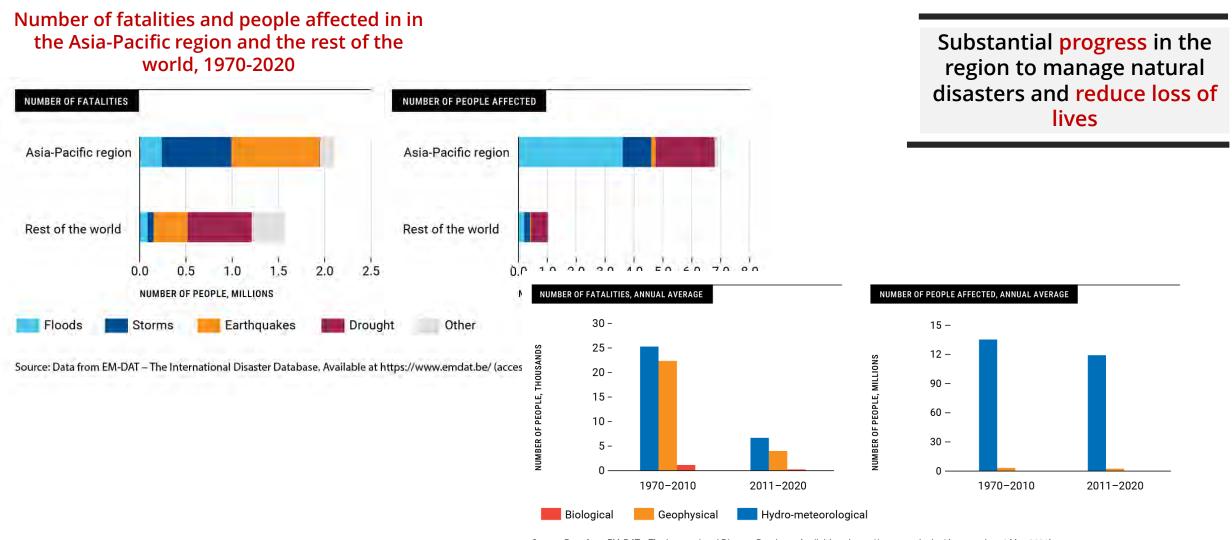# Emerging risks from the disaster-climate-health nexus in the Asia-Pacific

Managing systemic risks from multiple hazards

Madhurima Sarkar-Swaisgood
Economic Affairs Officer
Economic and Social Commission for Asia and the Pacific
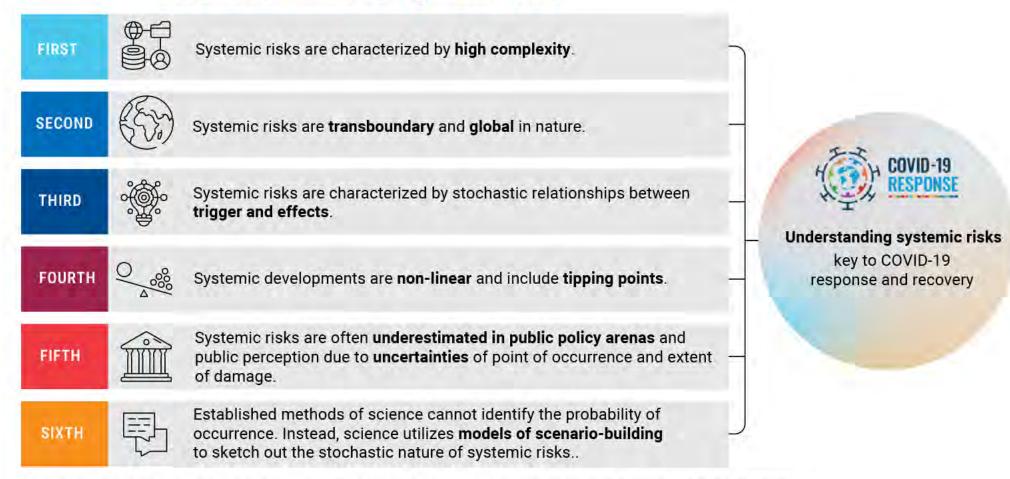United Nations

The Asia Pacific region has made good progress in reducing impacts from natural hazards

Number of fatalities and people affected in in the Asia-Pacific region and the rest of the world, 1970-2020

NUMBER OF FATALITIES

Asia-Pacific region

Rest of the world

0.0	0.5	1.0	1.5	2.0	2.5

NUMBER OF PEOPLE, MILLIONS

NUMBER OF PEOPLE AFFECTED

Asia-Pacific region

Rest of the world

0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0

- Floods
- Storms
- Earthquakes
- Drought
- Other

Source: Data from EM-DAT – The International Disaster Database. Available at https://www.emdat.be/ (acces

Substantial progress in the region to manage natural disasters and reduce loss of lives

NUMBER OF FATALITIES, ANNUAL AVERAGE

NUMBER OF PEOPLE, THOUSANDS

	30
	25
	20
	15
	10
	5
	0

1970−2010   2011−2020

NUMBER OF PEOPLE AFFECTED, ANNUAL AVERAGE

NUMBER OF PEOPLE, MILLIONS

	15
	12
	90
	60
	30
	0

1970−2010   2011−2020

- Biological
- Geophysical
- Hydro-meteorological

Source: Data from EM-DAT – The International Disaster Database. Available at https://www.emdat.be/ (accessed on 4 May 2021).

Source: Data from EM-DAT – The International Disaster Database

The Asia Pacific disaster riskscape is being reshaped by hazards under a new disaster-climate-health nexus where hazards converge increasing exposure and vulnerability of populations
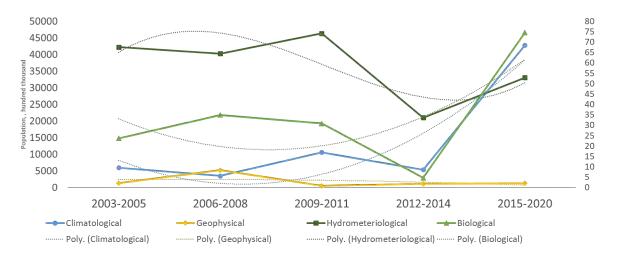
Six characteristics of systemic risk

FIRST		Systemic risks are characterized by **high complexity**.
SECOND		Systemic risks are **transboundary** and **global** in nature.
THIRD		Systemic risks are characterized by stochastic relationships between **trigger and effects**.
FOURTH		Systemic developments are **non-linear** and include **tipping points**.
FIFTH		Systemic risks are often **underestimated in public policy arenas** and public perception due to **uncertainties** of point of occurrence and extent of damage.
SIXTH		Established methods of science cannot identify the probability of occurrence. Instead, science utilizes **models of scenario-building** to sketch out the stochastic nature of systemic risks..

COVID-19 RESPONSE

Understanding systemic risks
key to COVID-19
response and recovery

Source: Adapted from Ortwin Renn and others, "Systemic risks from different perspectives", *Risk Analysis*, vol. 0, No. 0, (2020). Available at https://onlinelibrary.wiley.com/doi/epdf/10.1111/risa.13657

The convergence of natural and biological hazards has been increasing in the region
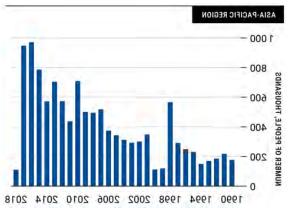
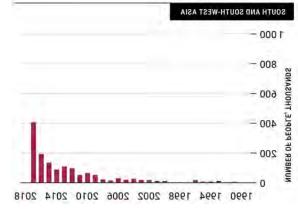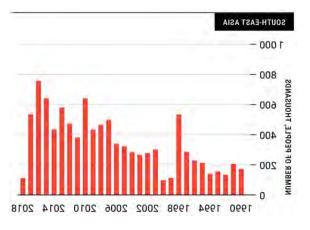**People in Asia and the Pacific affected by biological and other natural hazards, 2003–2020**

Dengue: In recent decades, the average number of dengue cases per year increased in Asia-Pacific. The increase was particularly rapid in SSWA and SEA.
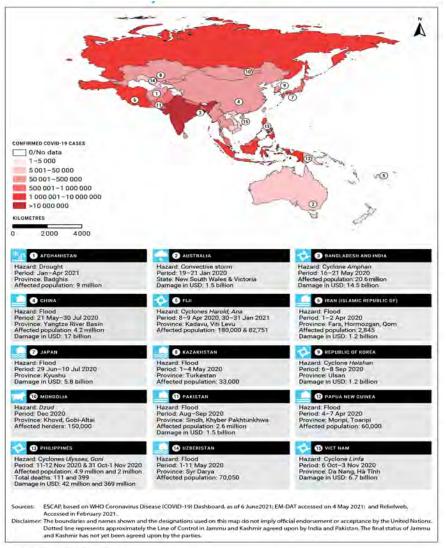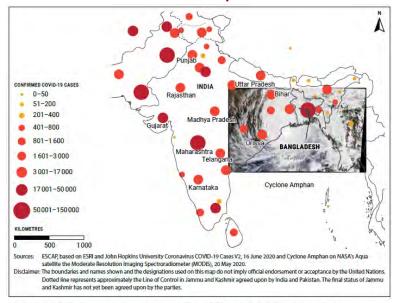

Convergence of biological and natural hazards will add to the stresses of poverty and inequality

COVID-19 shows that natural and biological hazards can converge to produce compounding impacts on vulnerable populations

COVID-19 and major disasters in 2020 and 2021

CONFIRMED COVID-19 CASES
- 0/No data
- 1–5 000
- 5 001–50 000
- 50 001–500 000
- 500 001–1 000 000
- 1 000 001–10 000 000
- >10 000 000

