Assessing Risks to India's Drinking Water, Sanitation, and Hygiene Systems from Extreme Climate Events

A UNICEF and CEEW collaboration

Report | December 2024

Access to adequate drinking water facilities in schools are necessary for children's health and promote learning, both of which enhance disaster response.

Image: Alamy

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Foreword

Water has been the cradle of life on our planet, and human civilization has flourished around it. The spread of cultures and societies near water-rich regions underscores the irreplaceable role this natural resource plays in sustaining life and in all things, tangible and intangible, that we hold dear.

Access to safe drinking water and sanitation is universally acknowledged as a fundamental human right. This principle has been solidified by the United Nations through the International Covenant on Economic, Social, and Cultural Rights, specifically under Article 11(1), which affirms the right to an adequate standard of living.

Today, we bear a critical responsibility: not only to realize universal access to safe drinking water and sanitation, as outlined in Sustainable Development Goal 6 by 2030, but also to ensure a sustainable achievement of this goal. Meeting this commitment necessitates our collective efforts in combating climate change. Climate change amplifies risks to water resources worldwide, threatening the foundations of economies, societies, biodiversity, and ecosystems. The dignity and health of human life are intrinsically linked to reliable drinking water, sanitation, and hygiene (WASH) services, which are now at risk from climate-induced challenges.

UNICEF has been deeply committed to advancing WASH services worldwide, including in India. UNICEF has been a longstanding partner of the Government of India, supporting flagship initiatives like the Swachh Bharat Mission and the Jal Jeevan Mission. Through its work, UNICEF has prioritized the needs of children, women, economically disadvantaged populations, and other vulnerable groups who are disproportionately affected by inadequate WASH services. Recognizing the critical intersection between climate change and WASH, this theme has remained central to UNICEF's mission, and the current study reflects this commitment.

This study offers a comprehensive assessment of climate-induced risks to the WASH sector in India. It brings together insights from government and civil society to develop a multifaceted risk analysis that includes social, economic, financial, gender, and hydrological dimensions. This assessment provides a foundation for crafting effective adaptation and mitigation strategies to address climate change and enhances the WASH sector's preparedness and response in disaster situations.

I commend the collaboration effort of the Council on Energy, Environment and Water (CEEW) and UNICEF India team as well government stakeholders in producing this invaluable work. While we have made a critical step toward building a climate-resilient WASH sector in India, we recognize that the journey ahead is long. Our commitment remains unwavering, and we will continue to advance toward this goal.

Paulos Workneh
Chief of WASH and Climate Change and Environmental Sustainability
UNICEF, India

Foreword

The planetary boundaries for freshwater have been transgressed, meaning that they have gone beyond its safe operating space. This, coupled with the rising frequency and intensity of climate extreme events, such as floods, droughts, heat waves, and cyclones, threaten our water security and economic and social development of countries.

India, one of the most at-risk countries globally for such events, has about 80 per cent of its population living in districts that are highly vulnerable to extreme hydro-meteorological disasters. This can have an adverse impact on water availability and access, and thus on the attainment of SDG 6, which envisages universal access to drinking water and sanitation for all by 2030. The water crisis also impacts many other related SDGs on poverty, education, gender equality, sustainable cities, and climate action. Estimates suggest that achieving SDG 6 on water sanitation alone could yield annualised net benefits worth a staggering USD 168 billion from 2021 to 2040.

Interdisciplinary risk assessment of the WASH sector helps identify the 'hotspots' where priority needs to be given to climate-proof WASH services and thereby sustain them. As per the findings of this study, nearly 60 per cent of the districts in India have low to medium risks to WASH services, indicating much more effort needs to be undertaken to climate-proof these services in districts that are still at high to very high risk. One of the important immediate actions is to facilitate the mainstreaming of such assessments within the various levels of government targeted for the programmes, schemes and missions on ensuring safely managed WASH services.

I hope this risk-mapping will add depth to India's efforts to ensure sustained and adequate WASH services. The findings can help the Indian Ministries of Jal Shakti, Housing and Urban Affairs, Health and Family Welfare, and Panchayati Raj to design climate-resilient WASH services.

I would take this opportunity to thank our partner, the United Nations Children's Fund (UNICEF), India. The study would not have been possible without their generous support. I wish The Council continues to harness the strengths of all actors in this space and becomes a 'lighthouse' for driving collective action on sustaining WASH services in India.

Shalu Agrawal
Director, Programmes
Council on Energy, Environment and Water (CEEW)

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The authors

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A key objective of *Swachh Bharat Mission* (SBM) (Urban) is to ensure cleanliness and hygiene in public spaces, making cities clean and garbage-free.

Image: Alamy

Executive summary

Climate change induced extreme events like floods, cyclones, droughts, etc. has been affecting India making it one of the most at risk nations globally (Eckstein, Künzel, and Schäfer 2021). For example, **between 2000 and 2019, India experienced an average of 17 flood events per year, making it the second most flood-affected country in the world** (CRED and UNDRR 2020). Also, in 2021, about **83 per cent of its population was exposed to droughts** (UNCCD 2021). More than 80 per cent of India's population lives in districts highly vulnerable to extreme hydro-meteorological disasters (Mohanty and Wadhawan 2021). The increasing frequency and intensity of such extreme events is leading to infrastructural and service-delivery failures, especially in the drinking water, sanitation, and hygiene (WASH) sector. Inadequate delivery of WASH services, whether in terms of **quantity, quality, or frequency and time of availability,** has far-reaching consequences for socio-economic inequities, and this can be directly corroborated through impacts on public health. Estimates by the World Health Organization (WHO) and the Institute of Health Metrics and Evaluation (IHME) for 2016 and 2019 attribute **1.6 million and 1.9 million deaths**, respectively, worldwide to unsafe WASH practices (Wolf et al. 2023). Another estimate from 2019 on the burden of diseases attributable to unsafe WASH practices shows that for the year 2019, **69 per cent of diarrhoeal diseases, 14 per cent of acute respiratory infections, 10 per cent of undernutrition-related diseases, and 100 per cent of the burden of soil-transmitted helminthiasis** could have been avoided with safe WASH practices (Wolf et al. 2023).

The climate-proofing of the WASH sector can aid in attaining 7 SDGs and 10 targets under them

The burden of (climate change–exacerbated) WASH-attributable diseases is borne disproportionately by women, children, elderly people, and impoverished people (WHO 2023b; WaterAid 2017). In 2023, it was estimated that about 1.8 billion people did not have drinking water on their premises, and in two out of three households, women were primarily responsible for water collection (UNICEF and WHO 2023). Improving access to WASH in households, healthcare facilities (HCFs), and educational facilities has been linked to better income, gender equity, lower maternal mortality, and lower child mortality (Richardson et al. 2024; UN Water n.d.; WaterAid 2017).

The attainment of sustainable development goals (SDGs) **6.1** (safe and affordable drinking water for all), **6.2** (adequate and equitable sanitation and hygiene for all), **1.4** (aspects of no poverty), **3.3** and **3.9** (aspects of good health and well-being), **4.a** (aspects of quality education), **5** (gender equality and empowerment of women and girls), **11.b and 11.5** (aspects of sustainable cities and communities, including disaster resilience), and 13.1 (aspects of climate action), is contingent on climate proofing of the WASH sector to ensure universal access to adequate WASH services. Estimates show that annualised net benefits worth **USD 168 billion**[1] can be reaped from 2021 to 2040 by achieving universal access to safely managed water, basic hygiene, and safely managed sanitation (WaterAid 2021).

It is thus imperative for policymakers to prioritise the integration of climate adaptation strategies into WASH planning to safeguard the well-being of India's most vulnerable populations and to ensure functionality of WASH services during and after hydro-meteorological disasters. This will prevent declines in the gains achieved under the *Swachh Bharat Mission* (SBM) and *Jal Jeevan Mission* (JJM), India's two major flagships schemes under WASH. For India, an investment of USD 1 towards adaptation could reduce the annualised average loss from extreme events, slow-onset hazards, and biological hazards by USD 5.5 (UNESCAP 2022). This necessitates identifying underlying risk concerns on a granular level through extensive risk assessments across sectors. This study is an effort in the same direction.

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

A. Objectives of risk assessment of the WASH sector in India

The purpose of this study is to develop a comprehensive climate risk assessment framework specifically tailored to the WASH sector in India. By taking into account the effects of acute and chronic climate events at the district level, the framework provides a granular understanding of how the WASH sector is impacted in different regions by climate-related risks. The study thus has the following objectives:

- Identification and finalisation of the list of indicators for climate extremes–induced WASH risk in India, with a focus on children, women, and vulnerable groups.
- Computation of the district-level climate extremes–induced WASH risk index.
- Identification of risk hotspots and the factors driving the same.

B. Methodology for the development, computation, and representation of the risk index

The definition of risk used in this study is from the Intergovernmental Panel on Climate Change (IPCC) *Fifth Assessment Report* (AR5), whereby risk is defined as a product of hazard, exposure, and vulnerability (adaptive capacity and sensitivity) (Pachauri and Meyer 2014). The methodology consisted broadly of five steps, starting from conducting a systematic literature review (SLR) of 97 studies from the grey and non-grey literature to plotting the GIS-based maps, as seen in Figure ES1.

The method used for the SLR was the larger 'PSAlSAR' framework, under which the research protocol was defined using the 'PICOST' framework (Figure ES1) and reporting of results was done using the 'PRISMA' format. The search phrases used in the SLR were such that there was a special focus on women, children, low-income groups, and caste, to align with the aims of the current study.

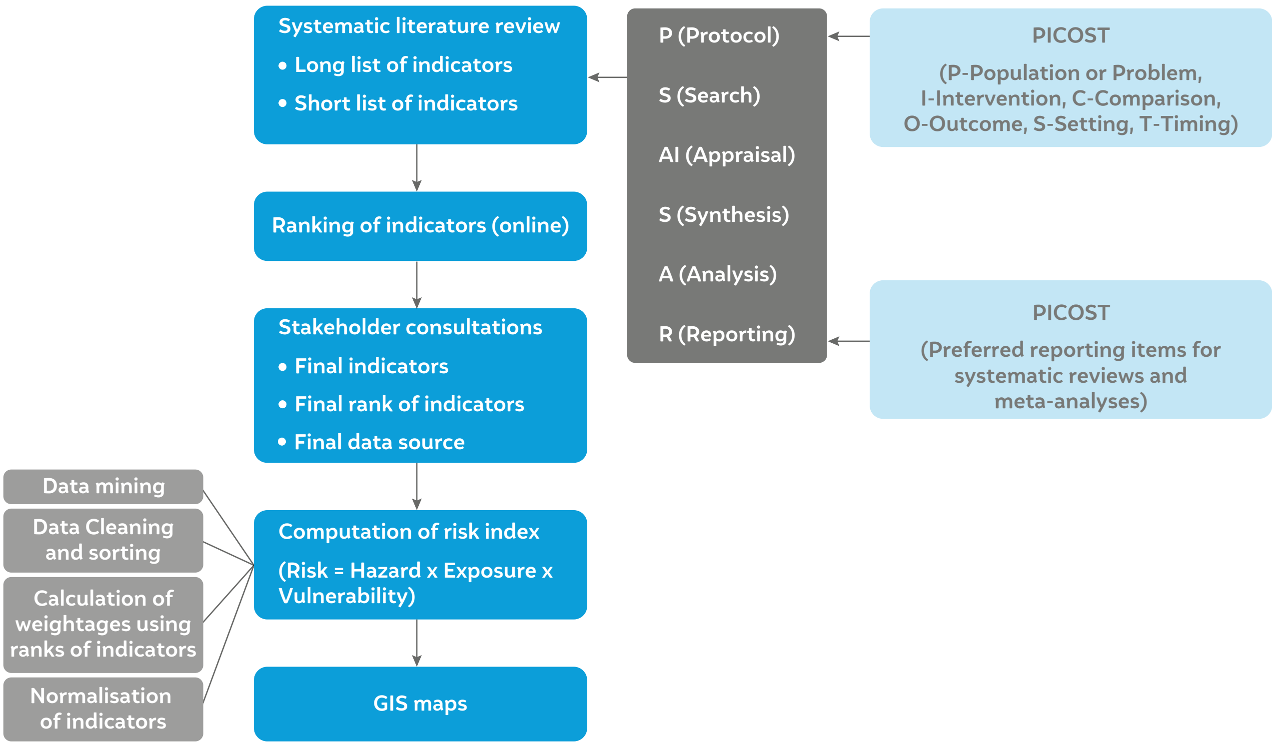
This helped with identification of the long list of indicators (428 in total), which were further shortlisted to 53 indicators after applying the inclusion and exclusion criteria. Of these 53 indicators, 19 focus on children, women, scheduled castes (SCs), scheduled tribes (STs), people with disabilities, rural agricultural landless households, and distressed migration (refer to indicator numbers 17, 18, 19, 20, 23, 25, 26, 27, 30, 31, 32, 33, 35, 37, 39, 40, 42, 43, and

1 Not adjusted for current year prices.

44 in Table 4). Figure ES2 presents a synthesised version of findings from the various stages using the PRISMA format.

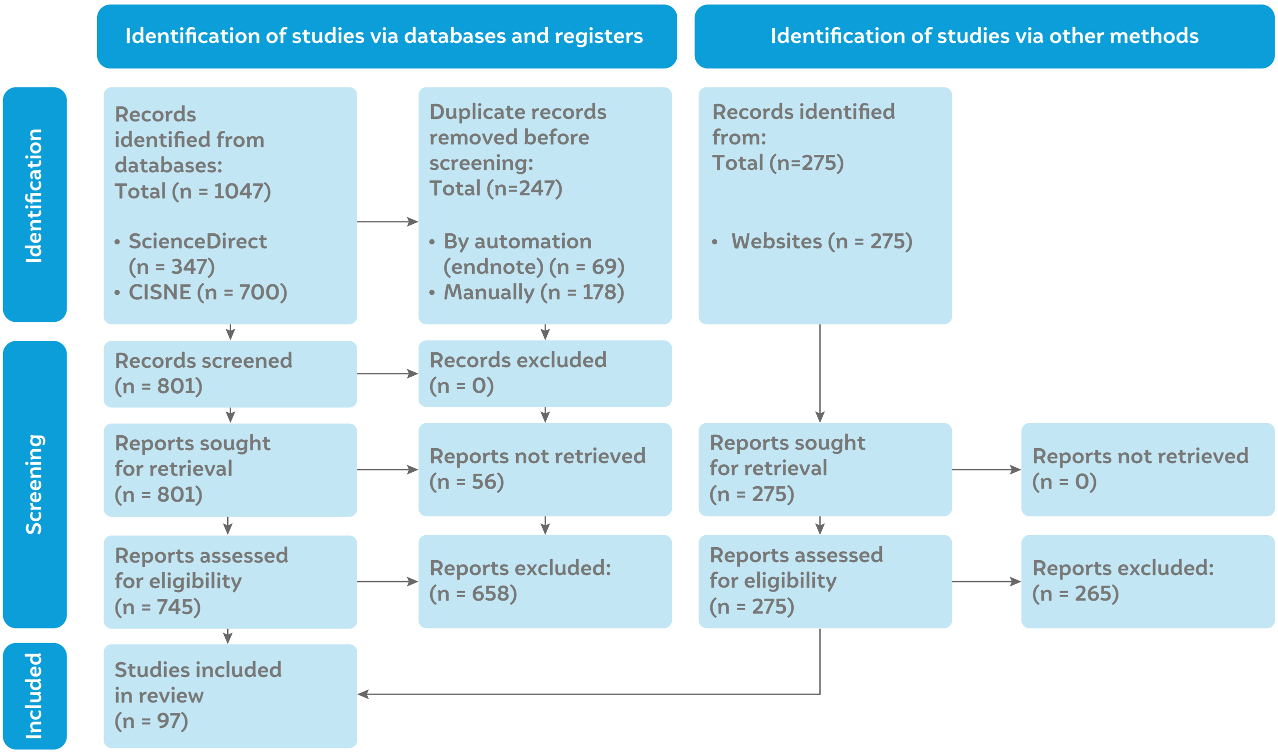
The shortlisted indicators were ranked using the Delphi method in online and offline mode on a scale of relevance ranging from 0 to 4, whereby 0 corresponds to not relevant, 1 to less relevant, 2 to moderately relevant, 3 to highly relevant, and 4 to very highly relevant. Finally, 53 indicators were selected, some of which were added during the Delphi process by the stakeholders. The ranks were utilised for assigning weights to the indicators. Thus, the risk index was computed and GIS maps were prepared for hazard, exposure, and vulnerability sub-indices and the overall risk index to WASH from climate extremes was determined.

Figure ES1 Research methodology used in this study



Source: Authors' analysis

Figure ES2 PRISMA chart on reporting of SLR steps



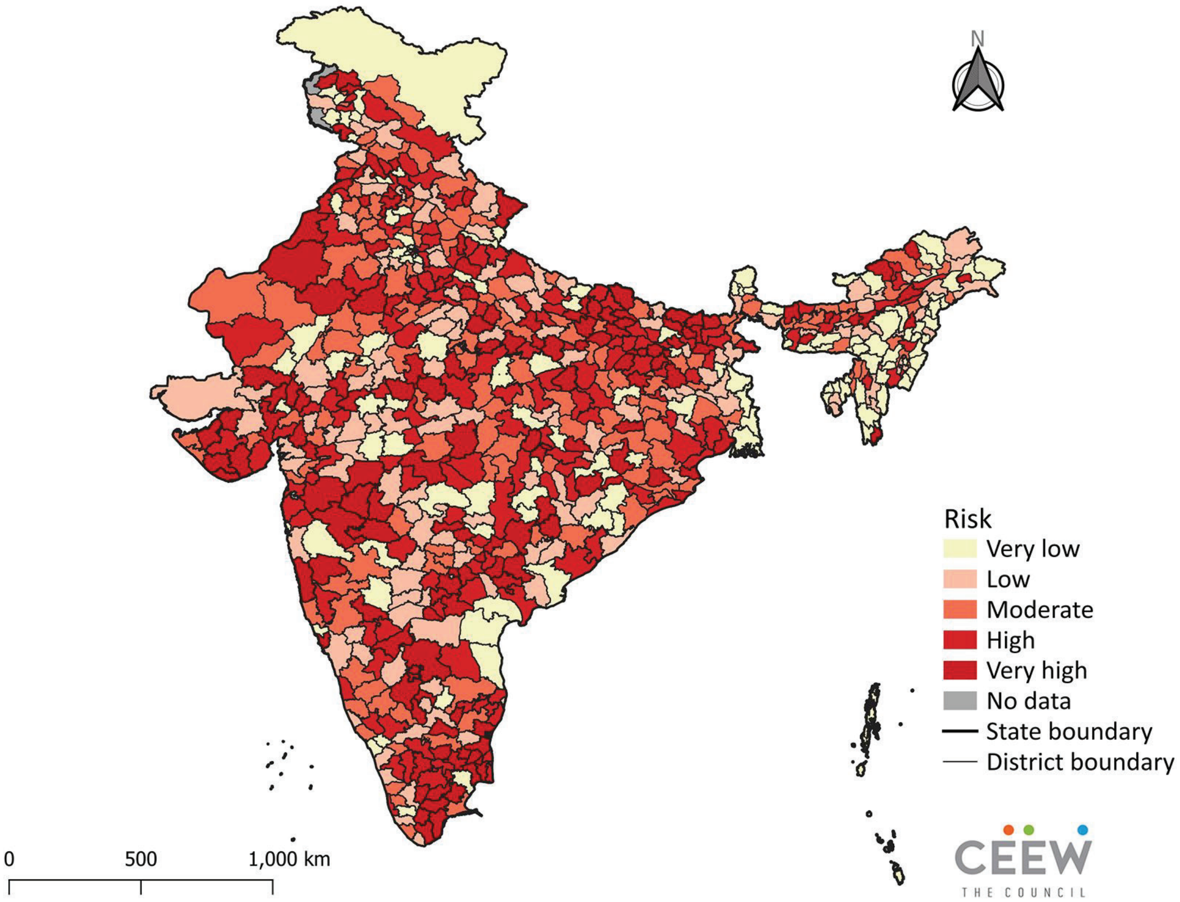
Source: Authors' representation based on PRISMA (2020)

C. Key findings

Figure ES3 shows the climate extremes risk map for the Indian WASH sector. **More than 40 per cent of districts** in India are either at very high or high risk. Furthermore, it can be seen in Figure ES3 that pockets of **very high risk** to WASH services are seen in **nine** states: **Uttar Pradesh, Tamil Nadu, Bihar, Telangana, Gujarat, Maharashtra, Punjab, Rajasthan, and parts of Karnataka**. The districts in the **high-risk** category are dispersed among **seven states**, including **Uttar Pradesh, Bihar, Madhya Pradesh, Tamil Nadu, Maharashtra, Telangana, and Gujarat**. The insights gained from studying the sub-components used in calculating the risk are as follows:

- **Hazards:** About **40 per cent of districts** in the country fall under the very high and high category of hazards. Districts in **Gujarat, Maharashtra, Uttar Pradesh, Bihar, Odisha, Tamil Nadu, Karnataka, and Rajasthan** fall under the **very high category of hazards.** Many districts in **Uttar Pradesh, Tamil Nadu, Rajasthan, Bihar, and Madhya Pradesh** fall under the **high category**. All the indicators are equally important and pose similar risks to WASH services. The names of the top 5 districts of these states in very high and high hazard category is listed in table ES1 below.
- **Exposure**: **More than 40 per cent of districts** in the country fall under very high and high categories of exposure. Pockets of **very high exposure** are seen in **Gujarat, Telangana, Punjab, Uttar Pradesh, Tamil Nadu, and Rajasthan**. Some districts in **Uttar Pradesh, Madhya Pradesh, Tamil Nadu, and Maharashtra** fall under the **high-exposure** category. The top five indicators identified for exposure are water resource availability per capita in the district, the average percentage of storm water drainage to total area of the district, the percentage of forest cover to total area in the district, and the percentage of rural population to the total district population in 2022, as well as the percentage of rural water supply schemes which are less than or equal to five years of age, at the district level. The names of the top 5 districts of these states in very high and high exposure category is listed in table ES1 below.

Figure ES3 Risk map for the WASH sector at the district scale for India



Source: Authors' analysis

- **Vulnerability: More than 41 per cent of districts**, including those in **Uttar Pradesh, Bihar, Tamil Nadu, Telangana, Madhya Pradesh, Assam, Karnataka, and Maharashtra** show very high to high levels of vulnerability. In this study, the top five indicators of both sensitivity and adaptive capacity were identified. The top five drivers identified for **sensitivity** are as follows: altitude (elevation) of the district; percentage of all rural drinking water schemes relying only on surface water in the district; percentage of all rural drinking water schemes relying only on groundwater in the district; percentage of the total SC and ST households in the district with access to at least basic hygiene facilities; and percentage of the total SC and ST households in the district with access to at least basic sanitation facilities.

  For **adaptive capacity**, the top five indicators are the number of functional government health facilities in the district per 1,000 population; the density of automatic weather stations (AWSs) and automatic rain gauge (ARG) stations in the district, per square kilometre; the percentage of rural schools and *aanganwadis* with availability of drinking water through tap connection, at the district level; the annual average budget expenditure by the government on WASH in rural areas per district per household for the years 2020–23; and the percentage of the total wards/urban local bodies declared as ODF++, in the district. The names of the top 5 districts of these states in very high and high vulnerability category is listed in table ES1 below.

