Interdisciplinary Climate Risk Assessment: A Tool for Prioritising and Financing WASH Programmes

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Council on Energy Environment and Water (CEEW)

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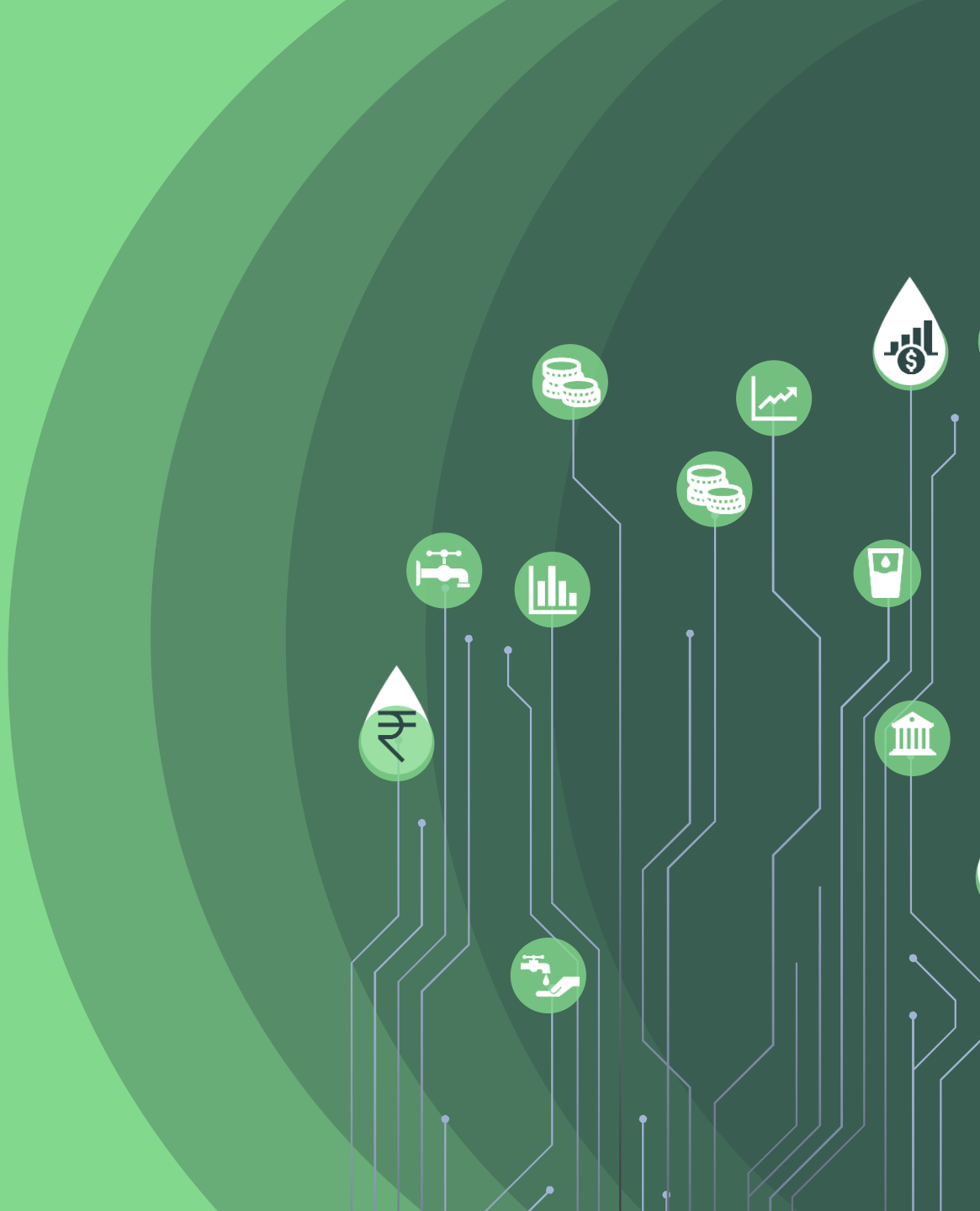


Impacting sustainable development at scale with data, integrated analysis, and strategic outreach

TRANSFORMATIONS

- Low-carbon Economy
- Energy Transitions
- Power Markets
- Industrial Sustainability
- Sustainable Livelihoods

QUALITY OF LIFE

- Clean Air
- Sustainable Water
- Sustainable Food Systems
- Sustainable Cooling
- Sustainable Mobility

ENABLERS

- Sustainable Finance
- Technology Futures
- Circular Economy
- Climate Resilience
- International Cooperation

