Climate Impact and Services for Disaster Resilience in Asia-Pacific

Sanjay Srivastava
Chief, Disaster Risk Reduction
UN Economic and Social Commission for Asia and the Pacific, Bangkok, Thailand

18th Session of the
Forum on Regional Climate Monitoring, Assessment and Prediction for Asia (FOCRAII)

9 May 2022

Asia-Pacific is the world's most climate impacted region

A person in Asia and the Pacific is four times more at risk than a person in Africa and sixteen times than in North America and Europe.

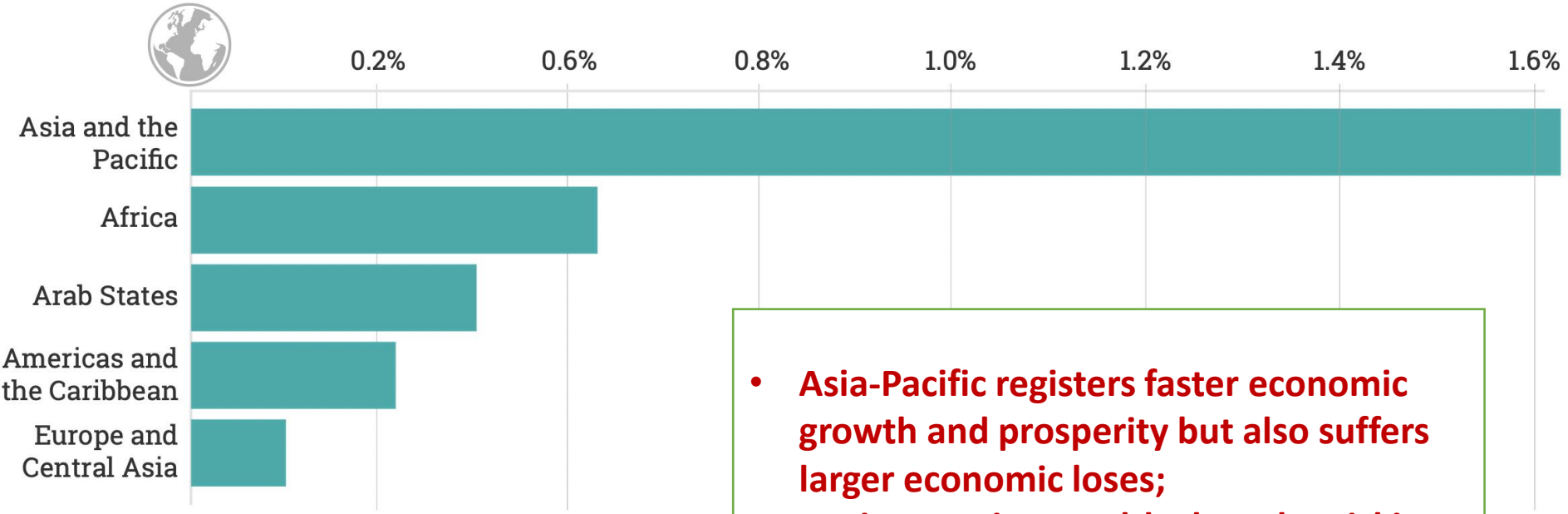
The riskscape of the region stems not only from its inherent natural, biological, and environmental hazards but its socio-economic vulnerabilities and rapid urbanization.

Nexus of disaster, climate change and associated diseases, gives rise to hotspots of intensifying & emerging risks.

https://www.unescap.org/kp/2021/asia-pacific-disaster-report-2021

Asia-Pacific suffers disproportionate economic losses

Average economic loss from disasters as share of GDP by region (Sendai Framework Target c), 2005-2020



- **Asia-Pacific registers faster economic growth and prosperity but also suffers larger economic loses;**
- **Region turning wealthy but also riskier**

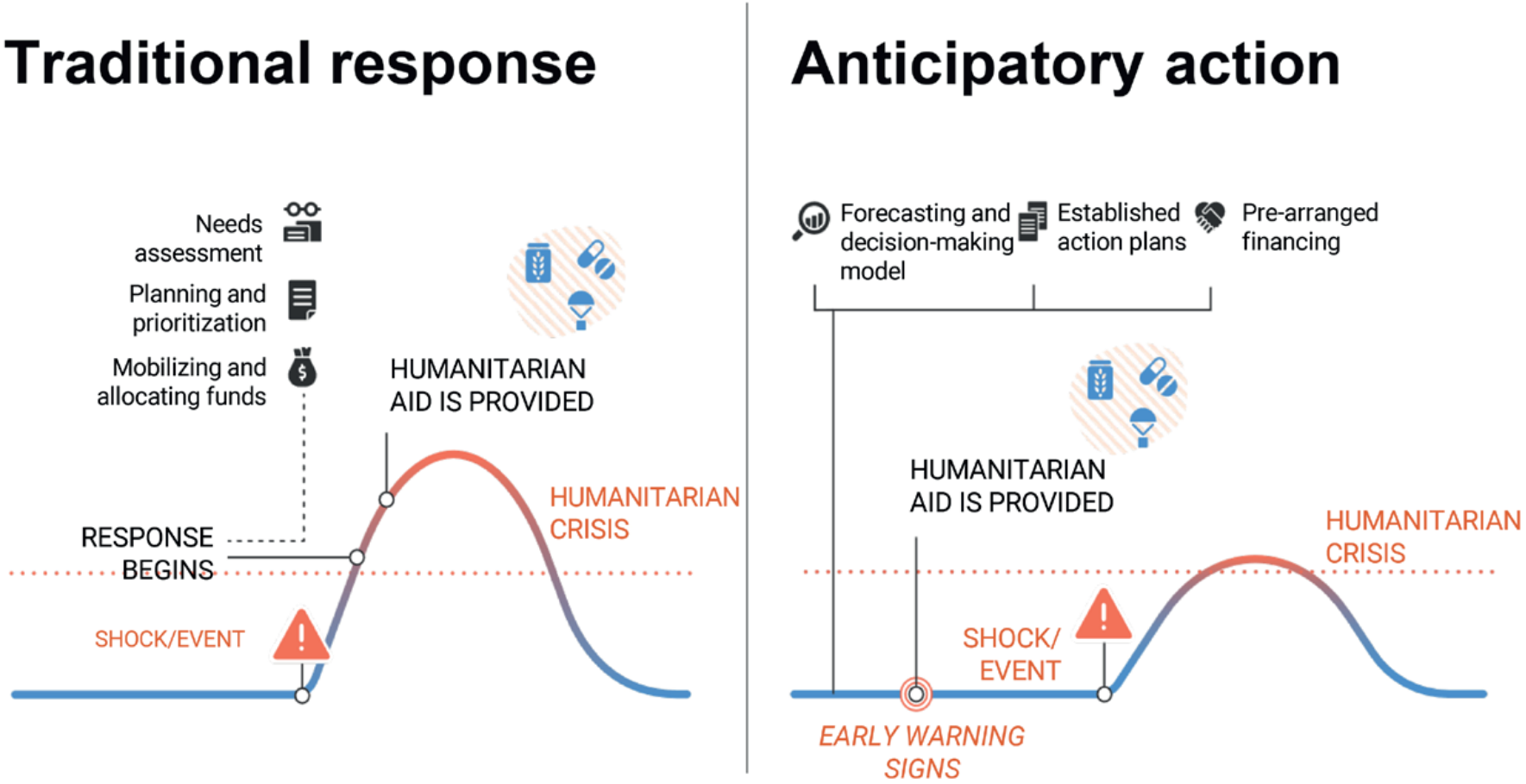
Source: UNDRR analysis based on DesInventar (UNDRR, 2021d) and SFM (UNDRR 2021c)

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

GAR
Global Assessment Report on Disaster Risk Reduction
Our World at Risk: Transforming Governance for a Resilient Future

ESCAP 75
MOVING FORWARD TOGETHER

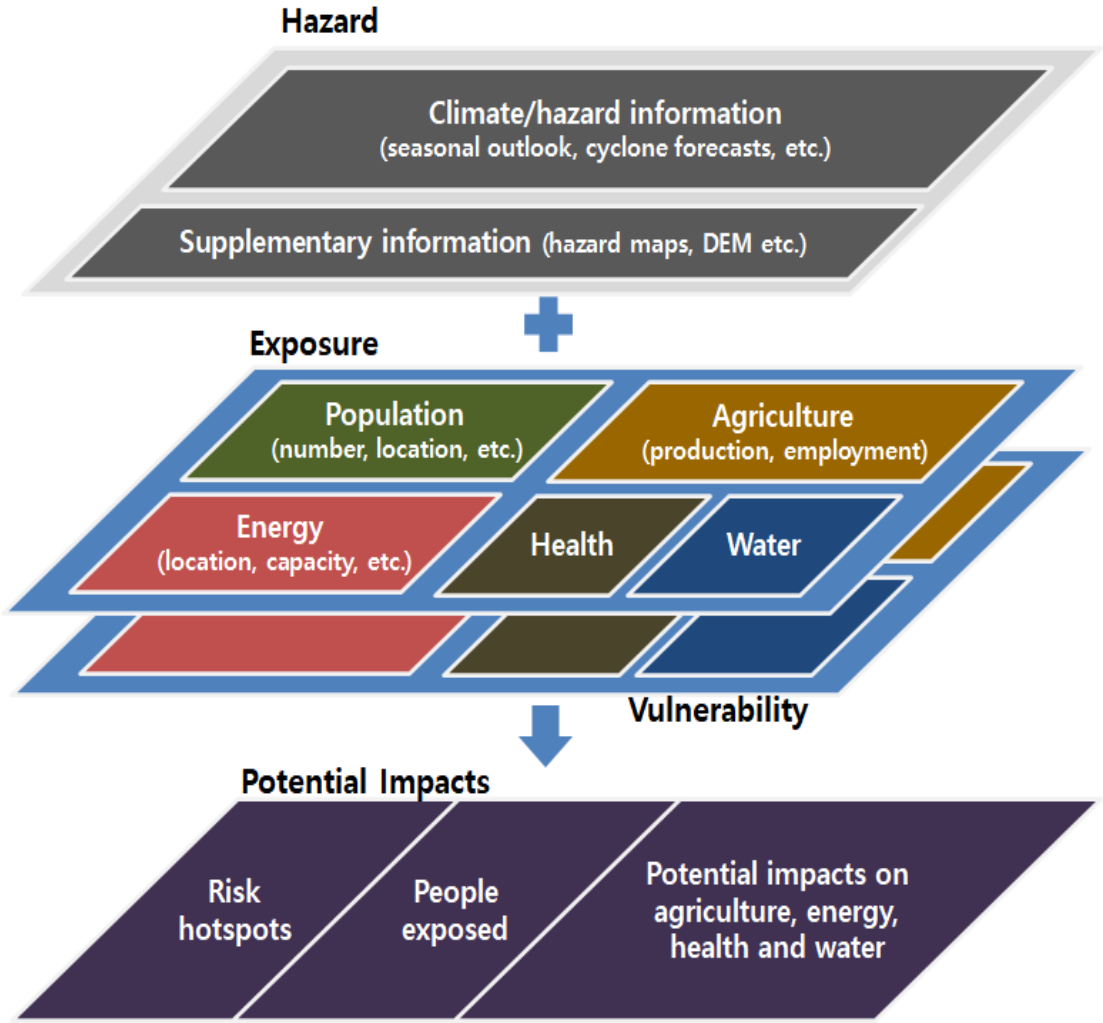
#2. A paradigm shift towards managing disaster risk: Early warning is to enable anticipatory action



