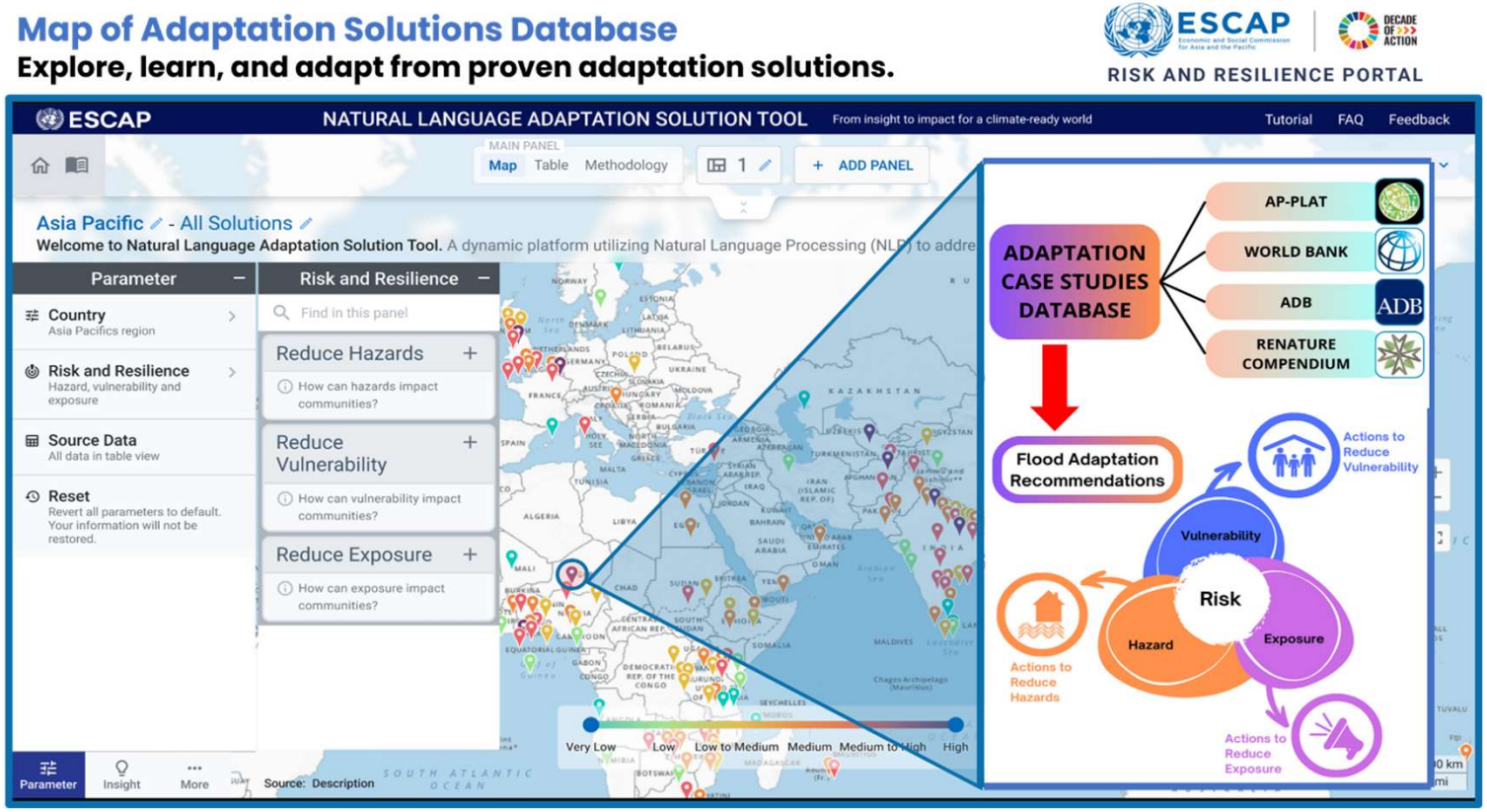
Geophysical Hazard

Earthquake

Tsunami — Hazard & Climate Data

Tool 2: ClimaWise: AI-Powered Exposure Reduction and Adaptation Planning

ClimaWise leverages CDRI Data(to generate risk profile) and AI to provide critical insights for reducing exposure to hazards and guiding disaster preparedness strategies.