KILOMETRES
0   2000   4000

1 AFGHANISTAN
Hazard: Drought
Period: Jan–Apr 2021
Province: Badghis
Affected population: 9 million

2 AUSTRALIA
Hazard: Convective storm
Period: 19–21 Jan 2020
State: New South Wales & Victoria
Damage in USD: 1.5 billion

3 BANGLADESH AND INDIA
Hazard: Cyclone *Amphan*
Period: 16–21 May 2020
Affected population: 20.6 million
Damage in USD: 14.5 billion

4 CHINA
Hazard: Flood
Period: 21 May–30 Jul 2020
Province: Yangtze River Basin
Affected population: 4.2 million
Damage in USD: 17 billion

5 FIJI
Hazard: Cyclones *Harold, Ana*
Period: 8–9 Apr 2020, 30–31 Jan 2021
Province: Kadavu, Viti Levu
Affected population: 180,000 & 82,751

6 IRAN (ISLAMIC REPUBLIC OF)
Hazard: Flood
Period: 1–2 Apr 2020
Province: Fars, Hormozgan, Qom
Affected population: 2,845
Damage in USD: 1.2 billion

7 JAPAN
Hazard: Flood
Period: 29 Jun–10 Jul 2020
Province: Kyushu
Damage in USD: 5.8 billion

8 KAZAKHSTAN
Hazard: Flood
Period: 1–4 May 2020
Province: Turkestan
Affected population: 33,000

9 REPUBLIC OF KOREA
Hazard: Cyclone *Heishen*
Period: 6–8 Sep 2020
Province: Ulsan
Damage in USD: 1.2 billion

10 MONGOLIA
Hazard: *Dzud*
Period: Dec 2020
Province: Khovd, Gobi-Altai
Affected herders: 150,000

11 PAKISTAN
Hazard: Flood
Period: Aug–Sep 2020
Province: Sindh, Khyber Pakhtunkhwa
Affected population: 2.6 million
Damage in USD: 1.5 billion

12 PAPUA NEW GUINEA
Hazard: Flood
Period: 4–7 Apr 2020
Province: Moripi, Toaripi
Affected population: 60,000

13 PHILIPPINES
Hazard: Cyclones *Ulysses, Goni*
Period: 11-12 Nov 2020 & 31 Oct-1 Nov 2020
Affected population: 4.9 million and 2 million
Total deaths: 111 and 399
Damage in USD: 42 million and 369 million

14 UZBEKISTAN
Hazard: Flood
Period: 1-11 May 2020
Province: Syr Darya
Affected population: 70,050

15 VIET NAM
Hazard: Cyclone *Linfa*
Period: 6 Oct–3 Nov 2020
Province: Da Nang, Hà Tĩnh
Damage in USD: 6.7 billion

Sources: ESCAP, based on WHO Coronavirus Disease (COVID-19) Dashboard, as of 6 June2021; EM-DAT accessed on 4 May 2021; and Reliefweb, Accessed in February 2021,.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.

Note: Confirmed cases are as of 6 June 2021.

Convergence of cyclone Amphan with the COVID-19 pandemic

CONFIRMED COVID-19 CASES
- 0–50
- 51–200
- 201–400
- 401–800
- 801–1 600
- 1 601–3 000
- 3 001–17 000
- 17 001–50 000
- 50 001–150 000

KILOMETRES
0   500   1000

Sources: ESCAP, based on ESRI and John Hopkins University Coronavirus COVID-19 Cases V2, 16 June 2020 and Cyclone Amphan on NASA's Aqua satellite the Moderate Resolution Imaging Spectroradiometer (MODIS), 20 May 2020.
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.
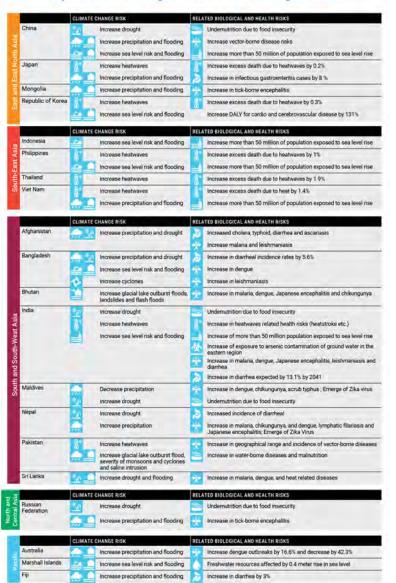
Source: United Nations, Economic and Social Commission of Asia and the Pacific (ESCAP), "Protecting the most vulnerable to cascading risks from climate extremes and the COVID-19 in South Asia", policy brief, 14 August 2020b. Available at https://www.unescap.org/resources/protecting-most-vulnerable-cascading-risks-climate-extremes-and-covid-19-south-asia

Cyclone Amphan was **one of the strongest** recorded cyclones that hit densely populated coastal areas and led to extensive flooding

In West Bengal, India, it damaged 563 primary health centres, 169 block level health centres and 5,142 community sub-centres

Climate change is exacerbating the impacts of converging natural and biological hazards

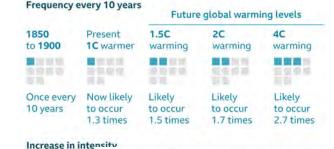**Impacts of climate change on natural and other biological hazards**

		CLIMATE CHANGE RISK	RELATED BIOLOGICAL AND HEALTH RISKS
East and East North Asia	China	Increase drought	Undernutrition due to food insecurity
		Increase precipitation and flooding	Increase vector-borne disease risks
		Increase sea level risk and flooding	Increase more than 50 million of population exposed to sea level rise
	Japan	Increase heatwaves	Increase excess death due to heatwaves by 0.2%
		Increase precipitation and flooding	Increase in infectious gastroenteritis cases by 8 %
	Mongolia	Increase precipitation and flooding	Increase in tick-borne encephalitis
	Republic of Korea	Increase heatwaves	Increase excess death due to heatwave by 0.3%
		Increase sea level risk and flooding	Increase DALY for cardio and cerebrovascular disease by 131%

		CLIMATE CHANGE RISK	RELATED BIOLOGICAL AND HEALTH RISKS
South-East Asia	Indonesia	Increase sea level risk and flooding	Increase more than 50 million of population exposed to sea level rise
	Philippines	Increase heatwaves	Increase excess death due to heatwaves by 1%
		Increase sea level risk and flooding	Increase more than 50 million of population exposed to sea level rise
	Thailand	Increase heatwaves	Increase excess death due to heatwaves by 1.9%
	Viet Nam	Increase heatwaves	Increase excess death due to heat by 1.4%
		Increase precipitation and flooding	Increase more than 50 million of population exposed to sea level rise

		CLIMATE CHANGE RISK	RELATED BIOLOGICAL AND HEALTH RISKS
South and South-West Asia	Afghanistan	Increase precipitation and drought	Increased cholera, typhoid, diarrhea and ascariasis
			Increase malaria and leishmaniasis
	Bangladesh	Increase precipitation and drought	Increase in diarrheal incidence rates by 5.6%
		Increase sea level risk and flooding	Increase in dengue
		Increase cyclones	Increase in leishmaniasis
	Bhutan	Increase glacial lake outburst floods, landslides and flash floods	Increase in malaria, dengue, Japanese encephalitis and chikungunya
	India	Increase drought	Undernutrition due to food insecurity
		Increase heatwaves	Increase in heatwaves related health risks (heatstroke etc.)
		Increase sea level risk and flooding	Increase of more than 50 million population exposed to sea level rise
			Increase of exposure to arsenic contamination of ground water in the eastern region
			Increase in malaria, dengue, Japanese encephalitis, leishmaniasis and diarrhea
			Increase in diarrhea expected by 13.1% by 2041
	Maldives	Decrease precipitation	Increase in dengue, chikungunya, scrub typhus , Emerge of Zika virus
		Increase drought	Undernutrition due to food insecurity
	Nepal	Increase drought	Increased incidence of diarrheal
		Increase precipitation	Increase in malaria, chikungunya, and dengue, lymphatic filariasis and Japanese encephalitis; Emerge of Zika Virus
	Pakistan	Increase heatwaves	Increase in geographical range and incidence of vector-borne diseases
		Increase glacial lake outburst flood, severity of monsoons and cyclones and saline intrusion	Increase in water-borne diseases and malnutrition
	Sri Lanka	Increase drought and flooding	Increase in malaria, dengue, and heat related diseases

		CLIMATE CHANGE RISK	RELATED BIOLOGICAL AND HEALTH RISKS
North and Central Asia	Russian Federation	Increase drought	Undernutrition due to food insecurity
		Increase precipitation and flooding	Increase in tick-borne encephalitis

		CLIMATE CHANGE RISK	RELATED BIOLOGICAL AND HEALTH RISKS
Pacific	Australia	Increase precipitation and flooding	Increase dengue outbreaks by 16.6% and decrease by 42.3%
	Marshall Islands	Increase sea level risk and flooding	Freshwater resources affected by 0.4 meter rise in sea level
	Fiji	Increase precipitation and flooding	Increase in diarrhea by 3%

Climate change increases **frequency and intensity** of hazards and **exacerbates interactions** between biological and other hazards, which in turn **increases the underlying risk drivers of poverty and inequality**

Increase in extreme rainfall

Projected increase in frequency and intensity of heavy rainfall in one day which only occurred once in every 10 years on average in a climate without human influence

Frequency every 10 years

		Future global warming levels		
1850 to 1900	**Present** 1C warmer	**1.5C** warming	**2C** warming	**4C** warming
Once every 10 years	Now likely to occur 1.3 times	Likely to occur 1.5 times	Likely to occur 1.7 times	Likely to occur 2.7 times

Increase in intensity

1850 to 1900				

Source: IPCC, 2021: Su...