Table ES1: The names of the states and top 5 districts under them (in bracket) lying in very high and high categories of risk, hazard, exposure, and vulnerability

Risk		Hazard		Exposure		Vulnerability	
Very high	High	Very high	High	Very high	High	Very high	High
Uttar Pradesh (Budaun, Moradabad, Kaushambi, Prayagraj, and Deoria)	Uttar Pradesh (Agra, Auraiya, Ghaziabad, Aligarh, and Etah)	Gujarat (Porbandar, Jamnagar, Janagadh, Ahmadabad, and Dangs)	Uttar Pradesh (Gautambudh nagar, Aligarh, Ballia, Gazipur, and Shrawasti)	Gujarat (Patan, Sabar Kantha, Mahesana, Mahisagar, and Devbhumi Dwarka)	Uttar Pradesh (Hathras, Sitapur, Lucknow, Sambhal, and Lalitpur)	Uttar Pradesh (Gorakhpur, Azamgarh, Shahjahanpur, Ambedkar-nagar, and Raibeareli)	Uttar Pradesh (Santkabir-nagar, Lalitpur, Banda, Kanpur, and Ballia)
Tamil Nadu (Dharmapuri, Teni, Virudhunagar, Thanjavar, and Tirunelveli)	Bihar (Saran, Patna, Gaya, Parnia, and Buxar)	Maharashtra (Nashik, Thane, Satara, Bid, and Jalna)	Tamil Nadu (Tiruvallar, Tirunelveli, Nagapattinam, Tiruppar, and Coimbatore)	Telangana (Rangareddy, Jagtial, Warangal (Urban), Jayashankar Bhupalapally, and Medchal-Malkajgiri)	Madhya Pradesh (Bhopal, Narshimapura, Chhindwara, Jabalpur, and Alirajpur)	Bihar (Jahanabad, Saran, Saharsa, Gopalganj, and Siwan)	Assam (Udalguri, Goalpara, Kokrajhar, Sonitpur, and Biswanath)
Bihar (Madhepura, Madhubani, Saharsa, Pashchimi Champaran, and Supaul)	Madhya Pradesh (Mandla, Agar Malwa, Jhabua, Chhatarpur, and Sehore)	Uttar Pradesh (Moradabad, Budaun, Deoria, Chitrakoot, and Lalitpur)	Rajasthan (Nagaur, Ajmer, Alwar, Tonk, and Jaipur)	Punjab (Kaparthala, Tarn Taran, Fazilka, Patiala, and Moga)	Tamil Nadu (Thanjavar, Tiruppar, Dharmapuri, Virudhunagar, and Sivaganga)	Tamil Nadu (Teni, Thiruvarar, Ariyalar, Perambalar, and Tirunelveli)	Karnataka (Tumakaru, Hassan, Gadag, Dharwad, and Ramanagaram)
Telangana (Yadadri Bhuvanagiri, Khammam, Nagarkurnool, Medchal-Malkajgiri, and Rangareddy)	Tamil Nadu (Vellore, Chengalpattu, Coimbatore, Karar, and Tiruvallar)	Bihar (Pashchimi Champaran, Supaul, Aurangabad, Madhepura, and Madhubani)	Bihar (Patna, Saharsa, Jamai, Bhagalpur, and Araria)	Uttar Pradesh (Bareilly, Basti, Bijnor, Kaushambi, and Jhansi)	Maharashtra (Washim, Dhule, Hingoli, Jalna, and Aurangabad)	Telangana (Warangal (Urban), Nagarkurnool, Nirmal, Khammam, and Yadadri Bhuvanagiri)	Madhya Pradesh (Sehore, Nimach, Burhanpur, Chhatarpur, and Sidhi)
Gujarat (Jamnagar, Ahmadabad, Gir Somnath, Janagadh, and Sabar Kantha)	Maharashtra (Nandurbar, Gadchiroli, Kolhapur, Palghar, and Wardha)	Odisha (Dhenkanal, Jagatsinghpur, Balasore (Baleshwar), Bolangir (Balangir), and Sambalpur)	Madhya Pradesh (Singrauli, Chhatarpur, Jabalpur, Agar Malwa, and Katni)	Tamil Nadu (Chengalpattu, Perambalar, Namakkal, Ramanatha-puram, and Vellore)	Assam (Karimganj, Marigaon, Hailakandi, Hojai, and Kamrup Rural)	Madhya Pradesh (Chhindwara, Betul, Mandla, Sagar, and Balaghat)	Tamil Nadu (Karar, Namakkal, Kanchipuram, Erode, and Dindigul)
Maharashtra (Ratnagiri, Satara, Jalna, Jalgaon, and Nashik)	Telangana (Wanaparthy, Peddapalli, Vikarabad, Nalgonda, and Adilabad)	Tamil Nadu (Cuddalore, Tenkasi, Tuticorin, Tiruppattar, and Virudhunagar)	Odisha (Keonjhar (Kendujhar), Khordha, Sundargarh, Koraput, and Kalahandi)	Bihar (Khagaria, Madhepura, Madhubani, Arwal, and Begusarai)	Gujarat (Bharach, Chhota Udepur, Vadodara, Anand, and Jamnagar)	Karnataka (Bengalaru Rural, Kodagu, Udupi, Dakshina Kannada, and Davangere)	Telangana (Kamareddy, Peddapalli, Nalgonda, Suryapet, and Ranjanna Sircilla)
Punjab (Fatehgarh Sahib, Patiala, Kaparthala, Barnala, and Firozpur)	Gujarat (Rajkot, Mahisagar, Dangs, Bhavnagar, and Anand)	Karnataka (Tumakaru, Bagalkot, Chik-kamagalaru, Ramanagaram, and Bidar)	Telangana (Medchal-Mal-kajgiri, Nalgon-da, Vikarabad, Mahabub-nagar, and Rangareddy)	Odisha (Jajapur, Jharsuguda, Subarnapur, Kendraparha, and Dhenkanal)	Bihar (Kaimur, Siwan, Gopalganj, Darbhanga, and Aurangabad)	Maharashtra (Ratnagiri, Satara, Jalgaon, Amaravati, and Jalna)	Maharashtra (Ahamadnagar, Solapur, Gadchiroli, Wardha, and Chandrapur)
Rajasthan (Nagaur, Pratapgarh, Jaipur, Bikaner, and Ganganagar)	Chhattisgarh (Mungeli, Raj Nandgaon, Sarajpur, Dhamtari, and Surguja)	Rajasthan (Ganganagar, Bharatpur, Dausa, Jaisalm-er, and Pali)	Maharashtra (Gadchiroli, Amaravati, Latar, Bhandara, and Wardha)	Rajasthan (Jodhpur, Jaipur, Ajmer, Dausa, and Raj Samand)	Chhattisgarh (Raipur, Kondagaon, Baloda Bazar, Sarajpur, and Bastar)	Chhattisgarh (Bijapur, Bastar, Janjgir - Champa, Sarajpur, and Dhamtari)	Gujarat (Jamnagar, Ahmadabad, Narmada, Tapi, and Chhota Udepur)

D. Recommendations

The findings can inform the development of **hyperlocal strategies** that can minimise impacts and avert or reduce loss and damage to WASH systems and services during disasters. We make the following recommendations to ensure the same:

- **Set up data dashboards to facilitate proper use of risk assessments:** Open-access and interactive dashboards that provide a one-stop solution for information on such assessments can help in designing more efficient and comprehensive risk-informed interventions to make WASH climate resilient. These dashboards can be set up as a joint effort between the Ministry of Jal Shakti (MoJS) and the National Disaster Management Authority (NDMA) at the national level, showing an aggregate of state level similar assessments. At the state level, such dashboards can be hosted by the water supply or public health and engineering department (PHED), with relevant editing rights to all the departments from whom input for such risk assessments is sought.
- **Strengthen existing datasets to enable such assessments**: The datasets that can enable a more nuanced and efficient risk assessment of the sector need to be harmonised and should focus on aspects that are necessary for the holistic assessment of any indicator. Furthermore, since aspects of WASH are linked to the right to life as mandated in the Constitution of India, all datasets should be freely available in the public domain at an adequate scale.
- **Mainstream granular-level, interdisciplinary assessments for climate extremes–induced risks in the WASH sector**: There is a need for the government to encourage risk assessments of the WASH sector to climate extremes at the sub-national (district and block) level and through an interdisciplinary lens. This is necessary because different aspects of WASH are governed by different ministries and departments (for instance, women and child development, rural development, *panchayati raj*, water supply and sanitation, groundwater), and the variation in the natural factors that influence WASH can only be captured at finer spatial levels. Therefore, the government should use comprehensive risk analysis frameworks that can capture these interdisciplinary nuances, such as those deployed in this study.
- **Assess and build capacities of the government institutions to enable such assessments**: There is a need to assess and systematically build the capacities of government institutions to make such risk-informed assessments. These would include capacities related to data management, monitoring and impact evaluation of existing WASH systems and services, innovative and participatory planning and implementation of new WASH systems, collaboration and coordination for operation and maintenance of WASH services, and other related technical aspects such as climate science and risk, and disaster management (Abraham et al. 2024). The participatory planning process should be guided by principles of inclusivity, such that the needs of women, children, and other vulnerable or under-represented groups are realised and incorporated.
- **Risk assessment–based prioritisation and financing of WASH schemes**: In order to climate proof the WASH sector in the country, it is crucial to formulate budgets and allocate resources based on the identification of climate change hotspots. Identifying specific vulnerabilities and adaptation capacity gaps at the district or local level can inform priority setting for judicious allocation of financial resources. Such assessments at the state level should be a joint effort between the water supply department/public health and engineering department (PHED) and the state disaster management authority (SDMA), with the former leading it. Other state departments should be consulted for inputs at various stages of the assessment.

Granular-level climate risk assessment of the WASH sector can enable hyperlocal strategies for its climate-proofing

WASH in healthcare facilities encompasses the provision of infrastructure and services for water, sanitation, waste management, hygiene, and environmental cleaning across all parts of a facility.

Image: iStock

1. Introduction

India's water, sanitation, and hygiene (WASH) sector is highly vulnerable to the increasing impacts of climate change. **India ranks as one of the most at-risk nations globally** (Eckstein, Künzel, and Schäfer 2021) **due to its exposure to extreme climate events such as floods, droughts, and cyclones, which poses a serious threat to the water and public health sectors**. A 2021 study by CEEW finds that a staggering 75 per cent of Indian districts are hotspots for such climatic extremes, and that 80 per cent of the population reside in vulnerable regions (Mohanty and Wadhawan 2021). The burden of this vulnerability is borne disproportionately by children. According to United Nations Children's Fund's (UNICEF's) children's climate risk index, India ranks 26th out of 163 nations, highlighting the urgent need for focused initiatives to safeguard the country's most vulnerable citizens (UNICEF 2021).

The severe water stress that India experiences compounds these challenges. The average per capita water availability, which is already quite low in India, is expected to reduce further to **1,341 cubic metres (m^3) by 2025** and **1,140 m^3** by 2050, close to the official water scarcity threshold (NITI Aayog 2019). The large population that is highly vulnerable to climate change and the increasing water scarcity, which can increase manifold due to lack of access to clean water during floods, cyclones, and heatwaves and reduced water availability during droughts, will exacerbate the challenges in the WASH sector. In many rural areas, the existing water supplies are unable to meet household demand during peak summers due to large-scale dependence on groundwater, especially from hard-rock aquifers, which have limited recharge and storage potential (Kumar, Bassi, and Kumar 2022).

As the frequency of extreme weather events, such as floods, droughts, cyclones, and so on, increases, the availability of adequate **WASH infrastructure and services** may become more skewed, creating far-reaching ramifications for **public health**. Estimates by the World Health Organization (WHO) and the Institute of Health Metrics and Evaluation (IHME) for 2016 and 2019 attribute **1.6 million and 1.9 million deaths**, respectively, worldwide to unsafe WASH practices (Wolf et al. 2023). Another estimate from 2019 on the burden of diseases attributable to unsafe WASH practices show that for the year 2019, **69 per cent of diarrhoeal diseases, 14 per cent of acute respiratory infections, 10 per cent of problems related to undernutrition, and 100 per cent of the burden of soil-transmitted helminthiasis** could have been avoided with safe WASH practices (Wolf et al. 2023).

This underscores the need for informed policymaking at the national and state levels to climate-proof WASH services. **Climate risk assessments** that can capture risk through an interdisciplinary lens, as attempted in this study, **are an invaluable preliminary step in designing climate-proofing interventions.** These assessments would inform **hyperlocal strategies** that could minimise impacts and avert or reduce loss and damage during disasters. For India, an investment of **USD 1 towards adaptation could reduce annualised average loss from extreme events, slow-onset hazards, and biological hazards by USD 5.5** (UNESCAP 2022).

Around 74% of all natural disasters between 2001 and 2018 were water related

1.1 Understanding the impact of physical climate risks on the WASH sector

The vulnerability of India's WASH sector to physical risks posed by climate change, both directly and indirectly, is increasing. The rising frequency and severity of extreme events, like heatwaves, floods, and cyclones, results in infrastructural and service-delivery failures in the WASH sector. A failure to deliver drinking water, sanitation, and hygiene services whether in terms of quantity, quality, when needed may exacerbate existing socio-economic inequities and pose grave threats to public health.

The number of weather-related disasters – floods, droughts, storms, and extreme temperatures – has **increased by a factor of five** over the past 50 years, claiming, on average, the lives of 115 people daily and causing **USD 202 million**[1] **in economic losses every day** (WMO 2021). In particular, water-related hazards have increased in frequency over the past 20 years. Since 2000, **flood-related disasters have increased by 134 per cent** and the number and duration of droughts by **29 per cent** (WMO 2021). Around **74 per cent of all natural disasters between 2001 and 2018 were water related** (UN WWDR 2020). The total number of deaths caused by floods and droughts alone exceeded 1,66,000, and the total economic damage amounted to almost **USD 700 billion** (UN 2020)

Flooding is the most prevalent climate change–related threat to global WASH infrastructure, with service disruptions expected for up to 13 per cent of the population in the most vulnerable countries (WaterAid 2021). India is the second most impacted country globally in terms of flood events, with an average of 17 floods annually, from 2000 to 2019 (CRED and UNDRR 2020). It has been estimated that between 1953 and 2010, the value of the damage to public utilities caused by floods was **INR 81.6 billion (USD 0.97 billion[2]**), or 44 per cent of all flood related damages put together (Singh and Kumar 2017). The 2013 cloud bursts, heavy rains, landslides, and floods in Uttarakhand in India compromised either fully or partially about 22 per cent of rural drinking water schemes (2,703 out of 12,182) in 13 affected districts, thereby impacting more than 1.2 million people in 0.2 million households (ADB, Government of Uttarakhand, and World Bank 2013). In the five worst affected districts, it was estimated that more than 347 km of the rural water supply pipeline, 1,054 sources, 1,045 civil works, 766 house connections, 496 stand posts, and 86 hand pumps were damaged (ADB, Government of Uttarakhand, and World Bank 2013). In urban towns, water supply schemes were impacted in 41 towns, which directly affected more than 0.1 million people. It has been surmised that damage to sanitation structures, though lesser in extent, caused greater health hazards since resorting to open defaecation led to the pollution of water and the overall environment. It was reported that 3,338 rural household toilets, 3,328 soak pits, and 41,770 m of drains were damaged (ADB, Government of Uttarakhand, and World Bank 2013). The total reconstruction costs for urban and rural WASH services amounted to more than **USD 33.5 million**, or five

1 Financial figures in this section have not been adjusted for the current time period, unless stated otherwise.
2 Conversion rate: 1 INR = 0.012 USD (as on 4 October 2024).

per cent of the total costs of such needs (ADB, Government of Uttarakhand, and World Bank 2013). The 2012 riverine floods in Assam, caused by 28 per cent higher rainfall than normal, led to the submergence of **70 per cent** of previously safe water sources and **80 per cent** of latrines in the 21 affected districts (Krishnan and Borah 2013). Unsafe WASH practices may cause an increase in waterborne diseases such as cholera, diarrhoea, and typhoid. The 2018 Kerala floods, for example, caused a surge in waterborne diseases, with nearly 500 deaths and 3,000 cases of leptospirosis reported in the aftermath (National Centre for Disease Control 2019).

Droughts are associated with long periods of dry weather and hydrological imbalances, and meteorological droughts are defined on the basis of the degree of dryness (in comparison to a set 'normal' or average amount) and the duration of the dry period (Parker et al. 2023). Droughts usually have widespread and cascading impacts, affecting societies, economies, and ecosystems both directly and indirectly (UNDRR 2021). It has been estimated that from 1998 to 2017, droughts have affected at least **1.5 billion people** and led to economic losses of at least **USD 124 billion** across the world (UNDRR 2021). Annual losses in the United States alone were estimated to be **USD 6.4 billion per annum** in direct costs. The effect of severe droughts on India's gross domestic product is estimated to be **2 to 5 per cent,** assuming that 83 per cent of the population is exposed to droughts (UNDRR 2021; UNCCD 2019). In 2019, about 49 per cent of the female population in India was exposed to mild, moderate, severe, or extreme drought (UNCCD 2019). Climate change–induced alterations in monsoon and temperature patterns in many regions of the world are intensifying drought impacts, increasing its frequency, severity, and duration. Southern India was hit by severe drought from 2016 to 2018 arising from low rainfall during the northeast monsoon. This led to a water crisis in Chennai impacting the city's population of 11 million. Four of the city's major reservoirs dried up completely and groundwater levels plummeted.[3]

Tropical cyclones are associated with **high wind speeds, surges in sea water, and heavy rainfall**. While globally the number of cyclones is perhaps falling, the Intergovernmental Panel on Climate Change (IPCC) states with 'medium confidence' that the average and peak rainfall rates associated with tropical cyclones are increasing, and so are the highest associated wind speeds (Poynting 2024). It is postulated that this is due to the **increase in water temperatures, a warmer atmosphere, and rising sea-levels**. For example, it is estimated that flood heights from Hurricane Katrina in 2005 – one of America's deadliest storms – were 15 per cent to 60 per cent higher than they would have been in the climate conditions of 1900. Super cyclone Amphan, which hit Bangladesh in 2020, destroyed more than 18,000 water points and 40,000 latrines in the most impacted districts (IFRC and RCS 2020). Also, many freshwater ponds inside forests got flooded with seawater. Cyclone Phailin, which hit the Indian state of Odisha in 2013, caused more than 3,000 piped water supply structures and 44,000 tubewells to go out of order because of massive damage to the energy infrastructure. The associated heavy rainfall resulted in high flood levels causing a number of breaches in the flood embankments. The resulting floods caused diarrhoeal outbreaks that resulted in 9,893 human deaths (Mommen, Roy, and Sethi 2014).

In 2019, about 49% of India's female population was exposed to drought

Heatwaves, another type of chronic climate event, are associated with **increased water demand and water stress**, compounding their impact on health and depriving affected communities of a critical cooling resource (IFRC and OCHA 2022). A *Lancet* study found that between 2018 and 2022, there were 86 days each year with dangerously high temperatures (Lancet Countdown 2023). Human-driven climate change made **60 per cent** of these extreme heat days more than twice as likely to occur. These impacts are particularly severe for

3 In the summer of 2019, a **'Day Zero'** was declared in Chennai city (Jain 2021).

vulnerable populations, including those who are ill, the elderly, women, and those living in poverty (Tasgaonkar et al. 2018). A Lancet report states that between 2000–2004 and 2018–2022, the number of heat-related deaths among adults over 65 rose by 85 per cent, which is twice as much as would have been if temperatures had stayed the same (Lancet Countdown 2023). Between 1992 and 2015, heatwave attributed fatalities in India were pegged at more than 24,000 (NRDC 2020). In sub-Saharan Africa, extreme heat dries water sources and affects food production, thus increasing women's workloads, because they must walk long distances in the sweltering sun to find water and food (IFRC and OCHA 2022). Higher water temperatures could also **reduce the self-purifying capacity of freshwater** bodies, thereby increasing the risks of water pollution and pathogenic contamination (UNESCO and UN WATER 2020).

Climate adaptation strategies for WASH must safeguard the well-being of the most vulnerable populations

The multifaceted impacts of extreme climate events on the WASH sector in general highlight the critical need for climate-resilient WASH systems. Policymakers must prioritise the integration of climate adaptation strategies into WASH planning to safeguard the well-being of the most vulnerable populations, especially in countries of the Global South such as India. However, creating context-specific adaptation solutions that account for uniqueness of challenges across locations is crucial to the successful application of these strategies. This requires identifying underlying risk factors at a granular level through comprehensive risk assessments across sectors. These evaluations can produce the scientific data that investors, administrators, and legislators require to improve decision-making and prioritise adaptation planning.

To this end, in this study, we have developed a comprehensive, unified, and scalable risk assessment framework to climate proof India's WASH sector against extreme climate events, ensuring that current investments in this sector are safeguarded and future investments are better targeted.

1.2 Major initiatives by the Government of India towards increasing the resilience of the WASH sector to climate extremes

Targets 6.1 and 6.2 under sustainable development goal (SDG) 6 include targets for universal access to safe drinking water, sanitation, and hygiene for all by 2030, whereby the word '*universal*' includes households, schools, healthcare facilities (HCFs), workplaces, and public places and the term '*for all*' implies services that are suitable for women, men, and girls and boys of all ages, including people living with disabilities (UNICEF and WHO 2019). In this section, we try to understand the governance and policy landscape of the WASH sector in India across various settings.

Institutional structure

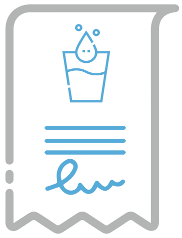
In India, the right to access clean drinking water is a fundamental right that can be drawn from the rights to health, food, and a clean environment, all of which are protected under the right to life header as detailed in Article 21 of the Indian Constitution (National Human Rights Commission, India 2021). The right to sanitation has not been recognised explicitly in the constitution, but it has been recognised by the Supreme Court and high courts of the country in some of their rulings as a justiciable right under Article 21 (Koonan 2016). The right to drinking water has also been read as part of Article 39b (concerning the distribution of material resources in the interest of the common goods), Article 47 (duty of the state government to raise the standard of living), and Article 51 (A) (g) (fundamental duties of citizens towards environments) (National Human Rights Commission, India 2021). Additionally, sanitation has also been read as part of Article 47 and Article 48A (duty of the state to protect and improve the environment) (Koonan 2016).

Drinking water (including water storage) and sanitation (including public health) are both state subjects in India, as listed in entry 17 and entry 6 of the second list of Article 246 under the seventh schedule of the Constitution (Ministry of Law and Justice 1949). Thus, law-making power and executive responsibility for water and sanitation services fall squarely within the purview of state legislatures (barring river water disputes, which fall within the purview of Parliament) (Wahi 2022). Different facets of WASH are governed by different ministries and their subsidiaries at the central and state levels. The Ministry of Jal Shakti (MoJS) (erstwhile Ministry of Drinking Water and Sanitation (MoDW&S) restructured in 2019) has the Department of Drinking Water and Sanitation (DoDW&S) under it, which aims to provide technical and financial assistance to the states to provide safe and adequate drinking water and sanitation services to rural India (DoDW&S 2022). The Ministry of Housing and Urban Affairs (MoHUA) which was reconstituted in 2017 from merging of Ministry of Urban Development (MoUD) and Housing and Urban Poverty Alleviation (MoHUPA). It has the mandate to ensure drinking water supply (in alignment with the national perspective of water planning and coordination as laid down by the MoJS) as well as sewage, drainage, and sanitation services in urban areas (MoHUA 2017). Since adequate WASH provisioning is imperative for both HCFs and education, the Ministry of Health and Family Welfare (MoH&FW) and Ministry of Education (MoE)(erstwhile Ministry of Human Resource Development (MoHRD)) continually formulate governance instruments (policies, schemes, and missions) to complement and supplement the efforts of the MoJS and MoHUA.

In 1992, the 73rd and 74th constitutional amendments to promote greater decentralisation of power mandated the state governments to devolve functions related to drinking water and sanitation in urban areas to institutions of local government, that is, municipalities, and in rural areas to *gram panchayat*s (GPs) (National Human Rights Commission, India 2021). Hence, the Ministry of Panchayati Raj (MoPR) is indispensable in ensuring the provisioning of WASH services in rural areas. The Fifteenth Finance Commission (FFC) of India has tied 60 per cent of its funds (about INR 32,000 crore per year) with GPs for five years (2021–26) to ensure adequate water supply and sanitation services in villages (WaterAid, NIRDPR, and UNICEF 2022).

The National Disaster Management Authority (NDMA), under the Ministry of Home Affairs (MoHA) and headed by the prime minister of India, is the apex body for disaster management in India. It was created under the *Disaster Management Act 2005* (National Disaster Management Authority, GoI 2005). The NDMA lays down the policies, plans, and guidelines for disaster management to ensure timely prevention and mitigation of disasters as well as preparedness and response to disasters. The act also sets up a National Executive Council to assist the NDMA, which has members from ministries responsible for drinking water and health. Similar structures are laid down at the state and district levels. Drinking water and sanitation have been recognised as the minimum requirements to be provided in the relief camps by national, state, and district bodies ("*Disaster Management Act, 2005*" 2005).

Each of the institutions discussed above has laid down policies to formalise and promote within the system the necessary ethos for adequate WASH provisioning, so that people's vulnerabilities (whether singular or compounding) to the deterioration in WASH services caused by climate change can be reduced. We discuss this in the following subsections.



Right to clean drinking water is a fundamental right in the Indian Constitution

Existing central policies for improvement in WASH services

Ten central policies govern varied aspects of WASH services in India and are enacted by different ministries, as stated above. These are the *National Urban Sanitation Policy, 2008*, by the MoHUA; the *National Policy on Disaster Management*, 2009, by the NDMA; *The Right of Children to Free and Compulsory Education Act*, *2009*; the *National Water Policy, 2012*, by the MoJS; the *National Policy on Early Childhood Care and Education, 2013*, by the Ministry of Women and Child Development; the *National Faecal Sludge and Septage Management Policy, 2017*, by the MoHUA; the *National Health Policy, 2017*, by the MoH&FW; the *National Disaster Management Plan, 2019*, by the NDMA; the *National Education Policy, 2020*, by the MoE; and the *Disaster Management Plan of the Department of Drinking Water and Sanitation, 2023*, drafted by the department itself. More details on this can be found in Annexure 2.