390+
Multidisciplinary team

550+
Peer-reviewed publications

700+
Roundtables & conferences

20+
Indian states engaged

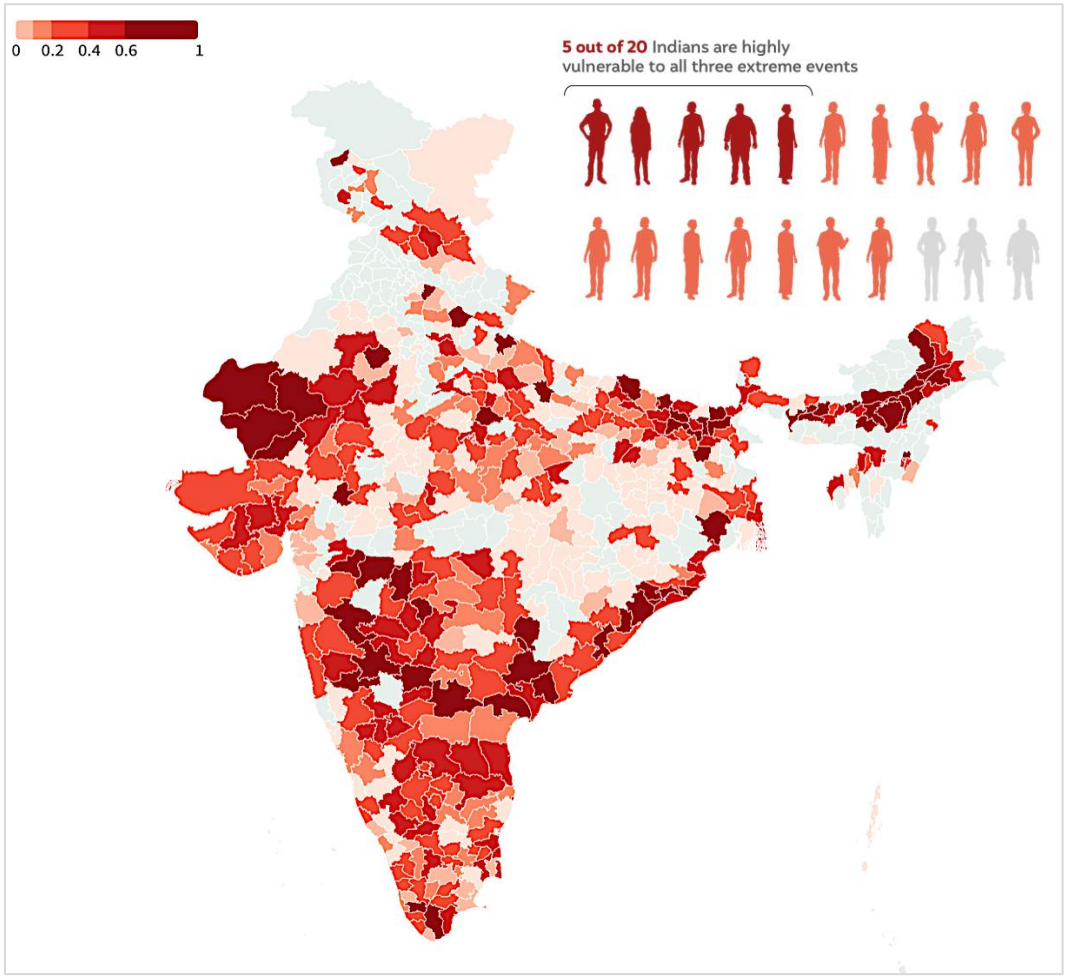
180+
Bilateral & multilateral initiatives promoted

SPECIAL INITIATIVES

- CEEW Green Finance Centre
- Powering Livelihoods
- Emerging Economies
- UP State Office