Extreme heat becomes more frequent

Projected increase in frequency and intensity of high temperatures which only occurred once in every 10 years on average in a climate without human influence
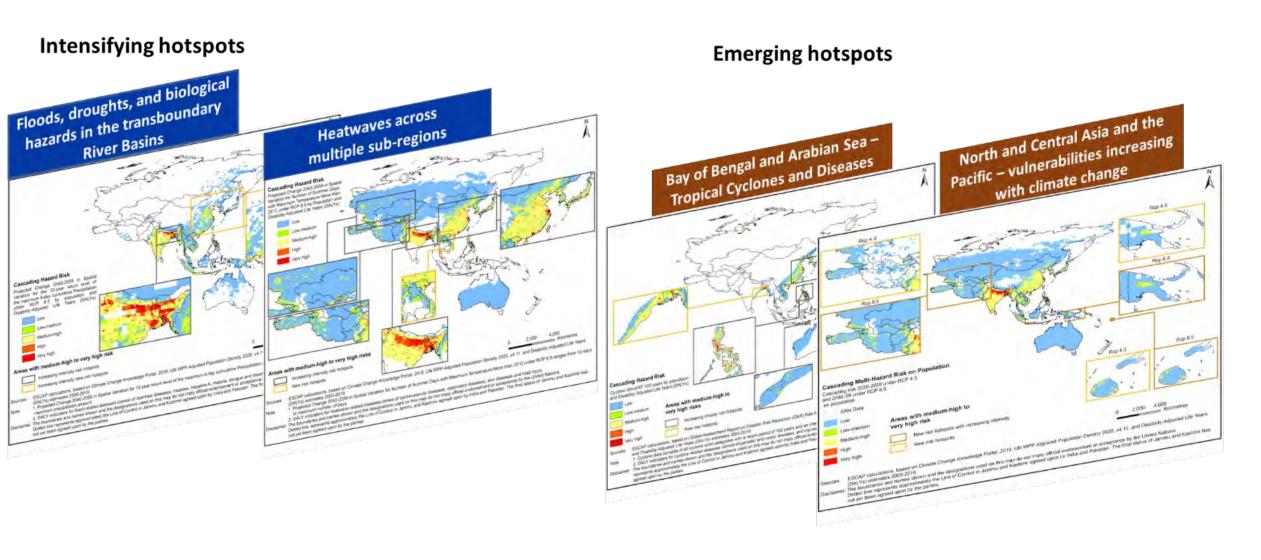
Frequency every 10 years

		Future global warming levels		
1850 to 1900	**Present** 1C warmer	**1.5C** warming	**2C** warming	**4C** warming
Once every 10 years	Now likely to occur 2.8 times	Likely to occur 4.1 times	Likely to occur 5.6 times	Likely to occur 9.4 times
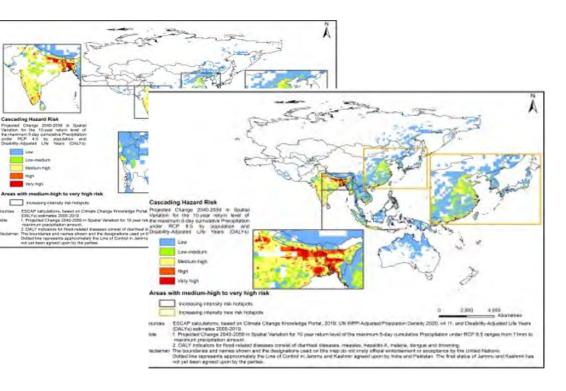
Increase in intensity

		Future global warming levels		
1850 to 1900	**Present** 1C warmer	**1.5C** warming	**2C** warming	**4C** warming
	+1.2C hotter	+1.9C hotter	+2.6C hotter	+5.1C hotter

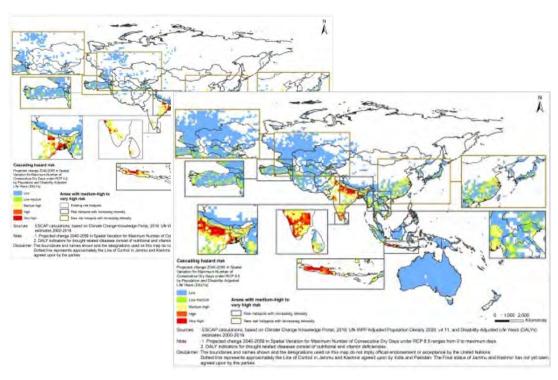Source: IPCC, 2021: Summary for Policymakers

BBC

Identifying hotspots intensifying and emerging overlaps of natural and biological hazards is imperative for risk informed policymaking

Floods and drought and related biological hazards will intensify under the worst-case climate change scenario in multiple areas of the region (8.5 RCP)

Population exposure to floods (left) and drought (right) and related diseases under worst case climate scenario
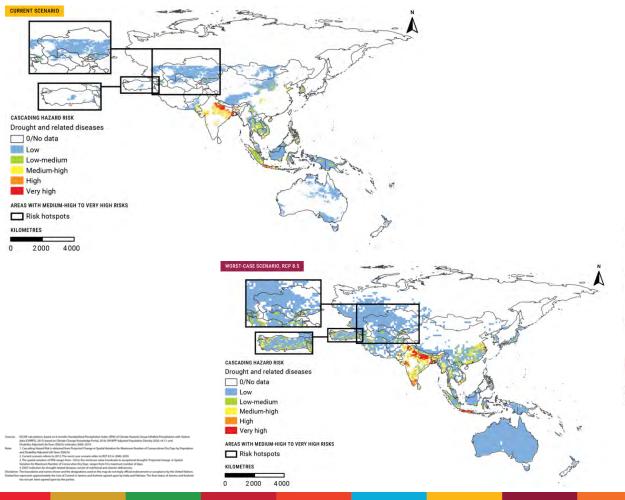

The **Ganga-Brahmaputra-Meghna basin**, will have an additional 10 million people exposed to complex risks due to climate change.
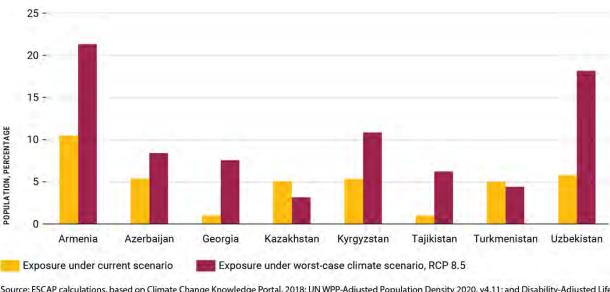
In **South-East Asia**, many countries will experience increases in **drought and drought related biological hazards**

Floods and drought and related biological hazards will intensify under the worst-case climate change scenario in multiple areas of the region (8.5 RCP)

Population exposure to drought and related diseases under current and worst case scenarios in North and Central Asia
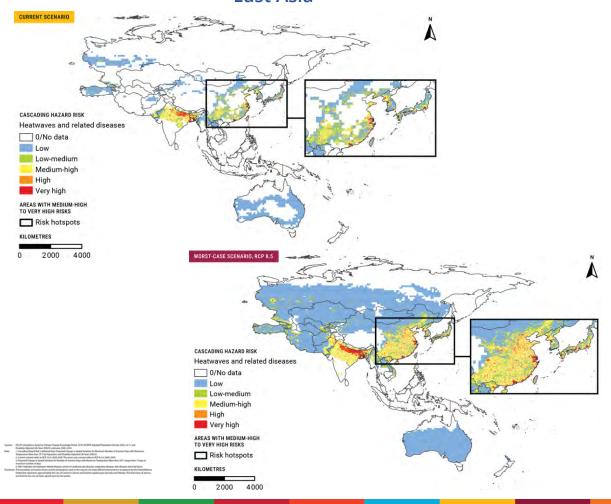
Increase in population exposure to droughts and related diseases under current and worst-case scenarios
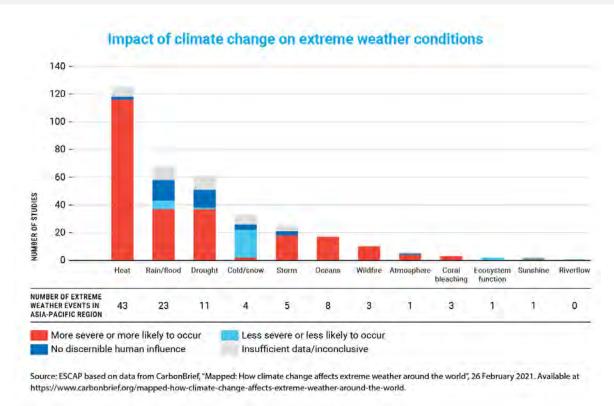
Source: ESCAP calculations, based on Climate Change Knowledge Portal, 2018; UN WPP-Adjusted Population Density 2020, v4.11; and Disability-Adjusted Life Years (DALYs) estimates 2000–2019.