Institutions for local self-governance are indispensable in ensuring adequate provisioning of WASH services

Existing central schemes, missions, and plans for improvement in WASH services

Table 1 explains some of the past efforts as well as ongoing efforts by the central government to improve access to various facets of WASH at the household, educational facility, and HCF levels. More details on this can be found in Annexure 3.

Table 1 The existing central schemes, missions, and plans for improvement in WASH in India

S. No.	Governance instrument	Objective/aim
WASH in households		
1.	*Jal Jeevan Mission* (JJM)	To provide 55 litres per capita per day (LPCD) of safe drinking water on a regular basis to every rural Indian household, school, and aanganwadi centre through a functional household tap connection (FHTC) by 2024 (MoJS 2019b).
2.	*Atal Mission for Rejuvenation and Urban Transformation* (AMRUT) – phase I and II	Phase I: To provide universal coverage of water supply through functional taps to all households in all the statutory towns in the country and improve coverage of sewerage/septage network in 500 cities (MoHUA 2021a). Phase II: To make cities water secure through a circular economy of water approach. The mission aims to provide universal coverage of water supply through functional taps to all households in all the statutory towns in the country and 100 per cent coverage of sewerage/septage management in 500 cities covered in the first phase of the scheme (MoHUA 2021a).
3.	*Swachh Bharat Mission (Rural)* – phase I and II	Phase I: To make rural India open defaecation free (ODF), by providing all rural households with improved sanitation facilities (MoJS 2020a). Phase II: To sustain the ODF-free status of villages and move them towards ODF+ status, whereby they safely manage their solid and liquid waste (MoJS 2020a).
4.	*Swachh Bharat Mission (Urban)* – phase I and II	Phase I: To make urban India ODF by providing it with improved sanitation facilities. Phase II: To make all cities of the country 'garbage-free' by focusing on sustainable management of solid waste and used water (including faecal sludge) with the help of citizen campaigns (MoHUA 2021b).

S. No.	Governance instrument	Objective/aim
5.	*Mission LiFE (LiFestyle for Environment)*	As a key to combatting climate change, *Mission LiFE* aims to nudge citizens to make environmentally conscious lifestyle choices for safeguarding a collective sustainable future. There are three phases in *Mission LiFE* that will help in achieving the goal of sustainability (MoEFCC 2024b): • Phase 1: Change in demand: make meaningful environmental changes in their daily lives. • Phase 2: Change in supply: modify demand to influence market adoption. • Phase 3: Change in policy: adopt sustainable policies for national and global impact.
WASH for educational facilities		
1.	*Swachh Bharat Swachh Vidyalaya* (SBSV)	To provide every school in India with functioning and well-maintained water, sanitation, and hygiene facilities (MoE 2014).
2.	*Swachh Vidyalaya Puraskar*	To reward and recognise government, government-aided, and private schools affiliated with central or state education boards that have demonstrated excellence in sanitation and hygiene practices by taking significant steps towards the mandates of the SBSV. The key objective is to motivate all other schools to adopt the key components under the SBSV (MoE 2021; MoHRD 2016).
WASH for healthcare facilities		
1.	*KAYAKALP* initiative	To give awards to public health facilities (up to level of district hospitals and central government hospitals) across the country based on internal, peer, and external assessments of criteria defined under the following heads: (i) hospital/facility upkeep, (ii) sanitation and hygiene, (iii) waste management, (iv) infection control, (v) support services, and (vi) hygiene promotion (MoH&FW 2015). In June 2024, the MoH&FW revised the *KAYAKALP* guidelines by incorporating 12 more climate resilience indicators. Also, in 2024, the MoE mandated the formation of youth and eco-clubs across all schools with a matching budgetary allocation.
2.	*Swachh Swasth Sarvatra* scheme	To enable GPs where *KAYAKALP*-awarded public health centres (PHCs) are located to become ODF; award INR 10 lakh to community health centres (CHCs) in ODF blocks to meet *KAYAKALP* standards; and provide training to CHC and PHC staff on WASH to promote capacity building (MoH&FW and MoDW&S 2016).
3.	*LaQshya (Labour Room Quality Improvement Initiative)*	To give awards to government medical college hospitals, district hospitals, sub-district hospitals, and other high-case-load community health facilities based on external assessments adhering to the national quality assurance standards checklist for labour room and maternity operation theatres. The checklist focuses on eight areas of concern: (i) service provision, (ii) patient rights, (iii) inputs, (iv) support services, (v) clinical services, (vi) infection control, (vii) quality management, and (viii) outcome. Among others, hand hygiene, waste management, availability of running and potable water 24/7, and availability of patient amenities, such as toilets and changing areas, are considered while conducting external assessments (MoH&FW 2017a).

Source: Authors' compilation based on various sources

Major announcements in the 2024–25 budget by the GoI

In the budget speech on 23 July 2024, the Union Minister for Finance and Corporate Affairs, Nirmala Sitharaman, stated, "*In partnership with the State Governments and Multilateral Development Banks we will promote water supply, sewage treatment, and solid waste management projects and services for 100 large cities through bankable projects. These projects will also envisage using treated water for irrigation and filling up tanks in nearby areas*" (Sitharaman 2024). For 2024–25, the *Swachh Bharat Mission (Rural)* (SBM(R)) has been allocated INR 71.9 billion (USD 863 million[4]) and the SBM Urban (SBM(U)), INR 50 billion (USD 600 million[5]), both unchanged from the previous year. Meanwhile, the *Jal Jeevan Mission* (JJM) has a budget of INR 701.6 billion (USD 8.4 billion[5]), marking a 0.2 per cent increase over last year's allocation (Ministry of Finance 2023, 2024).

1.3 Purpose and scope of the study

This study aims to create a comprehensive framework for assessing climate extreme induced risks to the WASH sector, specifically in the context of India. In order to provide a granular understanding of how various regions are impacted by these risks, this framework assesses and quantifies the effects of both acute and chronic climate events at the district level. This district-scale analysis will help to identify the specific regional vulnerabilities and risk factors that need to be addressed for building the overall climate resilience of the WASH sector across the country. The results from such an assessment can feed into works of state government departments (water supply or PHED, the state disaster management authority (SDMA), *panchayati raj* institutions, department of education, department of women and child development, department of health, department of urban affairs, etc.), the central government ministries corresponding to these state departments, and the not-for-profit organisations that work on the themes WASH or climate resilience, such as UNICEF.

This study's scope includes the evaluation of a wide range of climate-related hazards, such as heatwaves, floods, droughts, and cyclones, as well as long-term shifts in climate patterns, such as changes in seasonal temperature and rainfall, which can exacerbate WASH related challenges. In particular, we look at the WASH-specific exposure and vulnerability to such extreme climate events. The risk assessment framework is designed to integrate data on the natural, physical, institutional, and socio-economic factors to create a comprehensive, unified, and scalable tool that can be utilised by policymakers, administrators, and WASH professionals to ensure that the design of WASH systems and services is climate resilient. The ultimate goal is to provide actionable insights that will inform the development of targeted adaptation strategies, ensuring that India's WASH sector is equipped to withstand the increasing threats posed by climate change.

4 Conversion rate: 1 INR = 0.012 USD (as on 4 October 2024).

Objectives of the study

- Identification and finalisation of indicators for climate extremes–induced WASH risk in India, with a focus on children, women, and vulnerable groups.
- Computation of the district-level climate extremes–induced WASH risk index.
- Identification of risk hotspots and the factors driving the same.

This study conducts a national level climate risk assessment of the WASH sector at a district scale

Research questions

- What are the various natural, physical, social, economic, and institutional factors influencing climate extremes–induced risk to the WASH sector in India?
- What are the most crucial indicators that need to be monitored and managed to make the WASH sector resilient to climate extremes?
- What are the data sources necessary for monitoring these indicators?
- How can the climate risk assessment framework be used to improve decision-making concerning climate-resilient WASH systems?

This study conducted an interdisciplinary risk assessment of the WASH sector, assimilating insights gained by deploying hydrogeology, gender, healthcare, finance, disaster management, and other lenses.

Image: iStock

2. Methodology

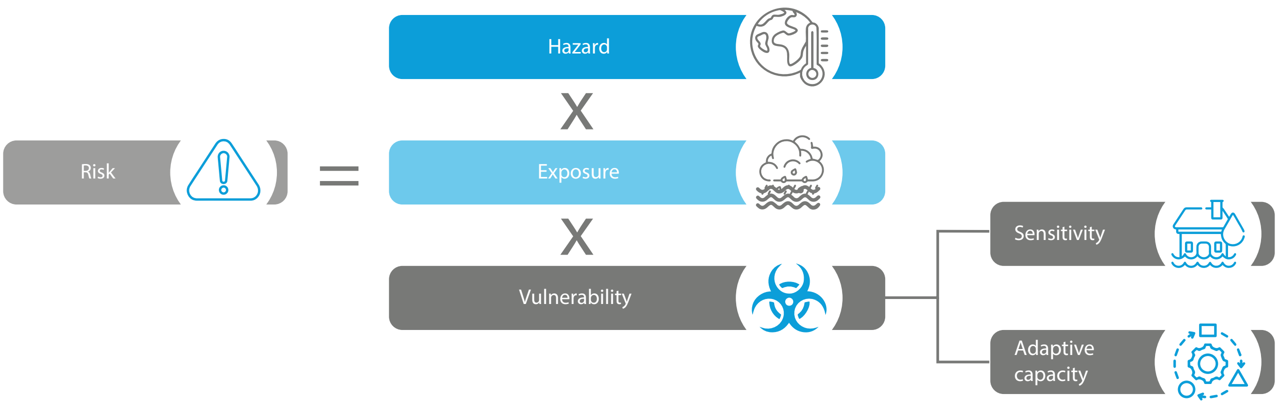
The methodology section is divided into two sub-sections – section 2.1 deals with methodology for development of risk index, and section 2.2 deals with that of systematic review of literature.

2.1 Development of the risk index

The risk to the WASH sector in India stemming from climate change–exacerbated extreme events can be expressed in the form of a risk index. A risk index is a composite measure that integrates various factors (used interchangeably with indicators in this study) contributing to overall hazard, exposure, and vulnerability within a system.

The development of the risk index in this assessment adheres to the methodology outlined in the IPCC *Fifth Assessment Report* (AR5), which states that risk arises from the interaction of three components: hazard, exposure, and vulnerability (Figure 1). The framework defines 'risk' as "*the potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems. In the context of climate change, risks can arise from potential impacts of climate change as well as human responses to climate change. Relevant adverse consequences include those on lives, livelihoods, infrastructure, health and wellbeing, economic, social and cultural assets and investments, infrastructure, services (including ecosystem services), ecosystems and species*" (Pachauri and Meyer 2014). The calculation of the risk index involved three specific steps, which are detailed in the following two subsections.

Figure 1 Risk assessment equation



Source: Representation based on (Pachauri and Meyer 2014)

2.2 Systematic review of the literature

A systematic literature review (SLR) is defined as a process for assembling, arranging, and assessing the existing literature in a research domain (Paul et al. 2021). The primary aim of an SLR is to conduct a comprehensive evaluation of the studies in an area by following a fixed procedure, which will result in an unbiased summary of the literature available on the subject. An SLR provides dual benefits: (i) it facilitates methodological understanding of the subject matter, and (ii) it presents findings in a robust manner through a reporting structure.

97 literary pieces were reviewed in this SLR to identify the indicators for risk assessment of the WASH sector

SLRs can be of many types, based on the research objective and the required output. Framework-based SLRs are part of domain-based reviews, which focus on a specific area or topic within the broader subject matter (Paul and Barari 2022). Such SLRs use robust structures to extract important insights, underscore research gaps, and provide directions for future research (Paul, Khatri, and Kaur Duggal 2023). Globally, a framework-based review coupled with organising frameworks is the most widely used methodology for conducting SLRs since it allows users to present a coherent synthesis of arguments with good clarity, coverage, and transparency (Paul et al. 2021).

The problem/intervention under consideration in an SLR can be a simple or complex one. All complex interventions are characterised by two common traits: intervention complexity and pathway complexity. The former refers to the multiplicity of components in the intervention, and the latter entails complicated or multiple causal pathways, feedback loops, synergies, mediators, and moderators of effect. In addition, complex problems may also have one or more of the following three additional characteristics: they could target multiple participants, groups, or organisational levels (population complexity); require multifaceted adoption, uptake, or integration strategies (implementation complexity); or work in a dynamic multidimensional environment (contextual complexity) (Booth et al. 2019; Kelly et al. 2017).

In this study, the SLR involved assessing indicators with the aim of understanding and explaining risk to the WASH sector in India. The problem at hand is complex and exhibits intervention, pathway, population, and contextual complexity. To explain the risk, its three sub-components (hazards, exposure, and vulnerability) have to be mapped separately, and both infrastructural and people-specific lenses should be taken into consideration – that is, the problem shows intervention complexity. These sub-components of risk influence and interact with each other, leading to multiple feedback loops and synergies, reflecting the presence of pathway complexity. For example, women's level of education is correlated with adoption rates of safe sanitation and menstrual hygiene behaviours (Metwally et al. 2007). Population complexity arises from a specialised focus on different types of vulnerable groups in this study – women, children, scheduled caste (SC), and scheduled tribe (ST) groups. The environment within which WASH systems operate in India is dynamic, as is obvious from the levels of governance and the ministries involved as well as the interaction of government with non-governmental space. This contributes to contextual complexity.

The detailed steps deployed to conduct the SLR for this complex intervention are explained below.

Research protocol – PSAlSAR framework

A research protocol is essential for a literature review. It ensures that the review is systematic by allowing replicability, transferability, and transparency of the work (Mengist, Soromessa, and Legese 2020). Additionally, protocols ensure that bias is reduced by establishing conditions for an exhaustive literature search. Hence, the first step in this SLR was to define the research protocol. This study makes use of the six-step PSAlSAR framework for defining the research protocol, which extends the more common Search, Appraisal, Synthesis, and Analysis (SALSA) framework by adding 'P' (Protocol) and 'R' (Report) to it (Mengist, Soromessa, and Legese 2019). The SALSA framework was devised in 2009 as a four-step simple analytical framework and remains one of the most used frameworks to guide SLRs because of its ability to impart accuracy, exhaustiveness, systematisation, and reproducibility to the review (Grant and Booth 2009; Mengist, Soromessa, and Legese 2019; Price and Cook 2022). Although defining the scope of the SLR and reporting the findings obtained from it are well-established steps in the literature, Mengist, Soromessa, and Legese added them to the SALSA framework to ensure that no step that is necessary to maintain the quality of an SLR is missed. Hence, this study follows the PSAlSAR framework.

The six steps of the framework are elaborated below.

Step 1: 'P' – Protocol (PICOST framework)

Step 1 consists of defining the scope of the study. While there are many frameworks available in the literature to define the same, this paper uses a variant of the very common 'PICO' framework (which, like the field of systematic review of literature, was developed for medical and health field) – the 'PICOST' – as it is suited for the kind of concepts this study entails (Booth et al. 2023; Davies 2011; Mengist, Soromessa, and Legese 2019; Sarri et al. 2022). An explanation of the framework for this study, as contextualised from the literature, is provided in Table 2.

Table 2 Elaboration of the PICOST framework to understand the research protocol for this study

Concept	Definition in the literature	Application for this study
P – Population or problem	The patient population that will be studied in the trial and the pertinent patient baseline, sociodemographic, and clinical characteristics. Define the selection criteria and consider biases that may be introduced by patient selection or attrition.	Scientific research on identifying/mapping/explaining indicators for assessing climate extreme–induced risks to the WASH sector. The search phrases were built using combinations of the following concepts (details in Annexure 4): • Components of WASH: drinking water, sanitation, and hygiene • Geographical boundary: regional (South Asia), country (India). • Types or causes of hazards: climate change, climate risk, extreme event, extreme climate event, flood, extreme flood, cyclone, extreme cyclone, drought, extreme drought, heat, extreme heat, hydro meteorological disaster, weather shocks • Vulnerabilities or vulnerable groups: women, children, low-income groups, disadvantaged castes • Deployment of infrastructural lens

Concept	Definition in the literature	Application for this study
I – Intervention	Techniques utilised to address the problem are identified	Only scientific research work that • explained the risk to one or more components of WASH; • arose from one or more causes/hazards listed above; • had a global, regional, country-specific, or sub-national focus; and • had infrastructural or people-specific or both lenses • was included. More details are given in Annexure 4.
C – Comparison	Placebo or active control comparator.	None
O – Outcome	The planned outcome measures and analyses in the protocol. Report all findings as defined in the protocol. Note any post hoc analyses.	• List of indicators that help to explain the risk to the WASH sector in India at the district level. • Segregation and frequency analysis of indicators into sub-components of risk (hazard, exposure, sensitivity, and adaptive capacity) and occurrence in the shortlisted literature, respectively
S – Setting	The setting (primary, specialty, inpatient, nursing homes, or other long-term care setting) where the study is implemented.	The indicators identified will be used for risk computation for the WASH sector in India, and similar studies from South Asia and India are sought. However, studies that capture risk to the WASH sector in any other part of the globe or have a focus ranging from global to local are accepted, provided they meet other criteria.
T – Timing	The time frame of treatment	2010 to 2023. In 2010, the UN General Assembly explicitly recognised the human right to water and sanitation. Since the study setting is also open to global studies, 2010 was considered an appropriate floor year. Also, the study began in early 2024, and hence, the year 2023 was chosen as the ceiling year.

Source: Authors' analysis based on Hartmann, Matchar, and Chang (2012); The United States Food and Drug Administration (2010)

Step 2: 'S' – Search

Step 2 entails defining the search strategy. For this study, we considered both grey and non-grey literature. Non-grey literature was interpreted to predominantly include literature from journals and books. As per the 12th International Conference on Grey Literature, "*grey literature stands for manifold document types produced on all levels of government, academics, business, and industry in print and electronic formats that are protected by intellectual property rights, of sufficient quality to be collected and preserved by library holdings or institutional repositories, but not controlled by commercial publishers, i.e., where publishing is not the primary activity of the producing body*" (Chatterjee 2017). Research reports by pioneering organisations who have worked on analysing risks to WASH from climate change were considered as non-grey literature. ScienceDirect and Cisne were chosen for searching non-grey literature. Works by think tanks and multilateral organisations which aligned with the SLR's objectives were chosen for grey literature. More details on this can be found in Annexure 4.

Step 3: 'AI' – Appraisal

In this stage, pieces from the non-grey literature and grey literature are screened for their relevance to the work's objectives (Mengist, Soromessa, and Legese 2019).

- The first step involved shortlisting papers and reports for full reading. This step had two parts:
  - Firstly, from the 184 search phrases used on both the platforms for non-grey literature, we identified a subset to be used, so as to optimise time. Five phrases were chosen from the category 'individual terminology'. For all other categories, the choice of phrases that had the term 'climate change' in them was as follows: one from the category 'geography – India'; one each from the categories 'social category – children', 'social category – women', and 'income category – low income'; two from the category 'caste'; and one from the category 'infrastructure'. This choice was meant to optimise for coverage of all the aspects in the SLR, taking into account the time constraints.
  - Secondly, on the basis of the two steps above, we defined the inclusion and exclusion criteria, which are given in Table 3.

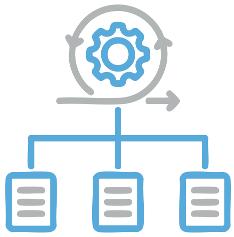
Table 3 Inclusion and exclusion criteria for pieces from the literature, as used in this study

S. No.	Criteria	Decision
1.a	When the predefined combinations of keywords exist at least in the title, keywords, or abstract of the paper (non-grey literature)	Included
1.b	Title, summary (if available), and table of contents speak of risk from climate-extreme events to WASH systems, access, and governance in general, or specifically those defined for this research; or if the title, summary (if available), and table of contents speak of WASH systems, access, and governance with respect to the vulnerabilities of women, children, and caste groups (grey literature)	Included
2.	The paper is published in a scientific peer-reviewed journal (non-grey literature)	Included
3.	The piece from the literature is in English (grey and non-grey literature)	Included
4.	The piece from the literature is a review of the literature or a meta-data piece (grey and non-grey literature)	Included
5.	Pieces from the literature published before 2010 and after 2023 (grey and non-grey literature)	Excluded
6.	Pieces from the literature that are not peer-reviewed (grey and non-grey literature)	Excluded
7.	Pieces from the literature that are not in open-access format (grey and non-grey literature)	Excluded

Source: Authors' analysis

Note: The inclusion criteria 1–3 must all be met for a piece from the literature to be included; if any one of the exclusion criteria is met, the piece will be excluded

- The second step was the removal of duplicates from articles and papers in the non-grey literature. This involved removing the duplicates within the same search phrase on the same platform, across search phrases on the same platform, and between the two platforms. For Cisne, the duplicate removal feature is inbuilt and has to be chosen each time a phrase is searched. ScienceDirect directly gives results without duplicates. For inter-phrase and inter-platform duplicate removal, a reference management software called EndNote was used by compiling the references. The final results from all the levels of duplicate removal can be seen in Figure ES2 and Annexure 4.
- The third step was assessing the pieces from the literature for eligibility for full-text reading. For non-grey literature, this was done by reading the full abstract. For grey literature, this was done by reading the whole summary and table of contents. Finally, 97 pieces from the literature were identified for inclusion in the literature review.



This SLR deployed PSALSAR, PICOST, and PRISMA frameworks

Step 4: 'S' – Synthesis

This step includes the extraction and classification of relevant data from selected papers to identify the climate risk indicators and subsequently understanding and using them to derive conclusions (Mengist, Soromessa, and Legese 2019). The pieces from the literature were read and the information from them was organised under the following heads: title of the paper, in-text citation, author, year of publication, objectives, methodology, variables identified, and rationale behind the variables. The results from this part of the study are provided in Annexure 5 and Annexure 12.

Step 5: 'A' – Analysis

This step encompasses the evaluation of the synthesised data along with further analysis to extract meaningful information from the selected papers to answer the research questions (Mengist, Soromessa, and Legese 2019). The objective of this systematic literature review was to identify the indicators that can capture the risks to the WASH sector in India. The steps involved are detailed below:

- Classify or reclassify the list of variables identified from the 97 pieces from the literature into hazard, exposure, adaptive capacity, and sensitivity variables, based on a 2017 study by Global Water Partnership and UNICEF (UNICEF and GWP 2017). This yielded a long list of 110 indicators under hazard, 31 under exposure, and 287 under vulnerability. Details of the same can be seen in Annexure 6 and Annexure 12.
- Shorten the long list of indicators to arrive at the final list of indicators. This was done using a frequency analysis of the indicators and also based on the authors' understanding of the relevance of these indicators to the Indian context. Initially, a list of 57 indicators was finalised. These details are given in Annexure 8 These indicators were further revised and re-ranked, and their spatial scales, temporal scales, sources of data, and classification under sub-components of risk were finalised in the stakeholder consultation. These details are given in Section 2.3.1.

Step 6: 'R' – Reporting (PRISMA framework)

This step of the literature review includes describing and presenting the above steps, the methods used, and the results obtained. For this, we used the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) framework, which is the most widely used set of guidelines for reporting systematic reviews and meta-analyses. This approach is more efficient in identifying the various indicators influencing the climate extremes–induced risk to WASH than random online searches or reaching out to authorities or researchers individually, with the latter usually having a low rate of response (Bassi, Schmidt, and De Stefano 2020).

Figure ES2 shows the results from various steps of this SLR using the PRISMA framework. This figure is based on the PRISMA 2020 flow diagram for new systematic reviews, which includes searches of databases, registers, and other sources (PRISMA 2020).

2.3 Computation of the risk index

After the identification of the indicators for all the sub-components of risk and their sources, the next step was to compute the risk index. This consisted of three steps, which are detailed in Sections 2.3.1 to 2.3.3 below.

Ranking of indicators

All the indicators identified through the SLR, excluding those for hazard, were ranked for their relevance in assessing the risk to the WASH sector in India and assigned weightages. For this, a five-point Likert scale was developed that ranged from 0 to 4, where 0 corresponds to not relevant, 1 to less relevant, 2 to moderately relevant, 3 to highly relevant, and 4 to very highly relevant. Fifty-two indicators, as presented in Annexure 8, were ranked on this five-point scale. All indicators under hazard were assumed to have equal weightage and were hence not subjected to stakeholder rating.