India faces the brunt of extreme weather events

More than 75 per cent of Indian districts are extreme events hotspots

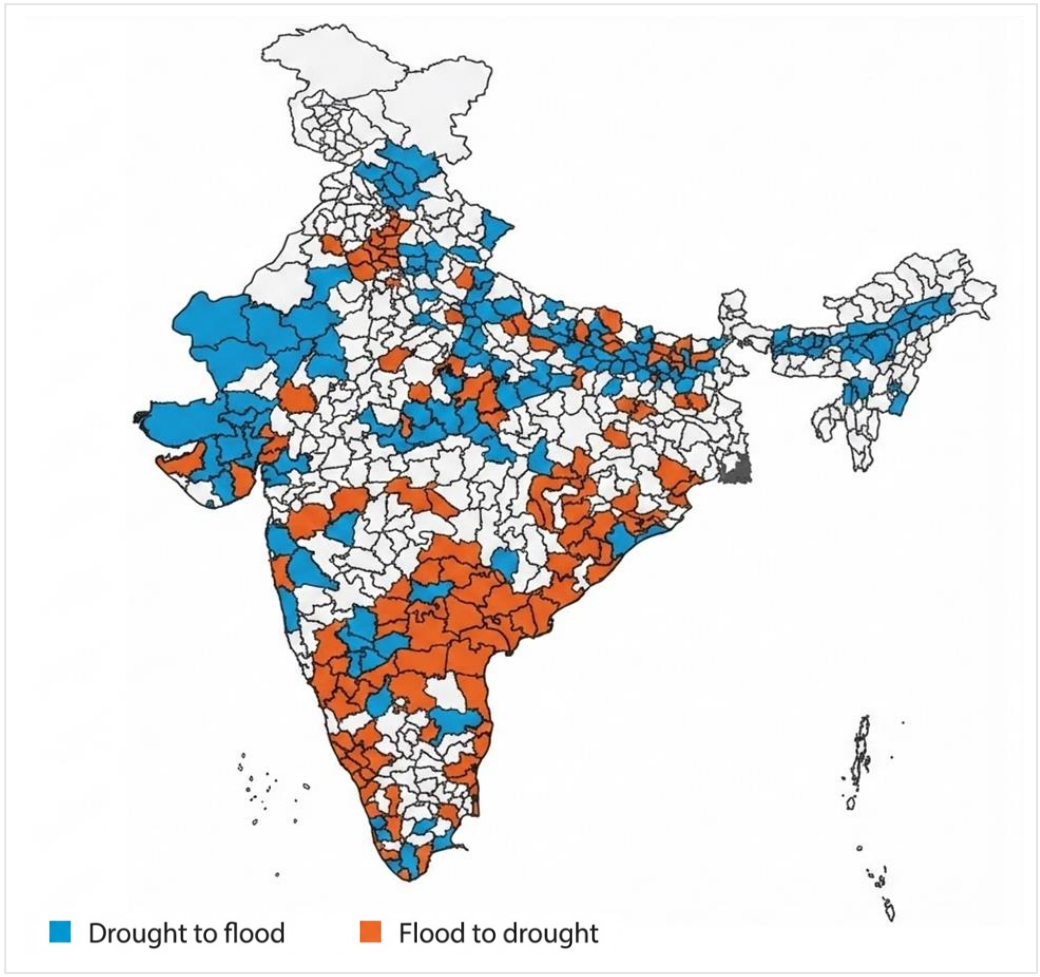


80%
India's population residing in districts highly vulnerable to extreme hydro-met disasters

12x
Increase in the number of associated cyclonic events between 1970-2019

20x
Increase in the number of associated flood events between 1970-2019

More than 40 per cent of Indian districts experience swapping trends



Source: CEEW 2020 (Mohanty, Abinash 2020), CEEW 2021 (Mohanty and Wadhawan 2021)

The brunt of climate extremes on WASH and public health is concerning

Between 1953 and 2010, **flood caused damage to public utilities** in India amounted to **USD 0.97 billion**.

Cyclone Phailin, 2013 in Odisha **damaged over 3,000 PWSS and 44,000 tubewells**, with flood-associated **diarrhoeal outbreaks causing 9,893 deaths**.

The 2016-18 severe **drought led to Chennai's four reservoirs drying up**, resulting in a **Day Zero** situation in 2019.

Extreme heat dries water sources, thus **increasing women's workloads**, as they must walk long distances to fetch water.

How can we make WASH systems climate-resilient ?

Source: Singh and Kumar 2017, Mommen, Roy, and Sethi 2014, and Mint 2021; Image source: Hindustan Times 2020, The Indian Express 2013, The Economic Times 2019, The Hindu 2021
PWSS: piped water supply systems

Risk assessment is the first step towards climate resilient WASH

UAE Framework for Global Climate Resilience, calls for all parties to **assess risks and vulnerabilities**, by 2030. Water being one of the key sectors identified for adaptation action.

For India, an **investment of USD 1 towards adaptation** could reduce the annualised average loss from extreme events and hazards by USD 5.5.

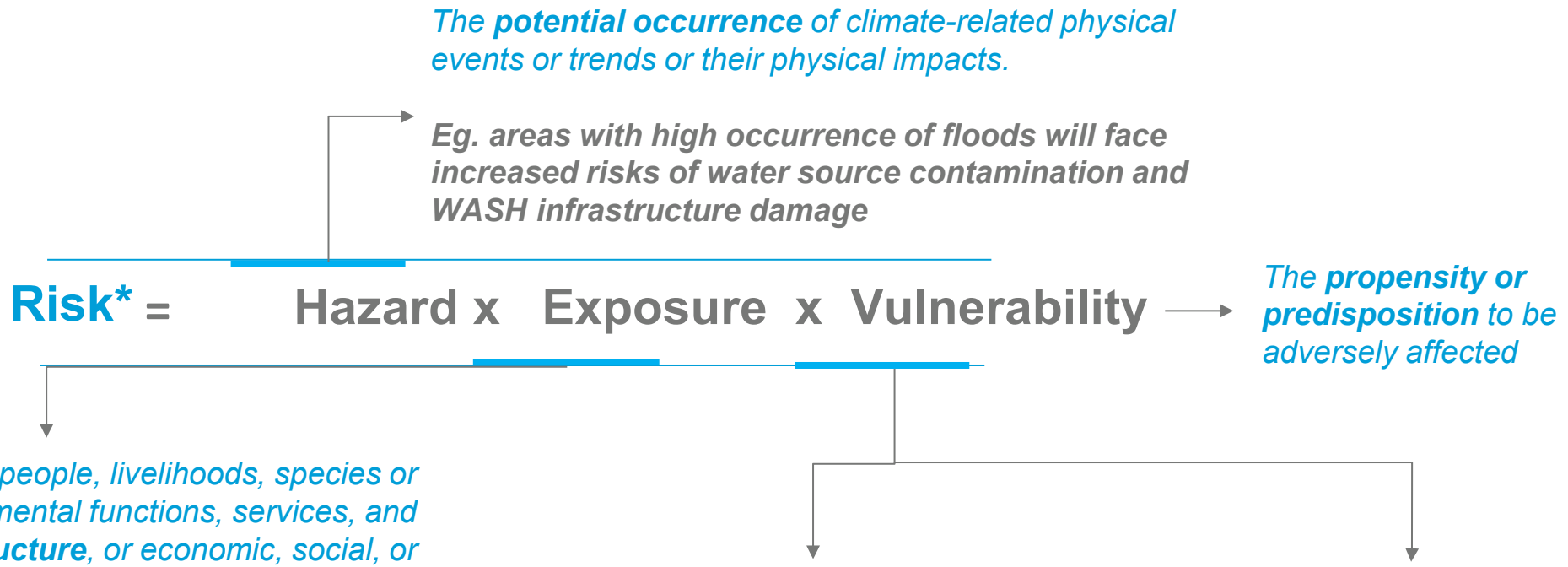
Climate proofing of the **WASH sector can aid** in attaining **7 SDGs and 10 targets** under them.