Many parts of Asia Pacific will face increasing exposure to heatwaves and related diseases will worsen under the worst-case climate change scenario (8.5 RCP)
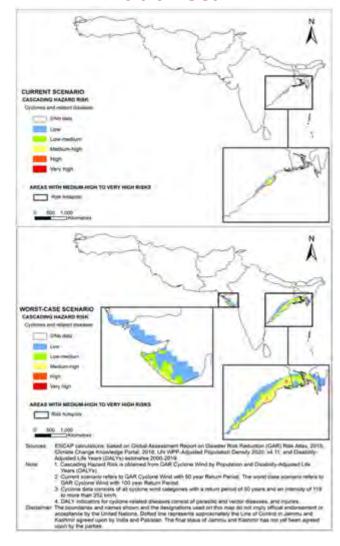
Population exposure to heatwaves and related diseases under current and worst case scenarios in East and North East Asia
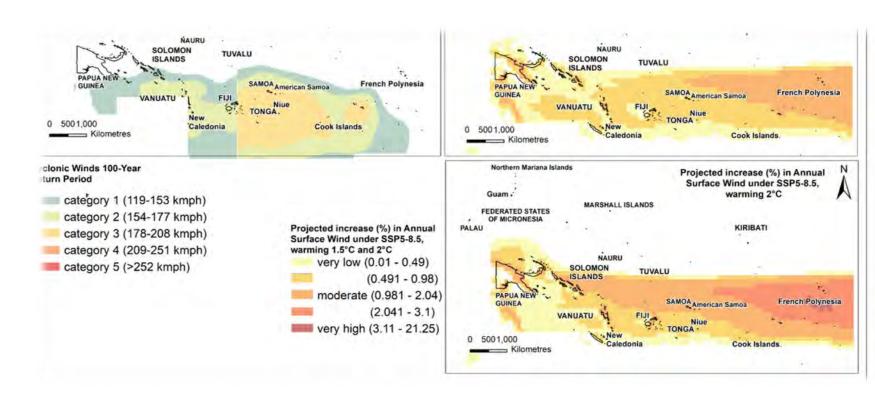
Tropical Cyclones and related biological hazards are becoming more extreme- increasing temperature will give rise to increasing and more intense cyclones under the worst-case climate change scenario

Emerging cyclones in the Arabian Sea

Between 1.5- and 2, every increment of a degree translates into **increased risks of tropical cyclone** in Pacific SIDS.

Pacific SIDS countries will face increasing annual wind speed of tropical cyclone and associated health hazards
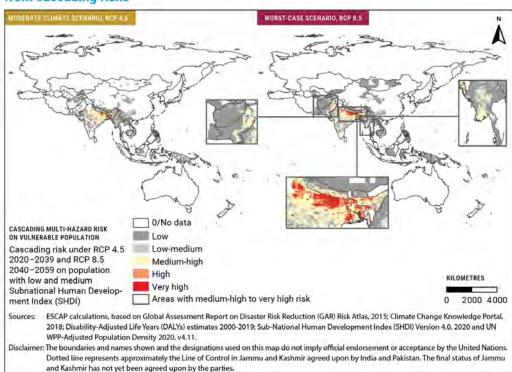
Increasing number of poor populations will be exposed to the disaster-climate-health nexus

Countries with the highest proportions of their poorest population exposed to multi-hazard cascading risk (current and two climate scenarios)
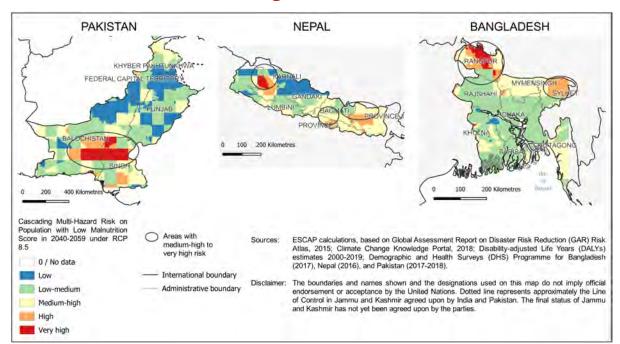
Subregion	Country	Percentage of population with low/medium HDI under RCP 4.5 (2020–2039)	Percentage of population with low/medium HDI under RCP 4.5 (2040–2059)	Percentage of population with low/medium HDI under RCP 8.5 (2020–2039)	Percentage of population with low/medium HDI under RCP 8.5 (2040–2059)
South and South-West Asia	Afghanistan	12	35	19	34
	Bangladesh	98	97	91	98
	Bhutan	22	39	45	43
	India	58	65	60	71
	Nepal	79	88	88	90
	Pakistan	22	79	31	79
South-East Asia	Cambodia	7	4	26	25
	Indonesia	7	15	14	15
	Lao People's Democratic Republic	14	23	26	30
	Myanmar	29	26	47	50
	Philippines	15	24	26	30
	Thailand	0.28	0.09	0.39	0.45
	Timor-Leste			18	8
	Viet Nam	12	23	25	30
North and Central Asia	Kazakhstan		0.1	0.1	0.1
	Kyrgyzstan	0.1	7	8	8
	Tajikistan	12	18	15	16
	Turkmenistan		5		5
	Uzbekistan		0.02	0.05	0.09
East and North-East Asia	China	3	4	3	3
Pacific	Papua New Guinea	15	17	16	16

Populations with lower levels of human development at risk from cascading risks

MODERATE CLIMATE SCENARIO, RCP 4.5 · WORST-CASE SCENARIO, RCP 8.5

CASCADING MULTI-HAZARD RISK ON VULNERABLE POPULATION

Cascading risk under RCP 4.5 2020–2039 and RCP 8.5 2040–2059 on population with low and medium Subnational Human Development Index (SHDI)

- 0/No data
- Low
- Low-medium
- Medium-high
- High
- Very high
- Areas with medium-high to very high risk

KILOMETRES
0 2000 4000

Sources: ESCAP calculations, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015; Climate Change Knowledge Portal, 2018; Disability-Adjusted Life Years (DALYs) estimates 2000-2019; Sub-National Human Development Index (SHDI) Version 4.0, 2020 and UN WPP-Adjusted Population Density 2020, v4.11.

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Children and women will be greatly impacted under the impacts of the disaster-climate-health nexus

Projected child malnutrition under the worst-case climate change scenario

Proportion of women with limited access to health care under the worst-case climate change scenario
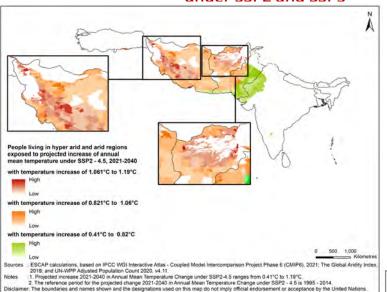

The convergence of climate change, and natural and biological hazards will also **increase child malnutrition**.

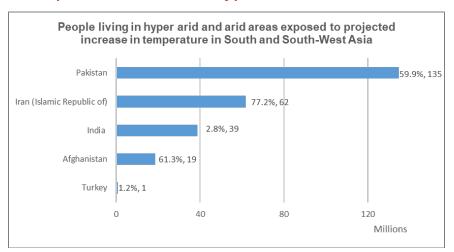In many countries, women and girls already face **multiple barriers in access to healthcare services**. Climate change is likely to exacerbate the problem

Drought and aridity will threaten agricultural populations

People living in hyper arid and arid regions with additional exposure to projected increase of annual mean temperature under SSP2 and SSP5
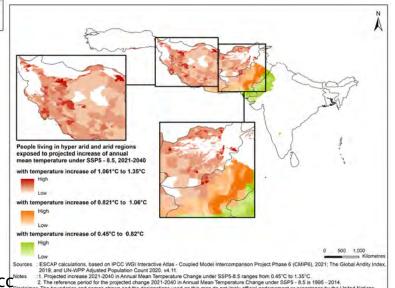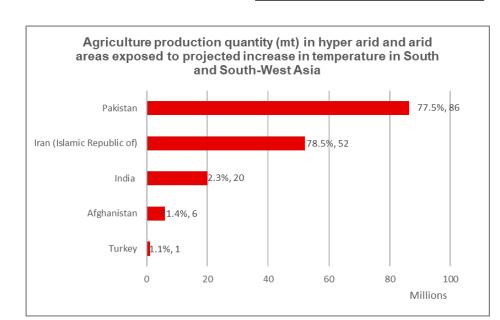
Population and agriculture production exposed to projected temperature increase in hyper arid and arid areas of SSWA

People living in hyper arid and arid regions exposed to projected increase of annual mean temperature under SSP2 - 4.5, 2021-2040

with temperature increase of 1.061°C to 1.19°C
High
Low

with temperature increase of 0.821°C to 1.06°C
High
Low

with temperature increase of 0.41°C to 0.82°C
High
Low

0 500 1,000 Kilometres

Sources : ESCAP calculations, based on IPCC WGI Interactive Atlas - Coupled Model Intercomparison Project Phase 6 (CMIP6), 2021; The Global Aridity Index, 2019; and UN-WPP Adjusted Population Count 2020, v4.11.
Notes : 1. Projected increase 2021-2040 in Annual Mean Temperature Change under SSP2-4.5 ranges from 0.41°C to 1.19°C.
2. The reference period for the projected change 2021-2040 in Annual Mean Temperature Change under SSP2 - 4.5 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.

People living in hyper arid and arid areas exposed to projected increase in temperature in South and South-West Asia

Country	% , Millions
Pakistan	59.9%, 135
Iran (Islamic Republic of)	77.2%, 62
India	2.8%, 39
Afghanistan	61.3%, 19
Turkey	1.2%, 1

Millions

Mean temperature increases in hyper-arid and arid areas will majorly impact dryland agriculture in Iran, Afghanistan, Pakistan, India and Turkey

Intersection of aridity with projected increases in temperature under SSP 2 and SSP 5 will raise concern in Islamic Republic of Iran, Afghanistan, Pakistan and north-western India.

People living in hyper arid and arid regions exposed to projected increase of annual mean temperature under SSP5 - 8.5, 2021-2040

with temperature increase of 1.061°C to 1.35°C
High
Low

with temperature increase of 0.821°C to 1.06°C
High
Low

with temperature increase of 0.45°C to 0.82°C
High
Low

0 500 1,000 Kilometres

Sources : ESCAP calculations, based on IPCC WGI Interactive Atlas - Coupled Model Intercomparison Project Phase 6 (CMIP6), 2019; and UN-WPP Adjusted Population Count 2020, v4.11.
Notes : 1. Projected increase 2021-2040 in Annual Mean Temperature Change under SSP5-8.5 ranges from 0.45°C to 1.35°C.
2. The reference period for the projected change 2021-2040 in Annual Mean Temperature Change under 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.

