ESCAP
MOVING FORWARD TOGETHER

25th South Asian Climate Outlook Forum (SASCOF-25)
Climate Services User Forum (CSUF)

Impact-Based Forecasting for the Seasonal Outlook JJAS 2023

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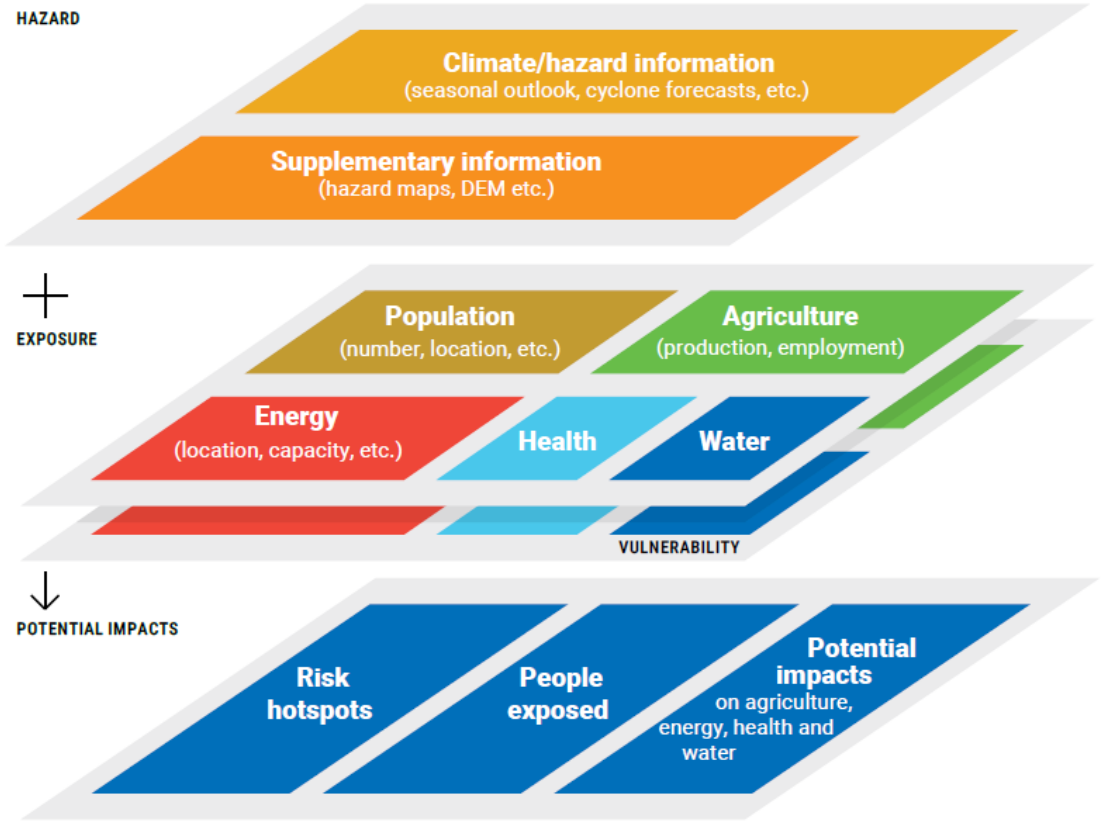
28 April 2023

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



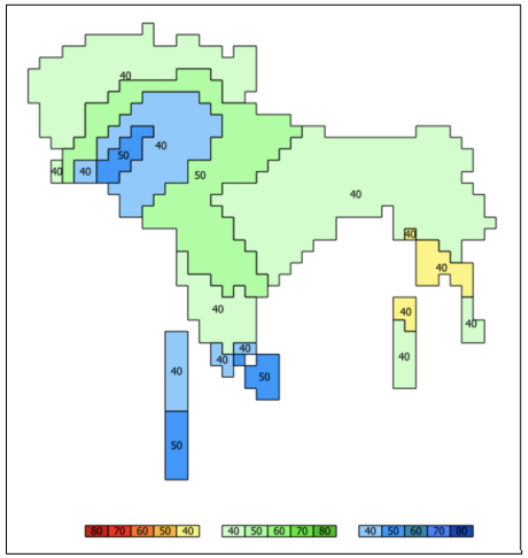
- **IBF based on seasonal forecast products** - Concept and cases were presented to SASCOF, EASCOF, ASEANCOF and FOCRAII.
- **IBF based on observed and forecast tracks of tropical cyclones (quadrant wind)** - Concept and a case were presented to and discussed at TC and PTC.

Source: ESCAP (2022) APDR – Pathways to Adaptation and Resilience in South and South-West Asia Overview of the work of secretariat and the UN system at the regional level. ESCAP/CDR/2021/INF/1

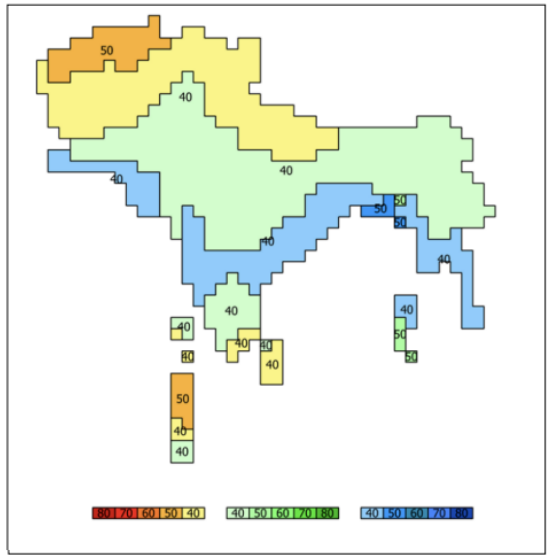
Seasonal Outlook to Socio-Economic Impact-Based Forecasting

Based on SASCOF seasonal forecast in 2020

(June to September)



(October to December)

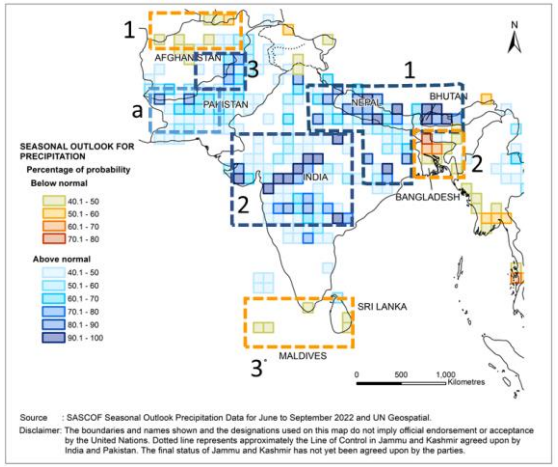


Source: http://rcc.imdpune.gov.in/SASCOF17/concensus.html (left), received from RCC of IMD in Pune, India (right)

Impact-based forecasting for South-Asia, JJAS 2022

In April 2022, potential flood risk hotspots were identified

Seasonal outlook for precipitation JJAS 2022



16-21 August 2022: AFGHANISTAN
Total deaths: 180
Total affected: 18,850
Parwan, Paktia, Paktika, Logar, Maidan-Wardak, Ghazni, Kunar, Laghman, Wardak, Nuristan , Zabul, Faryab, Farah, Kundoz provinces
(Source: Reliefweb, 2022)

June 2022: NEPAL
Total deaths: 21
Total affected: 544
Nepal

August 2022: NEPAL
Total deaths: 132
Total affected 5,500
Udayapur district; Saptakoshi

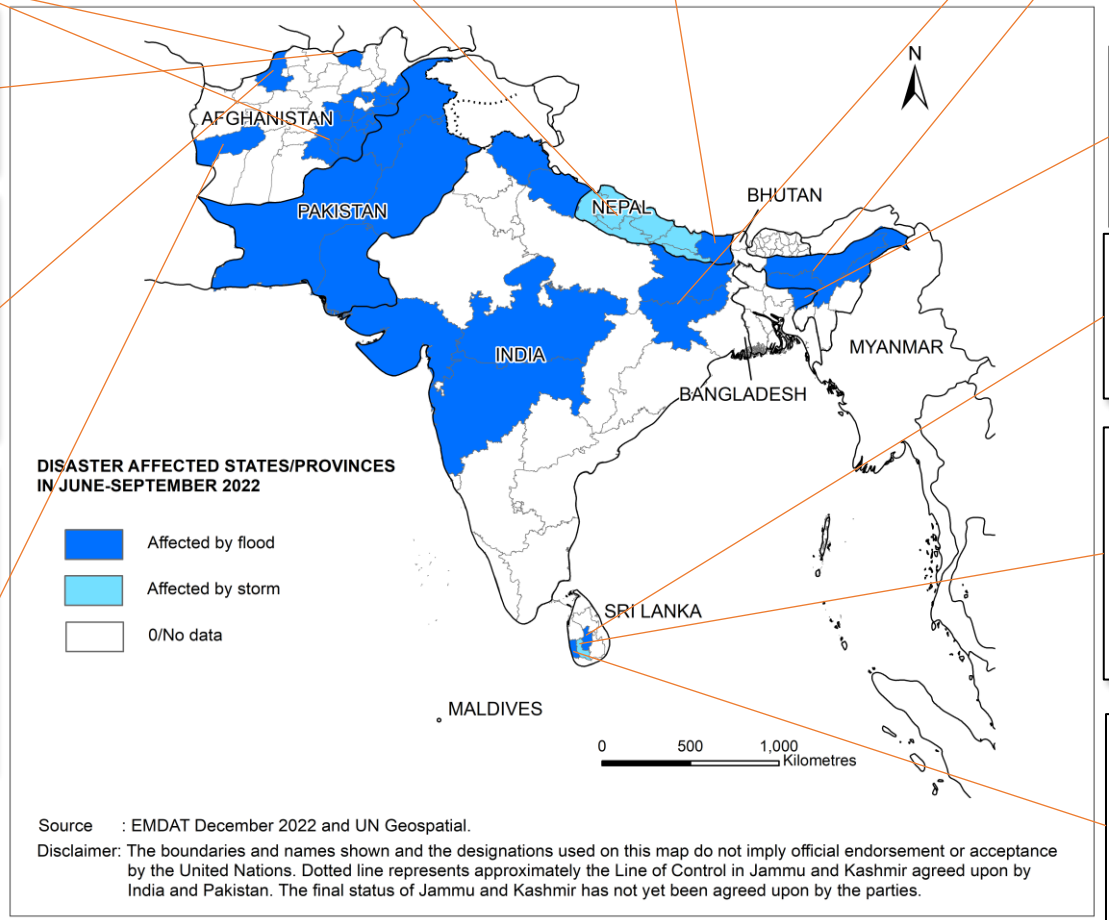
August 2022
Total deaths: 63
Total affected: 800,000
Himachal Pradesh, Uttarakhand and Jharkhand States