Source: UNESCAP 2022, Authors' analysis; Image source: GWP and UNICEF 2017; SDGs: Sustainable Development Goals

Objectives of the study

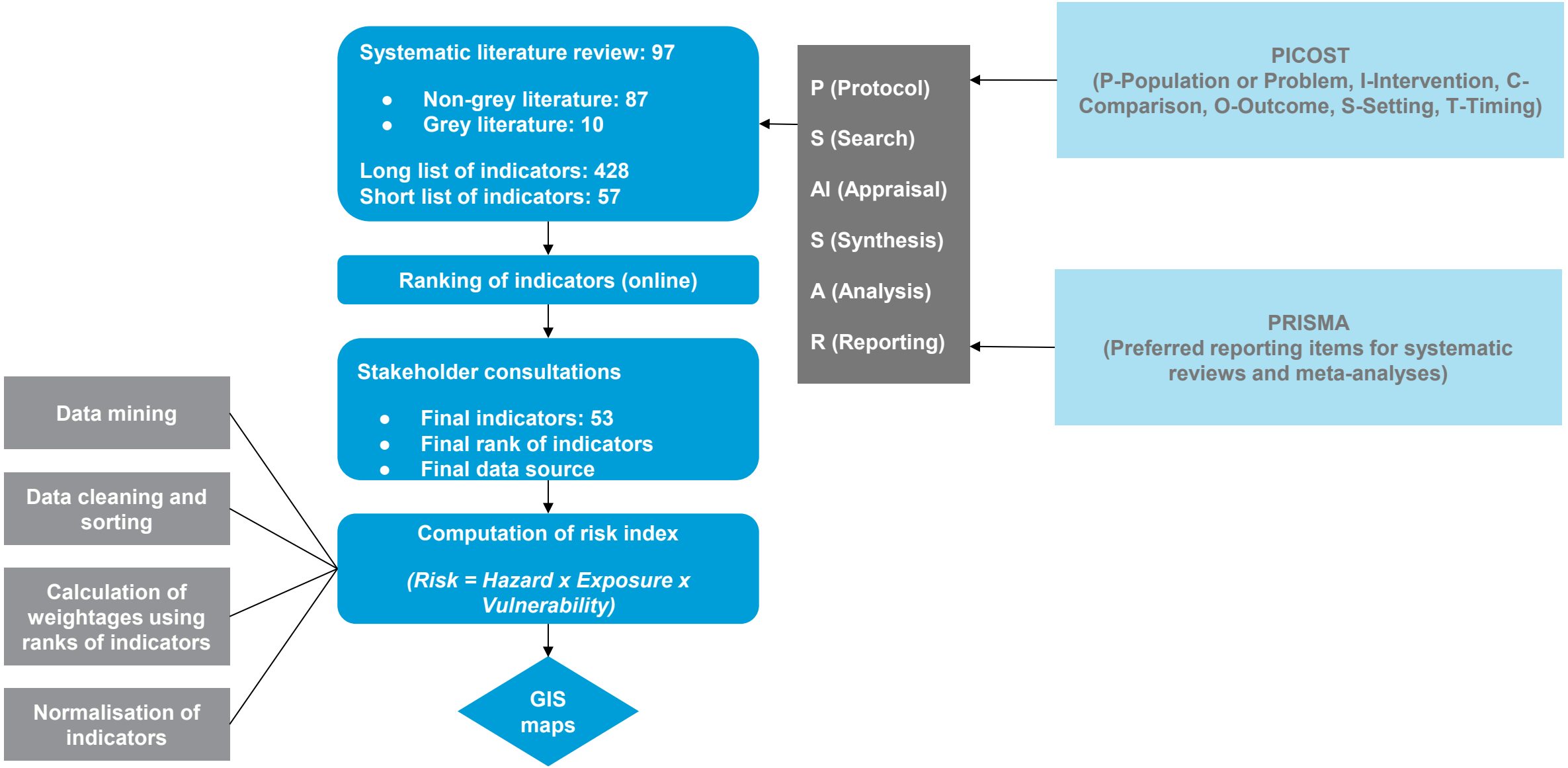
1. Identification of indicators through systematic review of literature for climate-induced WASH risk in India, with a focus on children, women, and vulnerable groups.
2. Finalisation of indicators for climate-induced WASH risk in India.
3. Computation of the district-level climate-induced WASH risk index, identification of risk hotspots and the factors driving the same.