Agriculture production quantity (mt) in hyper arid and arid areas exposed to projected increase in temperature in South and South-West Asia

Country	% , Millions
Pakistan	77.5%, 86
Iran (Islamic Republic of)	78.5%, 52
India	2.3%, 20
Afghanistan	1.4%, 6
Turkey	1.1%, 1

Millions

SSP: Shared Socioeconomic Pathways, projections by IPCC

Under worst-case climate change scenario, economic losses are projected to double from $161 to $322 billion for the subregion impacting the achievements of SDGs

(SDG 13- all targets, SDG 14- target 14.2, and SDG 15-target 15.3 with knock on impacts on SDG 1- target 1.5, SDG 2 -target 2.4, SDG 3-Target 3.d, SDG 9-Target 9.1 and SDG 11- target 11.5)

Increase in Average Annual Losses (AAL) from cascading risks under current, moderate (RCP 4.5), and worst-case (RCP 8.5) climate change scenarios, US$ millions

Increase in Average Annual Losses (AAL) as a percentage of GDP under current, moderate (RCP 4.5), and worst-case (RCP 8.5) climate change scenarios

The annual average losses from disasters have been increasing and will continue to rise with climate change with Pacific SIDs countries being heavily impacted

Building resilience to these complex risks will require multiple pathways of action

Managing emerging risks : # 5 key enablers
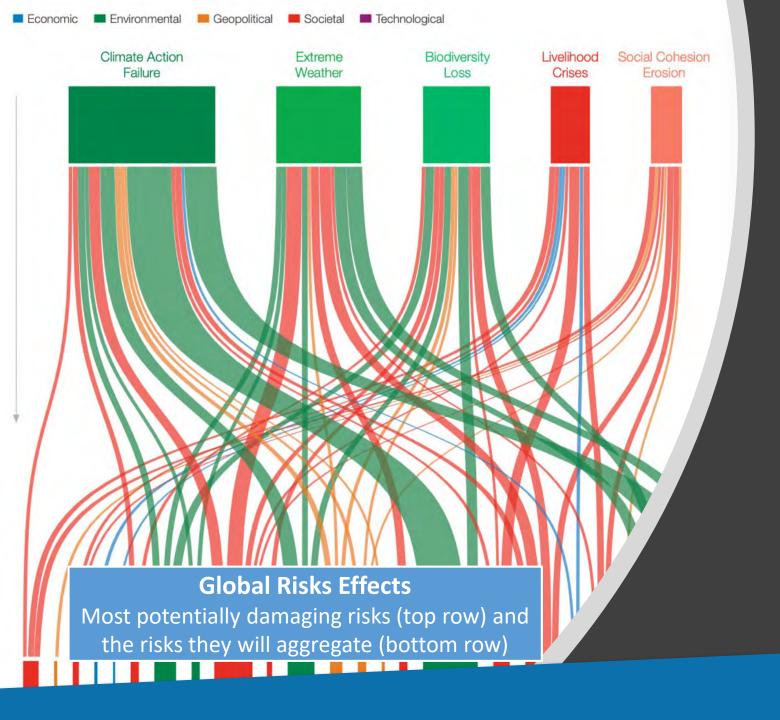
Sanjay Srivastava, Ph D
Chief, Disaster Risk Reduction
ESCAP

2022 APRU Multi-Hazards Webinar Series:

Emerging risks in a complex world

International Research Institute of Disaster Science, APRU Multi-Hazard Program
Tohoku University,
24 January 2022

ESCAP75
MOVING FORWARD TOGETHER

Emerging risks

Cross-cutting "complex interconnected risks"

5 global multiyear megatrends where the interconnection of the various global buckets of risk is deeply evident.

Source: World Economic Forum, Global Risk Report 2022
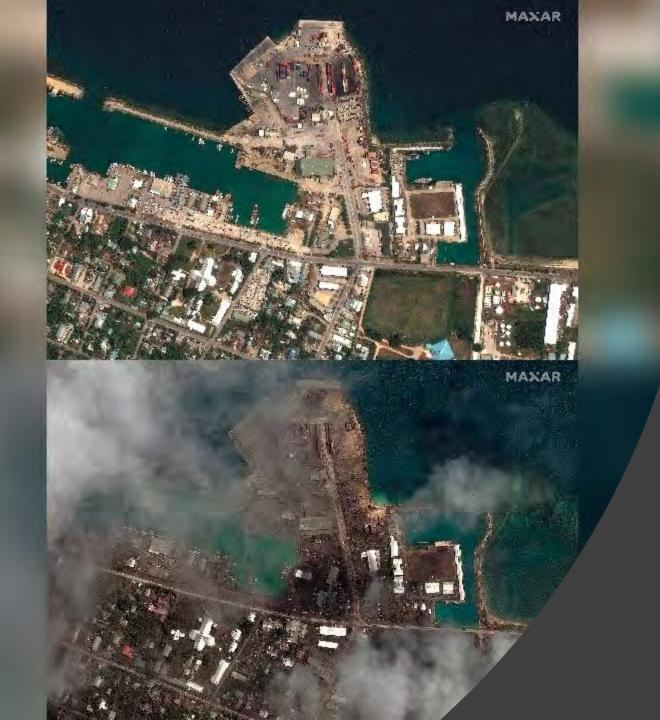
Managing emerging risks, cascading impacts

5 key enablers

1. **Multi-hazard approaches**
Risk assessment, early warning systems

2. **Policy coherence**
Multi-sectoral, integrated approach

3. **Resilient infrastructure**
Systemic risks in interdependent infra systems/services

4. **Community and terrestrial risk governance**
Risk global, resilience local

5. **Sendai Framework for Disaster Risk Reduction**
Health aspects of SFDRR – Bangkok, Cluster of SDGs

January 15, 2022
Tonga eruption:
A cascading risk with compounding impacts

Undersea volcano erupted in a giant mushroom cloud

Far-flung Tsunami,
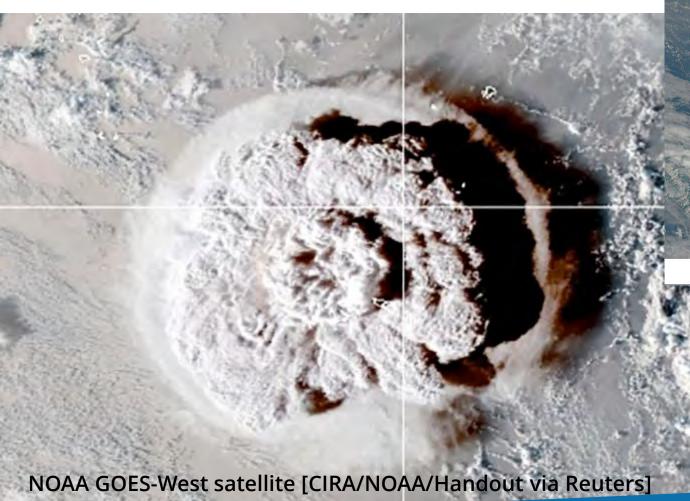
Falling Ash,
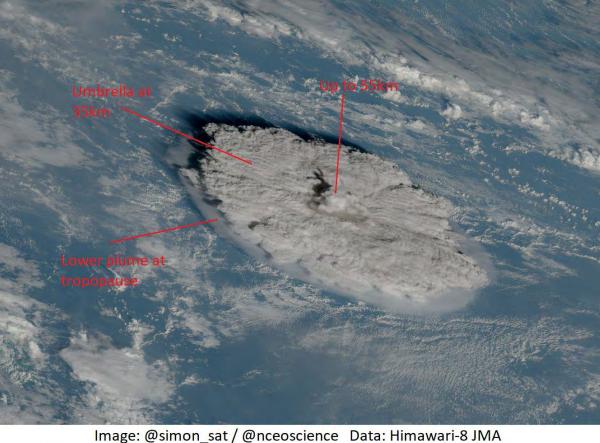
Disrupted submarine cables, Internet,

Impacted power system, supply chains, agricultural crops

Pumped sulfur dioxide into the stratosphere

The explosive nature of Tonga volcanic eruption with its large geographical swath in the Pacific was monitored through multiple EO satellite. This helped understand the trigger for Tsunami and its potential impact pathways

Umbrella at 35km

Up to 55km

Lower plume at tropopause

Image: @simon_sat / @nceoscience   Data: Himawari-8 JMA

A tsunami wave measuring 1.2 m was observed in Tonga's capital

Tsunami alerts were issued in the US West Coast, Japan (Amami islands)

NOAA GOES-West satellite [CIRA/NOAA/Handout via Reuters]

ESCAP

ANALYZED AREA 95 km²

DAMAGED STRUCTURES 54

POTENTIALLY DAMAGED STRUCTURES 3

ROAD OBSTACLES 6

VOLCANO TSUNAMI

VO20220115TON

Source: UNITAR

Tonga eruption:
Real time impact mapping,
Damage and loss assessment,
Risk communication – global to local

Hunga Tonga - hunga Ha'apai Volcano

100 km

Nuku'alofa

Map location

Map location

Damage assessment in 'Ohonua town, 'Eua Prope district, 'Eua division, Tonga as of 20 & 21 January 2022

This map illustrates the impact of the Hunga Tonga-hunga Ha'apai volcanic eruption and the subsequent tsunami in 'Ohonua town ('Eua Prope district, Tonga) and damage assessment as detected from Pleiades images acquired on 20 January 2022 at 11:20 local time and 21 January 2022 at 11:13 local time. Among the 2,028 structures were identified, of which 1,231 structures are in cloud-free areas. Amongst the analyzed 1,231 structures, 54 were identified as damaged or destroyed, three as potentially damaged structures, and 1,174 buildings appeared without any visible damage from space imagery analysis. Six road obstacles were also identified in the cloud-free areas. This is a preliminary analysis and has not yet been validated in the field. Please send ground feedback to the United Nations Satellite Centre (UNOSAT).