A two-step Delphi process was followed for finalising the indicators, their ranks, and data sources

A two-step Delphi process was followed to rank the exposure and vulnerability indicators. The first step entailed an online ranking of the indicators, and the second step was an in-person consultation to finalise the indicators, their ranks, and data sources. Both the steps were driven by the Chatham House Rule to ensure confidentiality, anonymity, and greater freedom of response. The decision to participate in one or both of the rounds was voluntary, and none of the sections or questions was mandatory to answer. The participants were well informed of the same, both in writing and verbally. The research methodology followed, intended use of the results generated from this study, and potential conflicts of interests were also well communicated in both the rounds. Further details are as follows:

- For the first step, which involved ranking the indicators online, a questionnaire was developed and shared with 42 experts These stakeholders were selected by the CEEW and UNICEF based on the collective experience and expertise of the research team. All care was taken to ensure that one third of the stakeholders were female and that most stakeholders had expertise not just in WASH, but also in areas that can capture the other lenses used in this study sufficiently well. Hence, stakeholders with specialisation in hydrogeology, gender, healthcare, climate science, disaster management, finance, and so on were chosen. Also, care was taken to ensure that these stakeholders (the number of stakeholders is given in brackets in what follows) spanned public and private academic institutions (3), government departments (5), public sector enterprises (2), funders and donors (3), and national and international civil society organisations (29). At least four follow-up rounds were conducted with the stakeholders to encourage them to reply to the questionnaire – two telephonic conversations and two emails each – after a waiting period of one week. Participation was voluntary, and 23 stakeholders responded to the questionnaire, whereas 19 did not. These 23 stakeholders had expertise in the following: disaster risk reduction (DRR) (1); finance (2); governance for climate action (1); hydrogeology (1); decentralised planning and local governance (1); public health and health systems strengthening (1); gender and water security (1); WASH, environment, and climate (2); WASH specialists in rural and/or urban areas (11); climate change adaptation in the water sector and flood risk assessment (1); and water quality and water treatment (1). Among them, three stakeholders represented the government and public sector enterprises.

The details of the questionnaire are provided in Annexure 7. The stakeholders also had the choice of suggesting new indicators along with their data source. The mode for each indicator was calculated and used for the next step.

- The second step was to invite all these stakeholders for an in-person consultation, in which they were presented with a simple mode of rank for each indicator from the previous round, and asked to re-rank them on the same scale of 0 to 4. Figure 2 is a photograph taken during the in-person consultation.

We held a facilitated discussion using a Mentimeter to obtain the new ranks of indicators. The consultation was attended by 22 stakeholders. Their details are presented in Annexure 9.

The closing or consensus criterion for rank of indicators was the **weighted average.** The ranks obtained in this round were finalised ranks, and 22 indicators obtained a different mode from the previous rank. The list of indicators was also reworked, based on the suggestions from the consultation, and their sources were finalised. Some indicators for which information is not available in the public domain were dropped. These are discussed separately in Section 2.4.2 and Section 4, the recommendations. It was ensured that priority was given to the latest publicly available datasets at the district level for computation of risk. The finalised list and details of indicators are given in Table 4. The ratio of indicator rank to the total rank score within each sub-index was used as the weight for each indicator.

Figure 2 **Consultation with stakeholders**

Image: CEEW

Representatives from the CEEW and 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

Table 4 Indicators and their sources for computation of the risk index

S. No.	Main indicator: correlation with risk – direct (D)/inverse (InV)	Sub-component of risk	Spatial scale	Time period of dataset	Source(s) of indicator	In-text citation
1	Number of flood events in the district in the past 40 years (D)	Hazard	District	1984–2023	CEEW analysis based on the EM-DAT database	(EM-DAT 2024)
2	Number of meteorological drought events in the district in the past 40 years (D)	Hazard	District	1984–2023	CEEW analysis based on the EM-DAT database	(EM-DAT 2024)
3	Change in the number of heavy rainfall (October, November, December) days in the past 10 years, as compared to climate baseline (D)	Hazard	District	2014–23 (Climate baseline: 1984–2013)	CEEW analysis	(Ministry of Earth Sciences, GoI 1979)
4	Change in the number of heavy rainfall (June, July, August, September) days in the past 10 years, as compared to climate baseline (D)	Hazard	District	2014–23 (Climate baseline: 1984 - 2013)	CEEW analysis	(Ministry of Earth Sciences, GoI 1979)
5	Change in the number of extremely hot days in the district for the past 10 years (D)	Hazard	District	2012–22 (Climate baseline: 1984–2013)	CEEW analysis	(Ministry of Earth Sciences, GoI 1979; Coordinated Regional Climate Downscaling Experiment 2024)
6	Number of cyclone events in the district in the past 40 years (D)	Hazard	District	1984–2023	CEEW analysis	(EM-DAT 2024)
7	Population density of the district in 2022 (D)	Exposure	District	2001 and 2011	CEEW analysis based on • City Population Website, (https://www.citypopulation.de/en/india/cities/) • Economic Survey 2022–23 Jammu and Kashmir Government, • Telangana Socio-economic Outlook 2023, • A-01: Number of villages, towns, households, population and area - Census 2001 • A-01: Number of villages, towns, households, population and area (India, states/UTs, districts and sub-districts) - Census 2011 • Area: Topographical Map of India by Survey of India	(Brinkhoff 2024; Directorate of Economics and Statistics of Kashmir 2023; Directorate of Economics and Statistics of Telangana 2023; MoHA 2001, 2011a; Ministry of Science and Technology 2022)

S. No.	Main indicator: correlation with risk – direct (D)/inverse (InV)	Sub-component of risk	Spatial scale	Time period of dataset	Source(s) of indicator	In-text citation
8	**Percentage of urban slum area to total area in the district (D)**	Exposure	District	2012	India – Urban Slums Survey, NSS 69th Round	(Ministry of Statistics and ProgramIPCme Implementation (MoSPI 2018)
9	**Percentage of rural population to total district population in 2022 (D)**	Exposure	District	2001 and 2011	Same as population sources in indicator 6	Same as indicator 6
10	**Percentage of rural water supply schemes which are less than or equal to five years of age, at the district level (InV)**	Exposure	District	2009–24	Format B-15: piped water supply schemes, JJM reports	(MoJS 2024a)
11	**Stage of groundwater development of the district (D)**	Exposure	District	2023	Dynamic groundwater resource of India – 2023	(MoJS 2023b)
12	**Groundwater quality index of the district (D)**	Exposure	District	2023	Water quality data of groundwater under the National Water Quality Monitoring Network (NWMP) – 2023	(MoEFCC 2022a)
13	**Surface water quality index of the district (D)**	Exposure	District	2023	Water quality of medium and minor rivers under the NWMP – 2023	(MoEFCC 2022b)
14	**Water resource availability per capita in the district (InV)**	Exposure	District	2019	CEEW estimates based on reassessment of water resources available in India using space inputs	(MoJS 2019a)
15	**Average percentage of stormwater drainage to total area of the district (InV)**	Exposure	District	Latest dataset available in the public domain	City-wise details of storm water drainage projects under the *Atal Mission for Rejuvenation and Urban Transformation* (AMRUT) – OGD Platform India and various service-level benchmarking reports of Indian states[5]	(Ministry of Electronics and Information Technology 2023)
16	**Percentage of forest cover to the total area of the district (InV)**	Exposure	District	2021	*India State of Forest Report 2021*	(MoEFCC 2021)
17	**Percentage of the total SC or ST households in the district with access to an improved source of drinking water within the premises that is available in sufficient quantities throughout the year (InV)**	Sensitivity	District	2019–21	Multiple Indicator Survey, NSS 78th round	(MoSPI 2023a)

5 Government of Rajasthan (2020); Local Government, Government of Punjab (2019); Government of Haryana (2020); State Urban Development Agency, West Bengal (2024); Urban Development Department, Government of Karnataka (2023); Urban Development and Urban Housing Department (2017); Urban Development and Housing Department, Government of Jharkhand (2019).

S. No.	Main indicator: correlation with risk – direct (D)/inverse (InV)	Sub-component of risk	Spatial scale	Time period of dataset	Source(s) of indicator	In-text citation
18	**Percentage of the total SC and ST households in the district with access to at least basic sanitation facilities (InV)**	Sensitivity	District	2019–21	Multiple Indicator Survey, NSS 78th round	(MoSPI 2023a)
19	**Percentage of the total SC and ST households in the district with access to at least basic hygiene facilities (InV)**	Sensitivity	District	2019–21	Multiple Indicator Survey, NSS 78th round	(MoSPI 2023a)
20	**Maternal mortality ratio (MMR) at the state level (D)**	Sensitivity	State	2018–20	Sample Registration System (SRS) – Special Bulletin on Maternal Mortality in India 2018–20	(MoHA 2020)
21	**Slope of the district (D)**	Sensitivity	District	-	United States Geological Survey	(USGS 2024)
22	**Altitude (elevation) of the district (InV)**	Sensitivity	District	-	United States Geological Survey	(USGS 2024)
23	**Total fertility rate at the state level (D)**	Sensitivity	State	2019–21	National Family Health Survey (NFHS-5), 2019–21	(MoH&FW and International Institute for Population Sciences 2021a)
24	**Change in land use/land cover of the district over 10 years (2005–15) (D)**	Sensitivity	District	2005–15	CEEW analysis based on Bhuvan, ISRO data	(NRSC 2023)
25	**Percentage of the total district population under the age of 5 and above 65 years, in 2022 (D)**	Sensitivity	District	2001 and 2011	C-14: Population in the five-year-old age group by residence and sex, Census 2001 and 2011	(MoHA 2011b)
26	**Percentage of children under five years old who are wasted, at the district level (D)**	Sensitivity	District	2019–21	National Family Health Survey (NFHS-5), 2019–21	(MoH&FW and International Institute for Population Sciences 2021a)
27	**Percentage of children under five years old who are stunted, at the district level (D)**	Sensitivity	District	2019–21	National Family Health Survey (NFHS-5), 2019–21	(MoH&FW and International Institute for Population Sciences 2021a)
28	**Percentage of all rural drinking water schemes relying only on surface water in the district (InV)**	Sensitivity	District	2024	Format B40: schemes with water source status, JJM reports	(MoJS 2024b)
29	**Percentage of all rural drinking water schemes relying only on groundwater in the district (D)**	Sensitivity	District	2024	Format B40: schemes with water source status, JJM reports	(MoJS 2024b)
30	**Percentage of persons with disabilities at the district level (D)**	Sensitivity	District	2019–21	Microdata – National Family Health Survey (NFHS 5), 2019–21	(MoH&FW and International Institute for Population Sciences 2021b)
31	**Sex ratio of the total district population (D)**	Sensitivity	District	2019–21	National Family Health Survey (NFHS-5), 2019–21	(MoH&FW and International Institute for Population Sciences 2021a)

S. No.	Main indicator: correlation with risk – direct (D)/inverse (InV)	Sub-component of risk	Spatial scale	Time period of dataset	Source(s) of indicator	In-text citation
32	**Percentage of rural agricultural landless households among the total households, at the state level (D)**	Adaptive capacity	State	2019	NSS Report No. 587: Situation Assessment of Agricultural Households and Land and Livestock Holdings of Households in Rural India, 2019, NSS 77th Round	(MoSPI 2021)
33	**Percentage of distress migrants among the total migrants in a district (D)**	Adaptive capacity	District	2019–21	Unit Level Data of Periodic Labour Force Survey (PLFS) July 2020 to June 2021, National Data Archive	(MoSPI 2023b)
34	**Percentage of the total population that is multidimensionally poor in a district (D)**	Adaptive capacity	District	2019–21	India – National Multidimensional Poverty Index: A Progress Review 2023	(NITI Aayog 2023)
35	**Prevalence of diarrhoea in the two weeks preceding the survey in children under five years old, at the district level (D)**	Adaptive capacity	District	2019–21	Microdata – National Family Health Survey (NFHS 5), 2019–21	(MoH&FW and International Institute for Population Sciences 2021b)
36	**Percentage of the total households having exclusive access to water from an improved source of drinking water located in the household premises, which is available in sufficient quantities throughout the year, at the district level (InV)**	Adaptive capacity	District	2019–21	Multiple Indicator Survey, NSS 78th round	(MoSPI 2023a)
37	**Percentage of rural schools and *aanganwadis* with availability of drinking water through tap connection, at the district level (InV)**	Adaptive capacity	District (rural)	2024	Format F26: Status of Pipe Water Supply in School, JJM reports	(MoJS 2024e)
38	**Percentage of rural households having individual household latrines, at the district level (InV)**	Adaptive capacity	District (rural)	2024	Format ER 77 (A): *Swachh Bharat Mission* target versus achievement on the basis of detail entered (entry status), SBM(R) Phase II MIS	(MoJS 2024d)
39	**Percentage of rural schools and *aanganwadis* having running water in toilets/ urinals, at the district level (InV)**	Adaptive capacity	District (rural)	2024	Format F26: Status of Pipe Water Supply in School, JJM reports	(MoJS 2024e)
40	**Percentage of rural schools in the district with gender-separate toilets (InV)**	Adaptive capacity	District (rural)	2024	Format F26: Status of Pipe Water Supply in School, JJM reports	(MoJS 2024e)
41	**Percentage of households with hand-washing facility available within the premises, at the district level (InV)**	Adaptive capacity	District	2019–21	Multiple Indicator Survey, NSS 78th round	(MoSPI 2023a)
42	**Percentage of rural schools and *aanganwadis* having hand-washing facilities, at the district level (InV)**	Adaptive capacity	District (rural)	2024	Format F26: Status of Pipe Water Supply in School, JJM reports	(MoJS 2024e)

S. No.	Main indicator: correlation with risk – direct (D)/inverse (InV)	Sub-component of risk	Spatial scale	Time period of dataset	Source(s) of indicator	In-text citation
43	**Percentage of women aged 15–24 years in the district who use hygienic methods of protection during their menstrual period (InV)**	Adaptive capacity	District	2019–21	National Family Health Survey (NFHS-5), 2019–21	(MoH&FW and International Institute for Population Sciences 2021a)
44	**Percentage of women in the district with 10 or more years of schooling (InV)**	Adaptive capacity	District	2019–21	National Family Health Survey (NFHS-5), 2019–21	(MoH&FW and International Institute for Population Sciences 2021a)
45	**Average distance people travel to the principal source of drinking water at the district level (D)**	Adaptive capacity	District	2018	Multiple Indicator Survey, NSS 78th round	(MoSPI 2023a)
46	**Number of functional government health facilities in the district per 1,000 population (ID)**	Adaptive capacity	District	2021–22	Rural Health Statistics – 2021–22	(MoH&FW 2022)
47	**Annual average budget expenditure by government on WASH in rural areas per district per household for the years 2020–23 (InV)**	Adaptive capacity	District (rural/ IHHLs)	2020–24	Format MR 14: Physical and Financial Progress of IHHL Phase 2, SBM(R) Phase II MIS Format C33: State-wise Number of Schemes and Total Expenditure, JJM reports	(MoJS 2024f, 2024c)
48	**Restoring basic services as a part of the district disaster management plan (InV)**	Adaptive capacity	District	2020	CEEW analysis based on district disaster management plans (DDMPs)	CEEW analysis based on DDMPs
49	**Restoring critical infrastructure (transportation, telecommunication, health facilities, educational facilities, water supply) as a part of the district disaster management plan (InV)**	Adaptive capacity	District	2020	CEEW analysis based on DDMPs	CEEW analysis based on DDMPs
50	**Density of automatic weather stations (AWSs) and automatic rain gauge (ARG) stations in the district, per square kilometre (InV)**	Adaptive capacity	District	2023	AWS ARG Network, Indian Meteorological Department	(Ministry of Earth Sciences, GoI 2022)
51	**Percentage of the total villages or *gram panchayats* in districts with village water sanitation committees, or other similar local institutions in rural areas (InV)**	Adaptive capacity	District	2024	*Jal Jeevan Survekshan* 2023, JJM mission	(MoJS 2024h)
52	**Percentage of the total villages declared as ODF+ in the district (InV)**	Adaptive capacity	District	2024	SBM(R) Phase II MIS	(MoJS 2024g)
53	**Percentage of the total wards/urban local bodies declared as ODF++ in the district (InV)**	Adaptive capacity	District	2024	Swachh certification result, SBM(U) dashboard	(MoHUA 2024)

Source: Authors' analysis

Note: IMD, India Meteorological Department; IMDAA, Indian Monsoon Data Assimilation and Analysis; OGD, Open Government Data

More details on the computational methodology for each indicator are given in Annexure 10.

Normalisation and reclassification of indicators

The values of all the indicators were normalised by converting their units to dimensionless units, with the values of the normalised indicators lying between 0 and 1. The min–max normalisation technique was used to make them dimensionless. The normalisation is based on the functional relationship of indicators. For directly correlated indicators, that is, where risk increases with an increase in the value of the indicator, the following formula was used:

$$X_{ij}^{P} = \frac{X_{ij} - Min_i\{X_{ij}\}}{Max_i\{X_{ij}\} - Min_i\{X_{ij}\}'}$$

where *i* refers to the list of indicators and *j* refers to the district list; X_{ij} refers to a particular data value in the list of indicators (i), 'P refers to positive, Min refers to the minimum value in the list (i), and Max refers to the maximum value in the list (i).

For inversely related indicators, that is, where risk decreases with an increase in the value of the indicators, the following formula was used:

$$X_{ij}^{N} = \frac{Max_i\{X_{ij}\} - X_{ij}}{Max_i\{X_{ij}\} - Min_i\{X_{ij}\}'}$$

where 'N' refers to negative, and all other variables are as explained for the first equation.

Sub-indices and index computation

Once the indicators were normalised as per the relation to risk, the sub-indices were calculated by adding the product of each indicator's normalised score and its weightage. This was done for each district to compute the hazard, exposure, and vulnerability (sensitivity and adaptive capacity) sub-indices. The maximum value that could be obtained for each sub-index was 1, and the minimum was 0. Hazard, exposure, and vulnerability were divided into five categories – very low, low, medium, high, and very high – based on the natural quantile break method using QGIS software (Tables 5, 6, and 7).

Table 5 Hazard categories with their respective ranges of score

Range of score	Hazard category
0–0.1358	Very low
0.1358–0.1737	Low
0.1737–0.2090	Moderate
0.2090–0.2575	High
0.2575–0.5183	Very high

Source: Authors' decision based on equal quantiles

Table 6 Exposure categories with their respective ranges of score

Range of score	Exposure category
0–0.3288	Very low
0.3288–0.3703	Low
0.3703–0.4009	Moderate
0.4009–0.4407	High
0.4407–0.5838	Very high

Source: Authors' decision based on equal quantiles

Table 7 Vulnerability categories with their respective ranges of score

Range of score	Vulnerability category
0–0.2285	Very low
0.2285–0.2998	Low
0.2998–0.3603	Moderate
0.3603–0.4572	High
0.4572–1	Very high

Source: Authors' decision based on equal quantiles

Table 8 Risk categories with their respective ranges of score

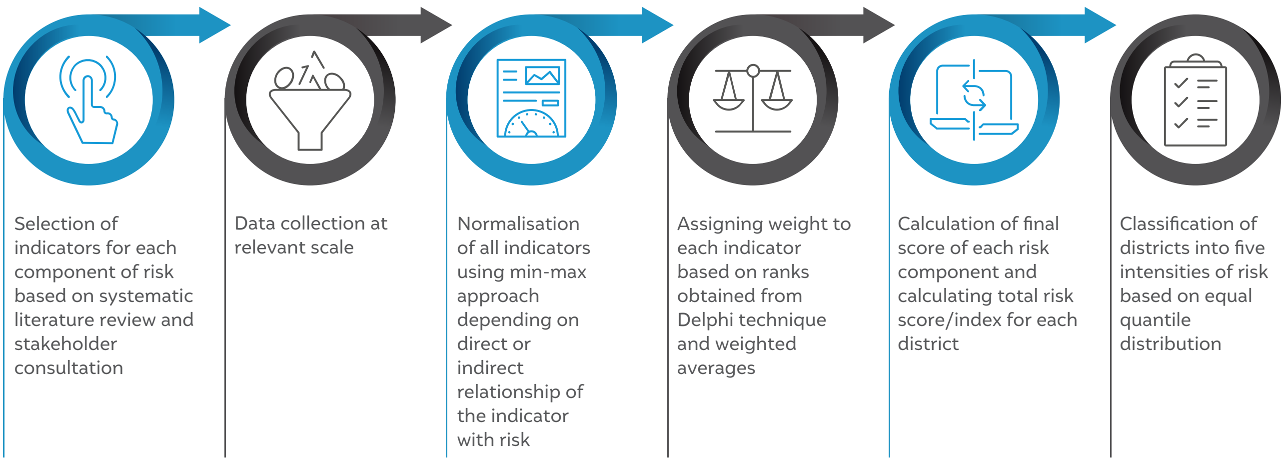
Range of score	Risk category
0–0.0135	Very low
0.0135–0.0197	Low
0.0197–0.0265	Moderate
0.0265–0.0379	High
0.0379–0.0957	Very high

Source: Authors' decision based on equal quantiles

After the sub-indices were calculated, the composite risk index score was computed for each district using the risk equation. To maintain uniformity, the risk scores were again normalised and categorised based on the five different types – very low, low, moderate, high, and very high – applying the same techniques used for hazard, exposure, and vulnerability which is depicted in Table 8

Following the IPCC AR5 risk assessment framework, the risk index was computed for all the districts. Furthermore, the top five drivers in each of the categories – exposure, sensitivity, and adaptive capacity – were identified (Pachauri and Meyer 2014). This was done by accounting for the total number of districts falling under the range, which was given by the interval between the maximum score and half of the maximum score obtained for that indicator. Since equal weightage has been given to all forms of hazard considered, the above analysis was not done for it. The steps are presented in Figure 3.

Figure 3 Schematic representation of the stepwise approach to compute the risk index



Source: Authors' analysis

2.4 Limitations of the study

The study's limitations arise from two aspects: one pertaining to the design and objectives of the study and the other to data availability and risk computation. They are detailed in Sections 2.4.1 and 2.4.2 below.

Limitations in the study arise from study design, and in the data sources used for index computation

Limitations of the study design

- The study focuses on extreme weather events such as cyclones, floods, and heatwaves but does not explicitly take into account associated events and other hazards such as landslides, rising sea levels, glacier melting, chemical disasters, and so on.
- The vulnerable groups considered are not exhaustive. For example, genders other than women, sanitation workers, and people with disabilities were not considered implicitly in the systematic review of literature categories.
- The study uses ScienceDirect and Cisne as the database and search engine, respectively. Hence, insights that could have been obtained from databases which are not covered in these may have been omitted.
- The study does not account for literature published in any language other than English. Therefore, findings from work done in other languages may not have been taken into account.
- The study does not take into account the literature which is not freely available in the public domain, which could have limited the information to that available only in open-access domains.
- While the index can support state- and district-level policymaking and planning, there is not sufficient localised insight available from the study to inform actions at a granular level. For instance, localised dynamics and nuances at the block level in India may not have been fully captured in this index. Therefore, finer-level assessments are needed.

Limitations related to the data used for computing indicators

These limitations are of the following three types:

- Some of the datasets used for computing the indicators are not from the most recent period.
- Some of the datasets used for computing the indicators do not capture all the aspects necessary for formulating a holistic understanding of the indicator.
- The datasets used for computing the indicators are either not available or not available at the required scale in the public domain.

Some examples for each of these data limitations are given in Annexure 11.

3. Results and findings

Image: iStock

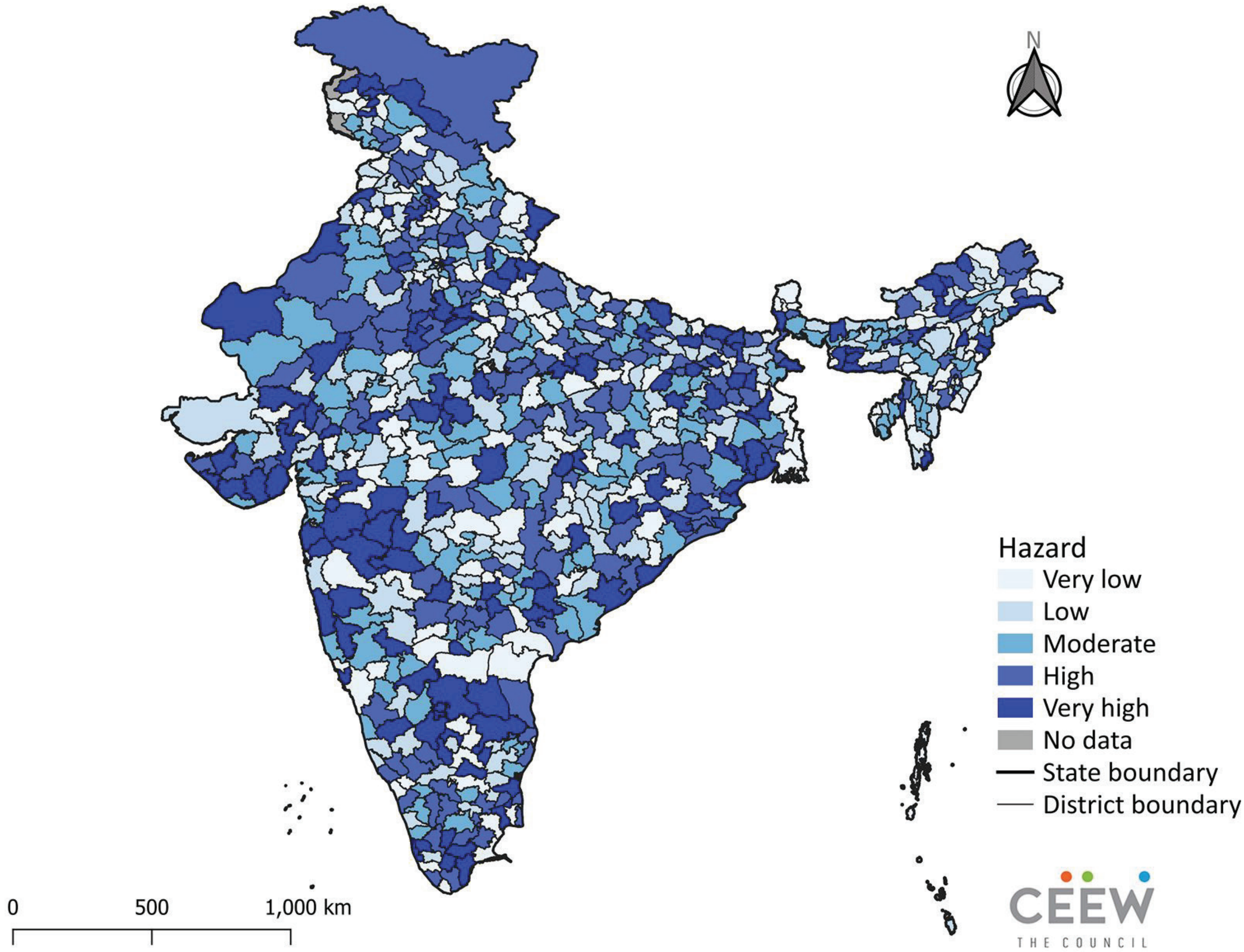
District level scores for hazard, exposure, and vulnerability (adaptive capacity and sensitivity) were calculated, and used to calculate risk index for WASH sector. The same were then used for generating maps. Findings from these are reported in sub-sections 3.1 to 3.4.