Framework for assessing climate risk



Source: Authors' analysis based on Intergovernmental Panel on Climate Change-Fifth Assessment Report (IPCC AR-5) Framework

Methodology of study



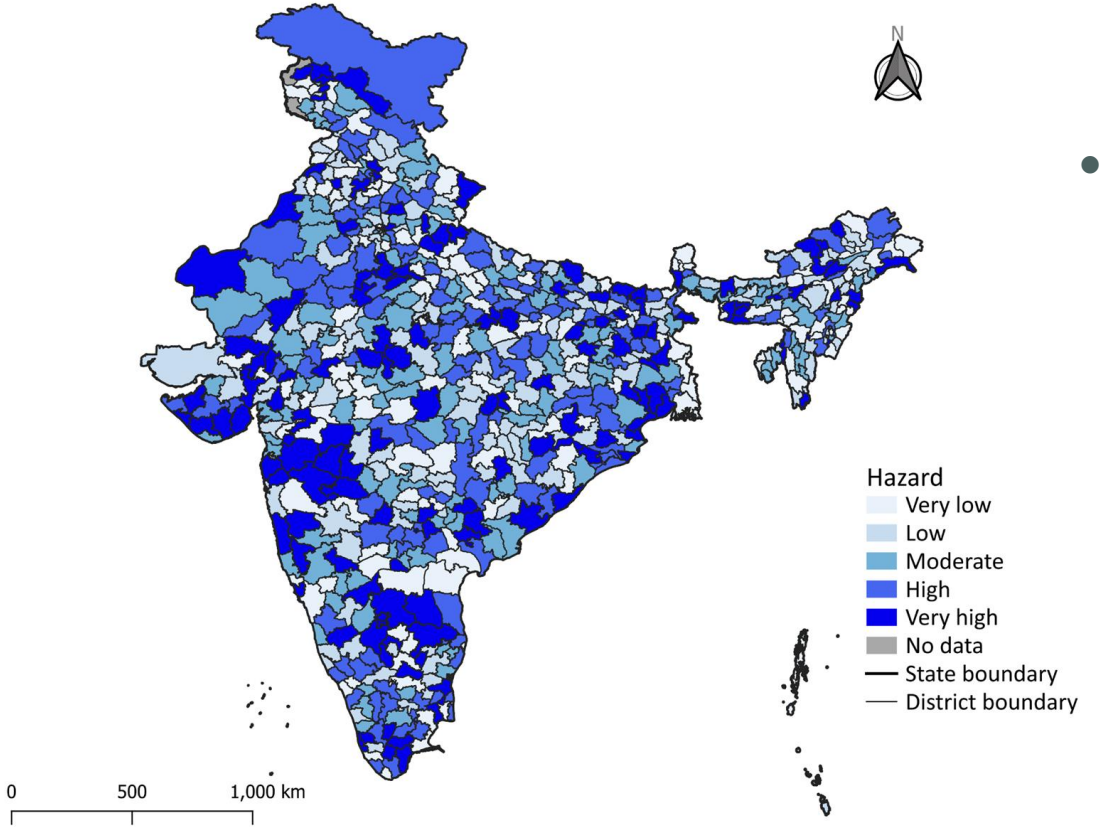
Source: Authors' analysis; GIS: geographic information system

Stakeholder consultation

Representatives from the CEEW and United Nations Children's Fund (UNICEF), and various government and non-government stakeholders at the consultation workshop held to finalise the indicators, their ranks, and data sources to compute the risk index for the WASH sector, conducted on 9 July 2024 at the India Habitat Centre, New Delhi