[14 Sep. 2021] Shoreline
[20 Jan. 2022] Shoreline

40 m

Washed away structures

50 m

Pléiades / 20 Jan 2022

BEFORE

WorldView-3/ 14 Sep 2021

50 m

AFTER

Washed away structures

Destroyed road

30 m

Pléiades / 21 Jan 2022

'Ohonua

'Eua
'Eua Prope

Legend

☐ Town
🚧 Road obstacle
🟥 Damaged structure
🟧 Potentially damaged structure
🟨 No visible damage
⬜ Cloud covered structure
— Road
▨ Cloud mask

cnes
AIRBUS

Spatial Reference
Satellite Data (Post-event): Pleiades
Satellite Data (Pre-event): Worldview-3
Boundary data: Secretariat of the Pacific Community, Statistics for
Analysis: United Nations Satellite Centre (UNOSAT)
Map Scale for A3: 1:5,500

#1. Message: Frontier technologies enable multi-hazard approaches and real time risk assessment

Drone

Social Media

Connected Device Data

Earth Observation

Geospatial

IoT

Cloud Computing

Big data Analytical Techniques

Source: ADB 2020

1 — **Service providers: Amazon, Google, Azure**
Data as ensembles: Skywatch, Mundi, Cleos

2 — **Data companies: Maxar, Planet Lab, Spire, Capella, ICEYE, UmbraLab…own satellite constellations**

3 — **Software as Service (SAAS), Databricks, ML/AI**

Maxar Automatic Mapping uses artificial Intelligence to integrate satellite imagery and other forms of data (e.g., social media or drone footage) **to develop real time impact outlook**

ESCAP 75 — MOVING FORWARD TOGETHER

Integrated Multi-hazard Early Warning Systems for Heat Waves
Case study: India

NWS Heat Index — Temperature (°F)

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

☐ Caution ☐ Extreme Caution ☐ Danger ☐ Extreme Danger

FIGURE 2-5 **More heatwaves but fewer deaths in Indian states, 2015–2020**

- Number of states affected by heatwaves
- Number of average heatwave days recorded
- Heatwave mortality

Data points:
- 2015: states 9, days 7.4, mortality 2 040
- 2016: states 13, days 8.3, mortality 1 111
- 2017: states 17, days 9.6, mortality 384
- 2018: states 19, days 9.8, mortality 25
- 2019: states 23, days 32.2, mortality 226
- 2020: mortality 4

NATIONAL ACTION PLAN ON **HEAT RELATED ILLNESSES**

JULY 2021

National Programme on Climate Change and Human Health
National Centre for Disease Control
Ministry of Health and Family Welfare
Government of India

ESCAP 75 — MOVING FORWARD TOGETHER

Health infrastructure in multi-hazard risk hotspots need to be strengthened, risk informed and resilient

Sources: ESCAP, based on DHS Programme Household Survey for Nepal, and multi-hazard data from Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Nepal

Sources: ESCAP, based on DHS Programme Household Survey and Service Provision Assessment Survey for Bangladesh, and multi-hazard data from Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Bangladesh

#3: Resilient Infrastructure

Promote risk-based approaches and lateral public health systems in multi-hazard risk areas

Resilient health care systems depend on and interact with wider disaster management and lifeline infrastructure systems

Health care system

2. Resilience of health care systems and networks

1. Resilience of health care facilities.

Emergency response agencies

3. Collaboration with emergency management and civil protection agencies.

e.g., fire fighters, military, security, community preparedness groups

Quality infrastructure systems

4. Resilient infrastructure systems

e.g., electricity, transport, water, telecommunications systems

Source: World Bank 2021
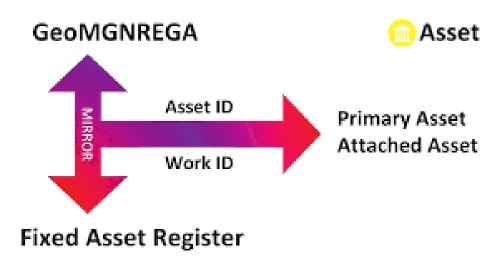
#4: Community and territorial governance

Multi-hazard risk management approach for shock responsive social protection

India: Total 3440 million person-days employment generated; 42.9 million assets geotagged; convergence of Natural Resources Management for drought/flood activities, geo-spatial and digital financial services

Geotagging of assets and monitoring of works

Pixel to people approach
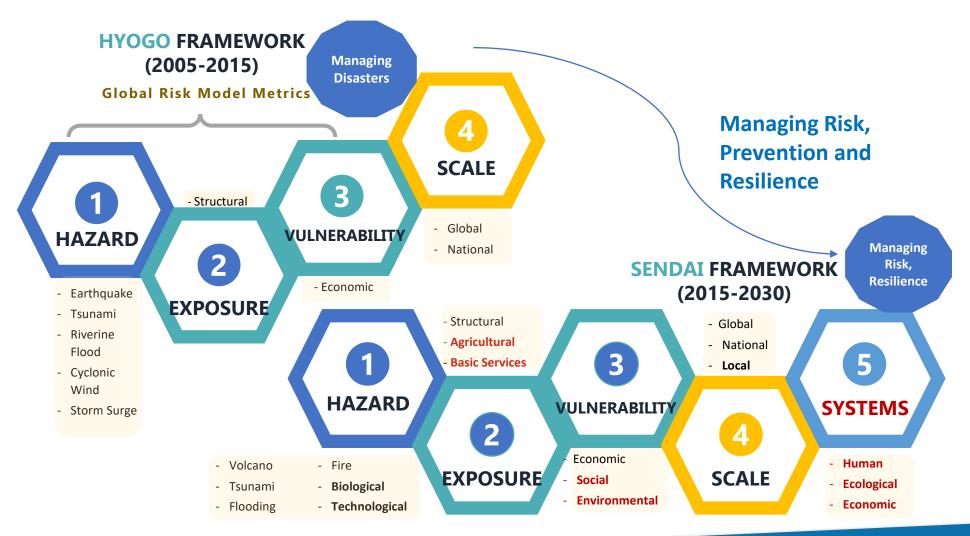
#5. System Approach for Building Resilience
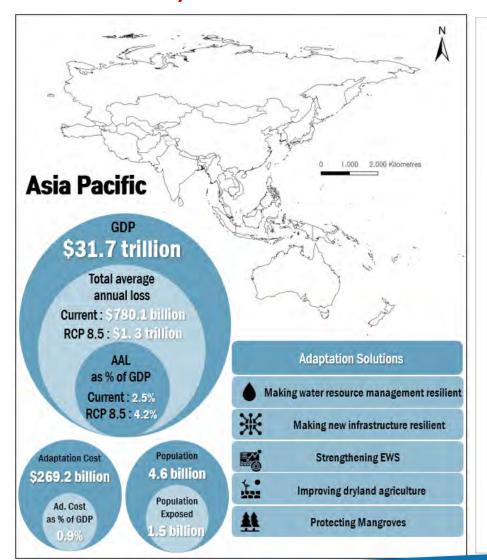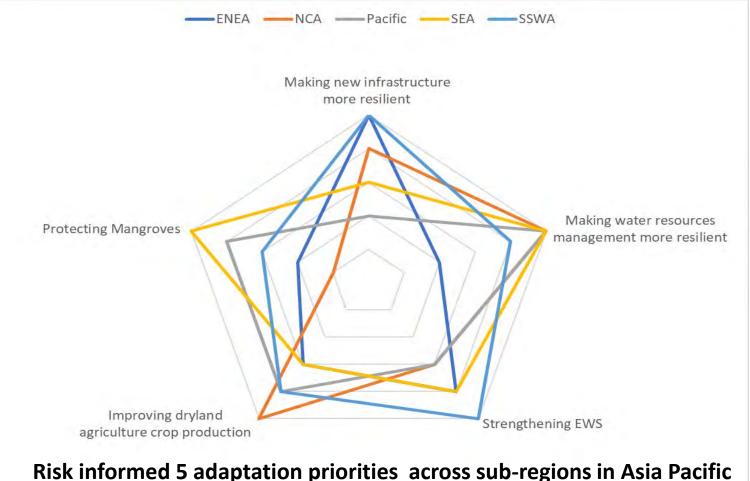
A Scenario Development Framework for Systemic Risks

In Asia-Pacific, Annualized Average Disaster Loss @ RCP 8.5 is $1.3 trillion, while cost of adaptation is $270 billion (5:1 Benefit Cost Ratio)

Asia Pacific

GDP **$31.7 trillion**

Total average annual loss
Current : $780.1 billion
RCP 8.5 : $1.3 trillion

AAL as % of GDP
Current : 2.5%
RCP 8.5 : 4.2%

Adaptation Cost
$269.2 billion

Ad. Cost as % of GDP
0.9%

Population
4.6 billion

Population Exposed
1.5 billion

Adaptation Solutions
- Making water resource management resilient
- Making new infrastructure resilient
- Strengthening EWS
- Improving dryland agriculture
- Protecting Mangroves

Radar chart legend: ENEA, NCA, Pacific, SEA, SSWA

Axes: Making new infrastructure more resilient; Making water resources management more resilient; Strengthening EWS; Improving dryland agriculture crop production; Protecting Mangroves