13 May - 13 September 2022
Total deaths: 2,035
Total affected: 1,301,260
Arunchal Pradesh, Assam, Meghalaya, Nagaland, Bihar, Himachal Pradesh, Madhya Pradesh, Gujarat, Maharasthra

22 June 2022: AFGHANISTAN
Total deaths: 19
Total affected: 1,379
Kunar, Laghman, Nangarhar & Nuristan Provinces

14 June – September 2022: PAKISTAN
Total deaths: 1,739
Total affected: 33,012,865
Balochistan, Khyber Pakhtunkhwa, Sindh, Punjab and Gilgit Baltistan

30 June –11 July 2022: AFGHANISTAN
Total deaths: 44
Total affected: 14,554
Nuristan, Kunar, Langman, Logar, Paktya, Ghazni, Maidan Wardak, Parwan Uruzgan, Kandahar, Zabul, Paktia, Khost, Nangarhar provinces



17 May – 28 June 2022: BANGLADESH
Total deaths 82
Total affected: 7,200,000i*….
Sylhet division

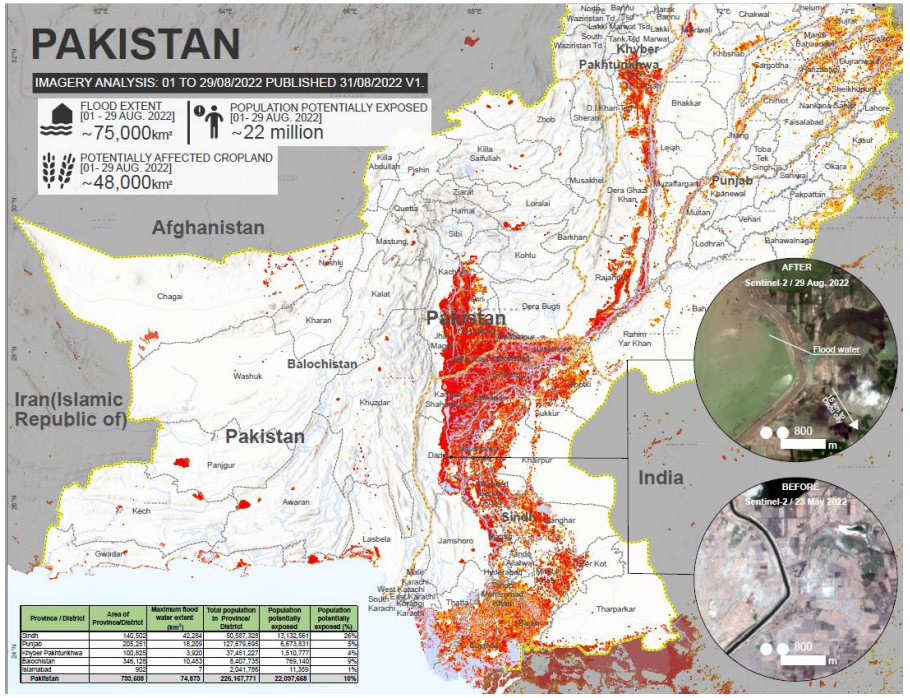
29 May – 2 June 2022: SRI LANKA
Total deaths: 1
Total affected: 22,338
Sabaragamuwa, Central provinces, Western Province

1 – 8 August 2022: SRI LANKA
Total deaths: 8
Total affected:15,448
Southern Central Province, central-western Central Province, Jaffna, Kandy, Matale, Gampaha, Galle, Matara, Hambantota, Kegalle, Rathnapura

2 – 6 September 2022: SRI LANKA
Total deaths: 1
Total affected: 5,478
Colombo, Kegalle, Kurunegala, Rathnapura, Kandy, Gampaha, Matale, Kalutara, Puttlam, Nuwara Eliya

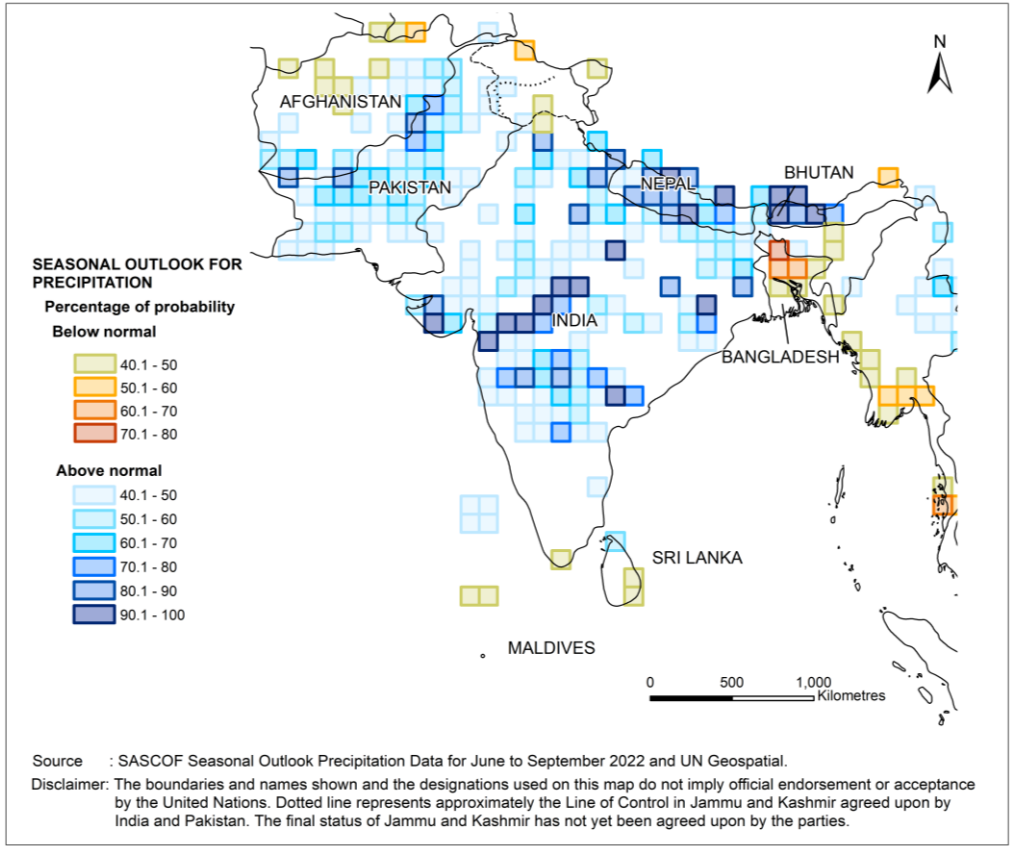
States or provinces affected by disasters from June to September 2022

Satellite image of flood affected provinces in Pakistan (2023)



- **Hotspots that stand out in the seasonal forecast coincide with provinces hit by floods in Pakistan:** Sindh, Punjab, Khyber Pakhtunkhwa, Balochistan, Islamabad.
- Despite certain limitations related data granularity and probabilistic nature of the analysis, it accurately identifies the hotspots of impending risks.
- Seasonal outlook for precipitation can prove to be an **effective decision-making support** for policymakers on the ground.

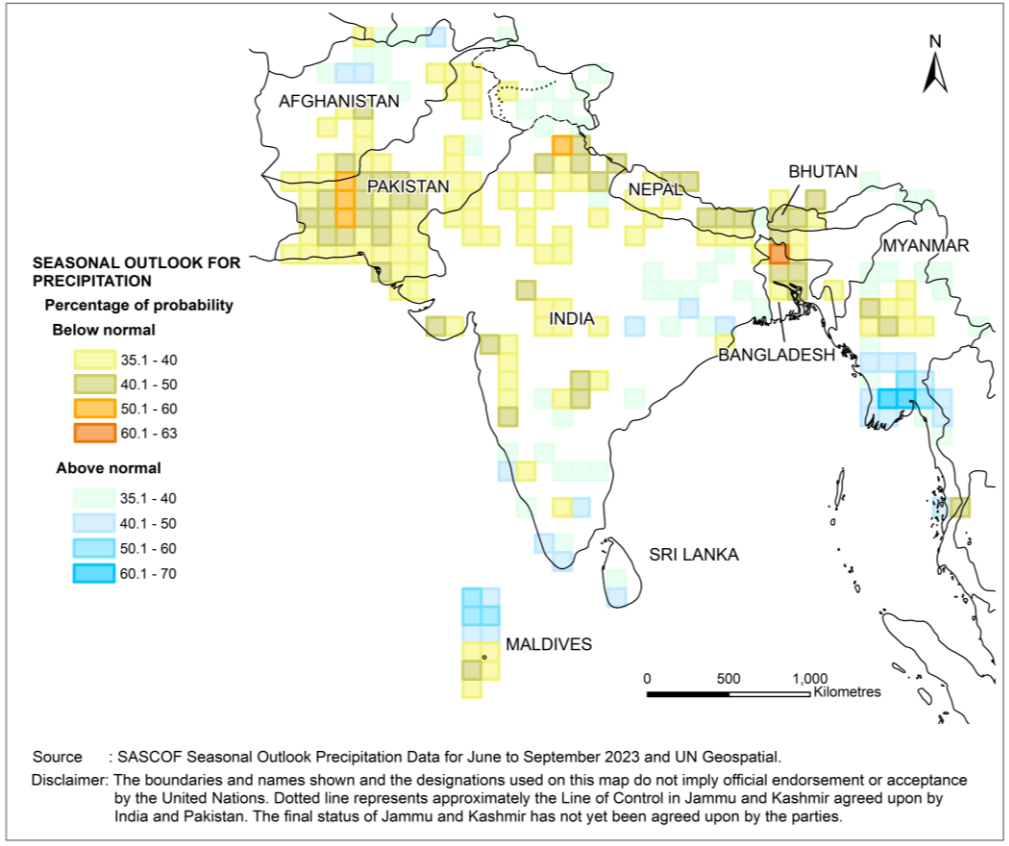
Seasonal outlook for precipitation JJAS 2022



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.

Seasonal outlook for precipitation JJAS 2023



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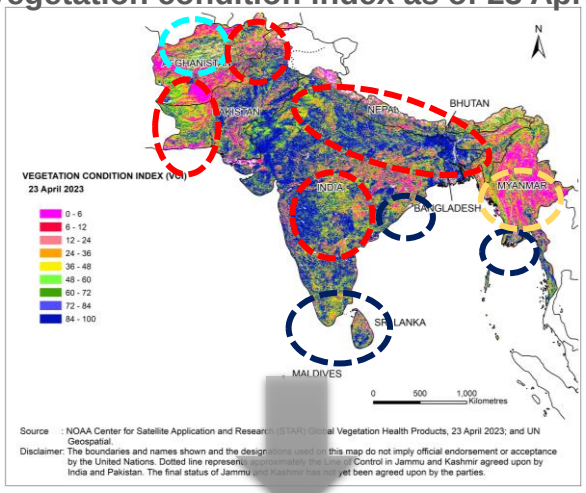
Seasonal Outlook JJAS 2023
Areas of attention for precipitation

Vegetation health during the most recent week, historical flood and drought hazard maps were used to find out the areas of attention for **above-normal** and **below-normal** precipitation.