Findings of the study

About 40% of districts fall under very high and high hazard category

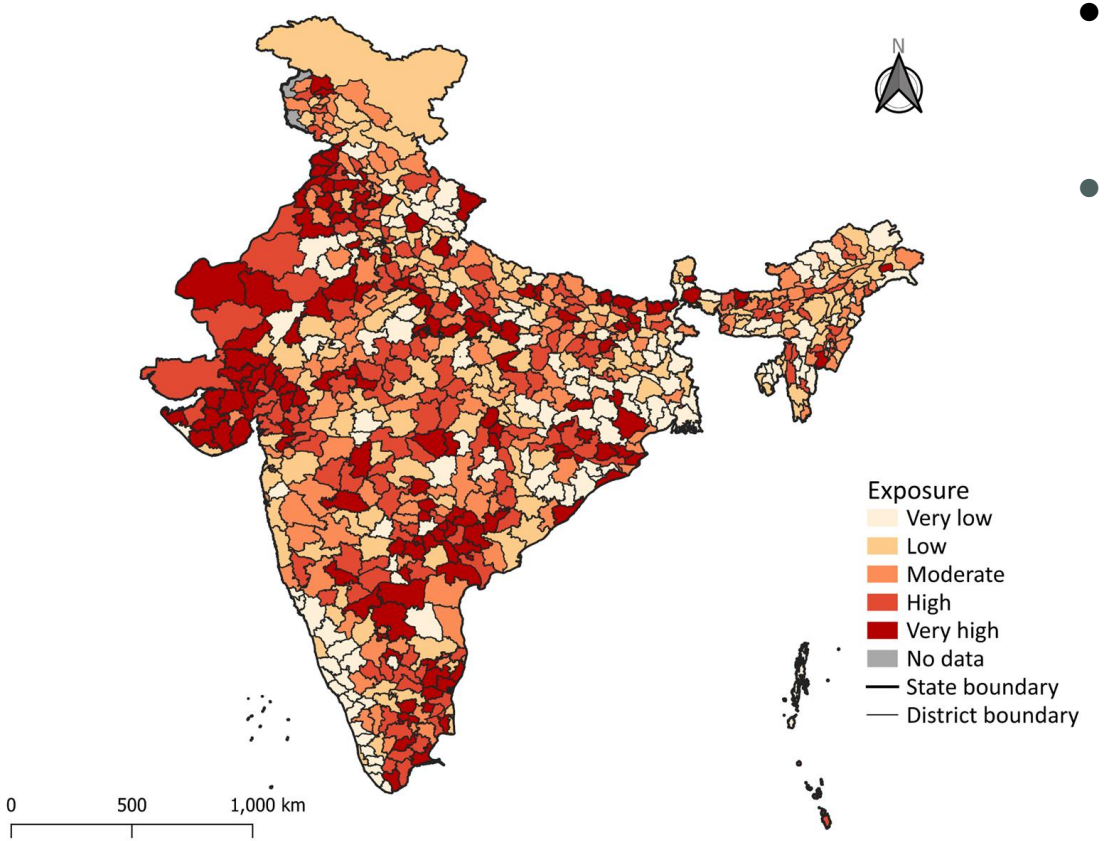


- **Very high hazard**: Gujarat (> 39%), Maharashtra (> 33%), Bihar (> 26%), Odisha (> 26%) and Uttar Pradesh (16%)
- **High hazard**: Rajasthan (> 33%), Uttar Pradesh (> 30%), Tamil Nadu (> 29%), Bihar (> 21%), and Madhya Pradesh (> 13%)

- All **6 indicators** identified under hazards are equally important:
  - Number of flood events in the district in the past 40 years (1984-2023)
  - Number of meteorological drought events in the district in the past 40 years (1984-2023)
  - Change in number of heavy rainfall (October-November-December) days in the past 10 years (2014-2023), as compared to climate baseline (1984-2013)
  - Change in number of heavy rainfall (June-July-August-September) days in the past 10 years (2014-2023), as compared to climate baseline (1984-2013).
  - Change in number of extremely hot days in the district for the last 10 years (2012-2022)
  - Number of cyclone events in the district in the past 40 years (1984-2023)

Source: Authors' analysis

More than 40% of districts fall under very high and high exposure category

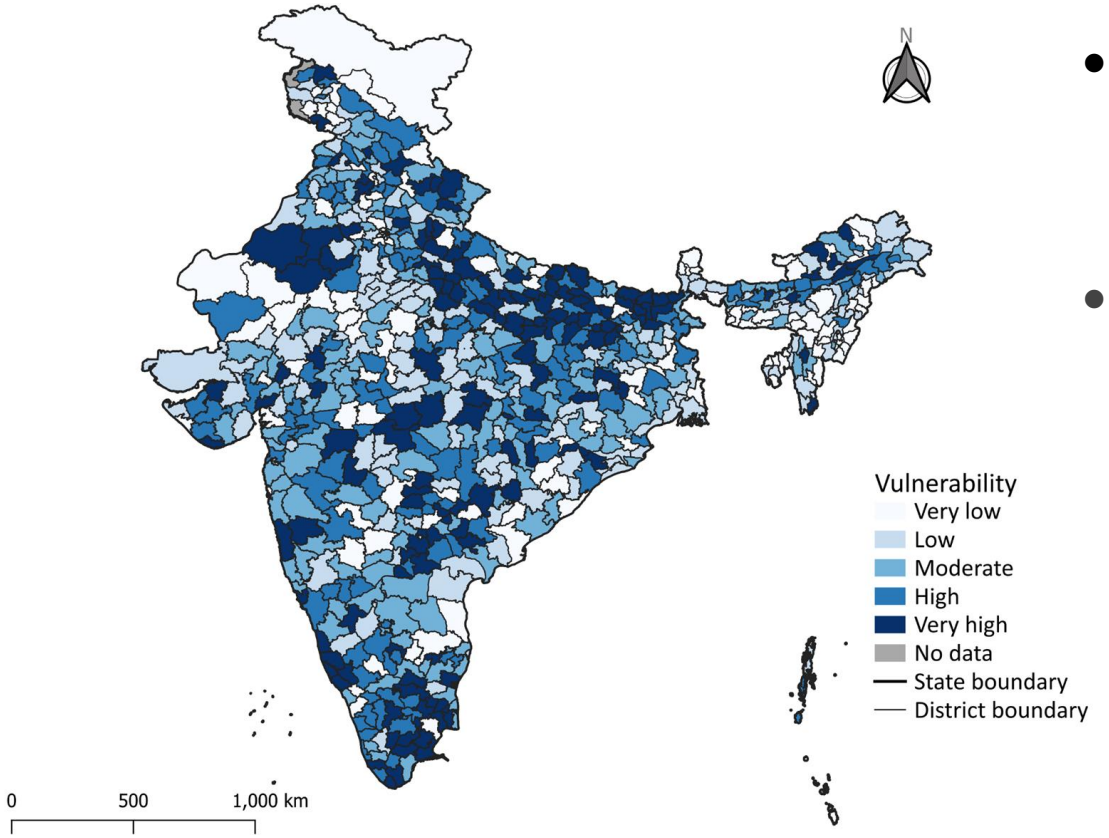


- **Very high exposure**: Punjab (> 59%), Gujarat (> 51%), Telangana (> 51%), Tamil Nadu (> 32%), and Uttar Pradesh (> 17%)
- **High exposure**: Tamil Nadu (> 35%), Maharashtra (> 27%), Assam (> 27%), Madhya Pradesh (25%), and Uttar Pradesh (> 21%)