Risk informed 5 adaptation priorities across sub-regions in Asia Pacific

Bridging the science policy gap for informed action

RISK AND RESILIENCE PORTAL
An Initiative of the Asia Pacific Disaster Resilience Network

https://rrp.unescap.org/

Thank you

www.unescap.org

unescap

unitednationescap
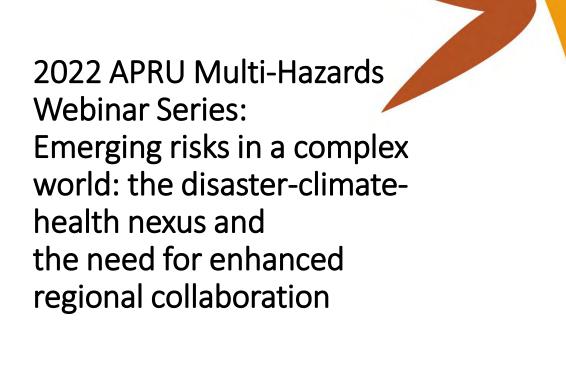
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2022 APRU Multi-Hazards
Webinar Series:
Emerging risks in a complex
world: the disaster-climate-
health nexus and
the need for enhanced
regional collaboration
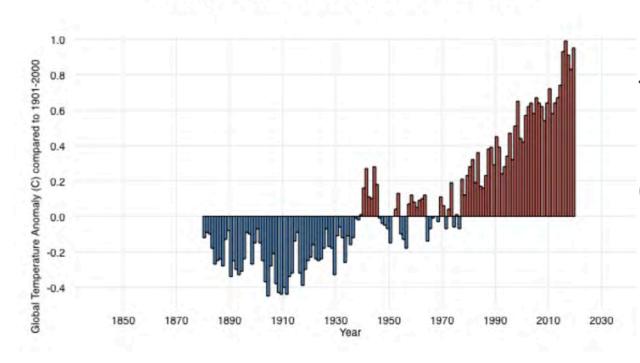
Manu Gupta Ph.d; Co-Founder
SEEDS

Global annual temperature is rising at twice the rate since 1981

History of global surface temperature since 1880

The global annual temperature has increased at an average rate of 0.07°C per decade since 1880 and over twice that rate (+0.18°C) since 1981.

Mami Mizutori
@HeadUNDRR

Major floods and storms last year were above the ten year average shown here. As with #COVID19 the #ClimateEmergency cries out for a coordinated global response & support to least developed countries with large vulnerable populations struggling to reduce their disaster losses.

DROUGHT	EARTHQUAKE	EXTREME TEMPERATURE	FLOOD	LANDSLIDE	MASS MOVEMENT (DRY)	STORM	VOLCANIC ACTIVITY	WILDFIRE	
263	445	130	1389	254	27	1457	84	163	1980 – 1999
338	552	432	3254	376	13	2043	102	238	2000 – 2019

6,681 climate-related disasters (2000-2019) compared to 3,656 (1980-1999)

13 October, International Day for Disaster Risk Reduction

#DRRday #ItsAllAboutGovernance

UNDRR
UN Office for Disaster Risk Reduction

4:31 PM · Jan 22, 2021 · Twitter Web App

55 Retweets   **3** Quote Tweets   **89** Likes

Number of climate induced disasters are doubling every decade

The challenge of Pandemic

The world is in turmoil. Economies are in freefall. We have been brought to our knees – by a microscopic virus.

The pandemic has demonstrated the fragility of our world. It has laid bare risks we have ignored for decades: inadequate health systems; gaps in social protection; structural inequalities; environmental degradation; the climate crisis.

Entire regions that were making progress on eradicating poverty and narrowing inequality have been set back years, in a matter of months.
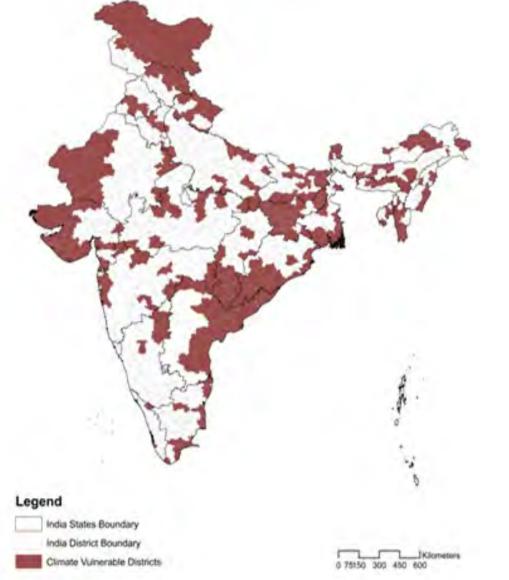
The virus poses the greatest risk to the most vulnerable: those living in poverty, older people, and people with disabilities and pre-existing conditions.

United Nations Secretary General, 18th July, 2020

What are communities saying?

- Affected communities aren't involved in decisions about how to reduce their own risk.

- Governments are producing more information about disaster risks, but this information isn't reaching communities.

- Civil society organisations aren't systematically sharing the real-life community experience of disasters with national and international decision-makers.

- Threats are complex and there is rarely a simple solution to each one: a wide range of solutions are needed – but integrated planning is not the norm

https://global-report.vfl.world/

The social and economic impact of climate change on people is exponentially rising every year

316 million* Indians in 225 most vulnerable districts will be suffering losses due to climate change by 2030!
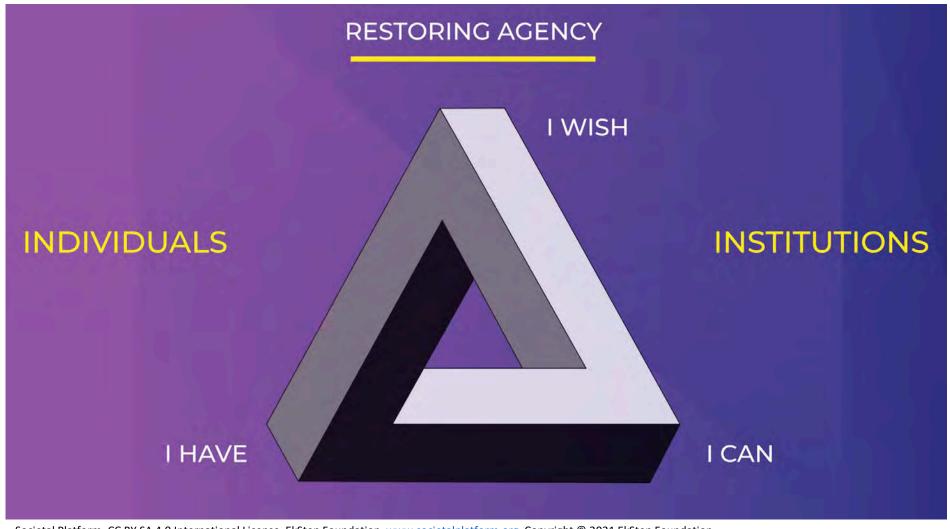
They will suffer from droughts, floods, cyclones, heatwaves, hailstorms, water stresses, GLOFs, forest fires, coastal erosion, landslides etc.

- Nearly 60 million people annual affected by floods
- Nearly 65% of India's population affected by heat waves
- 20% of India's population live on the 7,500 km long coastline of India
- Climate change can cause a 90% fall in India's GDP by 2100

Legend

India States Boundary

India District Boundary

Climate Vulnerable Districts

0 75 150 300 450 600 Kilometers

*Estimated population in 2030 of 225 most vulnerable districts of India

Bringing change
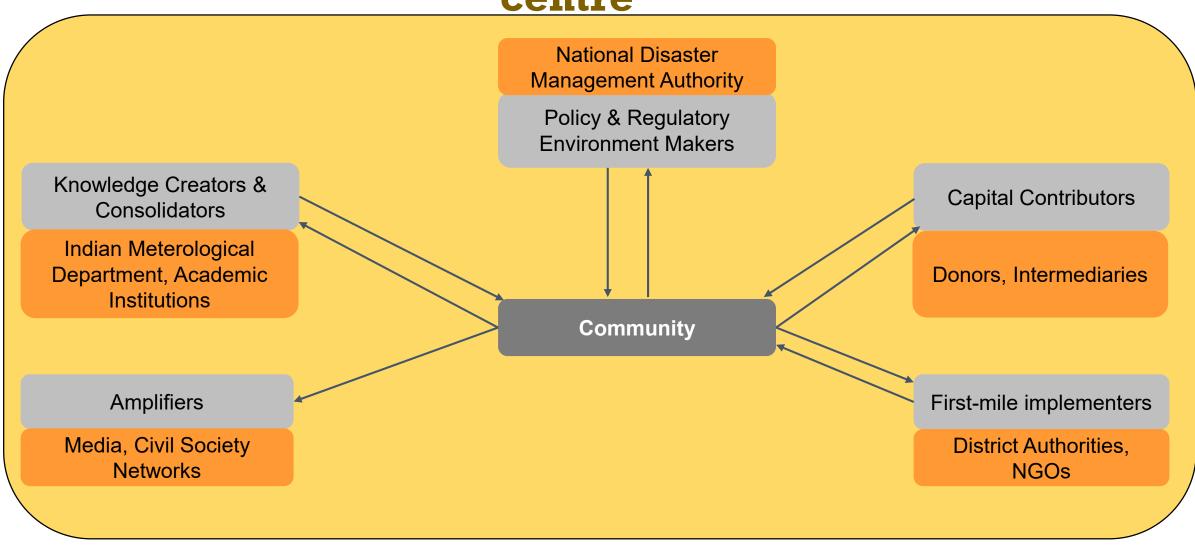
Restoring the agency of people