Source: Anticipatory Humanitarian Action pilot: 2020 Monsoon floods in Bangladesh

Source: Anticipatory action before the tipping point n Bangladesh (OCHA, UNRCO (Bangladesh), Anticipatory Action Pilot, 2020)

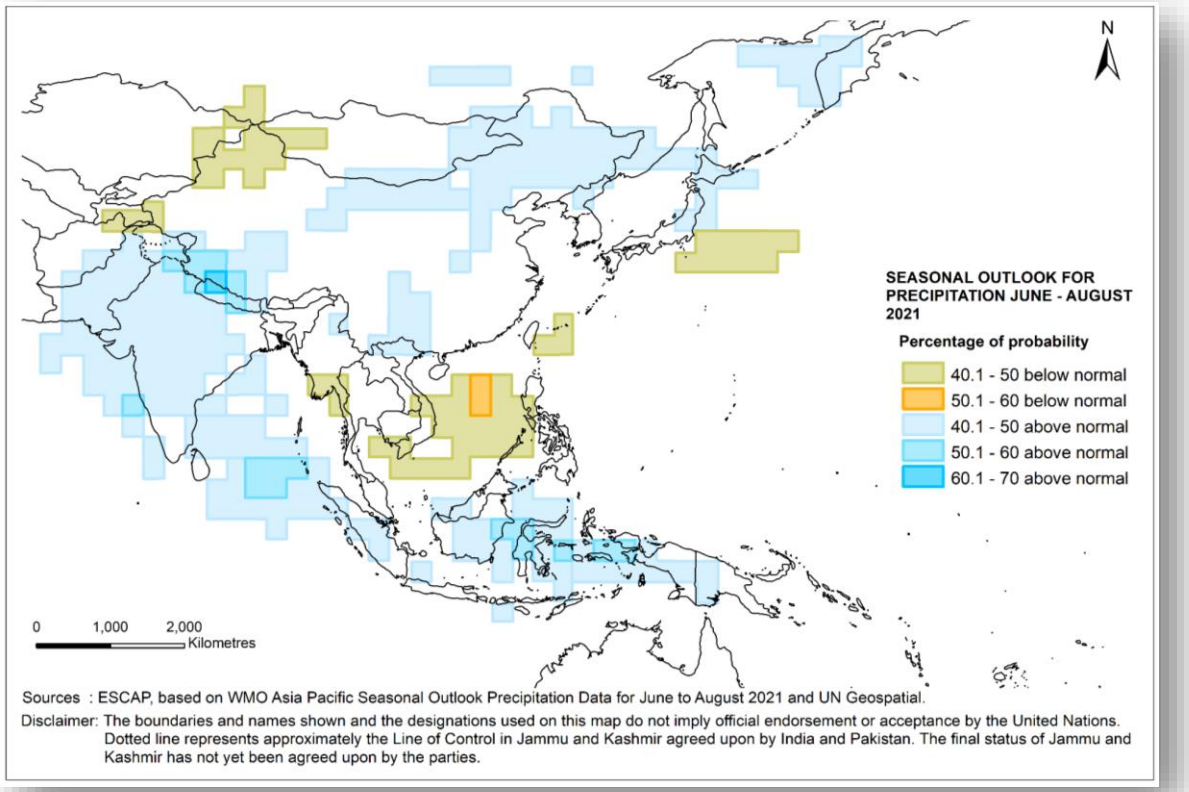
WMO Global Framework for Climate Services based ESCAP's impact-based forecasting approach



Source: APDR 2021

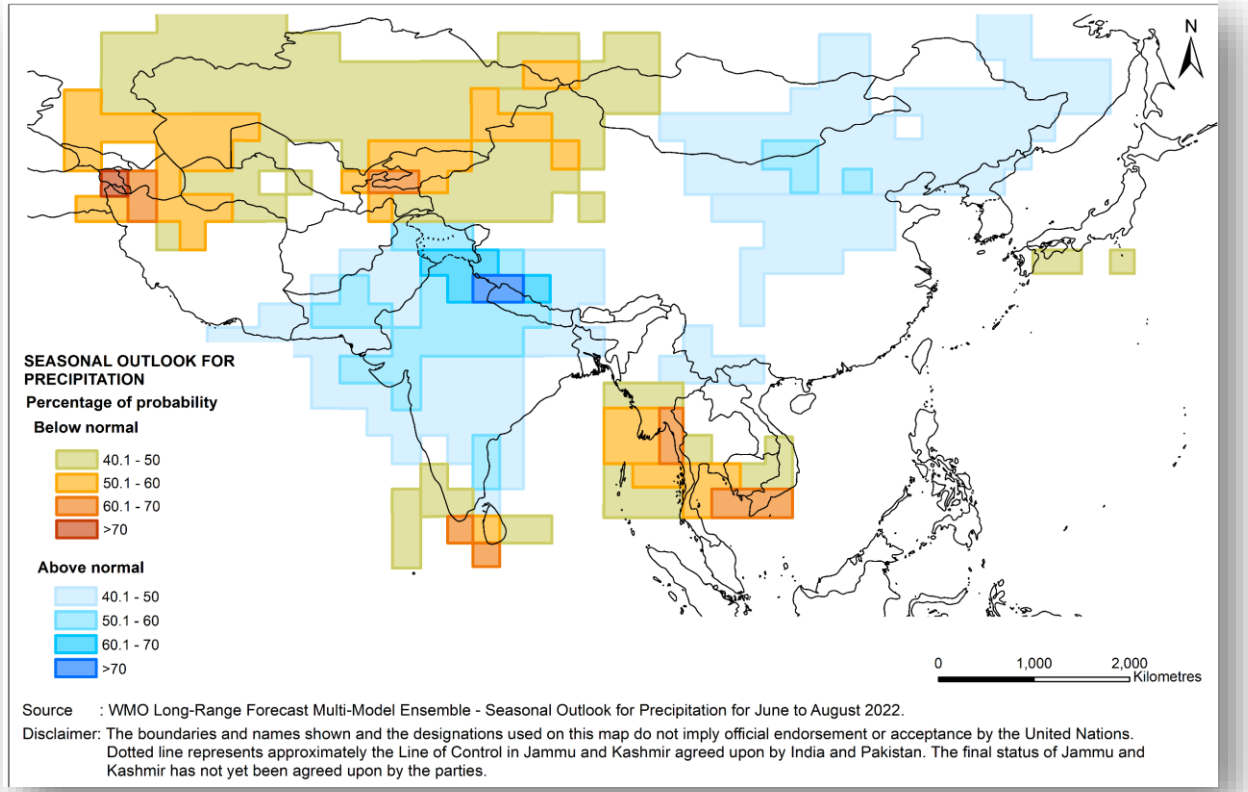
- **IBF based on seasonal forecast products** - Concept and cases were presented to SASCOF, EASCOF and FOCRAII.
- **IBF based on observed and forecast tracks of tropical cyclones (quadrant wind)** - Concept and a case were presented to and discussed at TC and PTC.

WMO Seasonal outlook for precipitation (ensemble)
JJA 2021



ESCAP used this forecast data for the
17th Session of FOCRA-II

WMO Seasonal outlook for precipitation (ensemble)
JJA 2022

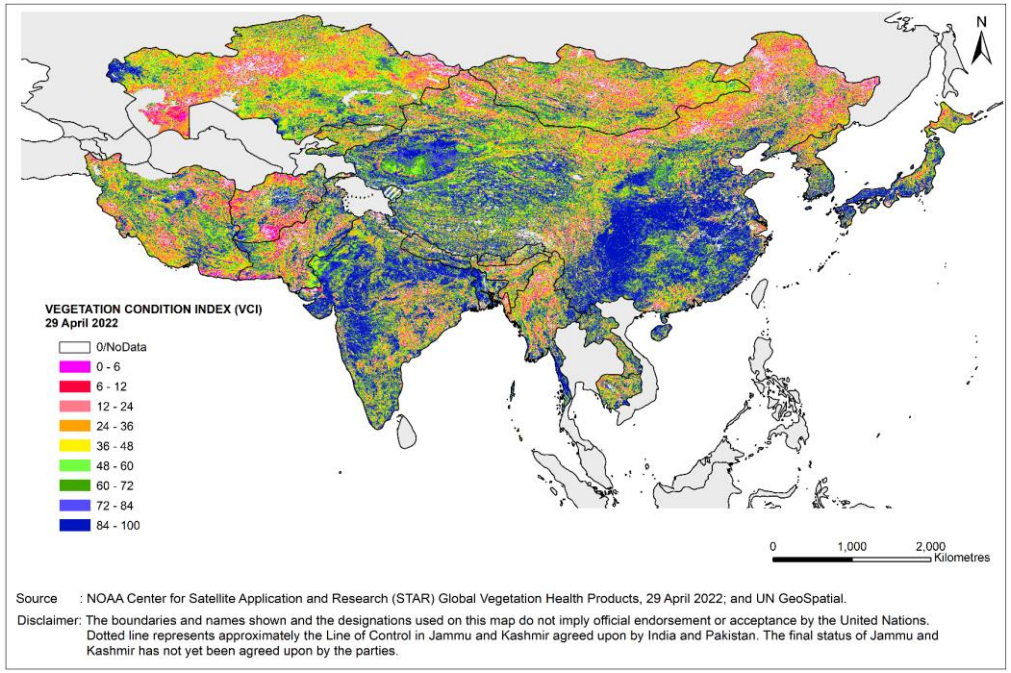


ESCAP used this forecast data for the
18th Session of FOCRA-II

Translating Seasonal Outlook 2022 to Impact Forecasting in specific context of floods: Areas of attention with above-normal precipitation

Vegetation health and flood hazard map were used to find out the areas of attention for above-normal precipitation.