People's centered early warnings: impact-based forecasting

USER INPUT*

- Population data
- Infrastructure data
- Hazard data
- Boundary data

OUTPUT

- Exposure and intensity zone of hazards
- Map & exportable table

GEOSPATIAL PYTHON AUTOMATION SCRIPT

GEOSPATIAL PRE-PROCESSING → PROCESS IDENTIFICATION → GEOSPATIAL EXPOSURE ANALYSIS

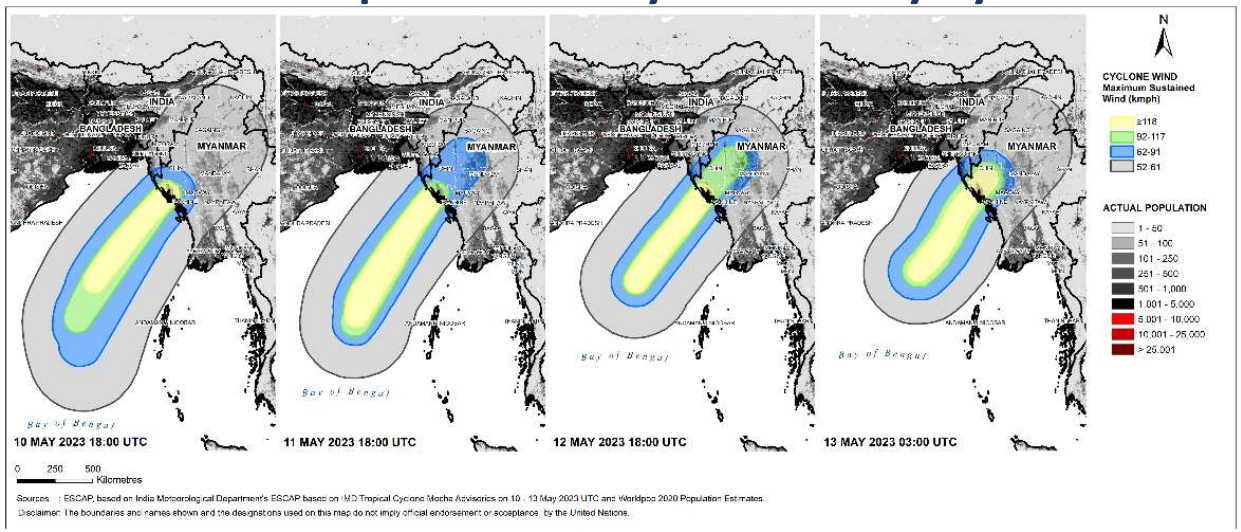
- Setting Coordinate Reference Systems
- Setting resolution
- Classifying hazard (based on intensities, create different hazard intensity zones)

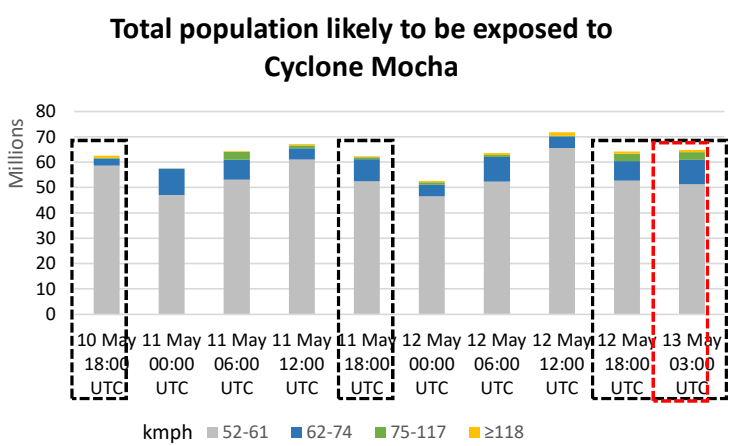
- Auto recognize type of infrastructure / population data

- Calculate exposure to all infrastructure and population
- Overlay & count exposure

Impact forecasting:

Estimation of Population likely to be hit by Cyclone Mocha

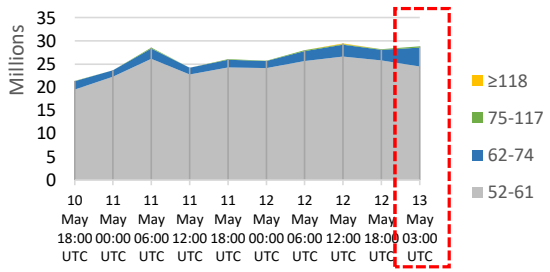




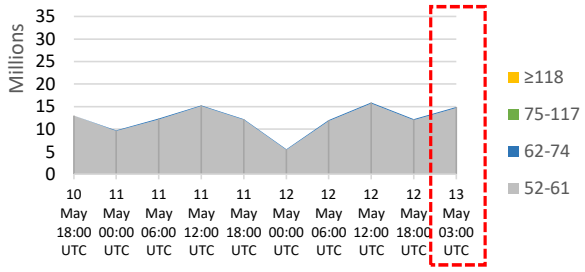
By using the data from RSMC Delhi – IMD, we were able to estimate the number of people likely to be affected by Cyclone Mocha from 10 to 13 May 2023, every 6 hours.
Generated by algorithm on spatial datasets, **the automation process enables rapid quantification of potential exposure in multiple sectors.**

Based on the latest advisory on **13 May, 03:00 UTC**, we quantified that **65 million** people were likely to be affected.
29 million in Bangladesh, 15 million in India, and 26 million in Myanmar.

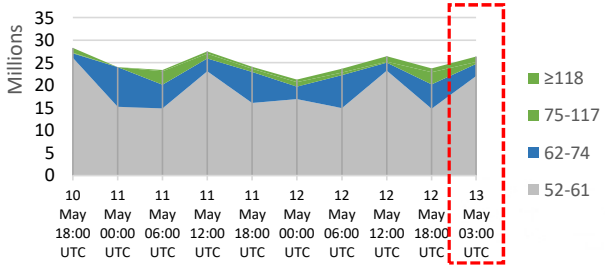
Bangladesh



India



Myanmar



Early warnings to protect critical Infrastructure to avoid cascading impacts, supply chain disruptions

Critical infrastructure sectors vital for securing the normal functioning of States and businesses, and for supporting the everyday life of people – often referred to as **'lifelines'.**

These sectors are not single systems but networks, which means that a local emergency could quickly spread and lead to severe disruptions;

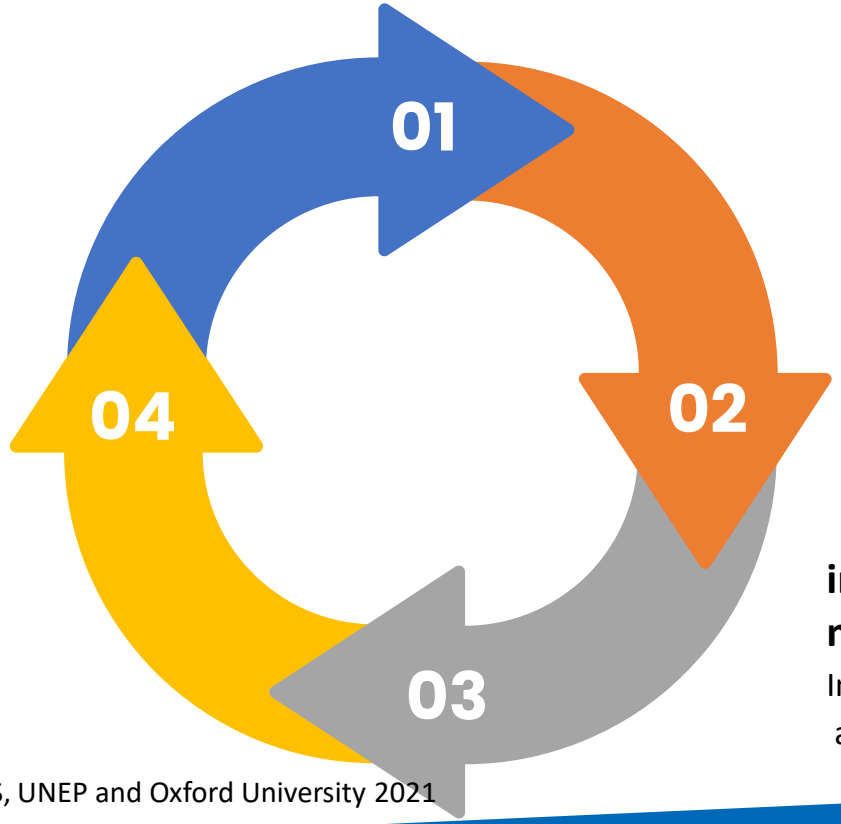
These sectors are becoming more and more interdependent, especially with the digitization of services.

Resilient water infrastructure

Water-energy and food nexus approach

Infrastructure is the key

responsible for 79 % emissions and 88% adaptation costs, across a range of sectors.