3.1 Hazard

District-level hazard to WASH is presented in Figure 4. It can be seen that **districts** (number of districts in brackets) in states like **Gujarat (13), Maharashtra (12), Uttar Pradesh (12), Bihar (10), Odisha (8), Tamil Nadu (8), Karnataka (7), and Rajasthan (7)** fall under the **very high category of hazards**. Many districts in **Uttar Pradesh (23), Tamil Nadu (11), Rajasthan (11), Bihar (8), and Madhya Pradesh (7)** also fall under the **high-hazard category**. More details on the categorisation of districts under the five categories of hazards (very low to very high) area given in Annexure 1.

Overall, **147 districts are in the very high category of hazard and 145 are in the high category**, together accounting for about **40 per cent** of the total number of districts in the country. Changes in the patterns of monsoons are a prime cause of extreme climatic events, which generate the above hazards and transform such areas into those with high risk.

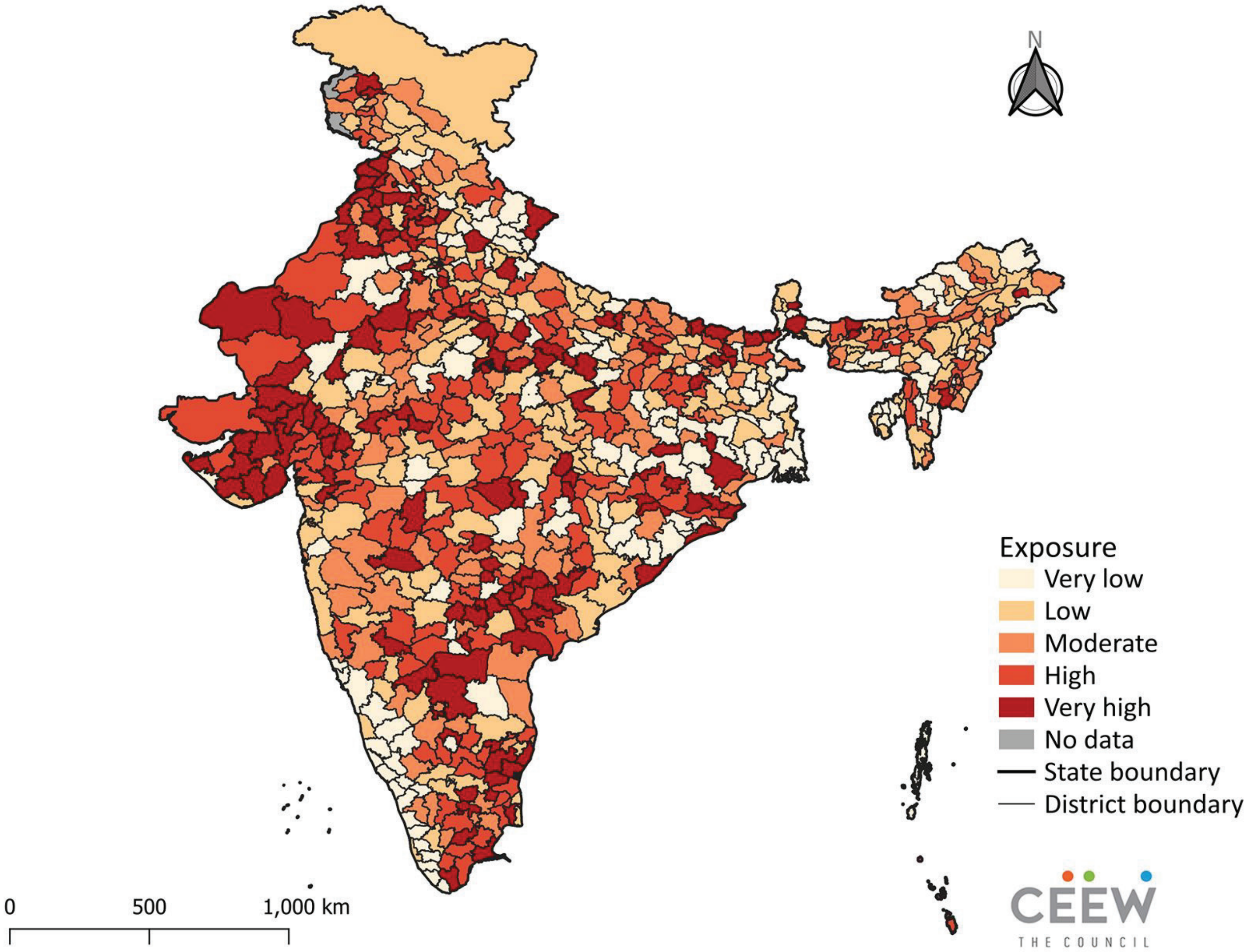
Figure 4 Hazard map at the district scale for India



Source: Authors' analysis

3.2 Exposure

Figure 5 Exposure map at the district level for India



Source: Authors' analysis

District-level exposure to WASH risk is presented in Figure 5, including districts (numbers mentioned in brackets) in the following states: **Gujarat (17), Punjab (13), Rajasthan (8) in western India; Telangana (17), and Tamil Nadu (12) in southern India; and Bihar (11) and Odisha (9) in eastern India.** Some districts in **Uttar Pradesh (13), Haryana (7), Madhya Pradesh (6), and Maharashtra (5)** also fall under the **very-high-exposure** category. Some districts in parts of **Uttar Pradesh (16), Madhya Pradesh (13), Tamil Nadu (13), Maharashtra (10), Assam (9), and Karnataka (8)** fall under the **high-exposure** category. More details on the classification of districts according to the five categories of exposure are available in Annexure 1.

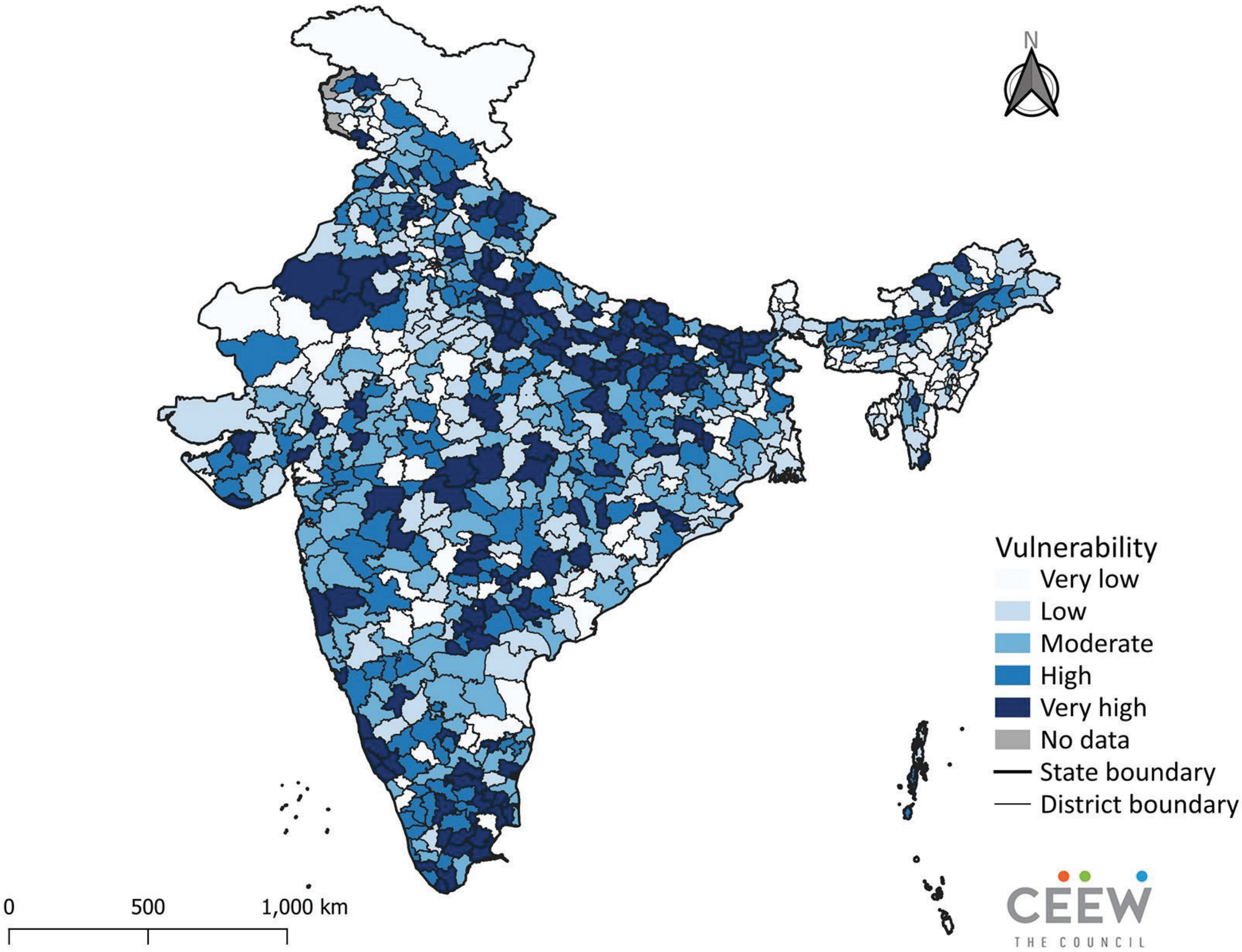
Overall, **148 districts lie in the very high category of exposure and 146 lie in the high-exposure** category, together accounting for more than **40 per cent** of all the districts in the country. The majority of districts fall under the very-high-exposure category for the WASH sector. The following five indicators have been identified as the top drivers of exposure:

- **Water resource availability per capita in the district :** Water resource availability in arid and semi-arid regions and in states such as Gujarat, Punjab, Haryana, Rajasthan, Telangana, and Tamil Nadu is already critically low, which leads to a high degree of water stress due to droughts, thereby contributing to WASH risk.
- **Average percentage of storm water drainage to total area of the district:** Storm water drainage is crucial to manage extreme climate events such as rainfall and floods, and it is imperative for urban and rural areas to build the necessary infrastructure to manage these events.
- **Percentage of forest cover to the total area of the district:** Regions with low forest cover are highly susceptible to extreme events because the capacity of such regions to absorb climate shocks is low. For example, clearing forests for agro-production can decrease transpiration, reduce the interception of precipitation, and increase the volume of run-off. It also reduces infiltration and increases flood run-off and peak discharges, ultimately impacting the soil's capacity to store water.
- **Percentage of rural population to total district population in 2022:** The extent and adequacy of WASH services in rural households, educational facilities, and HCFs are conventionally lower than that in urban areas, thus increasing exposure of the rural population.
- **Percentage of rural water supply schemes which are less than or equal to five years of age, at the district level:** Adequate, well-maintained infrastructure is necessary to weather extreme climatic events and conserve basic WASH services during these events.

60% of districts have very low to moderate exposure of the WASH sector to climate extremes

3.3 Vulnerability

Figure 6 The vulnerability map at the district level for India



Source: Authors' analysis

District-level vulnerability to WASH risk is presented in Figure 6. There is a high variability in vulnerability across India. It can be seen that some districts (numbers mentioned in brackets) in the states of **Uttar Pradesh (32), Bihar (23), Tamil Nadu (17), Telangana (14), and Madhya Pradesh (7) show very high levels of vulnerability. Parts of Uttar Pradesh (17), Assam (11), Madhya Pradesh (9), Karnataka (10), Tamil Nadu (9), Telangana (9), and Maharashtra (8)** show **high levels** of vulnerability.

More details on the classification of districts under the five categories of vulnerability are given in Annexure 1.

Overall, **152 districts lie in the very high category of vulnerability, and 147 lie in the high category,** together accounting for **more than 41 per cent** of all the districts in the country.

The majority of districts fall under the very-high-vulnerability category for the WASH sector. The following five indicators have been identified as the top drivers of sensitivity:

59% of districts have very low to moderate vulnerability of the WASH sector to climate extremes

- **Altitude (elevation) of the district:** In areas with lower elevation (such as valleys), the WASH infrastructure and services are more vulnerable to disruptions from climatic extreme events.
- **Percentage of all rural drinking water schemes relying only on surface water in the district:** Surface water and, hence, surface water–based schemes are more resilient to the impacts of climate change.
- **Percentage of all rural drinking water schemes relying only on groundwater in the district:** Vulnerability is high in hard-rock terrains where groundwater is limited and overexploited. These include regions in Andhra Pradesh, Karnataka, Maharashtra, Telangana, and Tamil Nadu. Additionally, the high dependence on groundwater in states like Punjab, Haryana, Gujarat, Maharashtra, and Rajasthan is also noticeable.
- **Percentage of SC and ST households in the district with access to at least basic hygiene facilities:** The socio-economic development of SCs and STs has been historically low in India. Their access to WASH facilities remains no exception.
- **Percentage of SC and ST households in the district with access to at least basic sanitation facilities:** As mentioned above, because of their low socio-economic status, SCs and STs face challenges in accessing basic sanitation facilities.

The following five indicators have been identified as the top drivers of adaptive capacity:

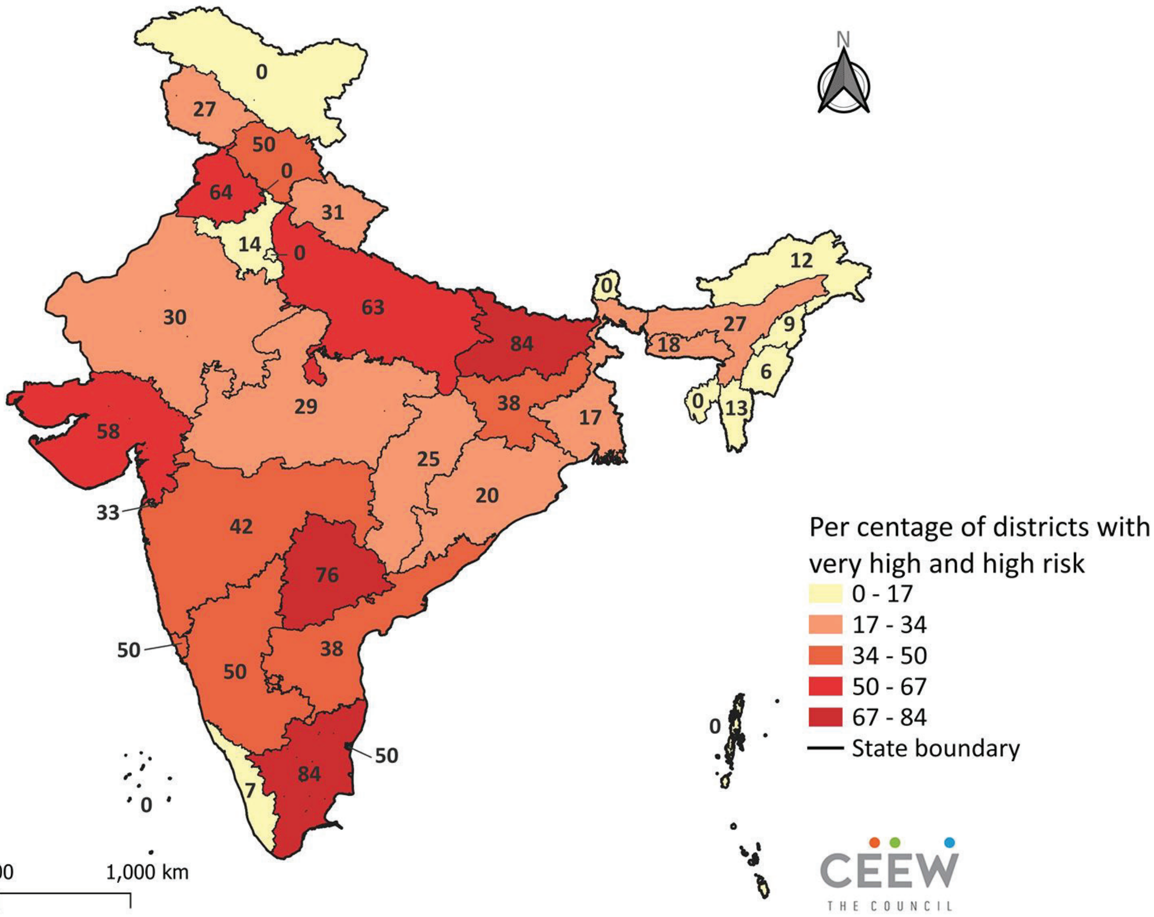
- **Number of functional government health facilities in the district per 1,000 population:** Such facilities will increase the adaptive capacity of a population to disasters and associated WASH risks because they will help in recovery after disasters.
- **Density of automatic weather stations (AWSs) and automatic rain gauge (ARG) stations in the district, per square kilometre:** A high density of AWSs and ARG stations can ensure more localised weather forecasting, which will help in comprehending and pre-empting risk better.
- **Percentage of rural schools and** *aanganwadis* **with availability of drinking water through tap connection, at the district level:** Adequate drinking water services in educational facilities are necessary not just for the health of children but to also promote better overall learning, both of which enable better disaster response. Also, such facilities could act as rehabilitation centres during times of disasters.
- **Annual average budget expenditure by government on WASH in rural areas per district per household for the years 2020–23:** This indicator can help in comprehending the efforts and intent of the government to strengthen and climate proof the delivery of WASH services.
- **Percentage of total wards/urban local bodies (ULBs) declared as ODF++ in the district:** This is a more holistic and robust indicator that captures various dimensions of the sanitation chain, such as mechanised cleaning of septic tanks and sewers, safe collection and treatment of used water, and safe management of faecal sludge from all toilets.

3.4 Risk index

District-level risk index for WASH is presented in Figure ES3. It can be seen that **very high risk** is seen in districts (numbers mentioned in brackets) in the northern region comprising the states of **Uttar Pradesh (20), Bihar (17), and Punjab (6)**. In the western region, districts of **Gujarat (12), Maharashtra (8), and Rajasthan (6)** fall under the very-high-risk category. In the southern region, parts of **Tamil Nadu (18), Telangana (13), and Karnataka (5)** show very high category of risk. In the **high-risk category**, there is a wide distribution across different regions of the country, including **Uttar Pradesh (23), Bihar (11), Madhya Pradesh (11), Tamil Nadu (10), Maharashtra (9), Telangana (7), and Gujarat (7).** More details on the classification of districts under the five categories of risk (very low to very high) are given in Annexure 1.

Overall, 148 districts have very high risk, 147 have high risk, 149 have moderate risk, 151 have low risk, and 136 have very low risk to WASH systems and services due to climate extremes.

Figure 7 Map highlighting the states with districts falling under the very-high-risk and high-risk categories



Source: Authors' analysis

At the state level, the total number of districts in different categories were determined to estimate the proportion of very-high-risk to very-low-risk districts. It can be seen that **Bihar and Tamil Nadu emerge as the states with the most number of districts falling in the very-high-risk and high-risk categories, followed by Telangana, Uttar Pradesh, and Punjab,** with more than 60 per cent of districts in the very-high-risk and high-risk categories. In **Gujarat, Himachal Pradesh, Puducherry, and Karnataka** more than 50 per cent of the districts are in the very-high-risk and high-risk categories.

On the other hand, **Ladakh, Chandigarh, Lakshadweep, Tripura,** and **Andaman and Nicobar Islands** have the least percentage of districts in the very-high-risk and high-risk categories. More details can be seen in Figure 7 and Table 9.

Table 9 Risk distribution across different states with the number of districts falling under the different risk categories

Intensity of risk ⇢ State/UT ⇣	Very high	High	Moderate	Low	Very low
Andaman and Nicobar islands	-	-	-	-	3
Andhra Pradesh	1	4	1	3	4
Arunachal Pradesh	3	2	5	7	8
Assam	5	5	10	6	7
Bihar	17	11	5	3	2
Chandigarh	-	-	-	-	1
Chhattisgarh	6	7	5	6	4
Dadra and Nagar Haveli and Daman and Diu	-	1	-	-	2
Delhi	-	2	-	1	8
Goa	1	-	-	-	1
Gujarat	12	7	8	5	1
Haryana	1	3	7	6	5
Himachal Pradesh	1	5	2	4	-
Jammu and Kashmir[6]	4	3	3	3	7
Jharkhand	3	4	9	6	2
Karnataka	5	6	6	11	2
Kerala	-	2	4	5	3
Ladakh	-	-	1	-	1
Lakshadweep	-	-	1	-	-
Madhya Pradesh	6	11	11	15	9
Maharashtra	8	9	6	8	5
Manipur	-	3	2	3	8
Meghalaya	1	1	1	2	6
Mizoram	1	1	-	2	4
Nagaland	1	-	1	3	6
Odisha	6	5	8	5	6
Puducherry	-	1	-	2	1
Punjab	6	4	6	4	2

6 Mirpur and Muzaffarabad districts in the state of Jammu and Kashmir are not considered for risk analysis due to limited data, which can result in biased risk values.

Intensity of risk ⇢ State/UT ⇣	Very high	High	Moderate	Low	Very low
Rajasthan	6	6	13	4	4
Sikkim	-	-	-	1	3
Tamil Nadu	18	10	4	4	1
Telangana	13	7	5	7	1
Tripura	-	-	1	2	5
Uttar Pradesh	20	23	15	12	5
Uttarakhand	2	1	4	4	2
West Bengal	1	3	5	7	7
Total	**148**	**147**	**149**	**151**	**136**

Source: Authors' analysis based on results shown in Annexure 1

Risk-assessment based allocation of financial resources towards the WASH sector is crucial for the sector's climate proofing.

Image: iStock

4. Conclusion and recommendations

The Indian government and state governments have undertaken many initiatives to deliver adequate WASH services at the household, educational facility, and HCF levels. However, there is much room for improvement in areas related to making the WASH infrastructure and service delivery mechanisms resilient to climate extreme events. This should be done in an informed and scientific manner, using an interdisciplinary lens to carry out climate risk assessments of the WASH sector. We have attempted to do this at the national level in this study. Based on our findings, we would like to propose the following recommendations:

Open-access and interactive dashboards can enable interdisciplinary WASH climate-risk assessments

- **Setting up data dashboards to facilitate such assessments:** Open-access and interactive dashboards which can provide one-stop solutions for such assessments can lead to more efficiency and comprehensiveness in the computation of the risk index. These dashboards need to include information not only from the relevant schemes and policies under various ministries being considered, but also from datasets obtained from agencies whose core mandate is data collection. This will ensure that datasets such as Census, NFHS, NSS, and so on are also included. At the state level, such dashboards can be hosted by the water supply department or PHED, with relevant editing rights to all the departments from which input for such risk assessments is sought.
- **Strengthening of existing datasets to enable such risk assessments:** Since the governance of different aspects of the WASH sector is fragmented, the databases that can potentially enable a more nuanced and efficient risk assessment are not integrated (as outlined in Section 2.4). The above-mentioned recommendations need to be implemented, so that datasets are updated and capture more aspects necessary for the holistic assessment of any indicator.