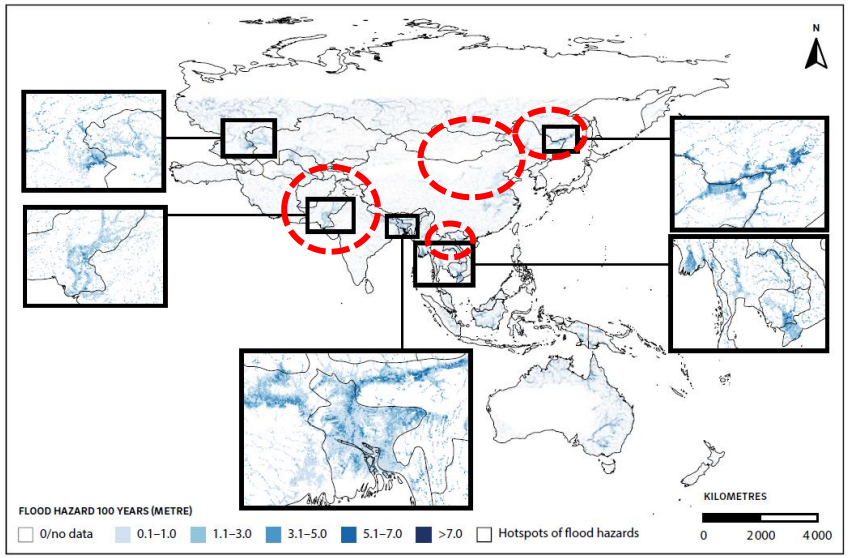
Vegetation condition index as of 29 April 2022



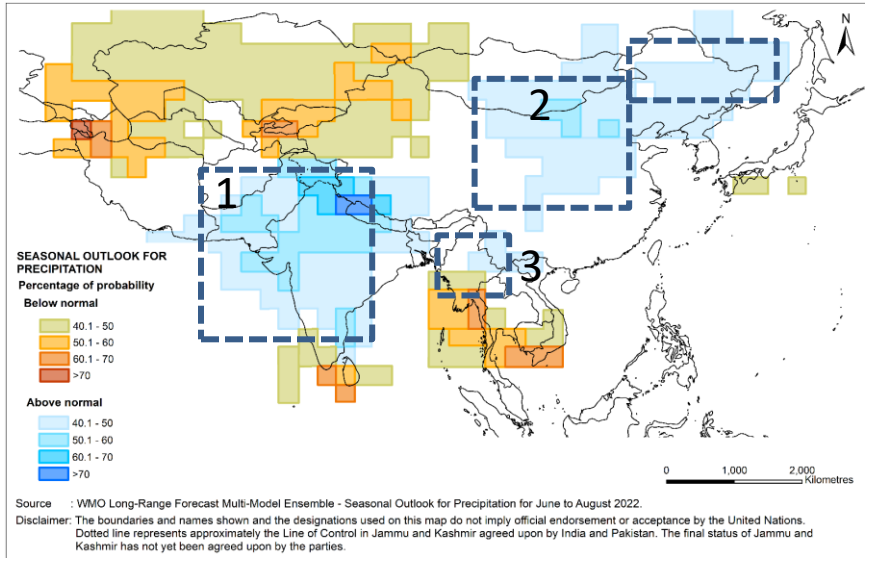
Source : NOAA Center for Satellite Application and Research (STAR) Global Vegetation Health Products, 29 April 2022; and UN GeoSpatial.

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

Flood hazard in 100-year return period



Seasonal forecast for precipitation JJA 2022



Source : WMO Long-Range Forecast Multi-Model Ensemble - Seasonal Outlook for Precipitation for June to August 2022.

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.

Areas of attention for above-normal precipitation

1. South:
Pakistan and north-eastern parts of India neighboring with Pakistan;

northern parts of India neighboring with Nepal, south-east parts of China (60% – more than 70% probability of above-normal precipitation);
central parts of India and east parts of India, and Bangladesh.

2. North-east:

North-eastern parts of China.

3. South-east:

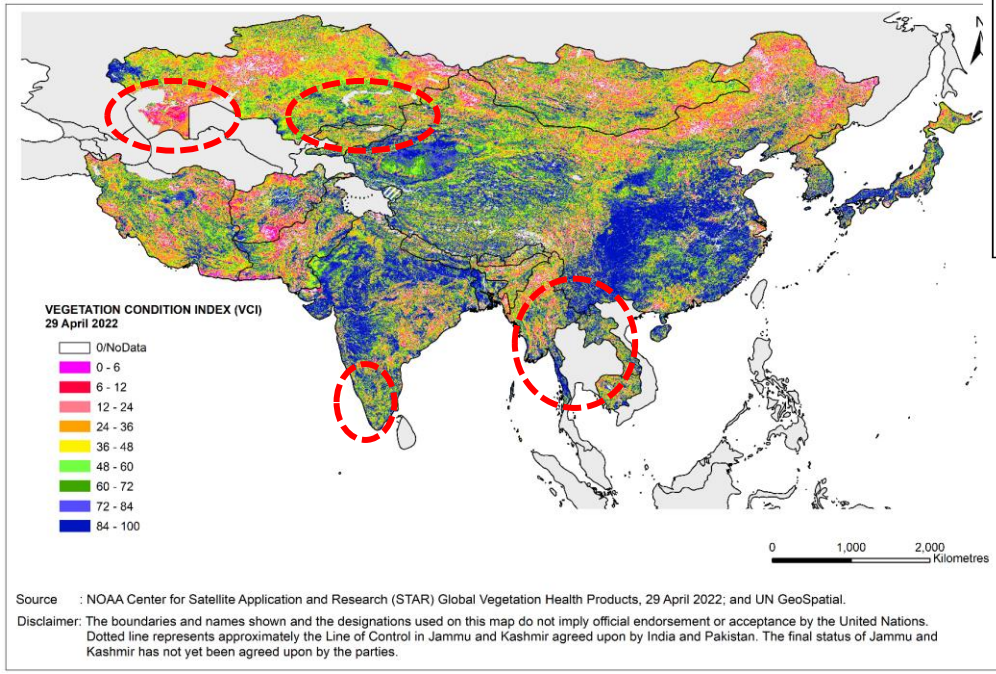
Southern parts of China neighboring with Myanmar and Lao PDR.

Translating Seasonal Outlook 2022 to Impact Forecasting in specific context of drought:

Areas of attention with below-normal precipitation

Vegetation health and flood hazard map were used to find out the areas of attention for below-normal precipitation.

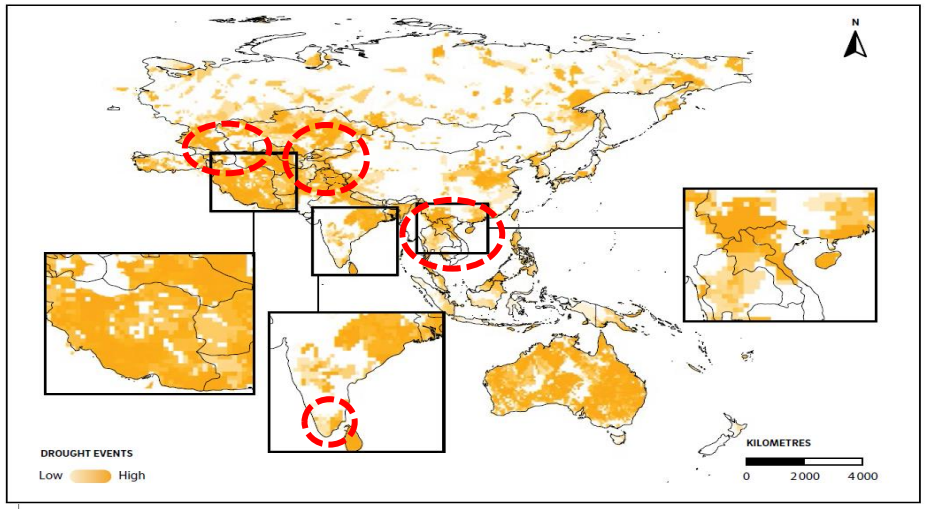
Vegetation condition index as of 29 April 2022



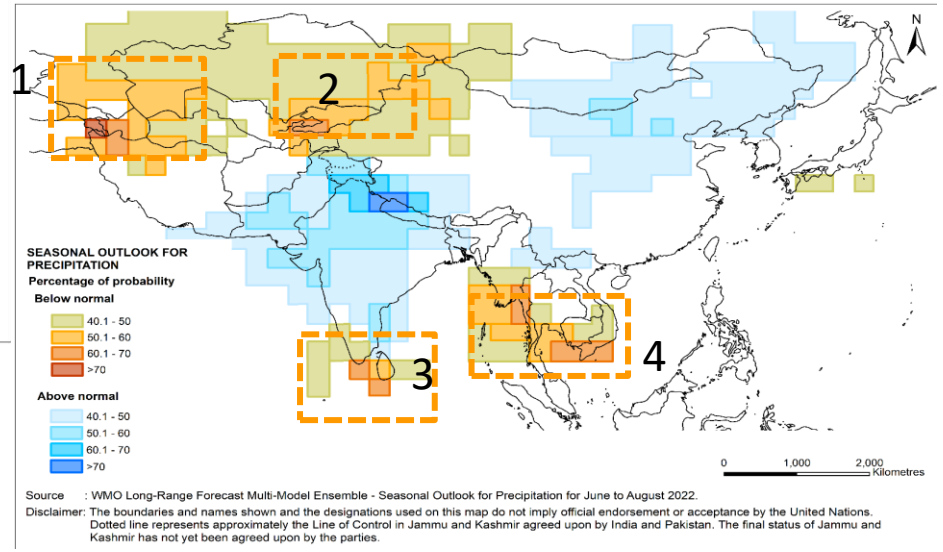
Source : NOAA Center for Satellite Application and Research (STAR) Global Vegetation Health Products, 29 April 2022; and UN GeoSpatial.