RESTORING AGENCY

I WISH

INDIVIDUALS

INSTITUTIONS

I HAVE

I CAN

- Freedom of choice and dignity

- Open value creation

- Seek rapid evolution

- Resolve for Diversity

- Distributed leadership
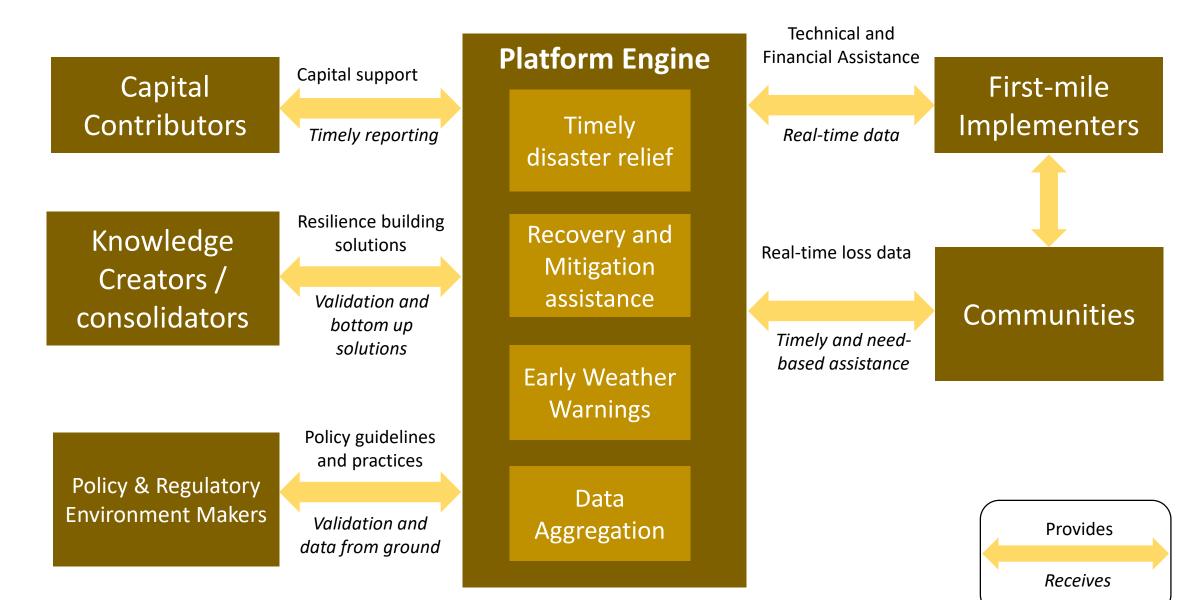
Whole-of-Society approach with community at the centre

National Disaster Management Authority

Policy & Regulatory Environment Makers

Knowledge Creators & Consolidators

Indian Meterological Department, Academic Institutions

Capital Contributors

Donors, Intermediaries

Community

Amplifiers

Media, Civil Society Networks

First-mile implementers

District Authorities, NGOs

Platform

Co-creator Type

Co-creator Example

9

Creating Platforms

Capital Contributors

→ Capital support
Timely reporting

Platform Engine

- Timely disaster relief
- Recovery and Mitigation assistance
- Early Weather Warnings
- Data Aggregation

Technical and Financial Assistance
Real-time data

First-mile Implementers

Knowledge Creators / consolidators

Resilience building solutions
Validation and bottom up solutions

Real-time loss data
Timely and need-based assistance

Communities

Policy & Regulatory Environment Makers

Policy guidelines and practices
Validation and data from ground

Provides
Receives

10

Demystifying Science & Technology

Examples:
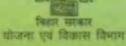
- Post-Disaster Reconstruction
- Early Warning Systems

निर्माण मार्गदर्शिका   भाग 2

विभिन्न आपदा प्रतिरोधी घरों का पुनर्निर्माण

बाँस की दीवार के साथ द्विछत्तिया घर

बिहार सरकार
योजना एवं विकास विभाग

कोसी आपदा पुनर्वास एवं पुनर्निर्माण परियोजना

रेखांकन

रेखांकन में सावधानी बरतें

रेखांकन, मकान की नींव बनाने के लिये अत्यंत महत्वपूर्ण प्रक्रिया है।

1. रेखाचित्र के अनुसार भवन के कोनों को अंकित करें। इन कोनों को जोड़ कर दीवारों के लिए सीधी रेखायें खींचें।
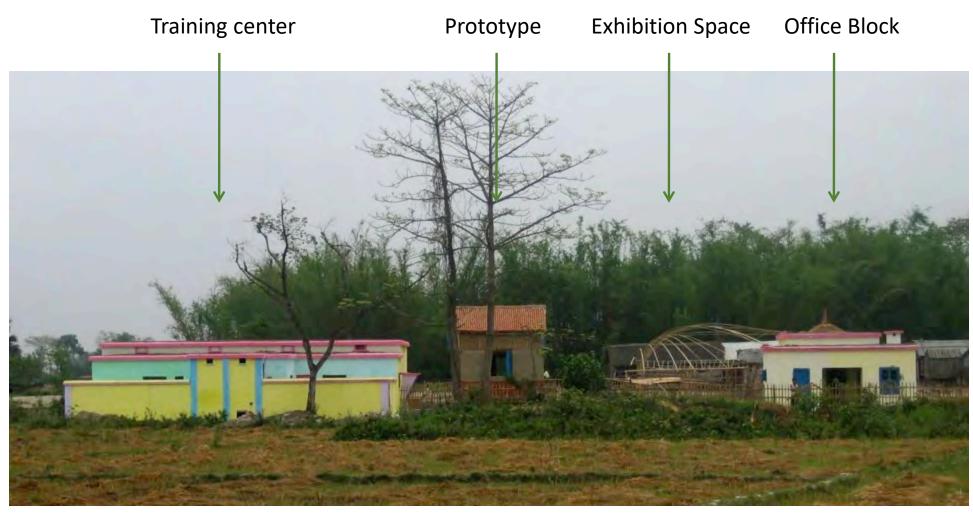
2. 3, 4 और 5 का त्रिकोण बना कर सुनिश्चित करें ताकि दीवारें 90° के कोण पर रहें।

3. डोरी की मदद से मध्यरेखाओं को दीवारों की चौड़ाई में परिवर्तित करें।

4. भूमि की मध्यरेखा से 2 फूट की दूरी सुनिश्चित करें।

नोट:
1. रेखांकन से पहले लकड़ी के मार्गदर्शक स्तम्भ लगा लें।
2. रेखांकन के समय ध्यान रखें कि अहाते के अन्दर शौचालय के लिए स्थान उपलब्ध हो।
3. रेखांकन के अनुसार ही नींव खोदें।
4. खोदी हुई मिट्टी को नींव से 3–5 फूट की दूरी पर डालें।

Community Learning Labs

Training center   Prototype   Exhibition Space   Office Block

Village – Madheli   **Block – Shankarpur**   **District - Madhepura**

Developing Community Based Early Warning Systems

सामाजिक मानचित्र गेमराहो (SOCIAL MAP GEMRAHO)

Dinanath Bhandari @DinanathB · 10m

What a systematic practice of #flood #earlywarning ! I hope #taskforces and #community will follow #protocol to evacuate and be safe. Proud to see the success of #EWS by @KamalKkt84 #Koshi #India

> **Kamal Tripathi** @KamalKkt... · 16m
>
> Warning 3 issue by Panchayat mukhiya of #SouthMahishi #Aarapatti #Sirbarbirbar #Naharwar #Rajanpur #Aina #Koshi River cross danger level at Rivers Gauge of Kothiya village #earlyarning #flood2019 @SeedsIndia @WetlandsInt @PfRglobal @ShantilakshmiC @BsdmaBihar @NitishKumar

♡ 3

⇄ Smriti Z Irani Retweeted

ISRO ✔ @isro · 57m

Current vs Future model

Current Relief Model
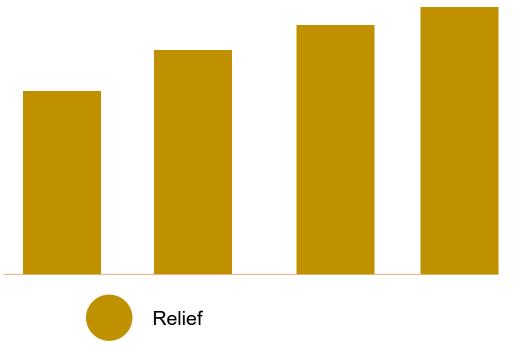
- After every disaster, relief, restoration, and repair carried out

- Cycle continues with each recurring disaster, needs continue to grow

- Increasing frequency of disasters, increases demand on resources for relief

- Engagement with users only post-disaster

Community Resilience Model

- After every disaster, relief, restoration and repair carried out with incentives to adopt resilience-building practices

- Cycle disrupted with recurring disaster, relief needs decrease as the community is more resilient.

- Resources freed from reduced relief, diverted to 'building resilience at scale'

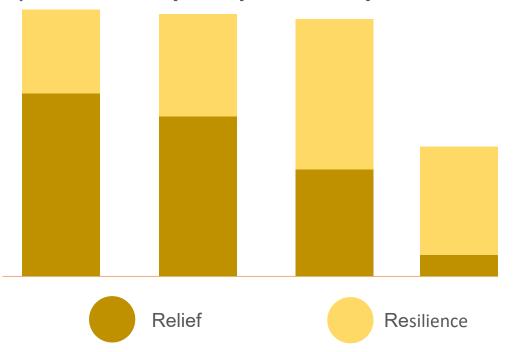- Sustained engagement with users catalyzes survive-adapt-thrive curve

Illustrative example: Investing in effective resilience practices can help reduce the net loss with subsequent disasters for farmers

Current Model
(Division of spend per subsequent disaster)

Relief

- Farmers lose their crops as part of every disaster
- The relief amounts are used for immediate needs
- Limited effort is spent on rehabilitation and rebuilding
- Relief amounts keep increasing with every disaster

Envisioned Model
(Division of spend per subsequent disaster)

Relief   Resilience

- Farmers lose crops in the first disaster
- In addition to relief, support provided for storage
- Mitigation and preparedness by changing cropping patterns, alternative income sources
- Net loss due to disasters reduce every disaster

23

Developing a National Disaster Resilience Platform

By 2030, enable the most marginalized of the 316 million people residing in 225 climate vulnerable districts of India to survive, adapt, and thrive despite recurring disasters.

Thankyou

Email: manu@seedsindia.org

Twitter: manu_seeds