Water sector is critical

adapt to the impacts of climate change, at 54 % of all adaptation costs

New generation water infra: grey and green infra

To reduce the cost for flood risk management and protect coastal cities

integrated water resources management (IWRM)

Interdependencies and impacts across subsectors (SDG 6)

Source: Infrastructure for climate action, UNOPS, UNEP and Oxford University 2021

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Harnessing the synergy of platforms

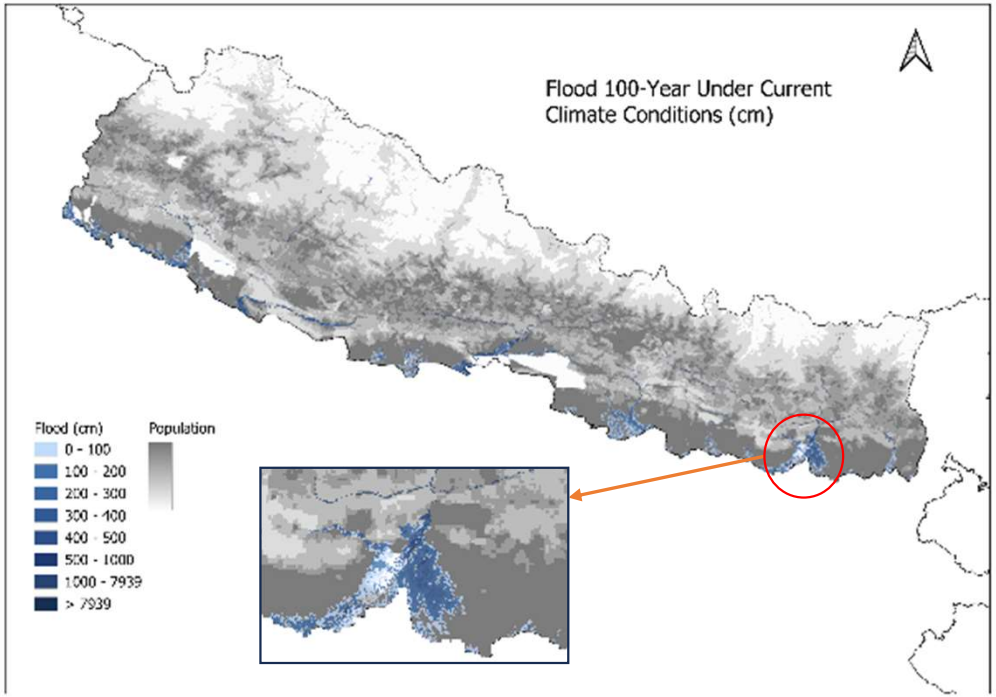
Elaborated modeling to generate hazard data using various variables
Very granular/fine resolution hazard data (100m~4km)

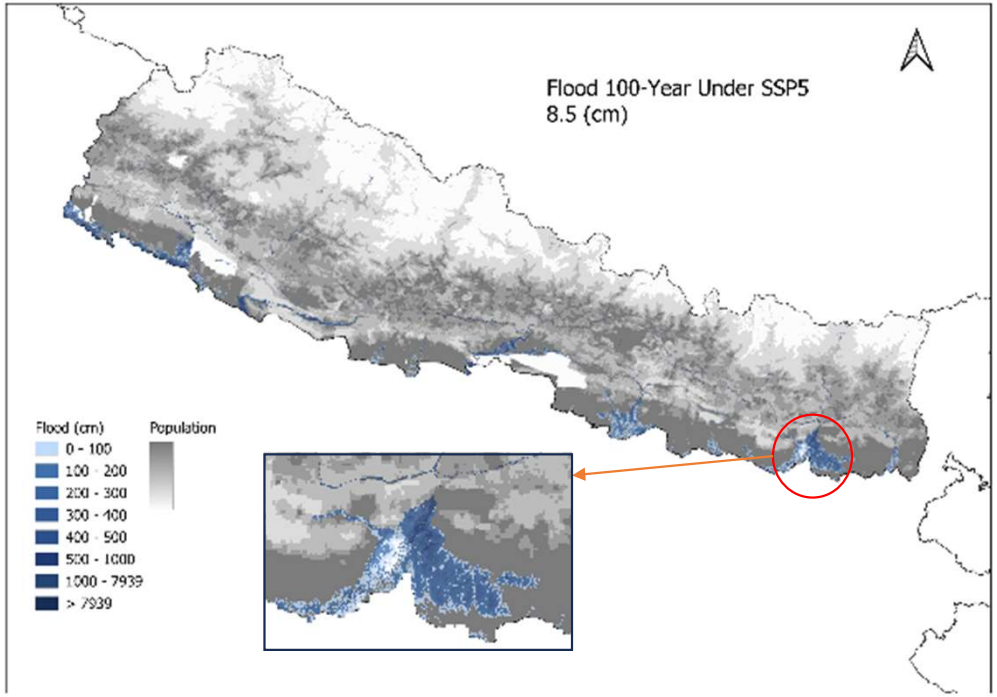
Visualizing and calculating hazards' impacts on exposures