- **Top 5 indicators** (out of 10) of exposure:
  - Water resource availability per capita in the district
  - Average percentage of storm water drainage to total area of the district
  - Percentage of forest cover to the total area of the district
  - Percentage of rural population to total district population in 2022
  - Percentage of rural water supply schemes which are less than or equal to five years of age, at the district level

Source: Authors' analysis

More than 41% of districts fall under very high and high vulnerability category



- **Very high vulnerability**: Bihar (> 60%), Tamil Nadu (> 45%), Uttar Pradesh (> 42%), Telangana (> 42%), and Madhya Pradesh (> 13%)
- **High vulnerability**: Karnataka (> 33%), Assam (> 33%), Tamil Nadu (> 24%), Uttar Pradesh (> 22%), and Madhya Pradesh (> 17%)

- **Top 5 indicators** of sensitivity (out of 15) and adaptive capacity (out of 22)

Sensitivity	Adaptive capacity
Altitude (elevation) of district	Number of functional government health facilities in district per 1,000 population
% of all drinking water schemes relying only on surface water in the district	Density of AWS and ARG stations in the district, per sq. km

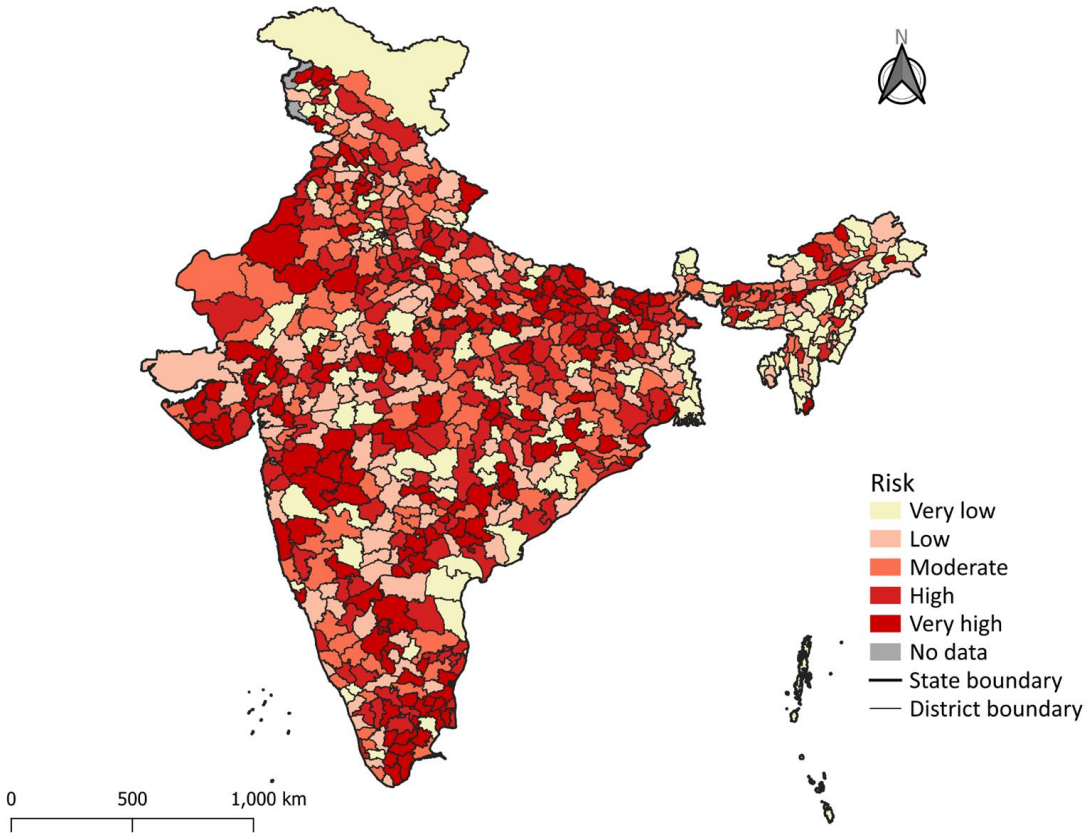
Source: Authors' analysis; AWS: automatic weather station; ARG: automatic rain gauge