Vegetation condition index as of 23 April 2023



Source : NOAA Center for Satellite Application and Research (STAR) Global Vegetation Health Products, 23 April 2023; and UN Geospatial.
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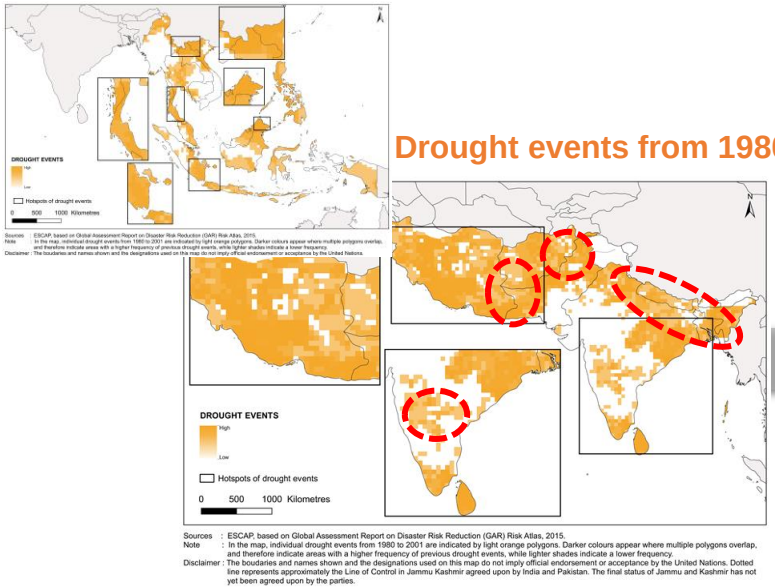
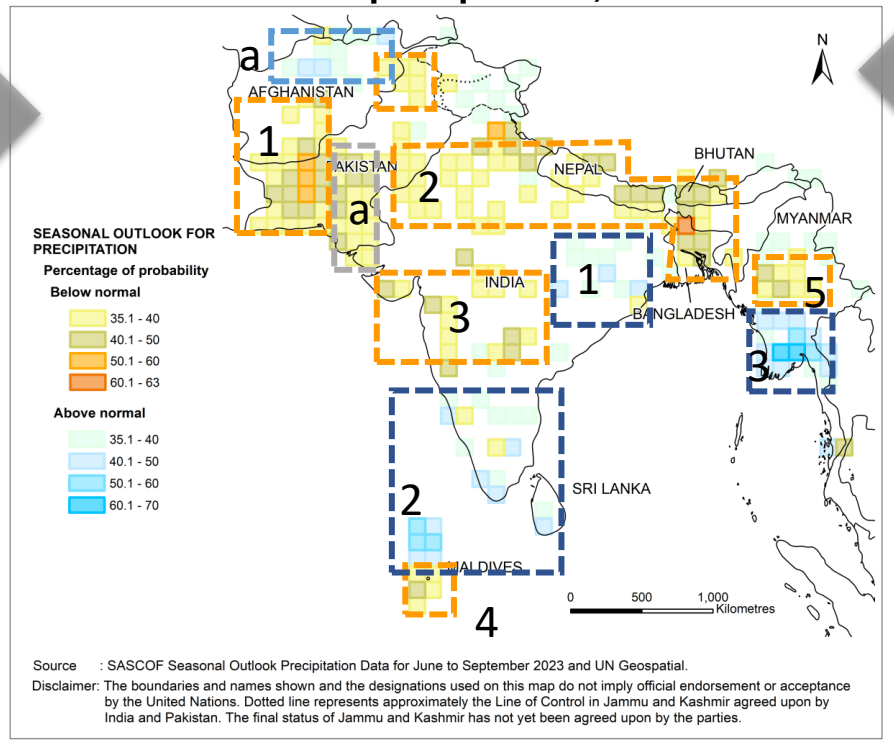
Drought events from 1980-2001



Sources : ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015.
Note : In the map, individual drought events from 1980 to 2001 are indicated by light orange polygons. Darker colours appear where multiple polygons overlap, and therefore indicate areas with a higher frequency of previous drought events, while lighter shades indicate a lower frequency.
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 Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.

Areas for attention for above-normal and below-normal precipitation, OND 2022



Source : SASCOF Seasonal Outlook Precipitation Data for June to September 2023 and UN Geospatial.
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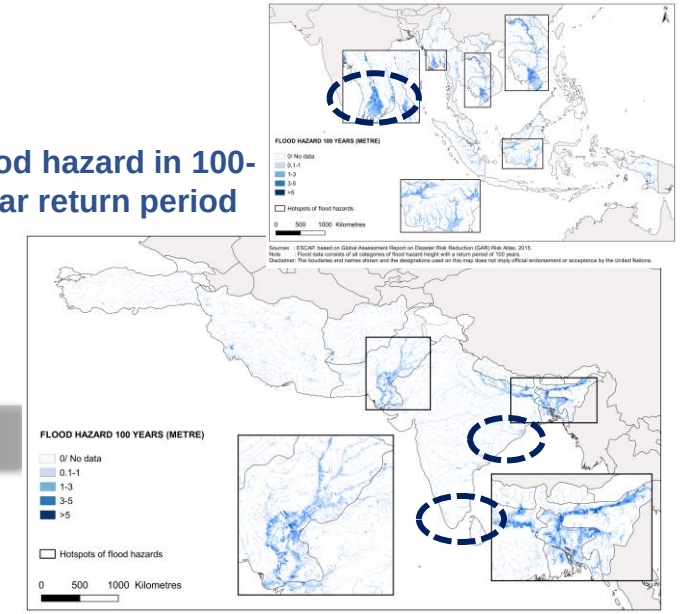
Flood hazard in 100-year return period



Sources : ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015.
Note : Flood data consists of all categories of flood hazard height with a return period of 100 years.
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Areas of attention for below-normal precipitation

1. North-west parts
2. North parts
3. Central parts
4. South parts
5. East parts

Areas with advantage - Below-normal precipitation

a. North-west parts

Areas of attention for above-normal precipitation

1. Central parts
2. South parts
3. East parts

Areas with advantage - Above-normal precipitation

a. North-east parts

Seasonal outlook for precipitation JJAS 2023

Areas of attention for below-normal precipitation

1. North-west parts: south-west parts of Afghanistan, and south-west parts of Pakistan (up to **60%** probability of below-normal precipitation, north-east parts of Afghanistan (up to **40%** probability).

2. North parts: north parts of India (up to **52%** probability of below-normal precipitation), central and east parts of Nepal (up to **40%** probability), Bhutan (up to **40%** probability), and Bangladesh (up to **63%** probability).

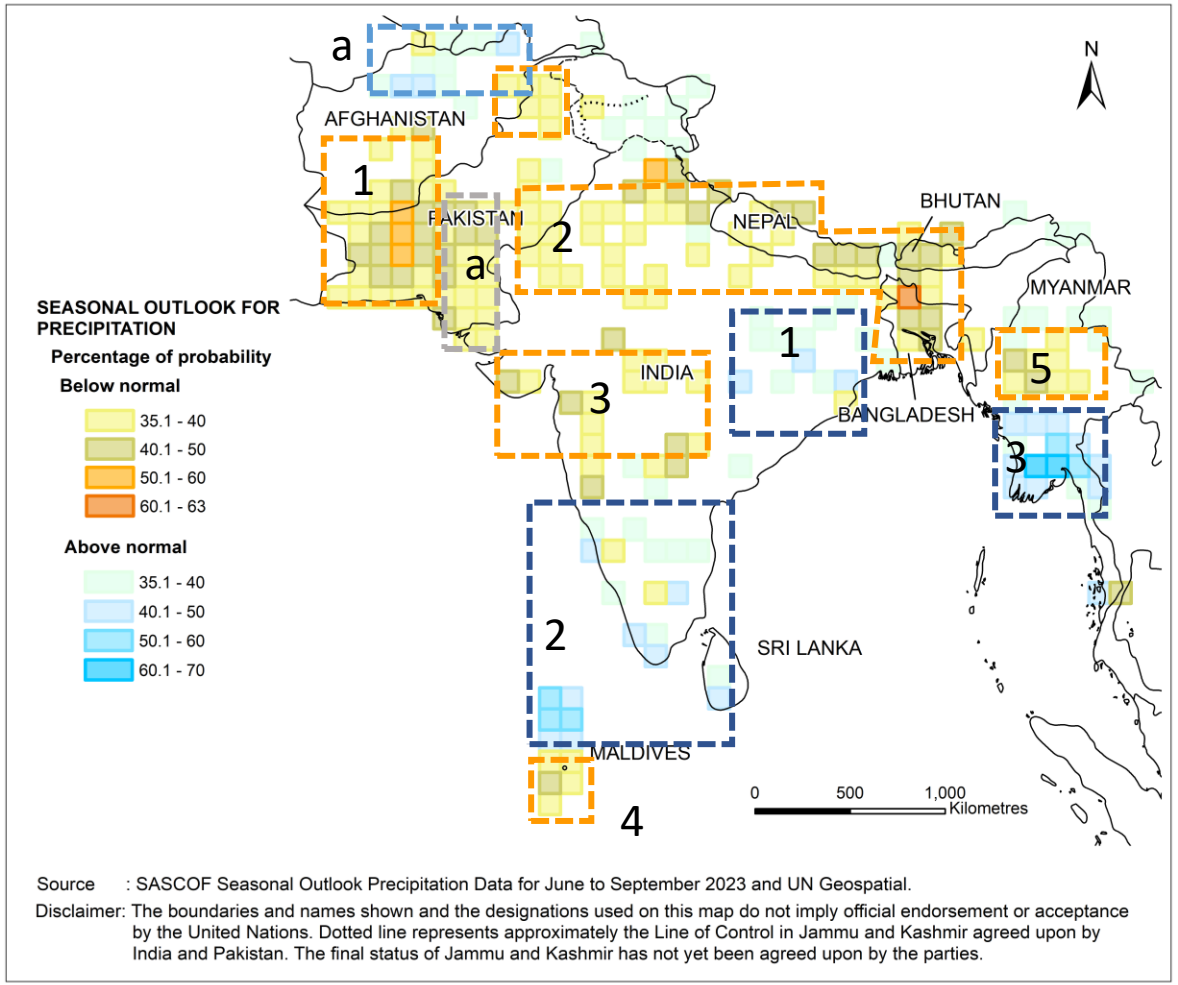
3. Central parts: central parts of India (up to **40%** probability of below-normal precipitation).