CDRI
Coalition for Disaster Resilient Infrastructure

Rich hazard risk information provided by Global Infrastructure Resilience Index (GIRI)

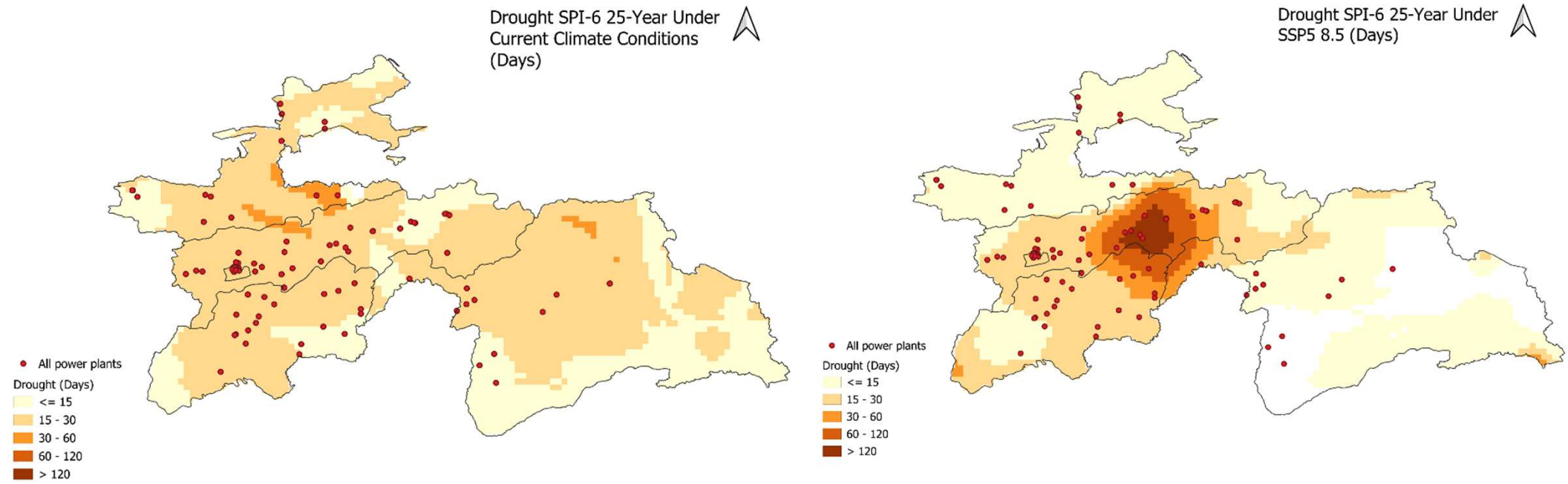
Flood climate projection x population (Nepal)





Sources: ESCAP calculations based on GIRI CDRI (2023); Global Spatially-Disaggregated Crop Production Statistics Data of 2010 (MapSPAM) V2r0 2020; and UN Geospatial.
Disclaimer: The boundaries and names shown, and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Drought climate projection x power plants (Tajikistan)



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Sources: ESCAP calculations based on IPCC WGI Interactive Atlas - Coupled Model Intercomparison Project Phase 6 (CMIP6) 2021; GIRI CDRI (2023); and UN Geospatial.

Key takeaways

01 Capitalize on technology ecosystems, digitalization for better understanding the complex and potentially systemic hazards stemming from climate change.

02 Build and capitalize on startups ecosystems to innovate, operate and scale frontier technology towards building a resilient society

03 Technologies and data systems provide the underpinning for evaluating risks, realizing people-centered early warnings and estimating loss and damage to support climate financing

04 As risks are always evolving, an iterative process of monitoring, evaluation and learning can inform both understanding and management of climate risks.

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Thank you!