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

Drought events from 1980-2001



Seasonal forecast for precipitation JJA 2022



Source : WMO Long-Range Forecast Multi-Model Ensemble - Seasonal Outlook for Precipitation for June to August 2022.

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.

Areas of attention for below-normal precipitation with below-normal precipitation

1. West and central:

south-western parts of Kazakhstan and Islamic Republic of Iran.

2. Central and north:
eastern parts of Kazakhstan neighboring with Kyrgyzstan and Mongolia.

3. South:

Maldives and south parts of India.

4. South-east:
south parts of Myanmar and south parts of Cambodia.

All of these areas are predicted to have 60% to more than 70% probability of below-normal precipitation

Translating seasonal outlook for precipitation JJA 2022 to Impact forecasting for floods and drought prone areas

Areas need attention in association with above-normal precipitation

1. South:
Pakistan and north-eastern parts of India neighboring with Pakistan;

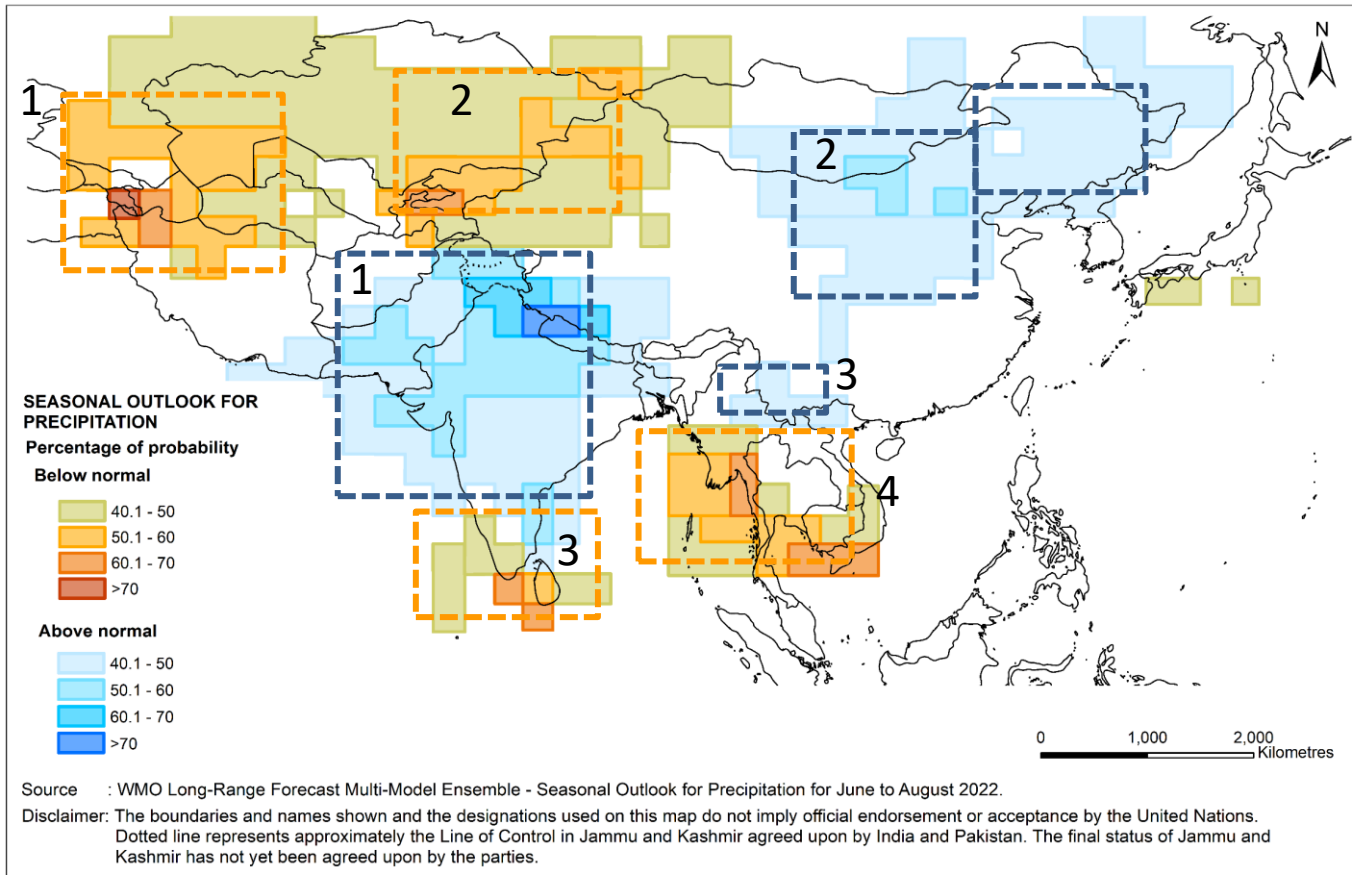
northern parts of India neighboring with Nepal, south-east parts of China (60% – more than 70% probability of above-normal precipitation);
central parts of India and east parts of India, and Bangladesh.

2. North-east:

North-east parts of China.

3. South-east:

Southern parts of China neighboring with Myanmar and Lao PDR.



Source : WMO Long-Range Forecast Multi-Model Ensemble - Seasonal Outlook for Precipitation for June to August 2022.

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.

Areas need attention in association with below-normal precipitation with below-normal precipitation

1. West and central:

south-western parts of Kazakhstan and Islamic Republic of Iran.

2. Central and north:
eastern parts of Kazakhstan neighboring with Kyrgyzstan and Mongolia.

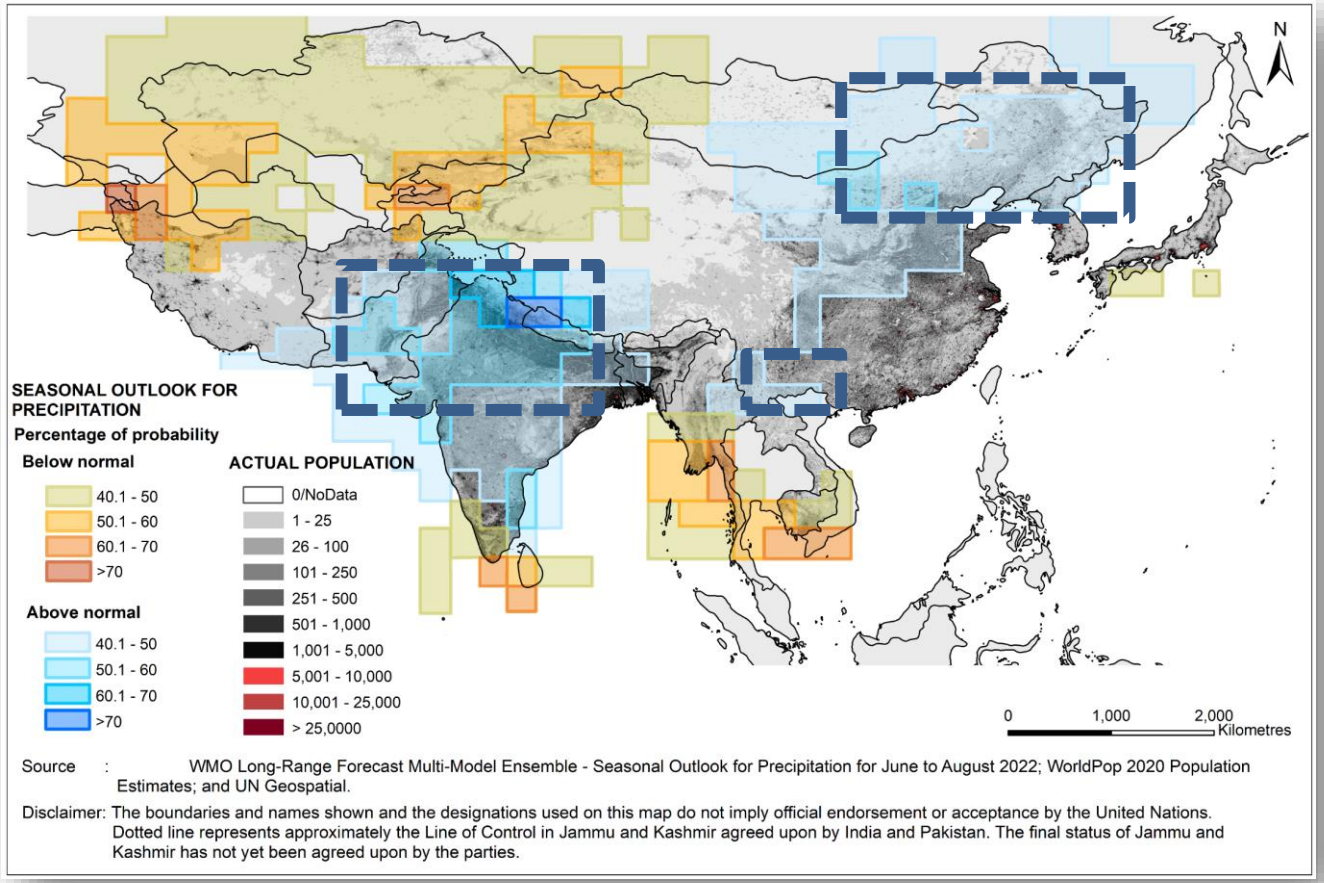
3. South:

Maldives and south parts of India.