4. South parts: central and south parts of Maldives (up to **40%** probability of below-normal precipitation).

5. East parts: central parts of Myanmar (up to **40%** probability of below-normal precipitation).

Areas with advantage - Below-normal precipitation

a. North-west parts: south-east parts of Pakistan (up to **40%** probability).



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Areas of attention for above-normal precipitation

1. Central parts: east parts of India (up to **50%** probability of above-normal precipitation).

2. South parts: south parts of India and south parts of Sri Lanka (up to **50%** probability of above-normal precipitation) north parts of Maldives (up to **60%** probability of above-normal precipitation).

3. East parts: south parts of Myanmar (up to **70%** of probability of above-normal precipitation).

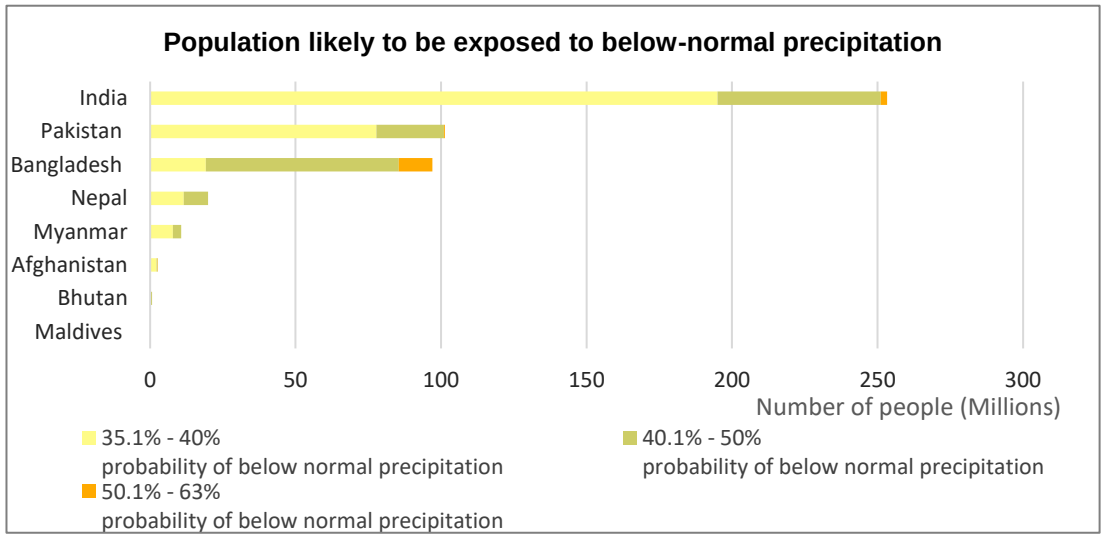
Areas with advantage - Above-normal precipitation

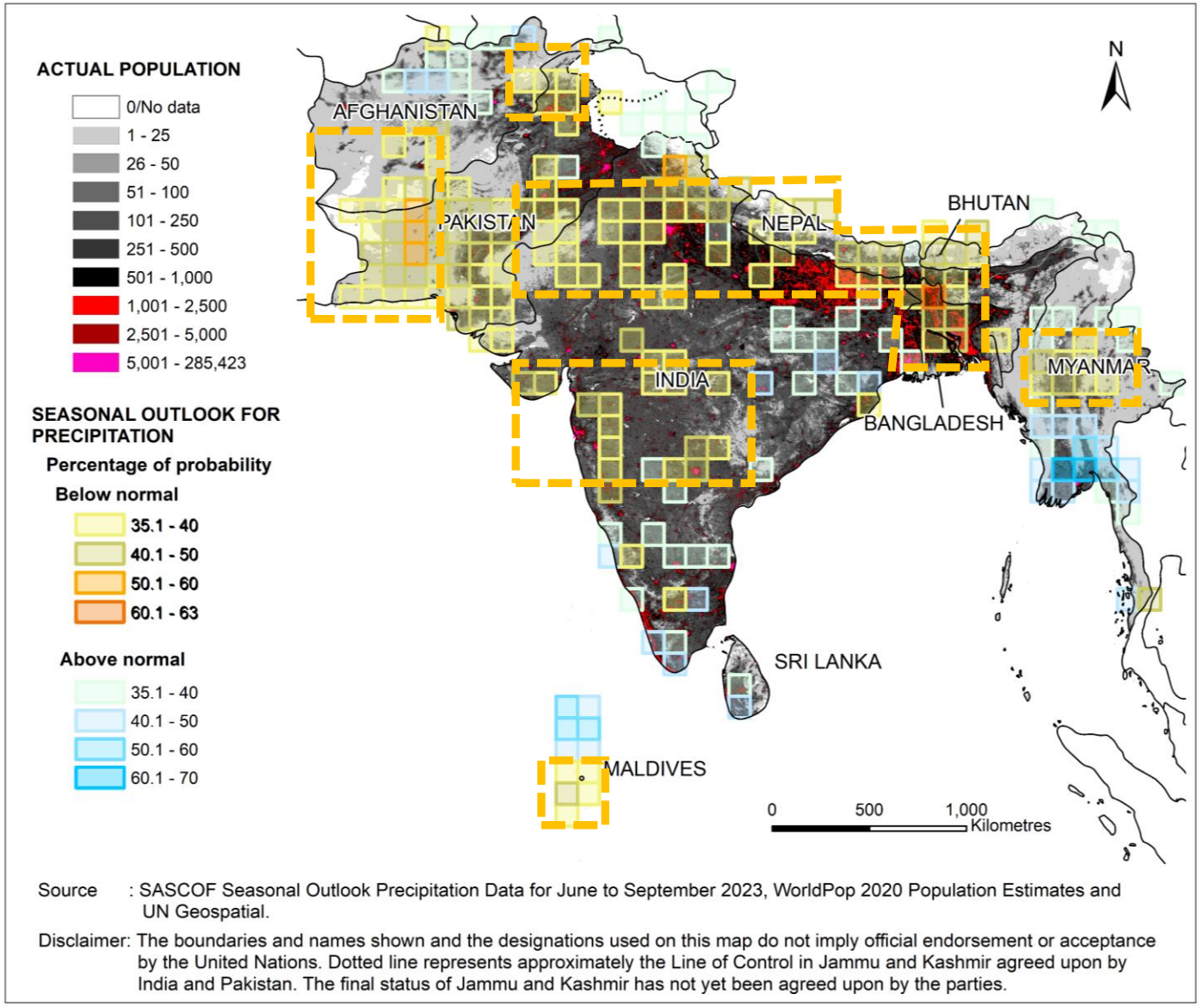
a. North-east parts: north parts of Afghanistan (up to **50%** probability of above-normal precipitation).

Estimation of population likely to be exposed to below normal precipitation

Country	Total population 2022 (thousands) ESCAP statistics	Percent of population exposure			
		35.1% - 40% probability of below normal precipitation	40.1% - 50% probability of below normal precipitation	50.1% - 63% probability of below normal precipitation	Below normal precipitation
Afghanistan	41,129	5.6%	1.1%	0.0%	6.7%
Bangladesh	171,186	11.7%	40.6%	7.1%	59.4%
Bhutan	783	28.5%	61.1%	0.0%	89.5%
India	1,417,173	14.3%	4.1%	0.2%	18.6%
Maldives	524	5.4%	0.0%	0.0%	5.4%
Myanmar	54,179	14.4%	5.4%	0.0%	19.8%
Nepal	30,548	39.4%	28.4%	0.0%	67.8%
Pakistan	235,825	36.0%	10.7%	0.1%	46.9%
Sri Lanka	21,832	0.0%	0.0%	0.0%	0.0%
Total	**1,973,178**	**16.6%**	**8.4%**	**0.7%**	25.7%

In total, **25.7%** population of this region are likely to be exposed to **more than 35%** probability of below-normal precipitation.





Source : SASCOF Seasonal Outlook Precipitation Data for June to September 2023, WorldPop 2020 Population Estimates and UN Geospatial.