  Another issue that is pertinent in this regard is the public availability of data. Since aspects of WASH are linked to right to life as mandated in the Constitution of India, there is a compelling case to have this data freely available in the public domain.
- **Mainstreaming granular-level interdisciplinary risk assessments of the WASH sector**: There is a need to conduct risk assessments of the WASH sector to climate extremes at a sub-national (district and block) level. As shown in this study, the indicators that explain the risk to the WASH sector come under a wide spectrum of governance areas. They include income, education, gender, child development, status of public health facilities, funds allotted to land use land covers, frequency of hazards, and so on. These subjects are governed by different ministries, mostly under the state and concurrent list, giving rise to sharp distinctions in the governance scape of these indicators. Additionally, there is a multitude of variation in the natural factors that influence these indicators, which can only be captured at finer spatial levels. If all these differences are

to be taken into account, risk assessment of the WASH sector needs to be conducted at a granular scale, accommodating influencing factors from interdisciplinary areas. Mandates within the government system to mainstream such assessments can go a long way in building climate resilience. The framework deployed in this study can support such assessments. At the state level, these assessments should be joint efforts between the water supply department/PHED and SDMA, with the former leading it. Other state departments should be consulted for inputs at various stages of the assessment.

- **Assessment and building of capacities of government institutions to enable such assessments**: There is a need to assess and systematically build the capacities of government institutions to deliver such assessments. These capacities involve various areas and include those related to perception, knowledge, and assessment; enabling provisions in the government's vision and mandates; monitoring and evaluation; innovative and participatory planning and implementation; collaboration and coordination; information dissemination; financing; and technical and non-technical capacities provided by human resources (Abraham et al. 2024). Capacity building and associated processes should be guided by principles of inclusivity, such that the needs of women, children, and other vulnerable or under-represented groups such as persons with disability are understood and incorporated at all stages of WASH service delivery and resilience building.
- **Risk assessment–based prioritisation and financing of WASH schemes**: In order to climate proof the WASH sector in the country, it is crucial to allocate resources and budgets based on risk assessments at the granular level. These assessments, which identify specific vulnerabilities at the district or local level, can inform priority setting and help integrate climate adaptation into WASH policies, acts, and schemes. Resource allocation should be closely tied to findings from localised climate risk assessments. By identifying the most vulnerable regions and populations, WASH financing can be efficiently directed to regions where it is most needed. This approach will ensure that climate adaptation is mainstreamed across national WASH policies and sectoral plans, promoting a more resilient WASH system.

Resource and budget allocation for WASH should be based on granular climate risk assessments

Acronyms

AR5	*Fifth Assessment Report*
ARG	automatic rain gauge
AWS	automatic weather station
CAGR	compound annual growth rate
CFAR	Centre for Advocacy and Research
CCRI	Central Council for Research in Indian Medicine
CHCs	community health centres
CWAP	city water action plan
DMP	disaster management plan
DDMP	District disaster management plan
DoDW&S	Department of Drinking Water and Sanitation
DRR	disaster risk reduction
ECCE	early childhood care and education
FFC	Fifteenth Finance Commission
FHTC	functional household tap connection
FSSM	faecal sludge and septage management
GoI	Government of India
GP	gram panchayat
HCFs	healthcare facilities
IEC	information, education, and communication
IHME	Institute for Health Metrics and Evaluation
IPC	infection prevention and control
IPCC	Intergovernmental Panel on Climate Change
IRAP	Institute for Resource Analysis and Policy
JJM	*Jal Jeevan Mission*
LPCD	litres per capita per day
MIS	Monitoring Information System
MoH&FW	Ministry of Health and Family Welfare
MoHUA	Ministry of Housing and Urban Affairs
MoJS	Ministry of Jal Shakti
MoUD	Ministry of Urban Development
MoWR	Ministry of Water Resources

NDMA	National Disaster Management Authority
NDMP	*National Disaster Management Plan*
NEP	*National Education Policy*
NWMP	National Water Quality Monitoring Network
ODF	open defaecation free
PHCs	public health centres
PHED	public health and engineering department
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-analyses
RTE	Right of Children to Free and Compulsory Education
SBM	*Swachh Bharat Mission*
SBM(R)	*Swachh Bharat Mission (Rural)*
SBM(U)	*Swachh Bharat Mission (Urban)*
SCs	Scheduled castes
SDGs	sustainable development goals
SDHs	sub-district hospitals
SDMA	state disaster management authority
SLR	systematic literature review
SSA	*Sarva Shiksha Abhiyan*
SSS	*Swachh Swasth Sarvatra*
STs	Scheduled tribes
SWSV	safe water storage vessel
ULB	urban local body
UNICEF	United Nations Children's Fund
UT	union territory
WASH	water, sanitation, and hygiene
WHO	World Health Organization

Glossary and necessary concepts

Adaptive capacity	Potential or ability of a system, region, or community to adapt to the effects or impacts of climate change. Enhancement of adaptive capacity represents a practical means of coping with changes and uncertainties in climate, including variability and extremes (Smit and Pilifosova 2018).
Basic drinking water services at educational facilities	Drinking water from an improved* water source, with water available at the school at the time of the survey (UNICEF and WHO 2024b).
Basic hygiene services at educational facilities	Hand-washing facilities, with water and soap available at the school at the time of the survey. Hand-washing facilities may be fixed or mobile and include sinks with tap water, buckets with taps, tippy taps, and jugs or just basins designated for hand washing. Soap includes bar soap, liquid soap, powder detergent, and soapy water but does not include ash, soil, sand, or other hand-washing agents (UNICEF and WHO 2024b).
Basic hygiene services at healthcare facilities (HCFs)	Functional hand hygiene facilities (with water and soap and/or alcohol-based hand rub) available at points of care and within 5 m of toilets (UNICEF and WHO 2022).
Basic hygiene services at the household level	Availability of a hand-washing facility on the premises with soap and water (UNICEF and WHO 2023).
Basic sanitation services at educational facilities	Improved sanitation facilities at the school that are single sex and usable at the time of the survey. Facilities are considered usable if they are available to students (doors are unlocked or a key is available at all times), functional (the toilet is not broken, the toilet hole is not blocked, and water is available for flush/pour-flush toilets), and private (there are closable doors that lock from the inside and no large gaps in the structure) (UNICEF and WHO 2024b).
Basic sanitation services at HCFs	Improved sanitation facilities** are usable, with at least one toilet dedicated for staff, at least one sex-separated toilet with menstrual hygiene facilities, and at least one toilet accessible to people with limited mobility (UNICEF and WHO 2022).
Basic water services at HCFs	Water is available from an improved source* on the premises (UNICEF and WHO 2022).
Community health centres (CHCs)	The CHCs constitute the secondary level of healthcare and were designed to provide referral as well as specialist healthcare to the rural population (MoH&FW 2012).
Delphi process	The Delphi technique is a group communication process aimed at consensus building by using a series of questionnaires to collect data from a panel of selected subjects. It aims at conducting detailed examinations and discussions of a specific issue for the purpose of goal setting, policy investigation, or predicting the occurrence of future events. The process allows for multiple iterations of response, anonymity of respondents, and a controlled feedback process and is compatible with diverse statistical analysis techniques for data interpretation(Hsu and Sandford 2007).

Environmental cleaning at HCFs	Protocols for cleaning are available, and staff with cleaning responsibilities have all received training (UNICEF and WHO 2022).
Exposure	Exposure is defined as the presence of people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be adversely affected (IPCC 2022).
Hazard	Hazard is defined as the potential for occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury, or other health impacts as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources. Physical climate conditions that may be associated with hazards are assessed in Working Group I as climatic impact drivers (IPCC 2022).
***Improved drinking water**	Improved drinking water sources, as defined internationally, are those, which by nature of their design and construction, have the potential to deliver safe water. Piped supplies include tap water in the dwelling, yard, or plot, including piped to a neighbour, and public taps or standpipes. Non-piped supplies include boreholes/tubewells; protected wells and springs; rainwater; packaged water, including bottled water and sachet water; delivered water, including tanker trucks and small carts/tanks/drums; and water kiosks. In the Indian scenario, non-piped sources also include bottled water and sachet water. (MoSPI 2019; UNICEF and WHO 2024a).
****Improved sanitation facilities**	Improved sanitation facilities are those designed to hygienically separate human excreta from human contact. These include networked sanitation technologies, such as flush and pour-flush toilets connecting to sewers, and on-site sanitation technologies, such as flush and pour-flush toilets connecting to septic tanks or pits, as well as ventilated improved pit latrines, pit latrines with slabs constructed from materials that are durable and easy to clean, and composting toilets, including twin-pit latrines with slabs and container-based systems (UNICEF and WHO 2024b).
Liquid waste	When water is used once and is no longer fit for human consumption or any other use, it is considered as liquid waste. Wastewater can be sub-categorised as industrial and domestic. Industrial wastewater is generated by manufacturing processes and is difficult to treat. Domestic wastewater includes water discharged from homes, commercial complexes, hotels, and educational institutions and can be treated (MoDW&S (erstwhile) 2016).
Normalisation	The normalisation procedure enables the aggregation of indicators having different units, by removing the units and converting all the values into dimensionless units. The normalised values of indicators lie between 0 and 1 (Sharma et al. 2018).
Open defaecation free (ODF)	A city/ward can be notified/declared as ODF city/ODF ward if not a single person is found defeacating in the open at any time of the day (MoHUA 2020a).

ODF+	A city/ward/work circle can be notified/declared as a *Swachh Bharat Mission* (SBM) ODF+ city/SBM ODF+ ward/SBM ODF+ work circle if, at any time during the day, not a single person is found defaecating and/or urinating in the open and all community and public toilets are functional and well maintained (Sharma et al. 2018).
ODF++	A city/ ward/ work circle can be notified/declared as a SBM ODF++ city/SBM ODF++ ward/SBM ODF++ work circle if, at any time during the day, not a single person is found defaecating and/or urinating in the open, all community and public toilets are functional and well maintained, and all faecal sludge/septage and sewage is safely managed and treated, with no discharging and/or dumping of untreated faecal sludge/ septage and sewage in drains, water bodies, or open areas (Sharma et al. 2018).
Safely managed drinking water services at the household level	Drinking water from an improved source which is located on the premises, available when needed, and free from faecal and priority chemical contamination (UNICEF and WHO 2023).
Safely managed sanitation services at the household level	Use of improved facilities that are not shared with other households and where excreta are safely disposed of in situ or transported and treated off-site (MoHUA 2020a; UNICEF and WHO 2023).
Sensitivity	This refers to the degree to which a system or species is negatively or positively affected by climate variability or change (IPCC 2022).
Solid waste	Solid waste refers to any type of rubbish or discarded material. It can be categorised according to where the waste is generated, for example as municipal solid waste, healthcare waste, or e-waste (WHO 2023a).
Vulnerability	Vulnerability is defined as the propensity or predisposition to be adversely affected and encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt (IPCC 2022).
WASH in HCFs	This refers to the provision of infrastructure and services related to water, sanitation, healthcare waste management, hygiene, and environmental cleaning across all parts of a facility. The term 'HCFs' encompasses all formally recognised facilities that provide healthcare, including primary (health posts and clinics), secondary and tertiary (district or national hospitals), public and private (including faith run), and temporary structures designed for emergency contexts (e.g., cholera treatment centres). They may be in urban or rural areas (UNICEF and WHO 2020).
Waste management at HCFs	Waste is safely segregated into at least three bins, and sharps and infectious waste are treated and disposed of safely (UNICEF and WHO 2022).
Water+	A city/ward/circle/zone can be declared as Water Plus if all wastewater released from households, commercial establishments, drains, nullahs, etc. is treated to a satisfactory level (as per Central Pollution Control Board norms) before it is released into the environment. Furthermore, adequate capacity of wastewater and sewage treatment facilities is to be ensured. The infrastructure should be maintained properly, with cost recovery ensured through reuse/recycling of treated wastewater to ensure sustainability (MoHUA 2020b).

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Annexure 1: District-wise scores of hazard, exposure, and, vulnerability for each state

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
1	Andaman & Nicobar	Nicobar	0.1458	Low hazard	0.4232	High exposure	0.0459	Very low vulnerability	0.0028	Very low risk
2	Andaman & Nicobar	North & Middle Andaman	0.0979	Very low hazard	0.3009	Very low exposure	0.2464	Low vulnerability	0.0073	Very low risk
3	Andaman & Nicobar	South Andaman	0.0994	Very low hazard	0.2495	Very low exposure	0.4000	High vulnerability	0.0099	Very low risk
4	Andhra Pradesh	Anantapur	0.3058	Very high hazard	0.4777	Very high exposure	0.3144	Moderate vulnerability	0.0459	Very high risk
5	Andhra Pradesh	Chittoor	0.3035	Very high hazard	0.3445	Low exposure	0.2201	Very low vulnerability	0.0230	Moderate risk
6	Andhra Pradesh	East Godavari	0.1883	Moderate hazard	0.3572	Low exposure	0.1458	Very low vulnerability	0.0098	Very low risk
7	Andhra Pradesh	Guntur	0.0999	Very low hazard	0.4460	Very high exposure	0.2659	Low vulnerability	0.0118	Very low risk
8	Andhra Pradesh	Krishna	0.2219	High hazard	0.4344	High exposure	0.3018	Moderate vulnerability	0.0291	High risk
9	Andhra Pradesh	Kurnool	0.1240	Very low hazard	0.4426	Very high exposure	0.3191	Moderate vulnerability	0.0175	Low risk
10	Andhra Pradesh	Potti Sriramulu Nellore	0.2140	High hazard	0.3866	Moderate exposure	0.1482	Very low vulnerability	0.0123	Very low risk
11	Andhra Pradesh	Prakasam	0.1166	Very low hazard	0.3976	Moderate exposure	0.2540	Low vulnerability	0.0118	Very low risk
12	Andhra Pradesh	Srikakulam	0.4128	Very high hazard	0.4538	Very high exposure	0.0980	Very low vulnerability	0.0183	Low risk
13	Andhra Pradesh	Visakhapatnam	0.2804	Very high hazard	0.3305	Low exposure	0.3084	Moderate vulnerability	0.0286	High risk
14	Andhra Pradesh	Vizianagaram	0.2124	High hazard	0.3761	Moderate exposure	0.3527	Moderate vulnerability	0.0282	High risk
15	Andhra Pradesh	West Godavari	0.1955	Moderate hazard	0.3751	Moderate exposure	0.2388	Low vulnerability	0.0175	Low risk
16	Andhra Pradesh	Y S R Kadapa	0.2635	Very high hazard	0.3280	Very low exposure	0.3093	Moderate vulnerability	0.0267	High risk
17	Arunachal Pradesh	Anjaw	0.1017	Very low hazard	0.3970	Moderate exposure	0.2323	Low vulnerability	0.0094	Very low risk
18	Arunachal Pradesh	Changlang	0.2827	Very high hazard	0.2614	Very low exposure	0.2455	Low vulnerability	0.0181	Low risk
19	Arunachal Pradesh	Dibang Valley	0.2135	High hazard	0.2166	Very low exposure	0.2966	Low vulnerability	0.0137	Low risk
20	Arunachal Pradesh	East Kameng	0.1557	Low hazard	0.3274	Very low exposure	0.2463	Low vulnerability	0.0126	Very low risk
21	Arunachal Pradesh	East Siang	0.1625	Low hazard	0.3309	Low exposure	0.4013	High vulnerability	0.0216	Moderate risk
22	Arunachal Pradesh	Kamle	0.1460	Low hazard	0.3373	Low exposure	0.3599	Moderate vulnerability	0.0177	Low risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
23	Arunachal Pradesh	Kra Daadi	0.4252	Very high hazard	0.3893	Moderate exposure	0.2195	Very low vulnerability	0.0363	High risk
24	Arunachal Pradesh	Kurung Kumey	0.2840	Very high hazard	0.3033	Very low exposure	0.5021	Very high vulnerability	0.0433	Very high risk
25	Arunachal Pradesh	Lepa Rada	0.1617	Low hazard	0.3342	Low exposure	0.2851	Low vulnerability	0.0154	Low risk
26	Arunachal Pradesh	Lohit	0.1009	Very low hazard	0.3527	Low exposure	0.3531	Moderate vulnerability	0.0126	Very low risk
27	Arunachal Pradesh	Longding	0.1399	Low hazard	0.4136	High exposure	0.1152	Very low vulnerability	0.0067	Very low risk
28	Arunachal Pradesh	Lower Dibang Valley	0.2117	High hazard	0.3534	Low exposure	0.2344	Low vulnerability	0.0175	Low risk
29	Arunachal Pradesh	Lower Siang	0.1209	Very low hazard	0.3613	Low exposure	0.1465	Very low vulnerability	0.0064	Very low risk
30	Arunachal Pradesh	Lower Subansiri	0.1481	Low hazard	0.3605	Low exposure	0.5503	Very high vulnerability	0.0294	High risk
31	Arunachal Pradesh	Namsai	0.2317	High hazard	0.4578	Very high exposure	0.4516	High vulnerability	0.0479	Very high risk
32	Arunachal Pradesh	Pakke Kessang	0.1086	Very low hazard	0.3752	Moderate exposure	0.4765	Very high vulnerability	0.0194	Low risk
33	Arunachal Pradesh	Papumpare	0.2681	Very high hazard	0.3096	Very low exposure	0.2527	Low vulnerability	0.0210	Moderate risk
34	Arunachal Pradesh	Shi Yomi	0.2714	Very high hazard	0.3948	Moderate exposure	0.4774	Very high vulnerability	0.0512	Very high risk
35	Arunachal Pradesh	Siang	0.1512	Low hazard	0.3809	Moderate exposure	0.2191	Very low vulnerability	0.0126	Very low risk
36	Arunachal Pradesh	Tawang	0.1468	Low hazard	0.3748	Moderate exposure	0.1825	Very low vulnerability	0.0100	Very low risk
37	Arunachal Pradesh	Tirap	0.1989	Moderate hazard	0.3819	Moderate exposure	0.3105	Moderate vulnerability	0.0236	Moderate risk
38	Arunachal Pradesh	Upper Siang	0.1009	Very low hazard	0.3298	Low exposure	0.2210	Very low vulnerability	0.0074	Very low risk
39	Arunachal Pradesh	Upper Subansiri	0.2422	High hazard	0.3025	Very low exposure	0.3457	Moderate vulnerability	0.0253	Moderate risk
40	Arunachal Pradesh	West Kameng	0.2276	High hazard	0.3754	Moderate exposure	0.2178	Very low vulnerability	0.0186	Low risk
41	Arunachal Pradesh	West Siang	0.1394	Low hazard	0.4214	High exposure	0.4331	High vulnerability	0.0254	Moderate risk
42	Assam	Baksa	0.1819	Moderate hazard	0.3302	Low exposure	0.3596	Moderate vulnerability	0.0216	Moderate risk
43	Assam	Barpeta	0.1674	Low hazard	0.3927	Moderate exposure	0.3657	High vulnerability	0.0240	Moderate risk
44	Assam	Biswanath	0.1625	Low hazard	0.4136	High exposure	0.4010	High vulnerability	0.0270	High risk
45	Assam	Bongaigaon	0.1832	Moderate hazard	0.4672	Very high exposure	0.2461	Low vulnerability	0.0211	Moderate risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
46	Assam	Cachar	0.0979	Very low hazard	0.3118	Very low exposure	0.2205	Very low vulnerability	0.0067	Very low risk
47	Assam	Charaideo	0.1276	Very low hazard	0.3651	Low exposure	0.2804	Low vulnerability	0.0131	Very low risk
48	Assam	Chirang	0.1637	Low hazard	0.4869	Very high exposure	0.3388	Moderate vulnerability	0.0270	High risk
49	Assam	Darrang	0.2030	Moderate hazard	0.3986	Moderate exposure	0.3006	Moderate vulnerability	0.0243	Moderate risk
50	Assam	Dhemaji	0.1886	Moderate hazard	0.3718	Moderate exposure	0.5404	Very high vulnerability	0.0379	High risk
51	Assam	Dhubri	0.1966	Moderate hazard	0.3897	Moderate exposure	0.3309	Moderate vulnerability	0.0254	Moderate risk
52	Assam	Dibrugarh	0.1407	Low hazard	0.3518	Low exposure	0.3719	High vulnerability	0.0184	Low risk
53	Assam	Dima Hasao	0.1888	Moderate hazard	0.2825	Very low exposure	0.1902	Very low vulnerability	0.0101	Very low risk
54	Assam	Goalpara	0.1584	Low hazard	0.3535	Low exposure	0.4255	High vulnerability	0.0238	Moderate risk
55	Assam	Golaghat	0.1117	Very low hazard	0.3603	Low exposure	0.2751	Low vulnerability	0.0111	Very low risk
56	Assam	Hailakandi	0.1919	Moderate hazard	0.4215	High exposure	0.3282	Moderate vulnerability	0.0265	Moderate risk
57	Assam	Hojai	0.1563	Low hazard	0.4193	High exposure	0.2627	Low vulnerability	0.0172	Low risk
58	Assam	Jorhat	0.1361	Low hazard	0.3651	Low exposure	0.3948	High vulnerability	0.0196	Moderate risk
59	Assam	Kamrup Metro	0.2604	Very high hazard	0.2894	Very low exposure	0.2446	Low vulnerability	0.0184	Low risk
60	Assam	Kamrup Rural	0.2075	Moderate hazard	0.4186	High exposure	0.3372	Moderate vulnerability	0.0293	High risk
61	Assam	Karbi Anglong	0.1363	Low hazard	0.3694	Low exposure	0.1830	Very low vulnerability	0.0092	Very low risk
62	Assam	Karimganj	0.2253	High hazard	0.4241	High exposure	0.2574	Low vulnerability	0.0246	Moderate risk
63	Assam	Kokrajhar	0.3485	Very high hazard	0.4125	High exposure	0.4155	High vulnerability	0.0597	Very high risk
64	Assam	Lakhimpur	0.3188	Very high hazard	0.3942	Moderate exposure	0.5131	Very high vulnerability	0.0645	Very high risk
65	Assam	Majuli	0.2120	High hazard	0.4049	High exposure	0.3111	Moderate vulnerability	0.0267	High risk
66	Assam	Marigaon	0.2445	High hazard	0.4230	High exposure	0.4745	Very high vulnerability	0.0491	Very high risk
67	Assam	Nagaon	0.2771	Very high hazard	0.3790	Moderate exposure	0.3685	High vulnerability	0.0387	Very high risk
68	Assam	Nalbari	0.2037	Moderate hazard	0.4107	High exposure	0.5370	Very high vulnerability	0.0449	Very high risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
69	Assam	Sibsagar	0.1009	Very low hazard	0.3864	Moderate exposure	0.3636	High vulnerability	0.0142	Low risk
70	Assam	Sonitpur	0.1068	Very low hazard	0.3751	Moderate exposure	0.4042	High vulnerability	0.0162	Low risk
71	Assam	South Salmara Mancachar	0.0968	Very low hazard	0.3713	Moderate exposure	0.2372	Low vulnerability	0.0085	Very low risk
72	Assam	Tinsukia	0.1009	Very low hazard	0.3325	Low exposure	0.3638	High vulnerability	0.0122	Very low risk
73	Assam	Udalguri	0.1458	Low hazard	0.3756	Moderate exposure	0.4304	High vulnerability	0.0236	Moderate risk
74	Assam	West Karbi Anglong	0.1757	Moderate hazard	0.3393	Low exposure	0.2758	Low vulnerability	0.0164	Low risk
75	Bihar	Araria	0.2299	High hazard	0.4812	Very high exposure	0.5217	Very high vulnerability	0.0577	Very high risk
76	Bihar	Arwal	0.2596	Very high hazard	0.4906	Very high exposure	0.4476	High vulnerability	0.0570	Very high risk
77	Bihar	Aurangabad	0.3378	Very high hazard	0.4042	High exposure	0.4480	High vulnerability	0.0612	Very high risk
78	Bihar	Banka	0.2593	Very high hazard	0.3881	Moderate exposure	0.2340	Low vulnerability	0.0235	Moderate risk
79	Bihar	Begusarai	0.2686	Very high hazard	0.4828	Very high exposure	0.3728	High vulnerability	0.0483	Very high risk
80	Bihar	Bhagalpur	0.2302	High hazard	0.3661	Low exposure	0.5478	Very high vulnerability	0.0462	Very high risk
81	Bihar	Bhojpur	0.1666	Low hazard	0.3385	Low exposure	0.4994	Very high vulnerability	0.0282	High risk
82	Bihar	Buxar	0.1881	Moderate hazard	0.4026	High exposure	0.4742	Very high vulnerability	0.0359	High risk
83	Bihar	Darbhanga	0.2104	High hazard	0.4049	High exposure	0.5093	Very high vulnerability	0.0434	Very high risk
84	Bihar	Gaya	0.1850	Moderate hazard	0.4020	High exposure	0.4929	Very high vulnerability	0.0367	High risk
85	Bihar	Gopalganj	0.2258	High hazard	0.4085	High exposure	0.6325	Very high vulnerability	0.0583	Very high risk
86	Bihar	Jahanabad	0.2225	High hazard	0.3526	Low exposure	0.7295	Very high vulnerability	0.0572	Very high risk
87	Bihar	Jamai	0.2389	High hazard	0.2763	Very low exposure	0.3120	Moderate vulnerability	0.0206	Moderate risk
88	Bihar	Kaimur	0.1379	Low hazard	0.4215	High exposure	0.4391	High vulnerability	0.0255	Moderate risk
89	Bihar	Katihar	0.1689	Low hazard	0.4028	High exposure	0.4318	High vulnerability	0.0294	High risk
90	Bihar	Khagaria	0.1130	Very low hazard	0.5041	Very high exposure	0.5139	Very high vulnerability	0.0293	High risk
91	Bihar	Kishanganj	0.1086	Very low hazard	0.4483	Very high exposure	0.5085	Very high vulnerability	0.0248	Moderate risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
92	Bihar	Lakhisarai	0.0351	Very low hazard	0.3734	Moderate exposure	0.2435	Low vulnerability	0.0032	Very low risk
93	Bihar	Madhepura	0.2927	Very high hazard	0.4959	Very high exposure	0.5765	Very high vulnerability	0.0786	Very high risk
94	Bihar	Madhubani	0.2751	Very high hazard	0.4959	Very high exposure	0.5765	Very high vulnerability	0.0786	Very high risk
95	Bihar	Munger	0.1579	Low hazard	0.3687	Low exposure	0.3346	Moderate vulnerability	0.0195	Low risk
96	Bihar	Muzaffarpur	0.2599	Very high hazard	0.3687	Low exposure	0.1398	Very low vulnerability	0.0188	Low risk
97	Bihar	Nalanda	0.2614	Very high hazard	0.3104	Very low exposure	0.5242	Very high vulnerability	0.0425	Very high risk
98	Bihar	Nawada	0.2009	Moderate hazard	0.4588	Very high exposure	0.4859	Very high vulnerability	0.0448	Very high risk
99	Bihar	Parbi Champaran	0.1371	Low hazard	0.3711	Moderate exposure	0.4446	High vulnerability	0.0226	Moderate risk
100	Bihar	Parnia	0.1674	Low hazard	0.3833	Moderate exposure	0.5677	Very high vulnerability	0.0364	High risk
101	Bihar	Pashchimi Champaran	0.3609	Very high hazard	0.3851	Moderate exposure	0.5144	Very high vulnerability	0.0715	Very high risk
102	Bihar	Patna	0.2494	High hazard	0.3789	Moderate exposure	0.3888	High vulnerability	0.0367	High risk
103	Bihar	Rohtas	0.1332	Very low hazard	0.3812	Moderate exposure	0.5964	Very high vulnerability	0.0303	High risk
104	Bihar	Saharsa	0.2437	High hazard	0.4817	Very high exposure	0.6555	Very high vulnerability	0.0770	Very high risk
105	Bihar	Samastipur	0.1484	Low hazard	0.3444	Low exposure	0.1883	Very low vulnerability	0.0096	Very low risk
106	Bihar	Saran	0.1471	Low hazard	0.3480	Low exposure	0.7257	Very high vulnerability	0.0371	High risk
107	Bihar	Sheikhpura	0.1997	Moderate hazard	0.3824	Moderate exposure	0.5557	Very high vulnerability	0.0424	Very high risk
108	Bihar	Sheohar	0.1758	Moderate hazard	0.4750	Very high exposure	0.3421	Moderate vulnerability	0.0286	High risk
109	Bihar	Sitamarhi	0.1281	Very low hazard	0.4796	Very high exposure	0.3082	Moderate vulnerability	0.0189	Low risk
110	Bihar	Siwan	0.1568	Low hazard	0.4113	High exposure	0.6147	Very high vulnerability	0.0396	Very high risk
111	Bihar	Supaul	0.3430	Very high hazard	0.3976	Moderate exposure	0.4786	Very high vulnerability	0.0653	Very high risk
112	Bihar	Vaishali	0.1522	Low hazard	0.3923	Moderate exposure	0.5017	Very high vulnerability	0.0300	High risk
113	Chandigarh	Chandigarh	0.2474	High hazard	0.4101	High exposure	0.1177	Very low vulnerability	0.0119	Very low risk
114	Chhattisgarh	Balod	0.1542	Low hazard	0.3275	Very low exposure	0.3820	High vulnerability	0.0193	Low risk
115	Chhattisgarh	Baloda Bazar	0.1769	Moderate hazard	0.4255	High exposure	0.3792	High vulnerability	0.0285	High risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
116	Chhattisgarh	Balrampur	0.1240	Very low hazard	0.3681	Low exposure	0.3223	Moderate vulnerability	0.0147	Low risk
117	Chhattisgarh	Bastar	0.1845	Moderate hazard	0.4100	High exposure	0.6501	Very high vulnerability	0.0492	Very high risk
118	Chhattisgarh	Bemetara	0.2522	High hazard	0.4817	Very high exposure	0.3451	Moderate vulnerability	0.0419	Very high risk
119	Chhattisgarh	Bijapur	0.2386	High hazard	0.3828	Moderate exposure	0.6690	Very high vulnerability	0.0611	Very high risk
120	Chhattisgarh	Bilaspur	0.1009	Very low hazard	0.3502	Low exposure	0.3167	Moderate vulnerability	0.0112	Very low risk
121	Chhattisgarh	Dakshin Bastar Dantewada	0.1791	Moderate hazard	0.3913	Moderate exposure	0.3244	Moderate vulnerability	0.0227	Moderate risk
122	Chhattisgarh	Dhamtari	0.1732	Low hazard	0.4094	High exposure	0.4599	Very high vulnerability	0.0326	High risk
123	Chhattisgarh	Durg	0.0994	Very low hazard	0.4462	Very high exposure	0.2482	Low vulnerability	0.0110	Very low risk
124	Chhattisgarh	Gariyaband	0.1714	Low hazard	0.3640	Low exposure	0.3131	Moderate vulnerability	0.0195	Low risk
125	Chhattisgarh	Gaurela-Pendra-Marwahi	0.1748	Moderate hazard	0.3615	Low exposure	0.2887	Low vulnerability	0.0182	Low risk
126	Chhattisgarh	Janjgir - Champa	0.1927	Moderate hazard	0.3663	Low exposure	0.5975	Very high vulnerability	0.0422	Very high risk
127	Chhattisgarh	Jashpur	0.1589	Low hazard	0.3811	Moderate exposure	0.3678	High vulnerability	0.0223	Moderate risk
128	Chhattisgarh	Kabirdham	0.3571	Very high hazard	0.4474	Very high exposure	0.3332	Moderate vulnerability	0.0532	Very high risk
129	Chhattisgarh	Kondagaon	0.3286	Very high hazard	0.4284	High exposure	0.2737	Low vulnerability	0.0385	Very high risk
130	Chhattisgarh	Korba	0.1389	Low hazard	0.3223	Very low exposure	0.4396	High vulnerability	0.0197	Moderate risk
131	Chhattisgarh	Korea	0.2255	High hazard	0.4038	High exposure	0.2465	Low vulnerability	0.0224	Moderate risk
132	Chhattisgarh	Mahasamund	0.1678	Low hazard	0.3857	Moderate exposure	0.4475	High vulnerability	0.0290	High risk
133	Chhattisgarh	Mungeli	0.2858	Very high hazard	0.3687	Low exposure	0.3639	High vulnerability	0.0383	High risk
134	Chhattisgarh	Narainpur	0.1419	Low hazard	0.3771	Moderate exposure	0.2366	Low vulnerability	0.0127	Very low risk
135	Chhattisgarh	Raigarh	0.1755	Moderate hazard	0.2988	Very low exposure	0.3289	Moderate vulnerability	0.0172	Low risk
136	Chhattisgarh	Raipur	0.1671	Low hazard	0.4335	High exposure	0.3498	Moderate vulnerability	0.0253	Moderate risk
137	Chhattisgarh	Raj Nandgaon	0.2540	High hazard	0.4053	High exposure	0.3619	High vulnerability	0.0372	High risk
138	Chhattisgarh	Sarajpur	0.1474	Low hazard	0.4217	High exposure	0.5466	Very high vulnerability	0.0340	High risk
139	Chhattisgarh	Sukma	0.1322	Very low hazard	0.4871	Very high exposure	0.2974	Low vulnerability	0.0192	Low risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
140	Chhattisgarh	Surguja	0.2737	Very high hazard	0.3756	Moderate exposure	0.3134	Moderate vulnerability	0.0322	High risk
141	Chhattisgarh	Uttar Bastar Kanker	0.1343	Very low hazard	0.3270	Very low exposure	0.2755	Low vulnerability	0.0121	Very low risk
142	Dadra & Nagar Haveli & Daman & Diu	Dadra & Nagar Haveli	0.1486	Low hazard	0.3705	Moderate exposure	0.0500	Very low vulnerability	0.0028	Very low risk
143	Dadra & Nagar Haveli & Daman & Diu	Daman	0.2173	High hazard	0.3707	Moderate exposure	0.0000	Very low vulnerability	0.0000	Very low risk
144	Dadra & Nagar Haveli & Daman & Diu	Diu	0.1486	Low hazard	0.4501	Very high exposure	0.4910	Very high vulnerability	0.0328	High risk
145	Delhi	Central	0.2538	High hazard	0.5178	Very high exposure	0.1118	Very low vulnerability	0.0147	Low risk
146	Delhi	East	0.1258	Very low hazard	0.4967	Very high exposure	0.0681	Very low vulnerability	0.0043	Very low risk
147	Delhi	New Delhi	0.1999	Moderate hazard	0.4471	Very high exposure	0.3363	Moderate vulnerability	0.0301	High risk
148	Delhi	North	0.1171	Very low hazard	0.3676	Low exposure	0.0456	Very low vulnerability	0.0020	Very low risk
149	Delhi	North East	0.1760	Moderate hazard	0.5204	Very high exposure	0.1007	Very low vulnerability	0.0092	Very low risk
150	Delhi	North West	0.2609	Very high hazard	0.4282	High exposure	0.0628	Very low vulnerability	0.0070	Very low risk
151	Delhi	Shahadra	0.2409	High hazard	0.3639	Low exposure	0.3662	High vulnerability	0.0321	High risk
152	Delhi	South	0.1347	Very low hazard	0.3622	Low exposure	0.1448	Very low vulnerability	0.0071	Very low risk
153	Delhi	South East	0.2062	Moderate hazard	0.4323	High exposure	0.0782	Very low vulnerability	0.0070	Very low risk
154	Delhi	South West	0.1914	Moderate hazard	0.4133	High exposure	0.1374	Very low vulnerability	0.0109	Very low risk
155	Delhi	West	0.1229	Very low hazard	0.3591	Low exposure	0.0868	Very low vulnerability	0.0038	Very low risk
156	Disputed (Madhya Pradesh & Gujarat)	Disputed (Alirajpur & Dahod)	NA		NA		NA		NA	
157	Disputed (Madhya Pradesh & Rajasthan)	Disputed (Baran & Sheopur	NA		NA		NA		NA	
158	Disputed (Madhya Pradesh & Rajasthan)	Disputed (Mandsaur & Jhalawar)	NA		NA		NA		NA	
159	Disputed (Madhya Pradesh & Rajasthan)	Disputed (Nimach & Chittaurgarh)	NA		NA		NA		NA	