4. South-east:
south parts of Myanmar and south parts of Cambodia.

All these areas are predicted to have 60% to more than 70% probability of below-normal precipitation

Population likely to be exposed to above-normal precipitation (floods)



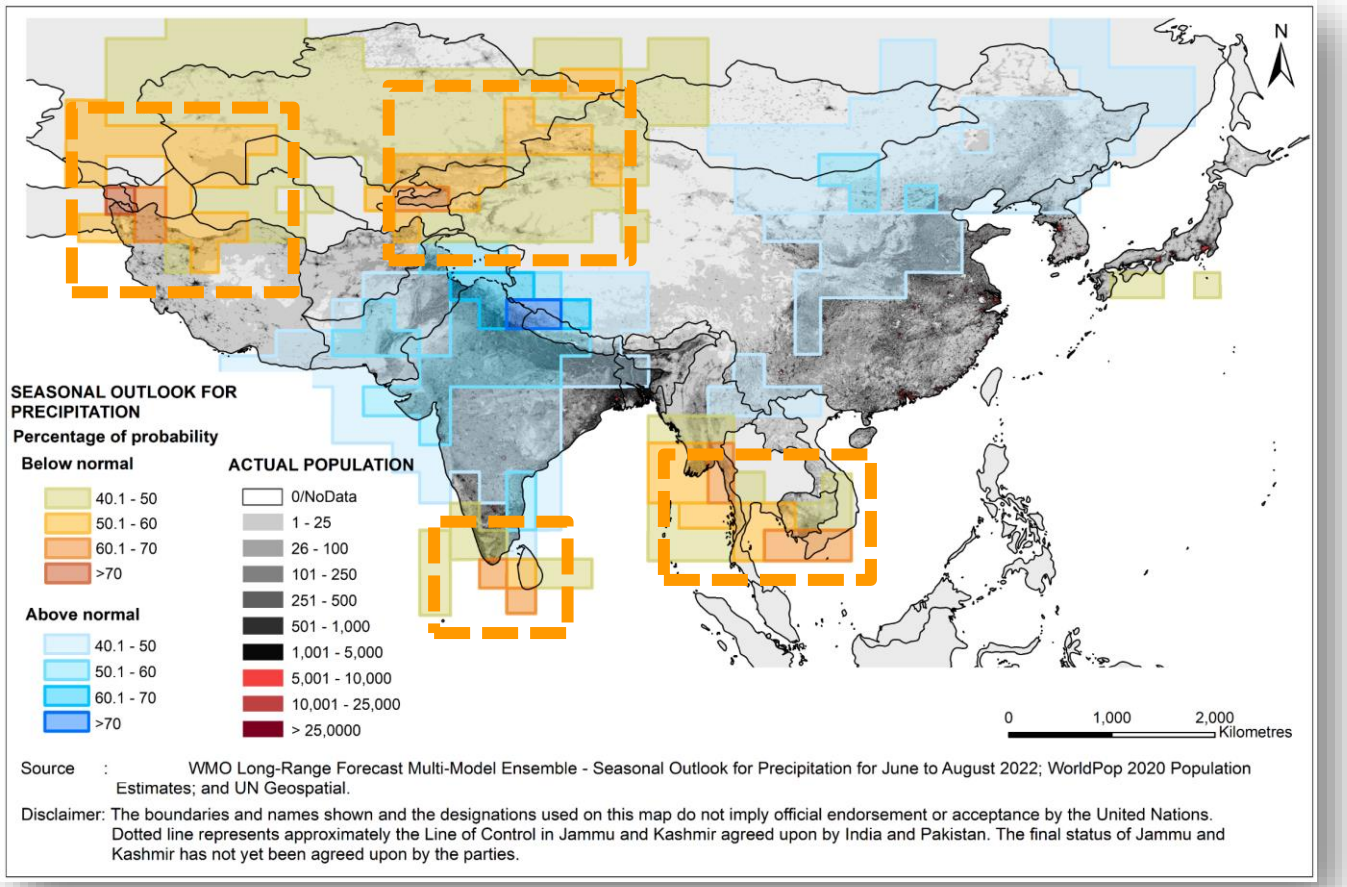
Areas needing attention due to above-normal rainfall

Country	Total pop. 2020 (in k) ESCAP statistics	Percent of pop. exposure to 40.1% - 50% probability of above-normal precipitation	Percent of pop. exposure to 50.1% - 80% probability of above-normal precipitation	Percent of pop. exposed to above-normal precipitation
Afghanistan	9	9.9%	0.9%	10.8%
Bangladesh	164,689	56.1%	0.0%	56.1%
Bhutan	772	0.0%	0.0%	0.0%
Cambodia	16,719	0.0%	0.0%	0.0%
China	1,439,324	41.5%	1.5%	43.1%
Hong Kong, China	7,497	0.0%	0.0%	0.0%
Macao, China	649	0.0%	0.0%	0.0%
DPR Korea	25,779	73.1%	0.0%	73.1%
India	1,380,004	34.6%	43.4%	78.0%
Iran, Islamic Rep.of	83,993	2.0%	0.0%	2.0%
Japan	126,476	0.0%	0.0%	0.0%
Kazakhstan	18,777	0.0%	0.0%	0.0%
Kyrgyzstan	6,524	0.0%	0.0%	0.0%
Lao PDR	7,276	3.4%	0.0%	3.4%
Maldives	541	0.0%	0.0%	0.0%
Mongolia	3,278	14.2%	0.7%	14.9%
Myanmar	54,410	7.9%	0.0%	7.9%
Nepal	29,137	26.9%	73.1%	100.0%
Pakistan	220,892	58.2%	41.2%	99.4%
Republic of Korea	51,269	0.0%	0.0%	0.0%
Total	3,638,015	36.3%	19.9%	56.2%

- The seasonal forecast data is overlaid with population data and this can help identify location and number of population exposed to more or less precipitation to normal years.
- This can help identify the number of population/population density in the areas of concerns.
- The above-normal precipitation is expected in 1. south (India, Pakistan, Nepal, Bangladesh), 2. north-east (China) and 3. south-east parts of the region (Myanmar, Lao PDR).

- 19.9% of population in these countries are likely to experience 50-80% probability of more rainfall.
- Countries with the greatest proportion of exposed population to 50-80% probability of more rainfall are: Nepal 73.1%, Pakistan 41.2%, and India 43.4%.

Population likely to be exposed to below-normal precipitation (drought)



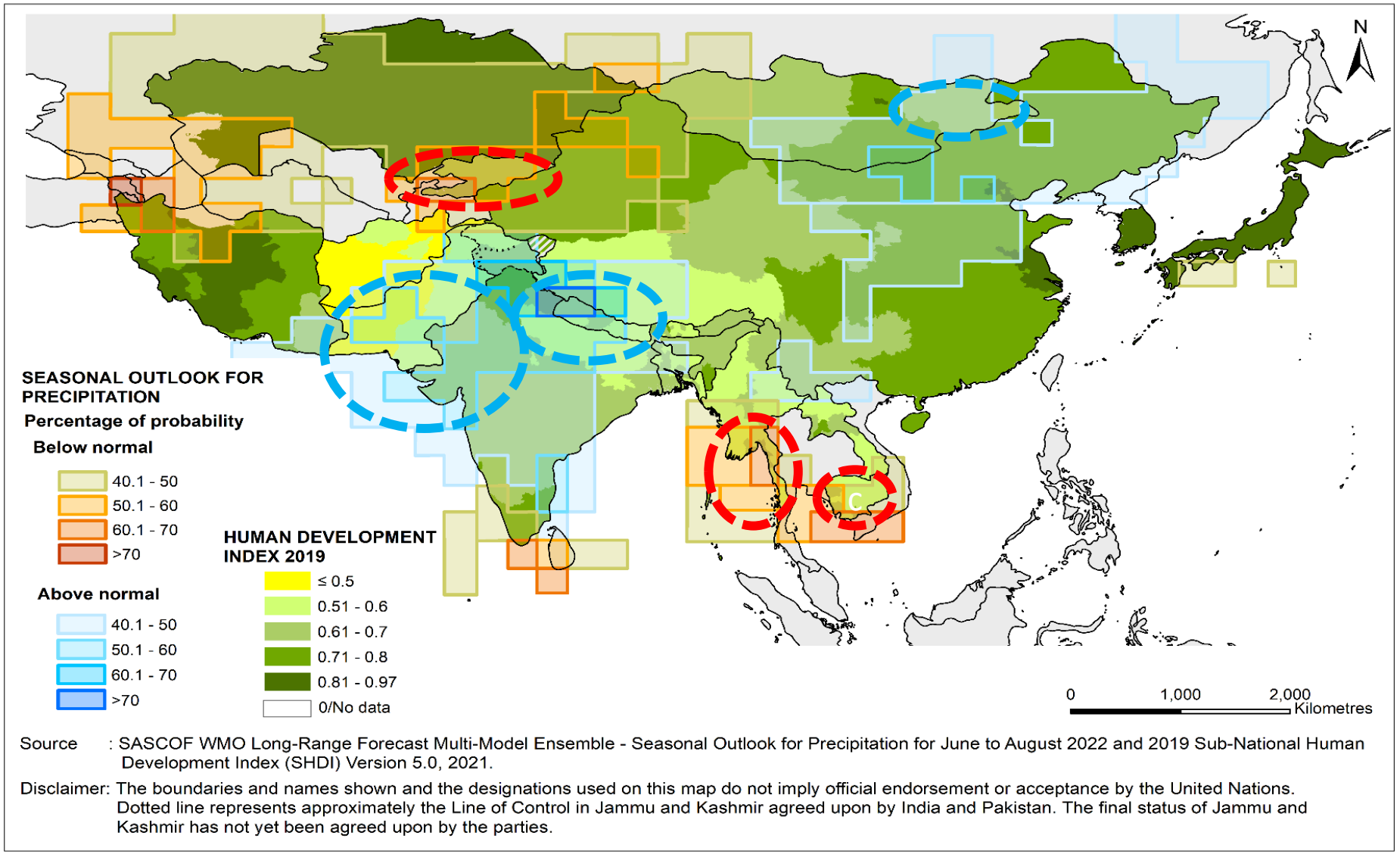
Areas needing attention due to below-normal rainfall