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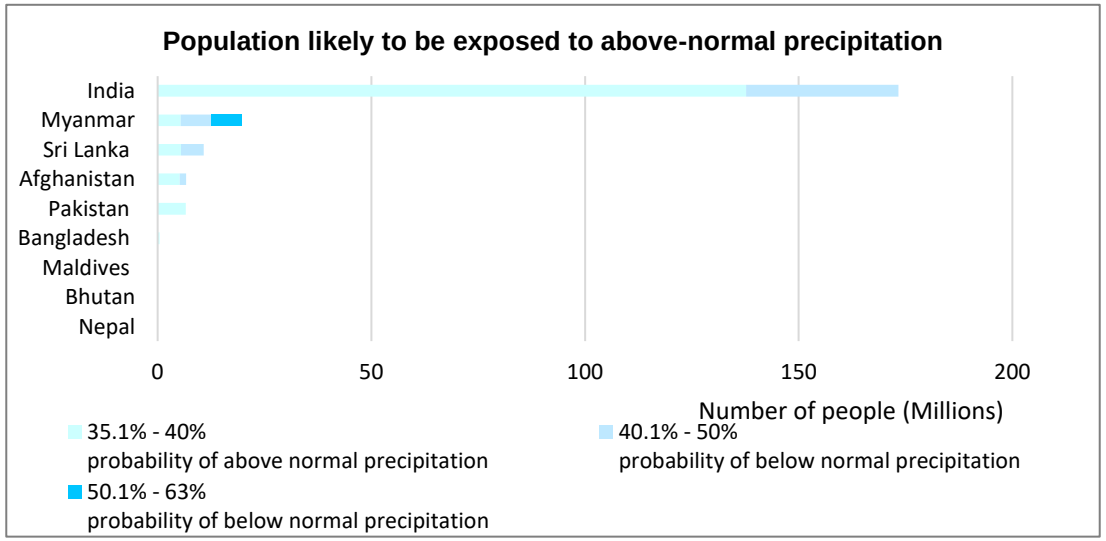
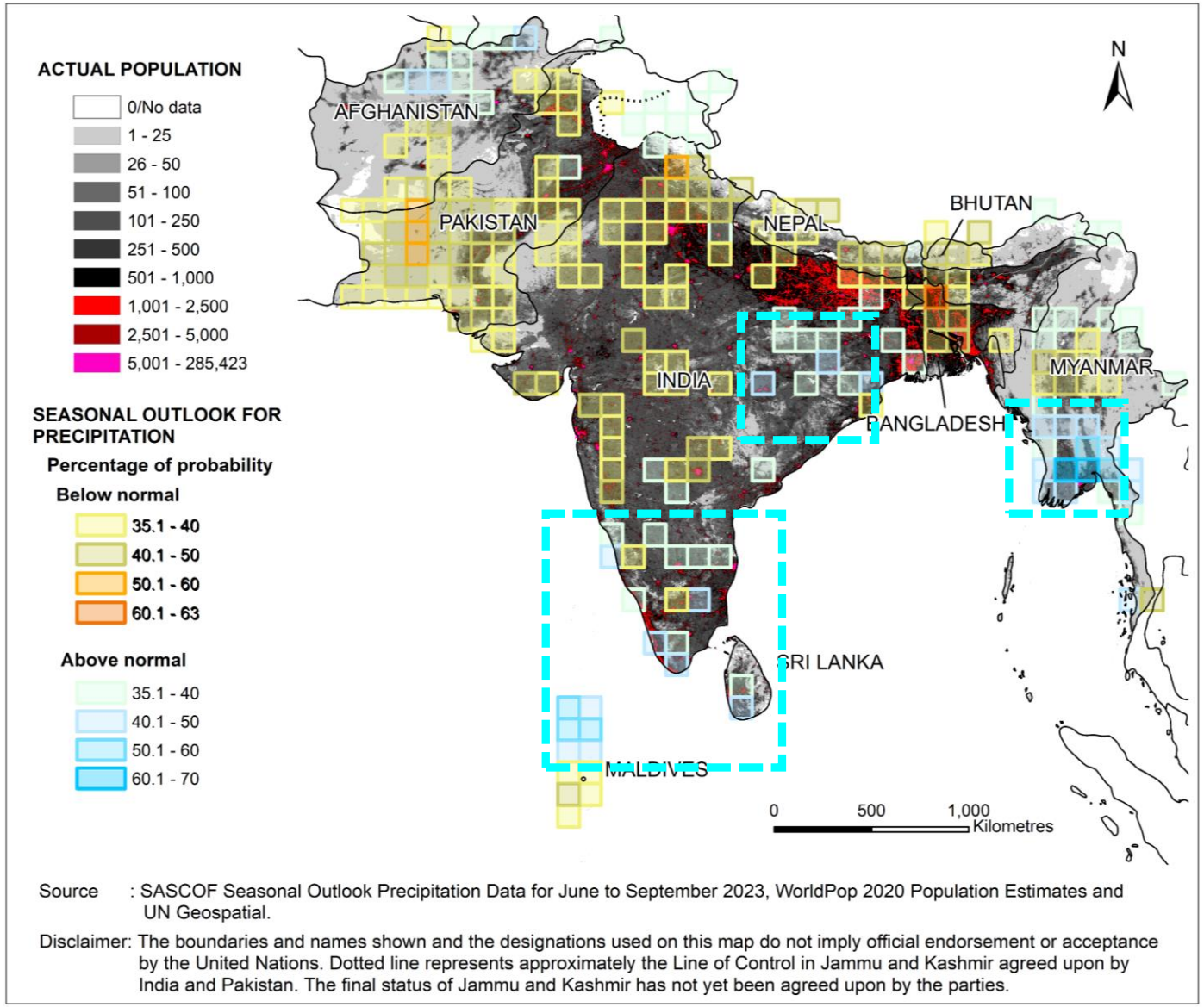
Estimation of population likely to be exposed to above-normal precipitation

Country	Total population 2022 (thousands) ESCAP statistics	Percent of population exposure			
		35.1% - 40% probability of above normal precipitation	40.1% - 50% probability of above normal precipitation	50.1% - 63% probability of above normal precipitation	Above normal precipitation
Afghanistan	41,129	13.3%	4.0%	0.0%	17.2%
Bangladesh	171,186	0.3%	0.0%	0.0%	0.3%
Bhutan	783	3.4%	0.0%	0.0%	3.4%
India	1,417,173	10.1%	2.6%	0.0%	12.7%
Maldives	524	0.0%	81.8%	0.0%	81.8%
Myanmar	54,179	10.0%	13.2%	13.0%	36.2%
Nepal	30,548	0.0%	0.0%	0.0%	0.0%
Pakistan	235,825	3.1%	0.0%	0.0%	3.1%
Sri Lanka	21,832	25.9%	25.3%	0.0%	51.2%
Total	**1,973,178**	**8.5%**	**2.6%**	**0.4%**	11.5%

In total, **11.5%** of South Asia population are likely to be exposed to above-normal precipitation.





Source : SASCOF Seasonal Outlook Precipitation Data for June to September 2023, WorldPop 2020 Population Estimates and UN Geospatial.

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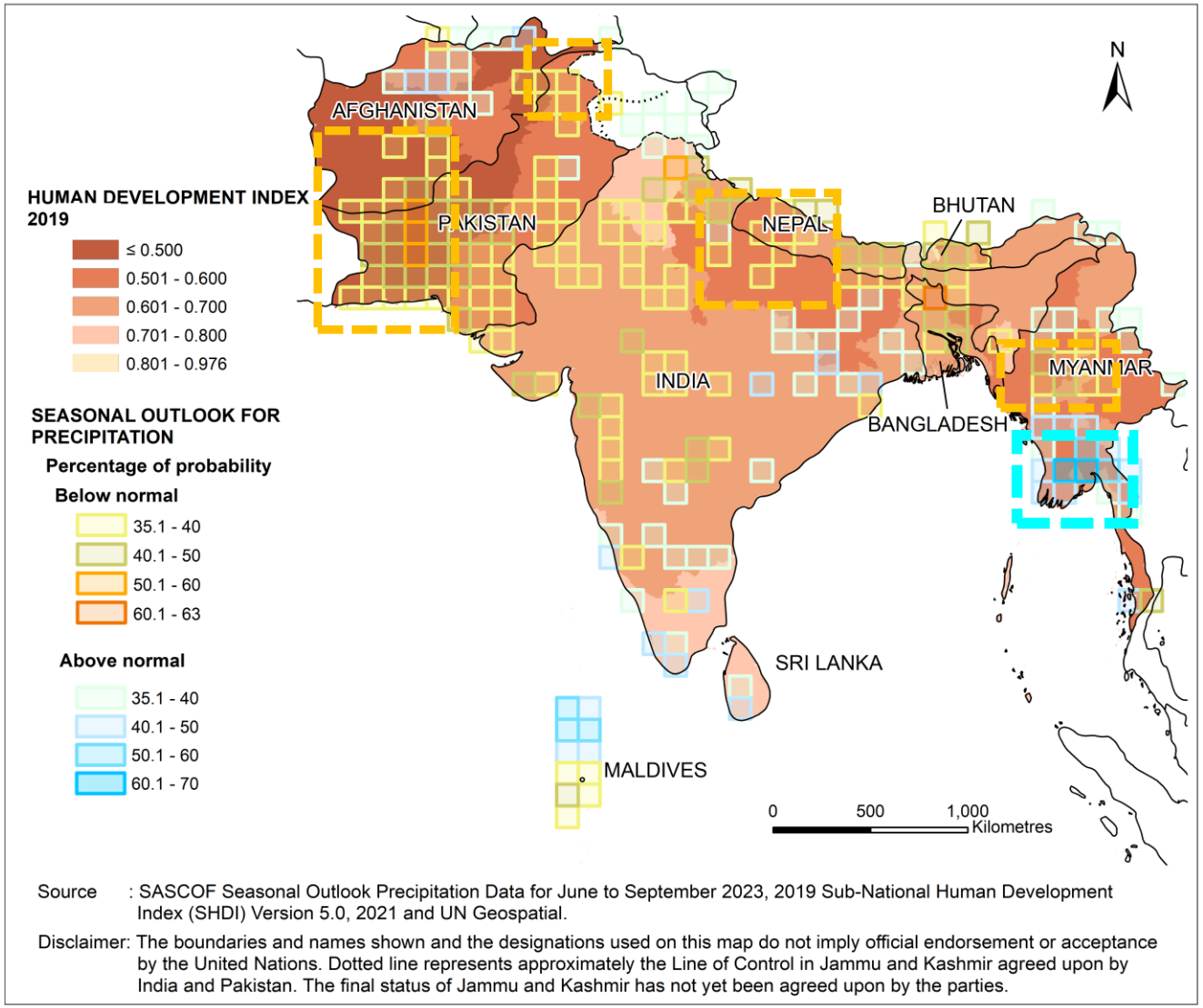
Vulnerability indicators can be added to understand the vulnerability of people likely to be affected.



Source : SASCOF Seasonal Outlook Precipitation Data for June to September 2023, 2019 Sub-National Human Development Index (SHDI) Version 5.0, 2021 and UN Geospatial.

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HDI is overlaid to understand the vulnerability of people exposed.

Sub-national Human Development Index (SHDI)

Dimension	Long and healthy life	Knowledge	A decent standard of living
Indicators	Life expectancy at birth	Expected year of schooling Mean years of schooling	GNI per capita(PPP)
Dimension Index	Life expectancy index	Education index	GNI index

Human development index(HDI)

Source: UNDP, 2019.

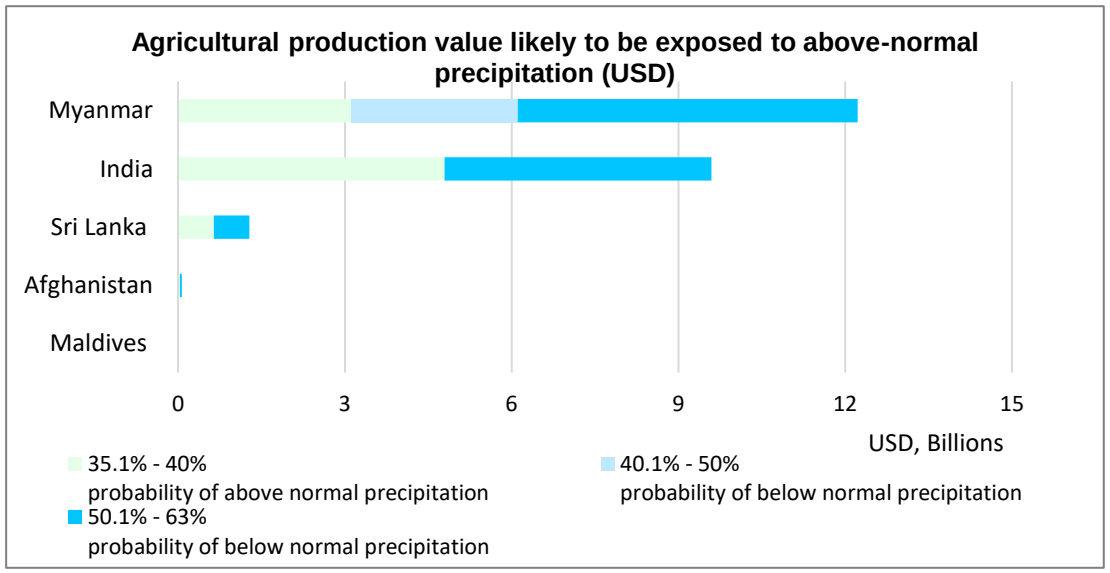
Other indicators (poverty, income, education, literacy, or other vulnerability indicators) can be used as appropriate.