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
160	Disputed (Madhya Pradesh & Rajasthan)	Disputed (Ratlam & Banswara)	NA		NA		NA		NA	
161	Disputed (Rajathan & Gujarat)	Disputed (Sabar Kantha & Sirohi)	NA		NA		NA		NA	
162	Disputed (Rajathan & Gujarat)	Disputed (Sabar Kantha & Udaipur)	NA		NA		NA		NA	
163	Disputed (West Bengal , Bihar & Jharkhand)	Disputed (Sahibganj, Maldah & Katihar)	NA		NA		NA		NA	
164	Goa	North Goa	0.1176	Very low hazard	0.2775	Very low exposure	0.3248	Moderate vulnerability	0.0106	Very low risk
165	Goa	South Goa	0.2774	Very high hazard	0.2641	Very low exposure	0.5518	Very high vulnerability	0.0404	Very high risk
166	Gujarat	Ahmadabad	0.3516	Very high hazard	0.4506	Very high exposure	0.4195	High vulnerability	0.0665	Very high risk
167	Gujarat	Amreli	0.2978	Very high hazard	0.4751	Very high exposure	0.3082	Moderate vulnerability	0.0436	Very high risk
168	Gujarat	Anand	0.1676	Low hazard	0.4255	High exposure	0.4616	Very high vulnerability	0.0329	High risk
169	Gujarat	Aravalli	0.2111	High hazard	0.4779	Very high exposure	0.4713	Very high vulnerability	0.0476	Very high risk
170	Gujarat	Banas Kantha	0.2771	Very high hazard	0.4865	Very high exposure	0.3001	Moderate vulnerability	0.0405	Very high risk
171	Gujarat	Bharach	0.2021	Moderate hazard	0.4401	High exposure	0.2151	Very low vulnerability	0.0191	Low risk
172	Gujarat	Bhavnagar	0.2812	Very high hazard	0.4832	Very high exposure	0.2627	Low vulnerability	0.0357	High risk
173	Gujarat	Botad	0.2222	High hazard	0.3814	Moderate exposure	0.3130	Moderate vulnerability	0.0265	Moderate risk
174	Gujarat	Chhota Udepur	0.1399	Low hazard	0.4300	High exposure	0.4061	High vulnerability	0.0244	Moderate risk
175	Gujarat	Dahod	0.2078	Moderate hazard	0.4828	Very high exposure	0.2530	Low vulnerability	0.0254	Moderate risk
176	Gujarat	Dangs	0.3307	Very high hazard	0.3953	Moderate exposure	0.2749	Low vulnerability	0.0359	High risk
177	Gujarat	Devbhumi Dwarka	0.2171	High hazard	0.4883	Very high exposure	0.2447	Low vulnerability	0.0259	Moderate risk
178	Gujarat	Gandhinagar	0.0935	Very low hazard	0.4159	High exposure	0.1206	Very low vulnerability	0.0047	Very low risk
179	Gujarat	Gir Somnath	0.1786	Moderate hazard	0.3681	Low exposure	0.9478	Very high vulnerability	0.0623	Very high risk
180	Gujarat	Jamnagar	0.3739	Very high hazard	0.4207	High exposure	0.4240	High vulnerability	0.0667	Very high risk
181	Gujarat	Janagadh	0.3588	Very high hazard	0.4467	Very high exposure	0.3674	High vulnerability	0.0589	Very high risk
182	Gujarat	Kachchh	0.1514	Low hazard	0.4113	High exposure	0.2967	Low vulnerability	0.0185	Low risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
183	Gujarat	Kheda	0.1563	Low hazard	0.4063	High exposure	0.3194	Moderate vulnerability	0.0203	Moderate risk
184	Gujarat	Mahesana	0.2775	Very high hazard	0.5089	Very high exposure	0.3370	Moderate vulnerability	0.0476	Very high risk
185	Gujarat	Mahisagar	0.2996	Very high hazard	0.4905	Very high exposure	0.2488	Low vulnerability	0.0366	High risk
186	Gujarat	Morbi	0.1966	Moderate hazard	0.4587	Very high exposure	0.5410	Very high vulnerability	0.0488	Very high risk
187	Gujarat	Narmada	0.1978	Moderate hazard	0.4692	Very high exposure	0.4185	High vulnerability	0.0388	Very high risk
188	Gujarat	Navsari	0.1885	Moderate hazard	0.3882	Moderate exposure	0.3243	Moderate vulnerability	0.0237	Moderate risk
189	Gujarat	Panch Mahals	0.3193	Very high hazard	0.3844	Moderate exposure	0.2598	Low vulnerability	0.0319	High risk
190	Gujarat	Patan	0.1268	Very low hazard	0.5687	Very high exposure	0.2704	Low vulnerability	0.0195	Low risk
191	Gujarat	Porbandar	0.3769	Very high hazard	0.3082	Very low exposure	0.1874	Very low vulnerability	0.0218	Moderate risk
192	Gujarat	Rajkot	0.2207	High hazard	0.4506	Very high exposure	0.3761	High vulnerability	0.0374	High risk
193	Gujarat	Sabar Kantha	0.3119	Very high hazard	0.5106	Very high exposure	0.3397	Moderate vulnerability	0.0541	Very high risk
194	Gujarat	Sarat	0.1463	Low hazard	0.3586	Low exposure	0.3188	Moderate vulnerability	0.0167	Low risk
195	Gujarat	Surendranagar	0.1389	Low hazard	0.4625	Very high exposure	0.2307	Low vulnerability	0.0148	Low risk
196	Gujarat	Tapi	0.1076	Very low hazard	0.4468	Very high exposure	0.4181	High vulnerability	0.0201	Moderate risk
197	Gujarat	Vadodara	0.3085	Very high hazard	0.4279	High exposure	0.2997	Low vulnerability	0.0396	Very high risk
198	Gujarat	Valsad	0.2040	Moderate hazard	0.3686	Low exposure	0.3881	High vulnerability	0.0292	High risk
199	Haryana	Ambala	0.1358	Very low hazard	0.3948	Moderate exposure	0.4226	High vulnerability	0.0227	Moderate risk
200	Haryana	Bhiwani	0.2821	Very high hazard	0.3006	Very low exposure	0.6448	Very high vulnerability	0.0547	Very high risk
201	Haryana	Charkhi Dadri	0.2104	High hazard	0.5009	Very high exposure	0.1790	Very low vulnerability	0.0189	Low risk
202	Haryana	Faridabad	0.1825	Moderate hazard	0.4350	High exposure	0.1096	Very low vulnerability	0.0087	Very low risk
203	Haryana	Fatehabad	0.1599	Low hazard	0.4679	Very high exposure	0.3263	Moderate vulnerability	0.0244	Moderate risk
204	Haryana	Gurugram	0.1738	Low hazard	0.3064	Very low exposure	0.2009	Very low vulnerability	0.0107	Very low risk
205	Haryana	Hisar	0.2220	High hazard	0.4124	High exposure	0.2841	Low vulnerability	0.0260	Moderate risk
206	Haryana	Jhajjar	0.1376	Low hazard	0.3565	Low exposure	0.2595	Low vulnerability	0.0127	Very low risk
207	Haryana	Jind	0.2389	High hazard	0.5082	Very high exposure	0.2876	Low vulnerability	0.0349	High risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
208	Haryana	Kaithal	0.1389	Low hazard	0.4308	High exposure	0.1824	Very low vulnerability	0.0109	Very low risk
209	Haryana	Karnal	0.2501	High hazard	0.3827	Moderate exposure	0.3117	Moderate vulnerability	0.0298	High risk
210	Haryana	Kurukshetra	0.1209	Very low hazard	0.4848	Very high exposure	0.1849	Very low vulnerability	0.0108	Very low risk
211	Haryana	Mahendragarh	0.1489	Low hazard	0.3040	Very low exposure	0.3210	Moderate vulnerability	0.0145	Low risk
212	Haryana	Mewat	0.1471	Low hazard	0.3354	Low exposure	0.4281	High vulnerability	0.0211	Moderate risk
213	Haryana	Palwal	0.1155	Very low hazard	0.4721	Very high exposure	0.3031	Moderate vulnerability	0.0165	Low risk
214	Haryana	Panchkula	0.1212	Very low hazard	0.3994	Moderate exposure	0.2798	Low vulnerability	0.0135	Low risk
215	Haryana	Panipat	0.1858	Moderate hazard	0.4031	High exposure	0.3012	Moderate vulnerability	0.0226	Moderate risk
216	Haryana	Rewari	0.1009	Very low hazard	0.4946	Very high exposure	0.3677	High vulnerability	0.0184	Low risk
217	Haryana	Rohtak	0.1953	Moderate hazard	0.3889	Moderate exposure	0.3019	Moderate vulnerability	0.0229	Moderate risk
218	Haryana	Sirsa	0.1981	Moderate hazard	0.3955	Moderate exposure	0.1980	Very low vulnerability	0.0155	Low risk
219	Haryana	Sonipat	0.2509	High hazard	0.4249	High exposure	0.3524	Moderate vulnerability	0.0376	High risk
220	Haryana	Yamunanagar	0.1276	Very low hazard	0.4439	Very high exposure	0.3908	High vulnerability	0.0221	Moderate risk
221	Himachal Pradesh	Bilaspur	0.1738	Low hazard	0.3434	Low exposure	0.2565	Low vulnerability	0.0153	Low risk
222	Himachal Pradesh	Chamba	0.1350	Very low hazard	0.3490	Low exposure	0.3197	Moderate vulnerability	0.0151	Low risk
223	Himachal Pradesh	Hamirpur	0.2304	High hazard	0.3725	Moderate exposure	0.5024	Very high vulnerability	0.0431	Very high risk
224	Himachal Pradesh	Kangra	0.2540	High hazard	0.3158	Very low exposure	0.3300	Moderate vulnerability	0.0265	Moderate risk
225	Himachal Pradesh	Kinnaur	0.1821	Moderate hazard	0.3979	Moderate exposure	0.1960	Very low vulnerability	0.0142	Low risk
226	Himachal Pradesh	Kullu	0.1656	Low hazard	0.4001	Moderate exposure	0.3785	High vulnerability	0.0251	Moderate risk
227	Himachal Pradesh	Lahul & Spiti	0.2163	High hazard	0.3381	Low exposure	0.4025	High vulnerability	0.0294	High risk
228	Himachal Pradesh	Mandi	0.1724	Low hazard	0.3987	Moderate exposure	0.4442	High vulnerability	0.0305	High risk
229	Himachal Pradesh	Shimla	0.1735	Low hazard	0.3695	Low exposure	0.5575	Very high vulnerability	0.0357	High risk
230	Himachal Pradesh	Sirmaur	0.1155	Very low hazard	0.3038	Very low exposure	0.3979	High vulnerability	0.0140	Low risk
231	Himachal Pradesh	Solan	0.4049	Very high hazard	0.3722	Moderate exposure	0.2479	Low vulnerability	0.0374	High risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
232	Himachal Pradesh	Una	0.2109	High hazard	0.4148	High exposure	0.3515	Moderate vulnerability	0.0308	High risk
233	Jammu And Kashmir	Anantnag	0.1240	Very low hazard	0.3895	Moderate exposure	0.1881	Very low vulnerability	0.0091	Very low risk
234	Jammu And Kashmir	Badgam	0.1086	Very low hazard	0.3575	Low exposure	0.1092	Very low vulnerability	0.0042	Very low risk
235	Jammu And Kashmir	Bandipura	0.2791	Very high hazard	0.4525	Very high exposure	0.4818	Very high vulnerability	0.0609	Very high risk
236	Jammu And Kashmir	Baramala	0.1151	Very low hazard	0.4046	High exposure	0.2814	Low vulnerability	0.0131	Very low risk
237	Jammu And Kashmir	Doda	0.1981	Moderate hazard	0.3398	Low exposure	0.2479	Low vulnerability	0.0167	Low risk
238	Jammu And Kashmir	Ganderbal	0.2747	Very high hazard	0.4510	Very high exposure	0.4224	High vulnerability	0.0523	Very high risk
239	Jammu And Kashmir	Jammu	0.2071	Moderate hazard	0.4367	High exposure	0.5116	Very high vulnerability	0.0463	Very high risk
240	Jammu And Kashmir	Kathua	0.2353	High hazard	0.3408	Low exposure	0.2969	Low vulnerability	0.0238	Moderate risk
241	Jammu And Kashmir	Kishtwar	0.1938	Moderate hazard	0.3672	Low exposure	0.4191	High vulnerability	0.0298	High risk
242	Jammu And Kashmir	Kulgam	0.2730	Very high hazard	0.4076	High exposure	0.2785	Low vulnerability	0.0310	High risk
243	Jammu And Kashmir	Kupwara	0.2643	Very high hazard	0.3907	Moderate exposure	0.4083	High vulnerability	0.0422	Very high risk
244	Jammu And Kashmir	Mirpur	NA		NA		NA		NA	
245	Jammu And Kashmir	Muzaffarabad	NA		NA		NA		NA	
246	Jammu And Kashmir	Panch	0.1163	Very low hazard	0.4832	Very high exposure	0.3082	Moderate vulnerability	0.0173	Low risk
247	Jammu And Kashmir	Pulwama	0.2858	Very high hazard	0.4006	Moderate exposure	0.2558	Low vulnerability	0.0293	High risk
248	Jammu And Kashmir	Rajauri	0.1784	Moderate hazard	0.3600	Low exposure	0.1434	Very low vulnerability	0.0092	Very low risk
249	Jammu And Kashmir	Ramban	0.1509	Low hazard	0.3918	Moderate exposure	0.1288	Very low vulnerability	0.0076	Very low risk
250	Jammu And Kashmir	Riasi	0.1575	Low hazard	0.3815	Moderate exposure	0.1286	Very low vulnerability	0.0077	Very low risk
251	Jammu And Kashmir	Samba	0.2057	Moderate hazard	0.3073	Very low exposure	0.1679	Very low vulnerability	0.0106	Very low risk
252	Jammu And Kashmir	Shupiyan	0.1394	Low hazard	0.3847	Moderate exposure	0.4057	High vulnerability	0.0218	Moderate risk
253	Jammu And Kashmir	Srinagar	0.1779	Moderate hazard	0.3853	Moderate exposure	0.3058	Moderate vulnerability	0.0210	Moderate risk
254	Jammu And Kashmir	Udhampur	0.2517	High hazard	0.3949	Moderate exposure	0.1609	Very low vulnerability	0.0160	Low risk
255	Jharkhand	Bokaro	0.2104	High hazard	0.3830	Moderate exposure	0.2291	Low vulnerability	0.0185	Low risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
256	Jharkhand	Chatra	0.5070	Very high hazard	0.4084	High exposure	0.2646	Low vulnerability	0.0548	Very high risk
257	Jharkhand	Deoghar	0.2424	High hazard	0.3622	Low exposure	0.3037	Moderate vulnerability	0.0267	Moderate risk
258	Jharkhand	Dhanbad	0.1573	Low hazard	0.3584	Low exposure	0.2368	Low vulnerability	0.0134	Low risk
259	Jharkhand	Dumka	0.2117	High hazard	0.3113	Very low exposure	0.2762	Low vulnerability	0.0182	Low risk
260	Jharkhand	East Singhbhum	0.3119	Very high hazard	0.2471	Very low exposure	0.2229	Very low vulnerability	0.0172	Low risk
261	Jharkhand	Garhwa	0.1755	Moderate hazard	0.3033	Very low exposure	0.4452	High vulnerability	0.0237	Moderate risk
262	Jharkhand	Giridih	0.3058	Very high hazard	0.3408	Low exposure	0.4080	High vulnerability	0.0425	Very high risk
263	Jharkhand	Godda	0.2870	Very high hazard	0.3184	Very low exposure	0.3271	Moderate vulnerability	0.0299	High risk
264	Jharkhand	Gumla	0.1489	Low hazard	0.2708	Very low exposure	0.3621	High vulnerability	0.0146	Low risk
265	Jharkhand	Hazaribagh	0.1922	Moderate hazard	0.3633	Low exposure	0.3522	Moderate vulnerability	0.0246	Moderate risk
266	Jharkhand	Jamtara	0.1660	Low hazard	0.3764	Moderate exposure	0.3429	Moderate vulnerability	0.0214	Moderate risk
267	Jharkhand	Khunti	0.1986	Moderate hazard	0.3896	Moderate exposure	0.2752	Low vulnerability	0.0213	Moderate risk
268	Jharkhand	Kodarma	0.1629	Low hazard	0.4233	High exposure	0.4182	High vulnerability	0.0288	High risk
269	Jharkhand	Latehar	0.1151	Very low hazard	0.2970	Very low exposure	0.3095	Moderate vulnerability	0.0106	Very low risk
270	Jharkhand	Lohardaga	0.1563	Low hazard	0.3452	Low exposure	0.3882	High vulnerability	0.0209	Moderate risk
271	Jharkhand	Pakur	0.1345	Very low hazard	0.3007	Very low exposure	0.1411	Very low vulnerability	0.0057	Very low risk
272	Jharkhand	Palamu	0.1614	Low hazard	0.3370	Low exposure	0.4168	High vulnerability	0.0227	Moderate risk
273	Jharkhand	Ramgarh	0.2033	Moderate hazard	0.4290	High exposure	0.3790	High vulnerability	0.0330	High risk
274	Jharkhand	Ranchi	0.1899	Moderate hazard	0.2868	Very low exposure	0.4690	Very high vulnerability	0.0255	Moderate risk
275	Jharkhand	Sahibganj	0.1591	Low hazard	0.3596	Low exposure	0.2618	Low vulnerability	0.0150	Low risk
276	Jharkhand	Saraikela-Kharsawan	0.1215	Very low hazard	0.4532	Very high exposure	0.5123	Very high vulnerability	0.0282	High risk
277	Jharkhand	Simdega	0.2292	High hazard	0.4543	Very high exposure	0.4700	Very high vulnerability	0.0489	Very high risk
278	Jharkhand	West Singhbhum	0.2330	High hazard	0.2420	Very low exposure	0.3833	High vulnerability	0.0216	Moderate risk
279	Karnataka	Bagalkot	0.3217	Very high hazard	0.4893	Very high exposure	0.3225	Moderate vulnerability	0.0508	Very high risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
280	Karnataka	Ballari	0.2617	Very high hazard	0.4486	Very high exposure	0.3423	Moderate vulnerability	0.0402	Very high risk
281	Karnataka	Belagavi	0.1817	Moderate hazard	0.3930	Moderate exposure	0.2908	Low vulnerability	0.0208	Moderate risk
282	Karnataka	Bengalaru Rural	0.2797	Very high hazard	0.4529	Very high exposure	0.5674	Very high vulnerability	0.0719	Very high risk
283	Karnataka	Bengalaru Urban	0.1404	Low hazard	0.3034	Very low exposure	0.3795	High vulnerability	0.0162	Low risk
284	Karnataka	Bidar	0.2817	Very high hazard	0.2862	Very low exposure	0.2406	Low vulnerability	0.0194	Low risk
285	Karnataka	Chamarajanagar	0.1550	Low hazard	0.3666	Low exposure	0.3028	Moderate vulnerability	0.0172	Low risk
286	Karnataka	Chik Ballapur	0.0961	Very low hazard	0.3884	Moderate exposure	0.3575	Moderate vulnerability	0.0133	Low risk
287	Karnataka	Chikkamagalaru	0.2917	Very high hazard	0.2976	Very low exposure	0.2824	Low vulnerability	0.0245	Moderate risk
288	Karnataka	Chitradurga	0.1866	Moderate hazard	0.3509	Low exposure	0.2624	Low vulnerability	0.0172	Low risk