Country	Total pop. 2020 (in k) ESCAP statistics	Percent of pop. exposure to 40.1% - 50% probability of below-normal precipitation	Percent of pop. exposure to 50.1% - 80% probability of below-normal precipitation	Percent of pop. exposed to below-normal precipitation
Afghanistan	9	0.4%	8.4%	8.8%
Bangladesh	164,689	0.2%	0.0%	0.2%
Bhutan	772	0.0%	0.0%	0.0%
Cambodia	16,719	55.5%	29.7%	85.2%
China	1,439,324	1.1%	42.2%	43.3%
Hong Kong, China	7,497	0.0%	0.0%	0.0%
Macao, China	649	0.0%	0.0%	0.0%
DPR Korea	25,779	0.0%	0.0%	0.0%
India	1,380,004	4.7%	0.4%	5.1%
Iran, Islamic Rep.of	83,993	16.6%	35.9%	52.4%
Japan	126,476	1.7%	0.0%	1.7%
Kazakhstan	18,777	47.2%	43.0%	90.2%
Kyrgyzstan	6,524	0.8%	99.2%	100.0%
Lao PDR	7,276	6.3%	0.0%	6.3%
Maldives	541	85.4%	0.0%	85.4%
Mongolia	3,278	6.7%	0.1%	6.7%
Myanmar	54,410	19.5%	45.2%	64.8%
Nepal	29,137	0.0%	0.0%	0.0%
Pakistan	220,892	0.1%	0.0%	0.1%
Republic of Korea	51,269	0.0%	0.0%	0.0%
Total	3,638,015	3.5%	18.8%	22.3%

- The below-normal precipitation is expected in 1. west and central (Kazakhstan, Islamic Rep. of Iran), 2. central and north (Kazakshtan, Kyrgyzstan and Mongolia), 3. South (Maldives and India), and 4) south-east parts of the region (Myanmar and Lao PDR).

- 18.8% of population in these countries are likely to experience 50-80% probability of less rainfall.
- Countries with the greatest proportion of exposed pop. to 50-80% probability of less rainfall are: Kyrgyzstan 99.2%, Myanmar 45.2%, Kazakhstan 43.0%, China 42.2%, and Islamic Rep. of Iran 35.9%.
- In total, around 22.3% of pop. in these countries are likely to experience less rainfall.

Vulnerable population likely to be exposed to below/above-normal precipitation



Source : SASCOF WMO Long-Range Forecast Multi-Model Ensemble - Seasonal Outlook for Precipitation for June to August 2022 and 2019 Sub-National Human Development Index (SHDI) Version 5.0, 2021.

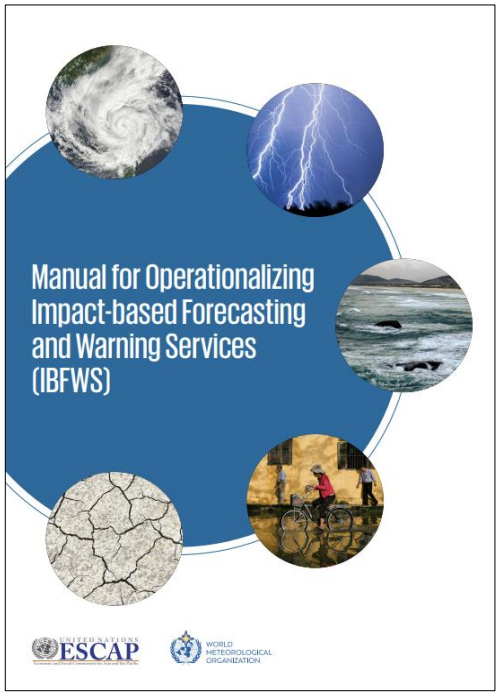
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir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

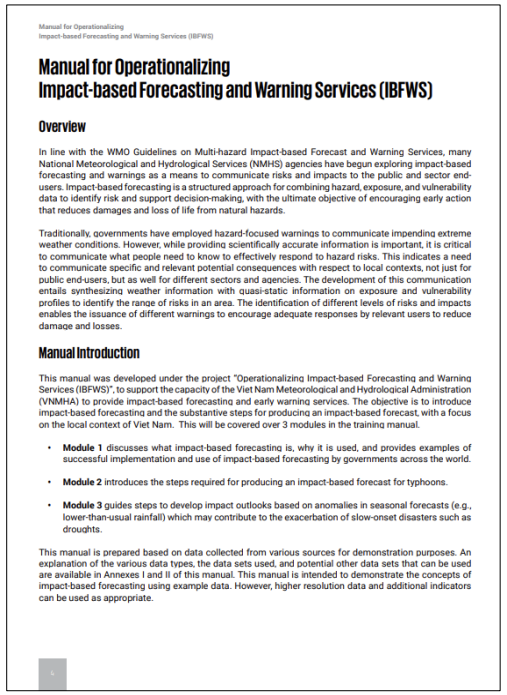
Areas needing attention due to above-normal rainfall and **lower Human Development Index (HDI)**

Areas needing attention due to below-normal rainfall and **lower Human Development Index (HDI)**

Impact-based forecast and warning services – training material

A project funded by WMO's CREWS-Canada





Manual for Operationalizing
Impact-based Forecasting and Warning Services (IBFWS)

Manual for Operationalizing Impact-based Forecasting and Warning Services (IBFWS)

Overview

In line with the WMO Guidelines on Multi-hazard Impact-based Forecast and Warning Services, many National Meteorological and Hydrological Services (NMHS) agencies have begun exploring impact-based forecasting and warnings as a means to communicate risks and impacts to the public and sector end-users. Impact-based forecasting is a structured approach for combining hazard, exposure, and vulnerability data to identify risk and support decision-making, with the ultimate objective of encouraging early action that reduces damages and loss of life from natural hazards.

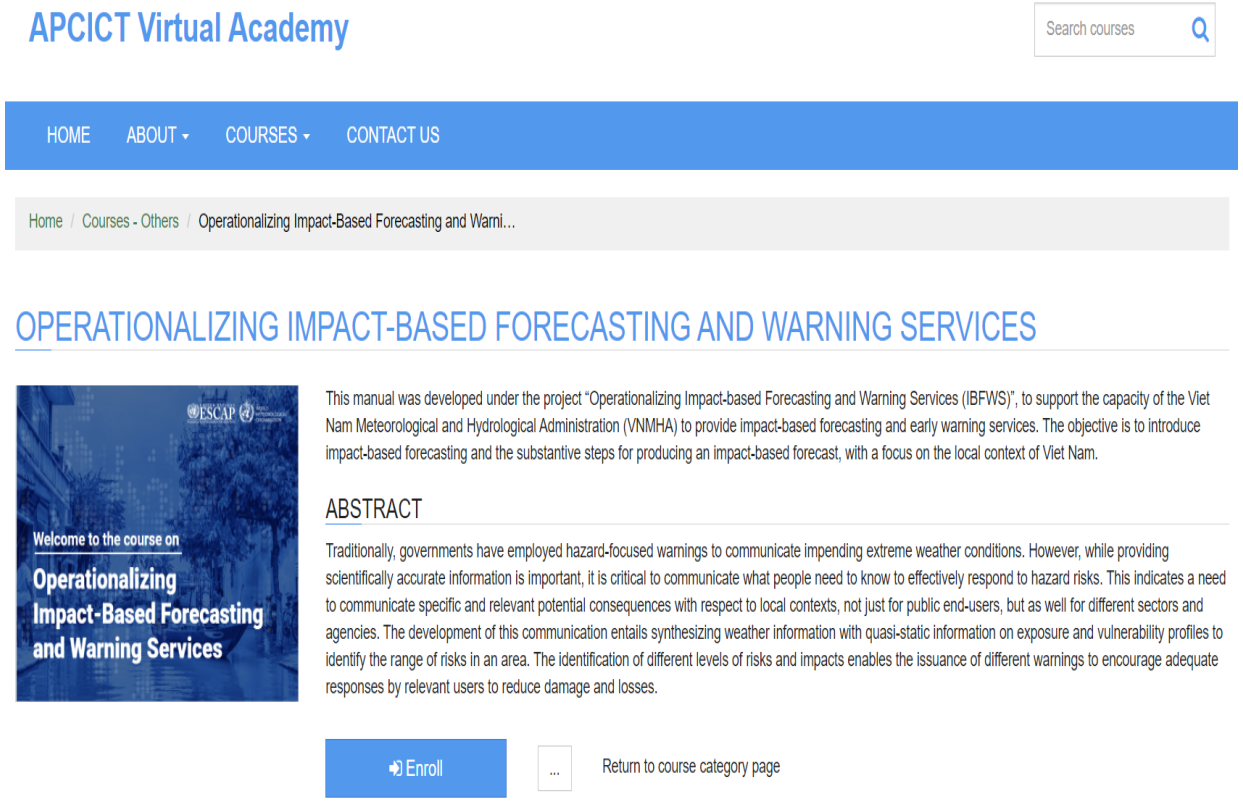
Traditionally, governments have employed hazard-focused warnings to communicate impending extreme weather conditions. However, while providing scientifically accurate information is important, it is critical to communicate what people need to know to effectively respond to hazard risks. This indicates a need to communicate specific and relevant potential consequences with respect to local contexts, not just for public end-users, but as well for different sectors and agencies. The development of this communication entails synthesizing weather information with quasi-static information on exposure and vulnerability profiles to identify the range of risks in an area. The identification of different levels of risks and impacts enables the issuance of different warnings to encourage adequate responses by relevant users to reduce damage and losses.

Manual Introduction

This manual was developed under the project "Operationalizing Impact-based Forecasting and Warning Services (IBFWS)", to support the capacity of the Viet Nam Meteorological and Hydrological Administration (VNMHA) to provide impact-based forecasting and early warning services. The objective is to introduce impact-based forecasting and the substantive steps for producing an impact-based forecast, with a focus on the local context of Viet Nam. This will be covered over 3 modules in the training manual.

- **Module 1** discusses what impact-based forecasting is, why it is used, and provides examples of successful implementation and use of impact-based forecasting by governments across the world.
- **Module 2** introduces the steps required for producing an impact-based forecast for typhoons.
- **Module 3** guides steps to develop impact outlooks based on anomalies in seasonal forecasts (e.g., lower-than-usual rainfall) which may contribute to the exacerbation of slow-onset disasters such as droughts.