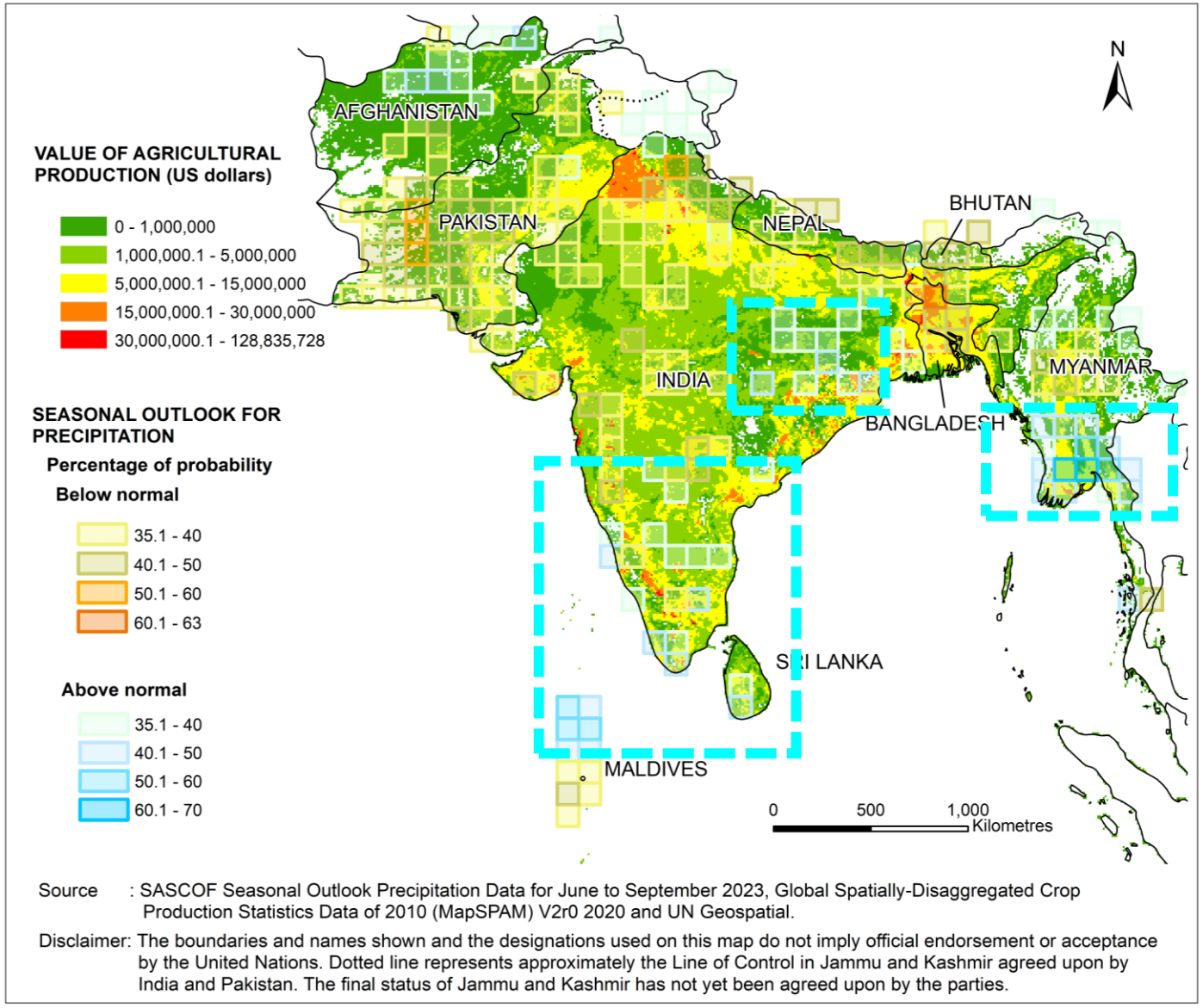
Potential exposure of Agricultural production value

- **1.3%** of South Asia agricultural value are likely to be exposed to **high probability (50%-70%) of above-normal precipitation**.
  Under this precipitation category, 18.4% of Myanmar's agricultural value are likely to be exposed. This equals to $3 billion.

- **3.7%** of South Asia agricultural value are likely to be exposed to **40.1%-50% probability of above-normal precipitation**. Under this precipitation category, $4.8 billion of India's agricultural value are likely to be exposed, followed by Myanmar at $3.1 billion, Sri Lanka at $641 million, Afghanistan at $34 million, and Maldives at US$168 thousand.

- **In total, 12%** of South Asia's agricultural value are likely to be exposed to **above-normal precipitation**.





Source : SASCOF Seasonal Outlook Precipitation Data for June to September 2023, Global Spatially-Disaggregated Crop Production Statistics Data of 2010 (MapSPAM) V2r0 2020 and UN Geospatial.

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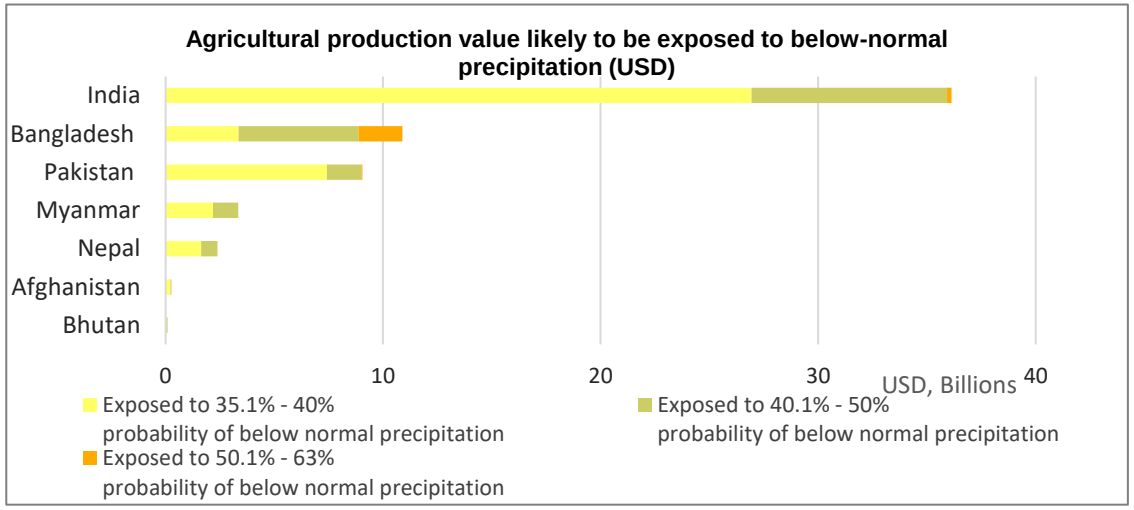
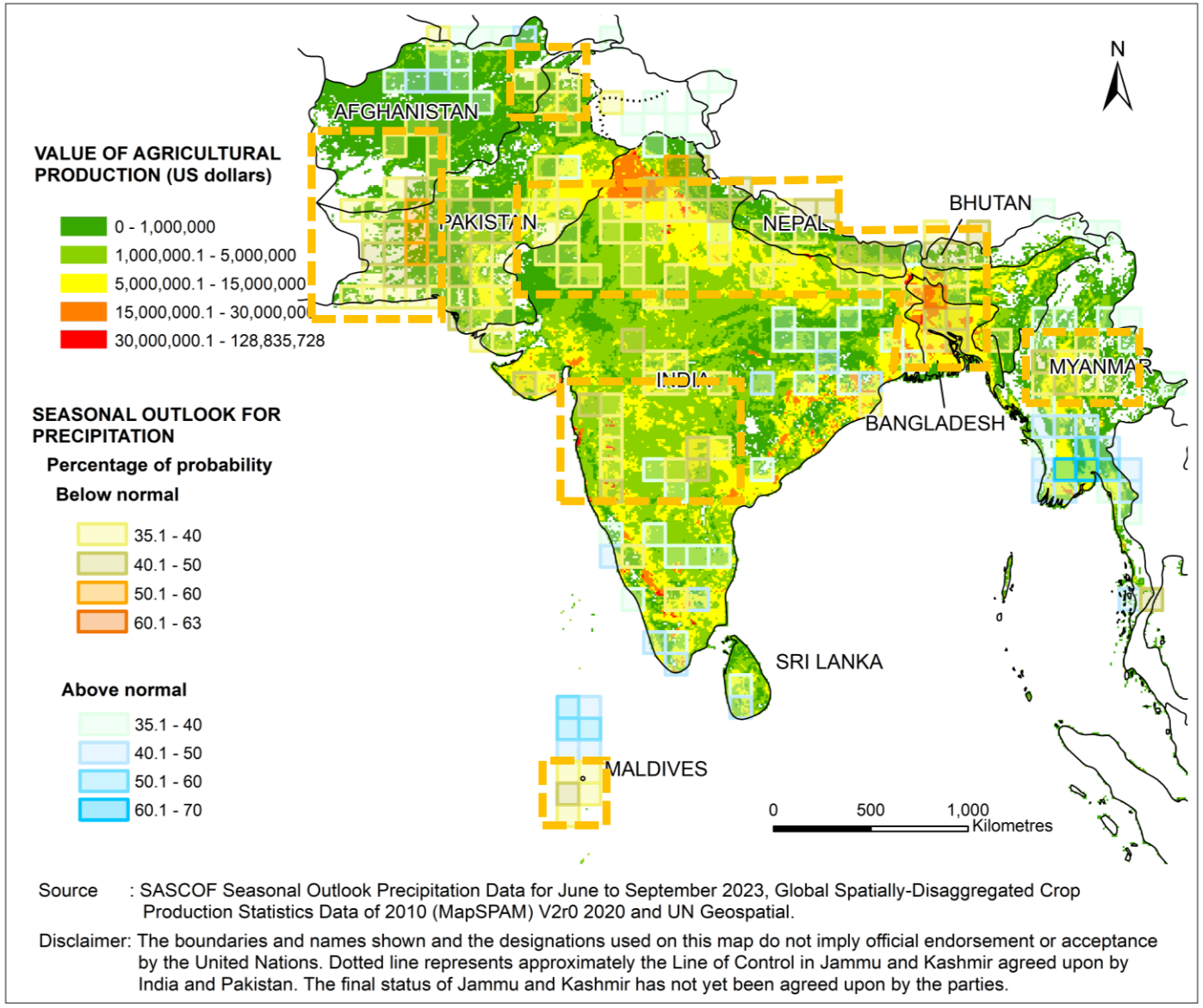
Potential exposure of Agricultural production value

- **8.8%** of South Asia agricultural value are likely to be exposed to **high (40%-63%) probability of above-normal precipitation.** This equals $20.4 billion.