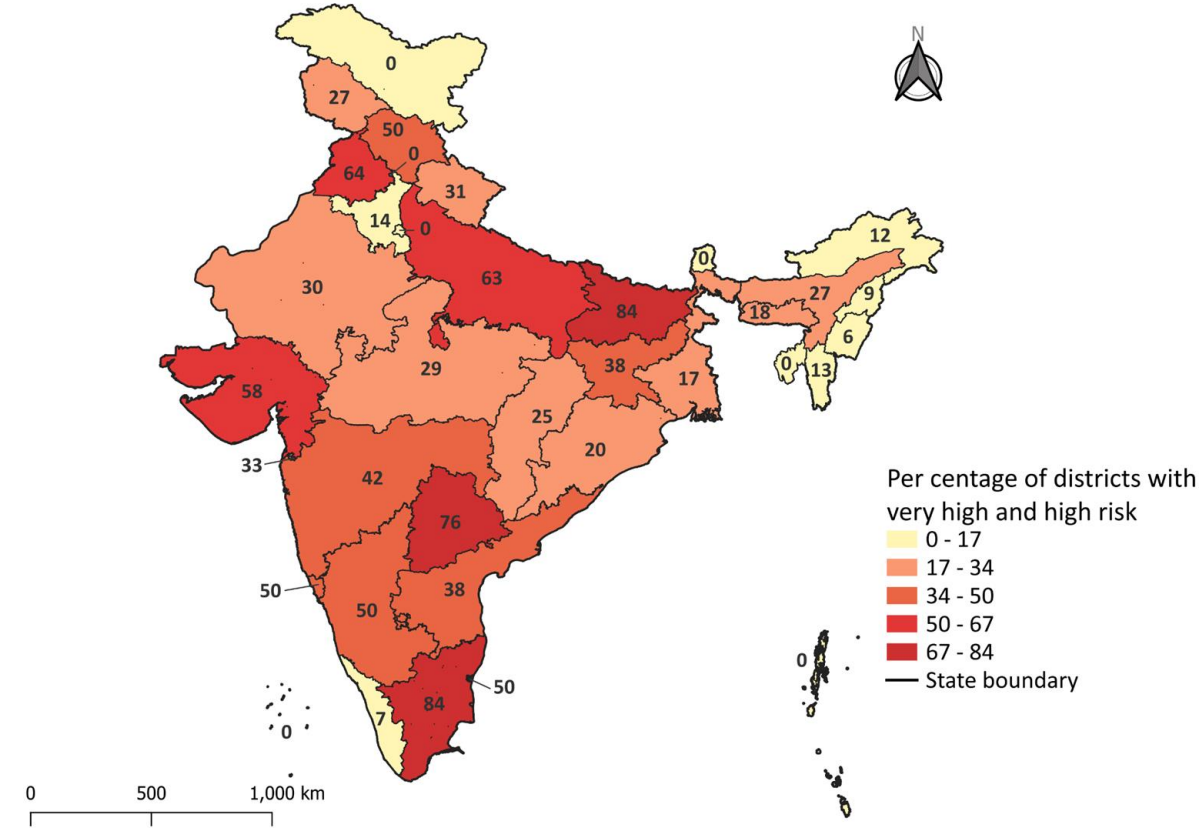
- **Top 5 indicators** of sensitivity (out of 15) and adaptive capacity (out of 22)

Sensitivity	Adaptive capacity
% of all drinking water schemes relying only on groundwater	% of rural schools and aanganwadi with availability of drinking water through tap connection, at district level
% of SC and ST households in the district with access to at least basic hygiene facilities	Annual average budget expenditure by government on WASH in rural areas per district per household for 2020-2023
% of SC and ST households in the district with access to at least basic sanitation facilities	% of the total wards/ULBs declared as ODF++, in the district

SC: scheduled caste; ST: scheduled tribe; ODF: open defecation free; ULBs: urban local bodies

Risk map and frequency distribution of risk





Very high and high risk	> 40% districts
Moderate risk	> 20% districts
Low and very low risk	> 39% districts

Source: Authors' analysis

Percentage of district in very high and high risk

- **Bihar and Tamil Nadu** have more than 80% districts in this category.
- **Gujarat, Himachal Pradesh, Puducherry, and Karnataka** have more than 50% districts in this category.
- **Ladakh, Chandigarh, Lakshadweep, Tripura, and Andaman and Nicobar Islands** have the least % of districts in this category.

Data gaps for conducting interdisciplinary risk assessment

Outdated datasets

For computation of;

- **Population related indicators**, like population density and per capita water availability, **Census 2001 and 2011** data was used and projected to 2022.
- **Urban slum area** (%), Urban Slums Survey, **NSS 69th round-2012** data was used.
- **Stormwater drainage area** (%), **service level benchmarking reports of non-uniform years** was used. These reports are available only for 12 states/ UTs.

Not covered all aspects

Data not covering all service aspects;

- **NSS 78th round** does **not capture** all aspects of **safely managed drinking water** services for households.
- **JJM reports** does **not capture** all aspects of **basic drinking water services** for educational facilities.
- **NFHS 5th round** does **not mention** if women have access to a safe **place to change and wash during menstrual period**.

Limited data availability

For computation of;

- Indicators on **coverage of WASH in the public health sector**, as measured in the Kayakalp programme, data is **not available in the public domain**.
- **Maternal mortality ratio** and total **fertility rate**, data is **not available at district-level**.
- **Surface water quality index**, **CPCB data** is **available only for** few regions of **some districts**.

Source: Authors' analysis; NSS: National Sample Survey; JJM: Jal Jeevan Mission; NFHS: National Family Health Survey; CPCB: Central Pollution Control Board

Recommendations

- Granular-level risk assessment-based prioritisation and financing of WASH schemes/ programmes
- Assess and build capacities of the government institutions to enable such assessments
- Strengthen existing datasets to enable such assessments
- Set up data dashboards to facilitate proper use of risk assessments

Thank You

WASH Economics Conference 2026

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CEPT UNIVERSITY FACULTY OF PLANNING
IFS Institute for Fiscal Studies
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Gates Foundation