This manual is prepared based on data collected from various sources for demonstration purposes. An explanation of the various data types, the data sets used, and potential other data sets that can be used are available in Annexes I and II of this manual. This manual is intended to demonstrate the concepts of impact-based forecasting using example data. However, higher resolution data and additional indicators can be used as appropriate.

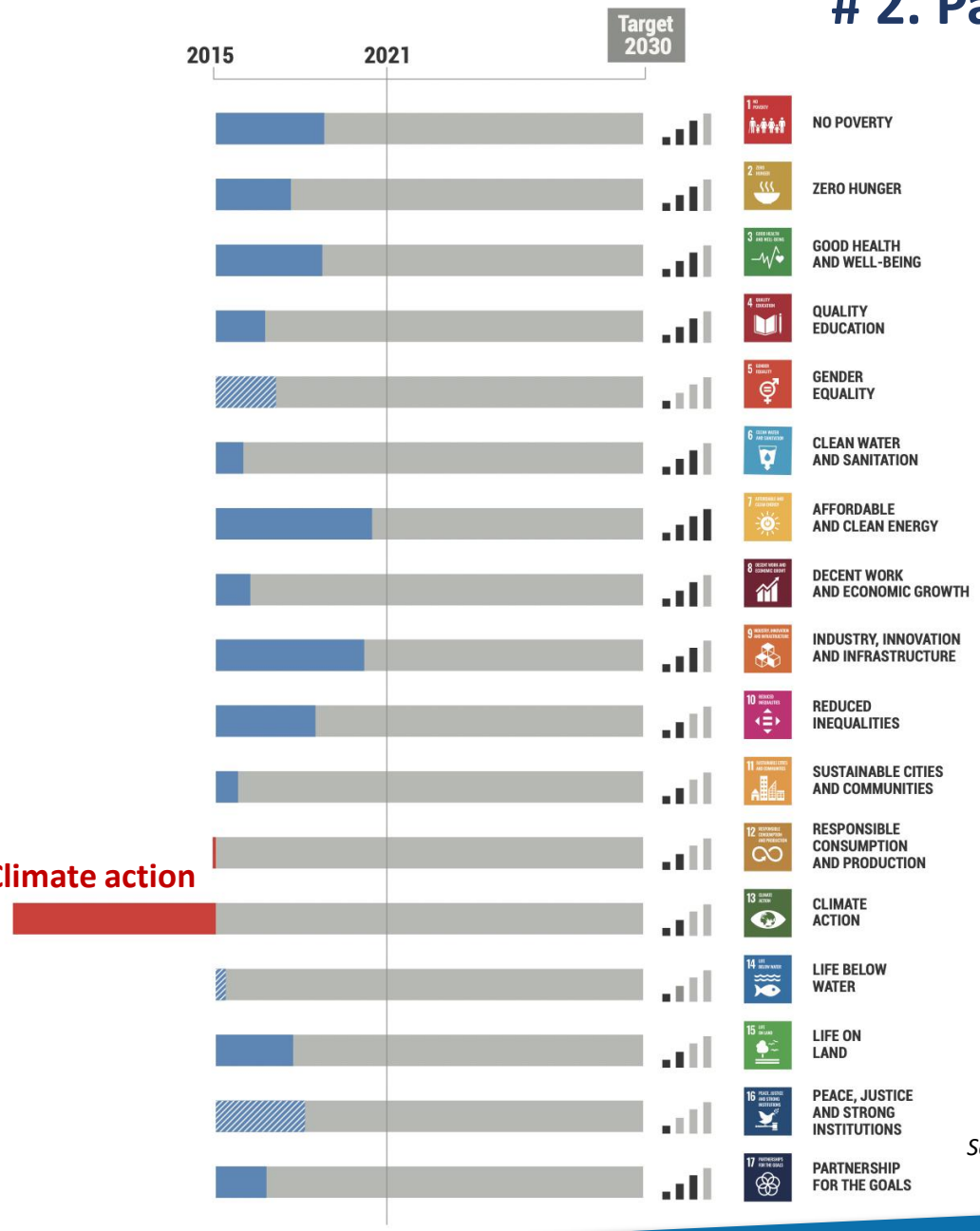


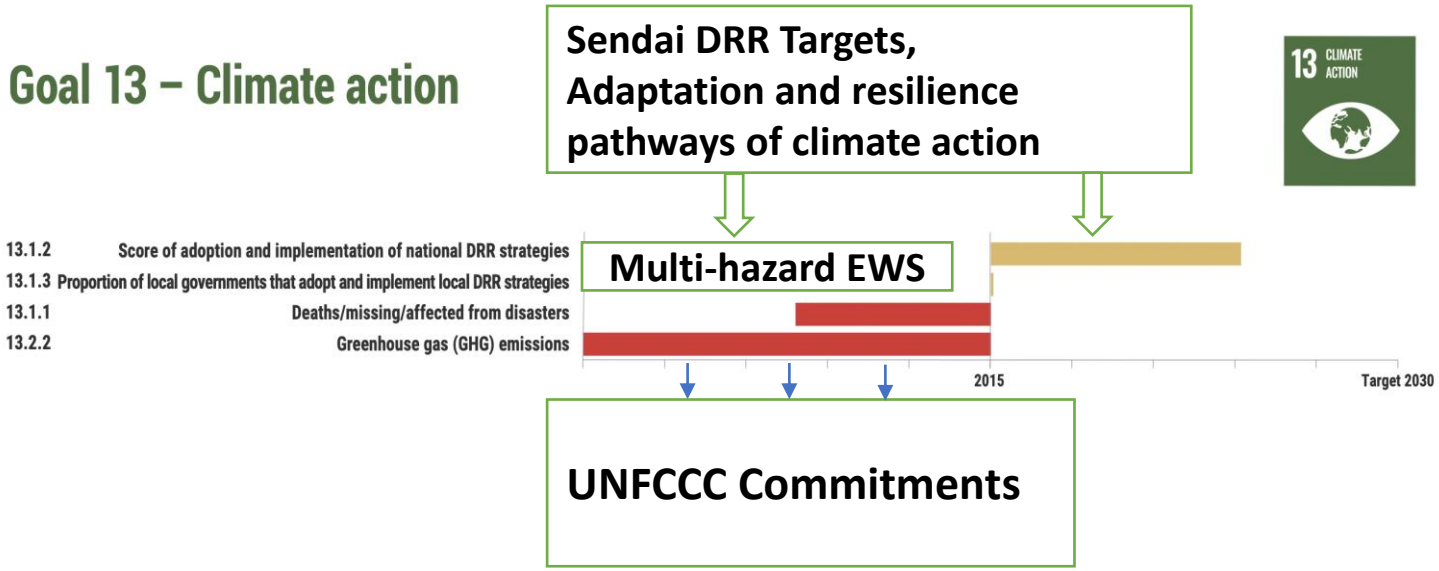
- Module 1. Introduction to impact-based forecasting
- Module 2. Impact-based forecasting for typhoons
- Module 3. Impact outlooks using seasonal forecasts

https://e-learning.unapcict.org/courses/detail?id=55

2. Paradigm shift: Climate action to reduce the impact and build resilience

SDG Progress in Asia-Pacific 2022





Source: UNESCAP, Asia and the Pacific SDG Progress Report 2022

Policy action in terms of 5 adaptation priorities for climate resilience which are aligned with cluster of SDGs

Improving dryland agriculture crop production	Making new infrastructure resilient	Making water resources management more resilient	Nature based solutions: green infrastructure	Multi-hazard risk assessment and early warning systems
				

Moving forward: Analytical work..

State of the Climate in Asia 2021 (RA II)
South-West Pacific 2021

Socio-economic impacts and policies

To be analyzed in terms of SDGs progress and the Sendai Mid-term Review report

GAR

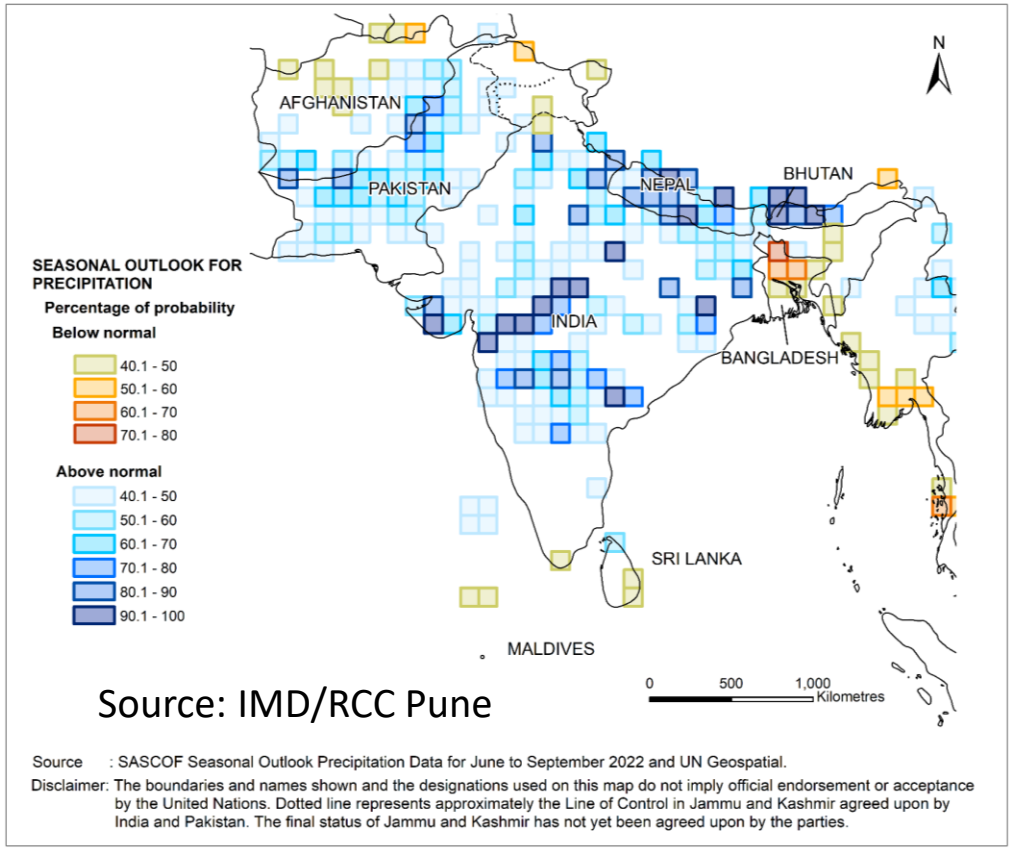
Global Assessment Report on Disaster Risk Reduction

Our World at Risk: Transforming Governance for a Resilient Future

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.