  Under this precipitation category, $9.2 billion of India's agricultural value are likely to be exposed, followed by Bangladesh at $7.5 billion, Pakistan at $1.6 billion, Myanmar at $1.2 billion, Nepal at $751 million, Bhutan at $67 million and Afghanistan at $29 million.

- **In total, 26.8%** of South Asia agricultural value are likely to be exposed to **below-normal precipitation**





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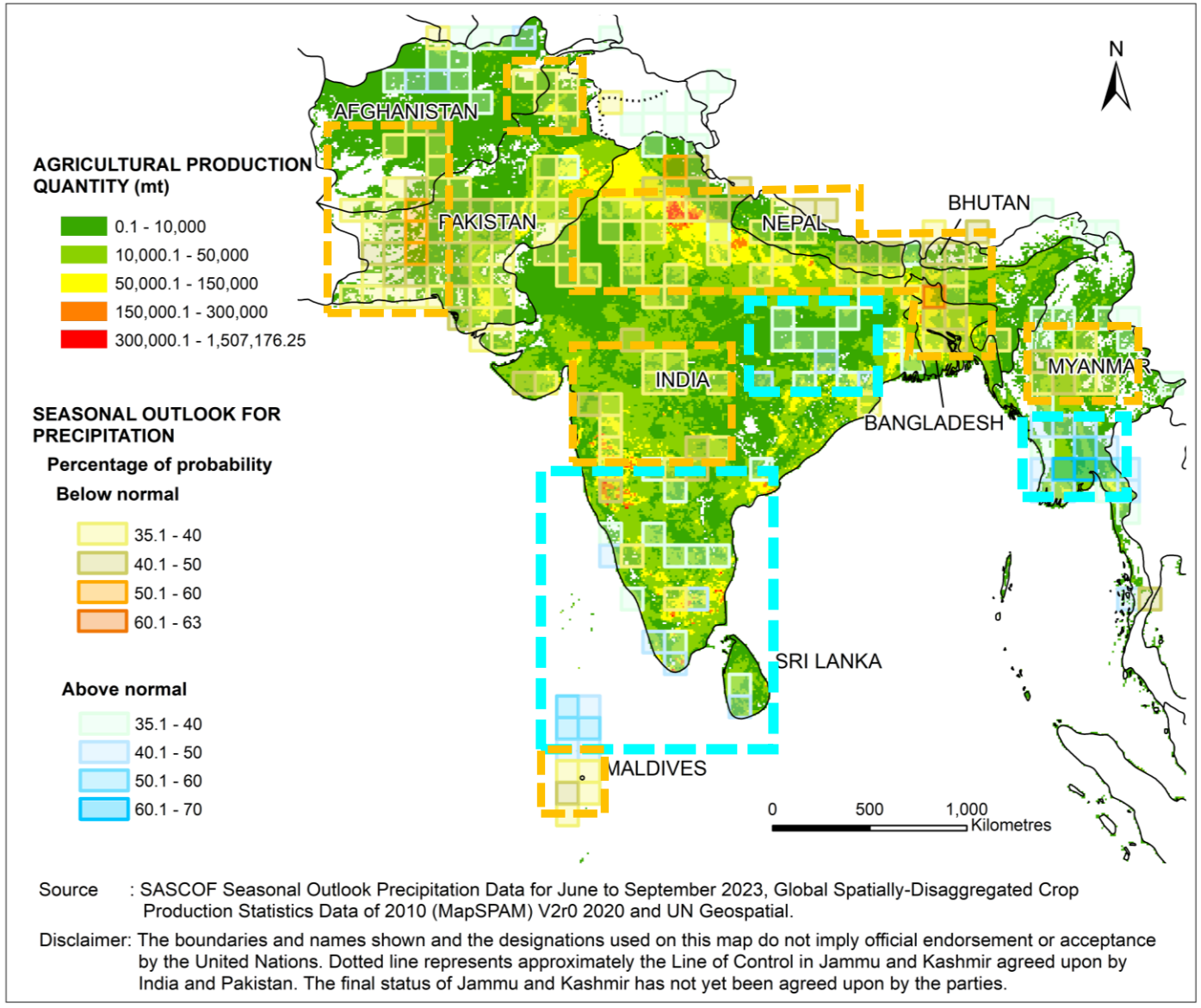
Potential exposure of Agricultural production quantity



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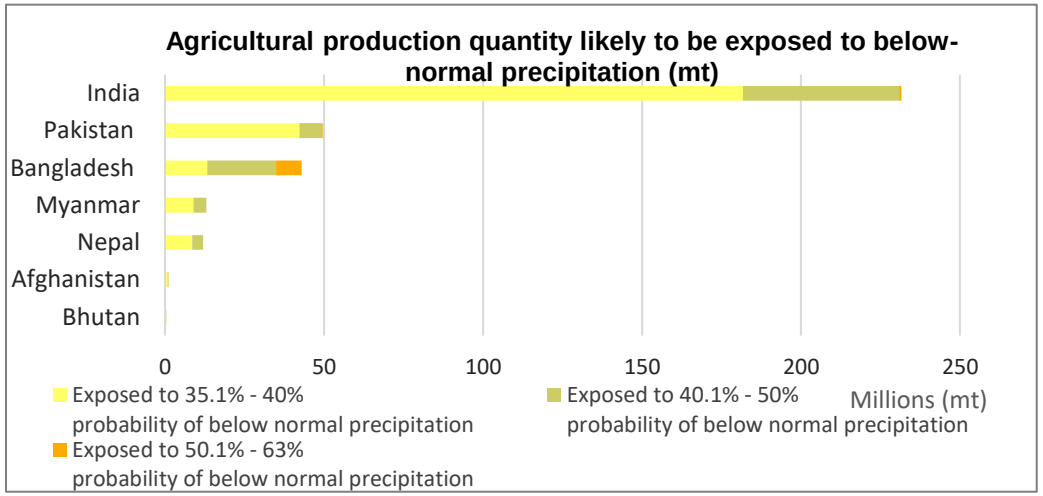
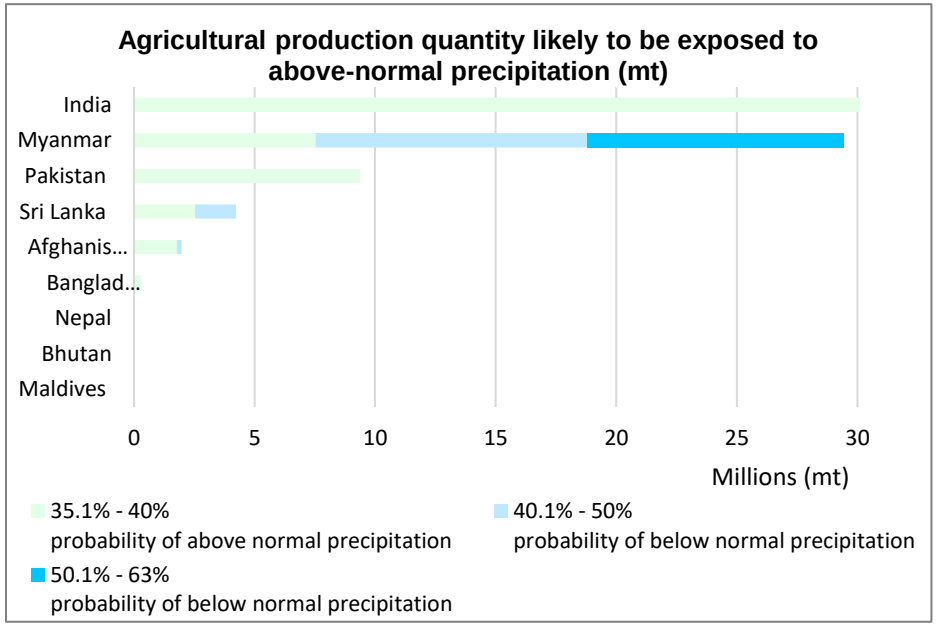
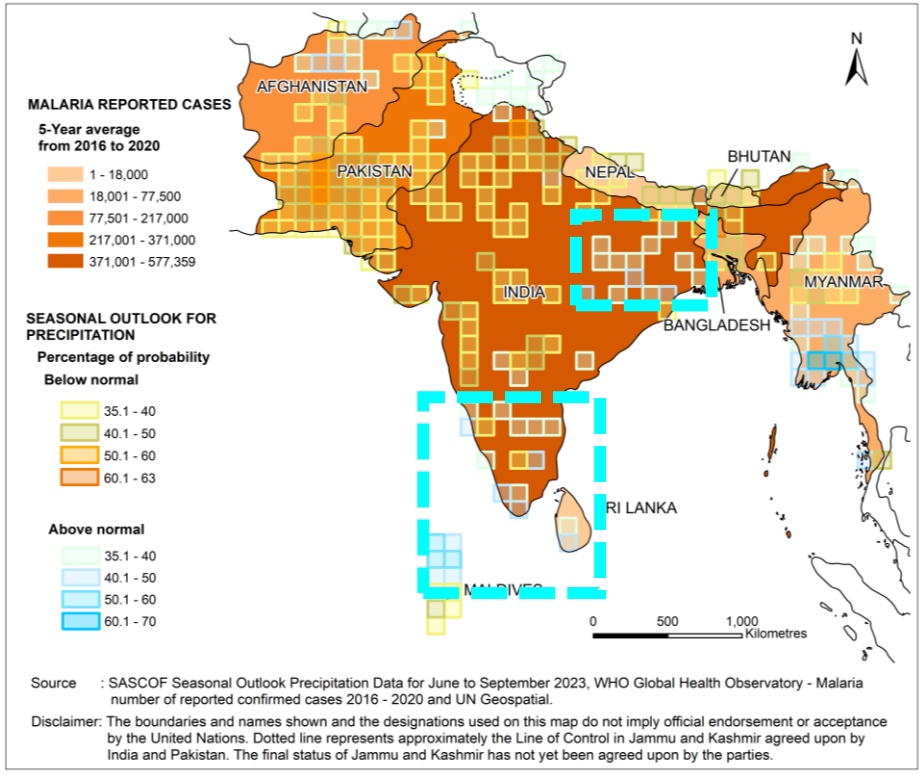




Malaria risk in South Asia based on seasonal forecast and malaria reported cases (WHO, 2016-2020)



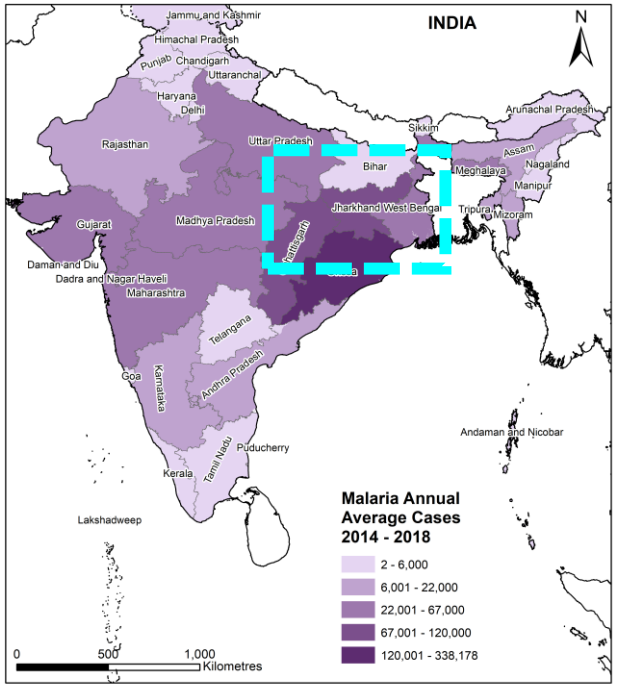
Based on the 5-year reported cases, India and Pakistan are the first and second highest in South Asia region.