Moving forward:
Impact forecasting, risk informed early warning for early action

SASCOF
South Asia Seasonal outlook for precipitation JJAS 2022

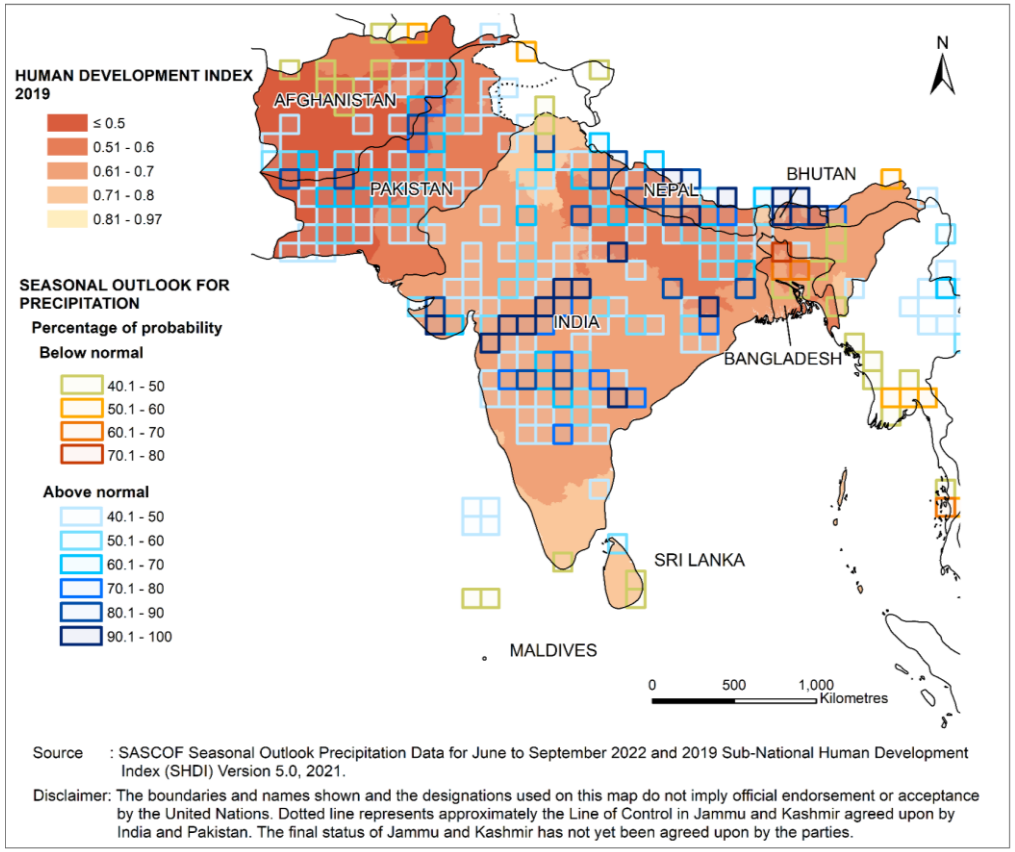


Source: IMD/RCC Pune

Source : SASCOF Seasonal Outlook Precipitation Data for June to September 2022 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. 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.

SASCOF
Targeting the most vulnerable to be exposed to precipitation JJAS 2022

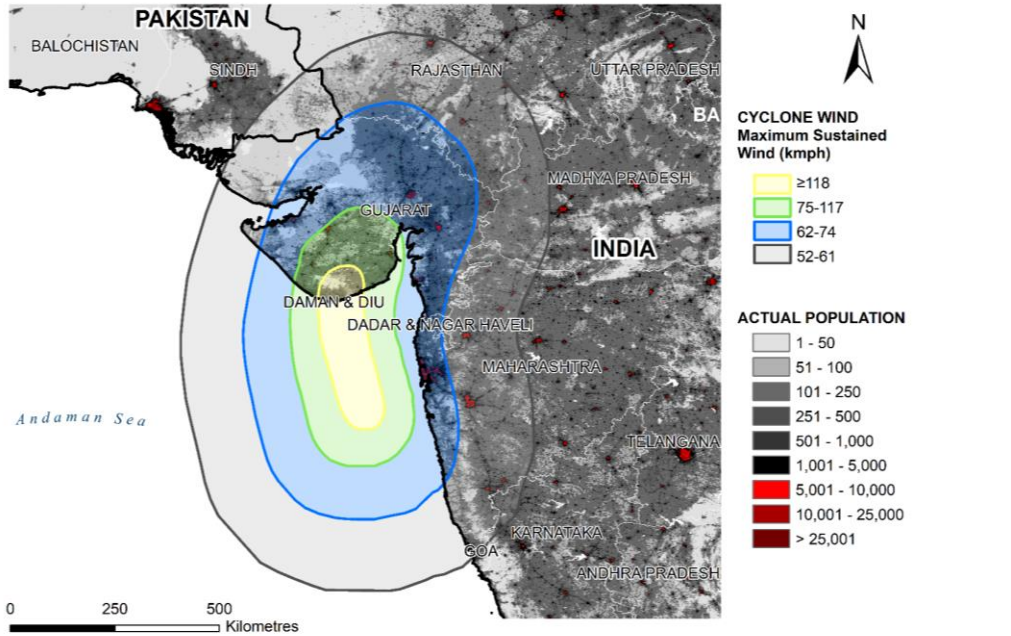


Source : SASCOF Seasonal Outlook Precipitation Data for June to September 2022 and 2019 Sub-National Human Development Index (SHDI) Version 5.0, 2021.

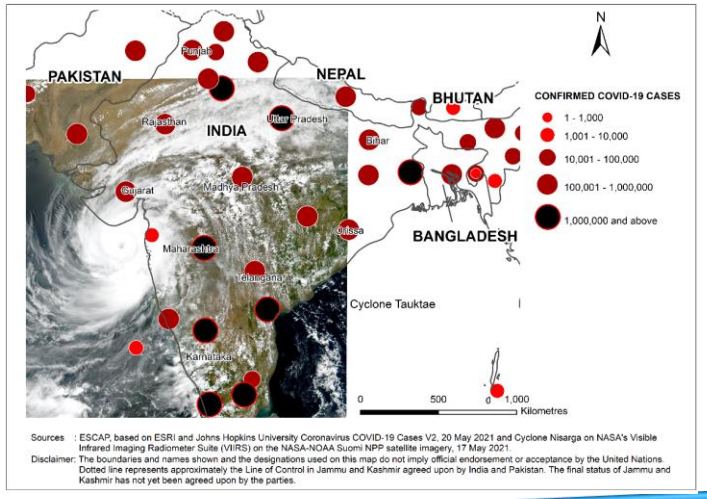
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir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

Impact forecasting, risk informed early warning for early action

Population likely to be hit by Cyclone Tauktae – May 2021

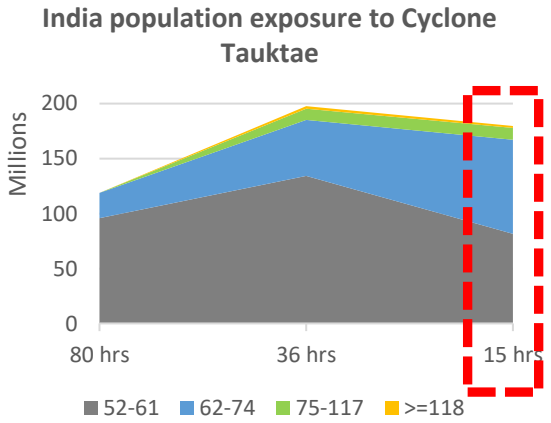


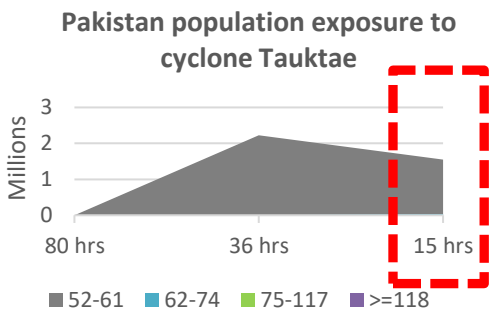
Sources : ESCAP, based on India Meteorological Department's ESCAP based on IMD Cyclone Amphan Observed and Forecast Data on 17 May 2021 (05:30 IST) and Worldpop 2020 Population Estimates for India and Pakistan.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.



Sources : ESCAP, based on ESRI and Johns Hopkins University Coronavirus COVID-19 Cases V2, 20 May 2021 and Cyclone Nisarga on NASA's Visible Infrared Imaging Radiometer Suite (VIIRS) on the NASA-NOAA Suomi NPP satellite imagery, 17 May 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. Dottad 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.

Cyclone wind Maximum Sustained Wind	Category	80 hrs		36 hrs		15 hrs	
		IND	PAK	IND	PAK	IND	PAK
52-61	1	95,951,965	0	134,188,285	2,222,065	81,646,847	1,544,966
62-74	2	22,911,284	0	50,779,203	0	85,554,279	33,019
75-117	3	0	0	10,398,294	0	10,672,006	0
>=118	4	0	0	2,269,487	0	1,614,419	0
TOTAL		118,863,249	0	197,635,269	2,222,065	179,487,550	1,577,985





Bridging the science policy gap for informed action

https://rrp.unescap.org/

Acknowledgement

Sanjay Srivastava,

Madhurima Sarkar-Swaisgood,

Maria Dewi,

Soomi Hong,

Jaehee Hwang,

Shashwat Avi,

Yoonji Kim

Thank you