Areas of attention for malaria risk and above normal precipitation

1. Central parts: east parts of India (up to 50% probability of above-normal precipitation).

2. South parts: south parts of India (up to 50% probability of above-normal precipitation)

Malaria risk at subnational level



Source : Government of India - Ministry of Health and Family Welfare,National Health Profile 2019; 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.

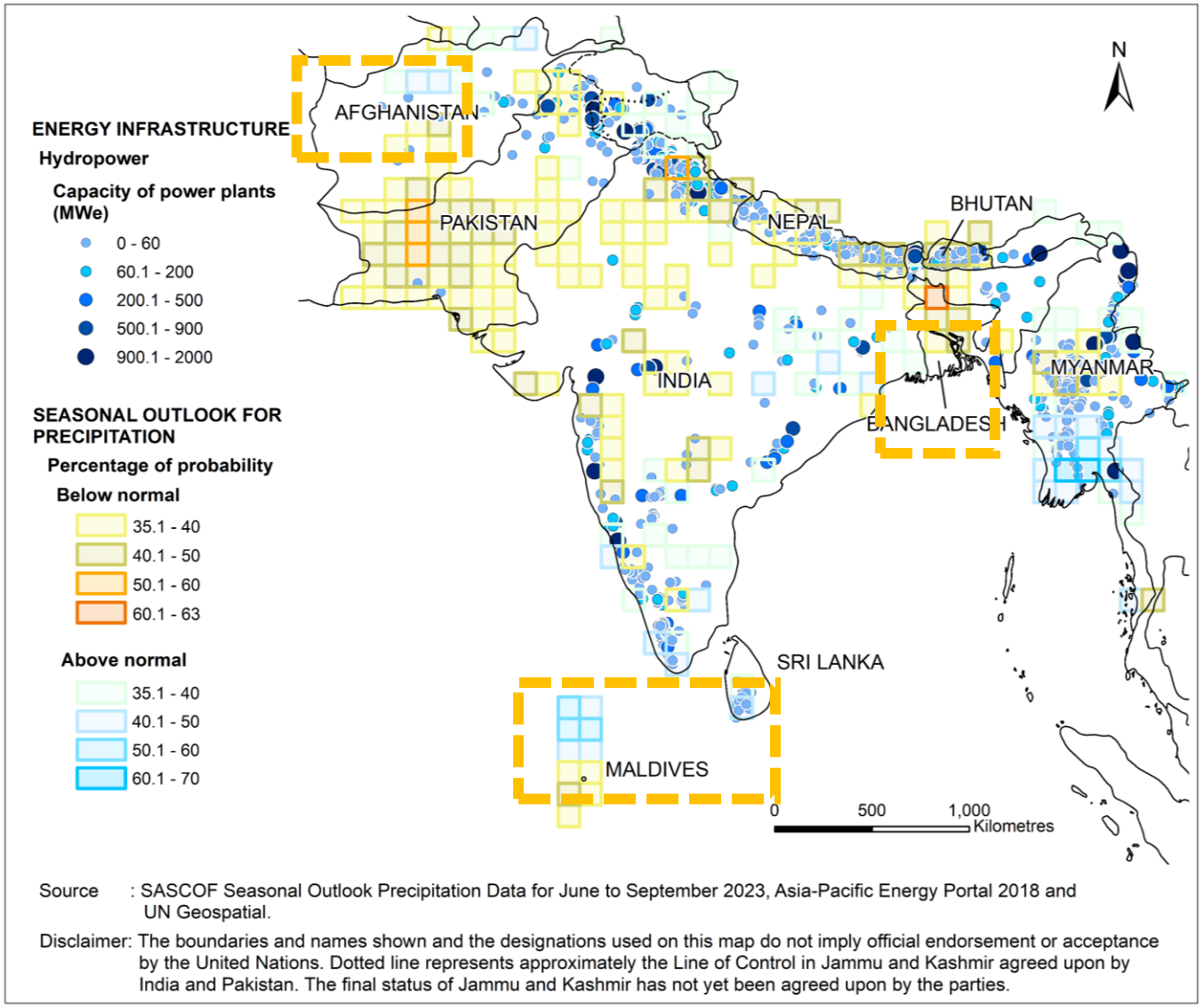
Hydropower exposure

Areas of attention for below normal precipitation

- **31.3%** of total hydropower plants' capacity in South Asia will be exposed to 35.1% - 63% probability of **below-normal precipitation**.
- Those are particularly located in Afghanistan, Bhutan, India, Myanmar, Nepal and Pakistan.

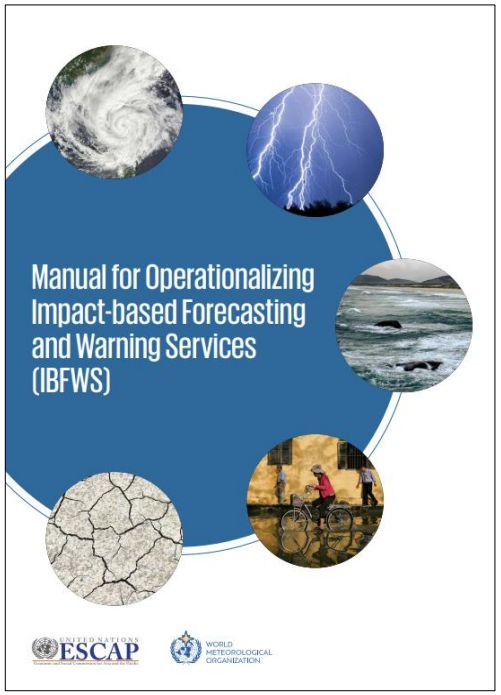
Areas of attention for above normal precipitation

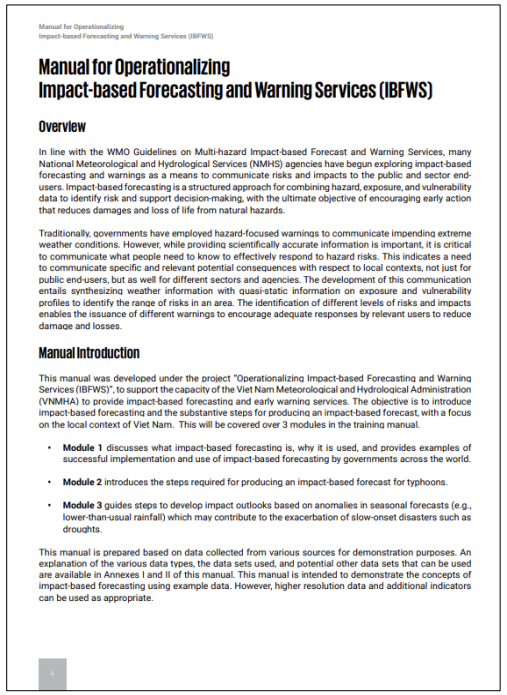
- **17.9%** of total hydropower plants' capacity in South Asia will be exposed to 35.1% – 70% probability of **above normal precipitation**.
- Those are located in Afghanistan, India, Myanmar and Sri Lanka.



Impact-based forecast and warning services - Training manual

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.

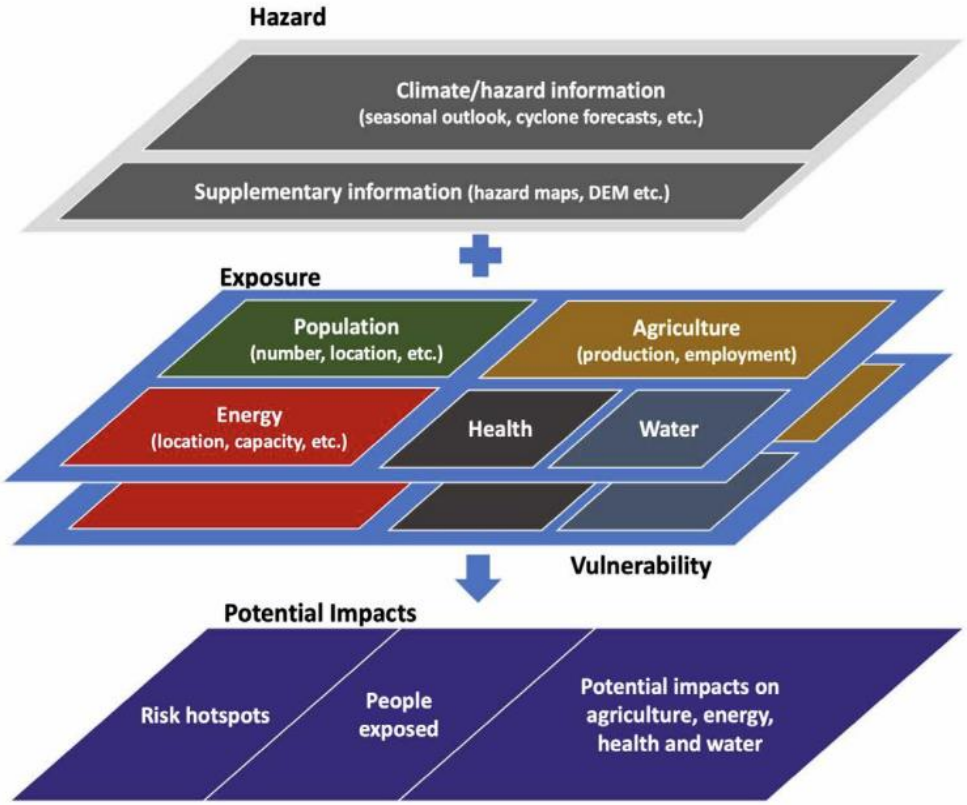
Traditionally, governments have employed hazard-focused warnings to communicate impending extreme weather conditions. However, while providing scientifically accurate information is important, it is critical to communicate what people need to know to effectively respond to hazard risks. This indicates 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

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Thank you