289	Karnataka	Dakshina Kannada	0.1595	Low hazard	0.2770	Very low exposure	0.5052	Very high vulnerability	0.0223	Moderate risk
290	Karnataka	Davangere	0.1538	Low hazard	0.3891	Moderate exposure	0.5023	Very high vulnerability	0.0301	High risk
291	Karnataka	Dharwad	0.0843	Very low hazard	0.4183	High exposure	0.4004	High vulnerability	0.0141	Low risk
292	Karnataka	Gadag	0.1979	Moderate hazard	0.3532	Low exposure	0.4079	High vulnerability	0.0285	High risk
293	Karnataka	Hassan	0.1496	Low hazard	0.3234	Very low exposure	0.4087	High vulnerability	0.0198	Moderate risk
294	Karnataka	Haveri	0.1781	Moderate hazard	0.3423	Low exposure	0.3110	Moderate vulnerability	0.0190	Low risk
295	Karnataka	Kalaburagi	0.2109	High hazard	0.3668	Low exposure	0.2259	Very low vulnerability	0.0175	Low risk
296	Karnataka	Kodagu	0.2444	High hazard	0.2600	Very low exposure	0.5260	Very high vulnerability	0.0334	High risk
297	Karnataka	Kolar	0.0963	Very low hazard	0.4272	High exposure	0.2211	Very low vulnerability	0.0091	Very low risk
298	Karnataka	Koppal	0.1850	Moderate hazard	0.4258	High exposure	0.3849	High vulnerability	0.0303	High risk
299	Karnataka	Mandya	0.2484	High hazard	0.4169	High exposure	0.1903	Very low vulnerability	0.0197	Moderate risk
300	Karnataka	Mysaru	0.2241	High hazard	0.4005	Moderate exposure	0.3797	High vulnerability	0.0341	High risk
301	Karnataka	Raichar	0.1183	Very low hazard	0.4029	High exposure	0.3310	Moderate vulnerability	0.0158	Low risk
302	Karnataka	Ramanagaram	0.2897	Very high hazard	0.4129	High exposure	0.3900	High vulnerability	0.0467	Very high risk
303	Karnataka	Shivamogga	0.2117	High hazard	0.3010	Very low exposure	0.3613	High vulnerability	0.0230	Moderate risk
304	Karnataka	Tumakaru	0.3286	Very high hazard	0.4008	Moderate exposure	0.4168	High vulnerability	0.0549	Very high risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
305	Karnataka	Udupi	0.2004	Moderate hazard	0.3455	Low exposure	0.5167	Very high vulnerability	0.0358	High risk
306	Karnataka	Uttara Kannada	0.1286	Very low hazard	0.3055	Very low exposure	0.3753	High vulnerability	0.0147	Low risk
307	Karnataka	Vijayapura	0.1722	Low hazard	0.4103	High exposure	0.1757	Very low vulnerability	0.0124	Very low risk
308	Karnataka	Yadgir	0.1322	Very low hazard	0.4156	High exposure	0.3165	Moderate vulnerability	0.0174	Low risk
309	Kerala	Palakkad	0.1858	Moderate hazard	0.3820	Moderate exposure	0.4009	High vulnerability	0.0284	High risk
310	Kerala	Kozhikode	0.1009	Very low hazard	0.2137	Very low exposure	0.3069	Moderate vulnerability	0.0066	Very low risk
311	Kerala	Alappuzha	0.2580	Very high hazard	0.3343	Low exposure	0.3869	High vulnerability	0.0334	High risk
312	Kerala	Ernakulam	0.1977	Moderate hazard	0.2931	Very low exposure	0.3948	High vulnerability	0.0229	Moderate risk
313	Kerala	Kasaragod	0.1371	Low hazard	0.2515	Very low exposure	0.5514	Very high vulnerability	0.0190	Low risk
314	Kerala	Thiruvanantha-puram	0.2435	High hazard	0.2379	Very low exposure	0.4008	High vulnerability	0.0232	Moderate risk
315	Kerala	Pattanamthitta	0.1432	Low hazard	0.2584	Very low exposure	0.3225	Moderate vulnerability	0.0119	Very low risk
316	Kerala	Trissar	0.1514	Low hazard	0.2333	Very low exposure	0.3944	High vulnerability	0.0139	Low risk
317	Kerala	Idukki	0.2420	High hazard	0.3314	Low exposure	0.2364	Low vulnerability	0.0190	Low risk
318	Kerala	Malappuram	0.2416	High hazard	0.2913	Very low exposure	0.2104	Very low vulnerability	0.0148	Low risk
319	Kerala	Kollam	0.1232	Very low hazard	0.2343	Very low exposure	0.5599	Very high vulnerability	0.0162	Low risk
320	Kerala	Kannar	0.2091	High hazard	0.2212	Very low exposure	0.4700	Very high vulnerability	0.0217	Moderate risk
321	Kerala	Kottayam	0.2816	Very high hazard	0.2546	Very low exposure	0.3000	Moderate vulnerability	0.0215	Moderate risk
322	Kerala	Wayanad	0.0994	Very low hazard	0.3229	Very low exposure	0.2059	Very low vulnerability	0.0066	Very low risk
323	Ladakh	Kargil	0.2868	Very high hazard	0.3787	Moderate exposure	0.1966	Very low vulnerability	0.0214	Moderate risk
324	Ladakh	Leh	0.2117	High hazard	0.3529	Low exposure	0.1372	Very low vulnerability	0.0102	Very low risk
325	Lakshadweep	Lakshadweep	0.1835	Moderate hazard	0.2971	Very low exposure	0.4341	High vulnerability	0.0237	Moderate risk
326	Madhya Pradesh	Agar Malwa	0.2253	High hazard	0.4455	Very high exposure	0.3448	Moderate vulnerability	0.0346	High risk
327	Madhya Pradesh	Alirajpur	0.1281	Very low hazard	0.4267	High exposure	0.3020	Moderate vulnerability	0.0165	Low risk
328	Madhya Pradesh	Anuppur	0.1484	Low hazard	0.3928	Moderate exposure	0.3215	Moderate vulnerability	0.0187	Low risk
329	Madhya Pradesh	Ashoknagar	0.1656	Low hazard	0.4261	High exposure	0.2395	Low vulnerability	0.0169	Low risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
330	Madhya Pradesh	Balaghat	0.1520	Low hazard	0.3405	Low exposure	0.4779	Very high vulnerability	0.0247	Moderate risk
331	Madhya Pradesh	Barwani	0.1217	Very low hazard	0.3406	Low exposure	0.3748	High vulnerability	0.0155	Low risk
332	Madhya Pradesh	Betul	0.0991	Very low hazard	0.3512	Low exposure	0.6071	Very high vulnerability	0.0211	Moderate risk
333	Madhya Pradesh	Bhind	0.1276	Very low hazard	0.5033	Very high exposure	0.2982	Low vulnerability	0.0192	Low risk
334	Madhya Pradesh	Bhopal	0.2776	Very high hazard	0.4397	High exposure	0.2145	Very low vulnerability	0.0262	Moderate risk
335	Madhya Pradesh	Burhanpur	0.2068	Moderate hazard	0.3282	Very low exposure	0.4018	High vulnerability	0.0273	High risk
336	Madhya Pradesh	Chhatarpur	0.2421	High hazard	0.3378	Low exposure	0.3825	High vulnerability	0.0313	High risk
337	Madhya Pradesh	Chhindwara	0.2631	Very high hazard	0.4386	High exposure	0.8094	Very high vulnerability	0.0934	Very high risk
338	Madhya Pradesh	Damoh	0.1973	Moderate hazard	0.4261	High exposure	0.2670	Low vulnerability	0.0225	Moderate risk
339	Madhya Pradesh	Datia	0.1453	Low hazard	0.3676	Low exposure	0.3041	Moderate vulnerability	0.0162	Low risk
340	Madhya Pradesh	Dewas	0.1112	Very low hazard	0.3511	Low exposure	0.3785	High vulnerability	0.0148	Low risk
341	Madhya Pradesh	Dhar	0.1569	Low hazard	0.3730	Moderate exposure	0.3313	Moderate vulnerability	0.0194	Low risk
342	Madhya Pradesh	Dindori	0.0217	Very low hazard	0.3352	Low exposure	0.2486	Low vulnerability	0.0018	Very low risk
343	Madhya Pradesh	Disputed (Ratlam & Mandsaur)	NA		NA		NA		NA	
344	Madhya Pradesh	East Nimar	0.1317	Very low hazard	0.3266	Very low exposure	0.1776	Very low vulnerability	0.0076	Very low risk
345	Madhya Pradesh	Guna	0.4104	Very high hazard	0.4118	High exposure	0.2284	Very low vulnerability	0.0386	Very high risk
346	Madhya Pradesh	Gwalior	0.1755	Moderate hazard	0.3107	Very low exposure	0.2661	Low vulnerability	0.0145	Low risk
347	Madhya Pradesh	Harda	0.2025	Moderate hazard	0.3461	Low exposure	0.3804	High vulnerability	0.0267	High risk
348	Madhya Pradesh	Hoshangabad	0.1963	Moderate hazard	0.3841	Moderate exposure	0.2526	Low vulnerability	0.0191	Low risk
349	Madhya Pradesh	Indore	0.1120	Very low hazard	0.3920	Moderate exposure	0.3446	Moderate vulnerability	0.0151	Low risk
350	Madhya Pradesh	Jabalpur	0.2263	High hazard	0.4335	High exposure	0.2442	Low vulnerability	0.0240	Moderate risk
351	Madhya Pradesh	Jhabua	0.1953	Moderate hazard	0.3365	Low exposure	0.4764	Very high vulnerability	0.0313	High risk
352	Madhya Pradesh	Katni	0.2209	High hazard	0.3457	Low exposure	0.3595	Moderate vulnerability	0.0275	High risk
353	Madhya Pradesh	Mandla	0.1542	Low hazard	0.3802	Moderate exposure	0.5952	Very high vulnerability	0.0349	High risk
354	Madhya Pradesh	Mandsaur	0.1204	Very low hazard	0.3852	Moderate exposure	0.3321	Moderate vulnerability	0.0154	Low risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
355	Madhya Pradesh	Morena	0.1856	Moderate hazard	0.3548	Low exposure	0.2688	Low vulnerability	0.0177	Low risk
356	Madhya Pradesh	Narshimapura	0.1253	Very low hazard	0.4394	High exposure	0.3079	Moderate vulnerability	0.0169	Low risk
357	Madhya Pradesh	Nimach	0.1753	Moderate hazard	0.3696	Low exposure	0.4063	High vulnerability	0.0263	Moderate risk
358	Madhya Pradesh	Nivari	0.1314	Very low hazard	0.4585	Very high exposure	0.3475	Moderate vulnerability	0.0209	Moderate risk
359	Madhya Pradesh	Panna	0.1209	Very low hazard	0.3118	Very low exposure	0.2784	Low vulnerability	0.0105	Very low risk
360	Madhya Pradesh	Raisen	0.1896	Moderate hazard	0.3591	Low exposure	0.2472	Low vulnerability	0.0168	Low risk
361	Madhya Pradesh	Rajgarh	0.4643	Very high hazard	0.4125	High exposure	0.3813	High vulnerability	0.0730	Very high risk
362	Madhya Pradesh	Ratlam	0.3394	Very high hazard	0.4518	Very high exposure	0.3506	Moderate vulnerability	0.0538	Very high risk
363	Madhya Pradesh	Rewa	0.0892	Very low hazard	0.3696	Low exposure	0.3470	Moderate vulnerability	0.0114	Very low risk
364	Madhya Pradesh	Sagar	0.1599	Low hazard	0.3636	Low exposure	0.5256	Very high vulnerability	0.0306	High risk
365	Madhya Pradesh	Satna	0.1822	Moderate hazard	0.3947	Moderate exposure	0.3129	Moderate vulnerability	0.0225	Moderate risk
366	Madhya Pradesh	Sehore	0.1771	Moderate hazard	0.4227	High exposure	0.4174	High vulnerability	0.0312	High risk
367	Madhya Pradesh	Seoni	0.1953	Moderate hazard	0.4186	High exposure	0.2514	Low vulnerability	0.0206	Moderate risk
368	Madhya Pradesh	Shahdol	0.0963	Very low hazard	0.3013	Very low exposure	0.1366	Very low vulnerability	0.0040	Very low risk
369	Madhya Pradesh	Shajapur	0.1904	Moderate hazard	0.4521	Very high exposure	0.0749	Very low vulnerability	0.0065	Very low risk
370	Madhya Pradesh	Sheopur	0.2156	High hazard	0.3638	Low exposure	0.3478	Moderate vulnerability	0.0273	High risk
371	Madhya Pradesh	Shivpuri	0.1751	Moderate hazard	0.3253	Very low exposure	0.1754	Very low vulnerability	0.0100	Very low risk
372	Madhya Pradesh	Sidhi	0.1717	Low hazard	0.4430	Very high exposure	0.3825	High vulnerability	0.0291	High risk
373	Madhya Pradesh	Singrauli	0.2427	High hazard	0.3396	Low exposure	0.4666	Very high vulnerability	0.0385	Very high risk
374	Madhya Pradesh	Tikamgarh	0.2165	High hazard	0.3816	Moderate exposure	0.2840	Low vulnerability	0.0235	Moderate risk
375	Madhya Pradesh	Ujjain	0.0784	Very low hazard	0.4145	High exposure	0.3514	Moderate vulnerability	0.0114	Very low risk
376	Madhya Pradesh	Umaria	0.1681	Low hazard	0.3324	Low exposure	0.3594	Moderate vulnerability	0.0201	Moderate risk
377	Madhya Pradesh	Vidisha	0.3963	Very high hazard	0.4234	High exposure	0.2310	Low vulnerability	0.0388	Very high risk
378	Madhya Pradesh	West Nimar	0.1917	Moderate hazard	0.3326	Low exposure	0.1889	Very low vulnerability	0.0120	Very low risk
379	Maharashtra	Ahamadnagar	0.2809	Very high hazard	0.3892	Moderate exposure	0.4334	High vulnerability	0.0474	Very high risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
380	Maharashtra	Akola	0.2684	Very high hazard	0.3689	Low exposure	0.2933	Low vulnerability	0.0290	High risk
381	Maharashtra	Amaravati	0.2453	High hazard	0.4048	High exposure	0.5050	Very high vulnerability	0.0501	Very high risk
382	Maharashtra	Aurangabad	0.1886	Moderate hazard	0.4175	High exposure	0.2174	Very low vulnerability	0.0171	Low risk
383	Maharashtra	Bhandara	0.2350	High hazard	0.4462	Very high exposure	0.2358	Low vulnerability	0.0247	Moderate risk
384	Maharashtra	Bid	0.3068	Very high hazard	0.4530	Very high exposure	0.3375	Moderate vulnerability	0.0469	Very high risk
385	Maharashtra	Buldhana	0.1553	Low hazard	0.4436	Very high exposure	0.2737	Low vulnerability	0.0189	Low risk
386	Maharashtra	Chandrapur	0.1209	Very low hazard	0.2455	Very low exposure	0.3694	High vulnerability	0.0110	Very low risk
387	Maharashtra	Dhule	0.1009	Very low hazard	0.4275	High exposure	0.3227	Moderate vulnerability	0.0139	Low risk
388	Maharashtra	Gadchiroli	0.2497	High hazard	0.3951	Moderate exposure	0.3861	High vulnerability	0.0381	High risk
389	Maharashtra	Gondia	0.2025	Moderate hazard	0.3267	Very low exposure	0.3612	High vulnerability	0.0239	Moderate risk
390	Maharashtra	Hingoli	0.1561	Low hazard	0.4260	High exposure	0.2665	Low vulnerability	0.0177	Low risk
391	Maharashtra	Jalgaon	0.2853	Very high hazard	0.3925	Moderate exposure	0.5076	Very high vulnerability	0.0568	Very high risk
392	Maharashtra	Jalna	0.2976	Very high hazard	0.4211	High exposure	0.4857	Very high vulnerability	0.0609	Very high risk
393	Maharashtra	Kolhapur	0.2586	Very high hazard	0.4165	High exposure	0.3523	Moderate vulnerability	0.0380	High risk
394	Maharashtra	Latar	0.2393	High hazard	0.3662	Low exposure	0.3326	Moderate vulnerability	0.0291	High risk
395	Maharashtra	Mumbai City	0.1817	Moderate hazard	0.4482	Very high exposure	0.2310	Low vulnerability	0.0188	Low risk
396	Maharashtra	Nagpur	0.2045	Moderate hazard	0.5500	Very high exposure	0.3010	Moderate vulnerability	0.0339	High risk
397	Maharashtra	Nanded	0.1922	Moderate hazard	0.4011	High exposure	0.1746	Very low vulnerability	0.0135	Low risk
398	Maharashtra	Nandurbar	0.2597	Very high hazard	0.4066	High exposure	0.3640	High vulnerability	0.0384	High risk
399	Maharashtra	Nashik	0.4613	Very high hazard	0.3497	Low exposure	0.3448	Moderate vulnerability	0.0556	Very high risk
400	Maharashtra	Palghar	0.2955	Very high hazard	0.3325	Low exposure	0.3570	Moderate vulnerability	0.0351	High risk
401	Maharashtra	Parbhani	0.1776	Moderate hazard	0.3724	Moderate exposure	0.3675	High vulnerability	0.0243	Moderate risk
402	Maharashtra	Pune	0.0958	Very low hazard	0.3869	Moderate exposure	0.3371	Moderate vulnerability	0.0125	Very low risk
403	Maharashtra	Ratnagiri	0.2724	Very high hazard	0.3682	Low exposure	0.6838	Very high vulnerability	0.0686	Very high risk
404	Maharashtra	Raygad	0.1650	Low hazard	0.3662	Low exposure	0.3009	Moderate vulnerability	0.0182	Low risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
405	Maharashtra	Sangli	0.1932	Moderate hazard	0.3620	Low exposure	0.3472	Moderate vulnerability	0.0243	Moderate risk
406	Maharashtra	Satara	0.3224	Very high hazard	0.3862	Moderate exposure	0.5099	Very high vulnerability	0.0635	Very high risk
407	Maharashtra	Sindhudurg	0.1789	Moderate hazard	0.4004	Moderate exposure	0.3290	Moderate vulnerability	0.0236	Moderate risk
408	Maharashtra	Solapur	0.1532	Low hazard	0.3802	Moderate exposure	0.3971	High vulnerability	0.0231	Moderate risk
409	Maharashtra	Sub Urban Mumbai	0.1514	Low hazard	0.3716	Moderate exposure	0.0508	Very low vulnerability	0.0029	Very low risk
410	Maharashtra	Thane	0.3400	Very high hazard	0.2929	Very low exposure	0.3193	Moderate vulnerability	0.0318	High risk
411	Maharashtra	Usmanabad	0.1247	Very low hazard	0.3577	Low exposure	0.1860	Very low vulnerability	0.0083	Very low risk
412	Maharashtra	Wardha	0.2209	High hazard	0.4037	High exposure	0.3851	High vulnerability	0.0343	High risk
413	Maharashtra	Washim	0.1553	Low hazard	0.4310	High exposure	0.2636	Low vulnerability	0.0176	Low risk
414	Maharashtra	Yavatmal	0.1176	Very low hazard	0.3453	Low exposure	0.3006	Moderate vulnerability	0.0122	Very low risk
415	Manipur	Bishnupur	0.1650	Low hazard	0.3738	Moderate exposure	0.3023	Moderate vulnerability	0.0186	Low risk
416	Manipur	Chandel	0.0966	Very low hazard	0.3897	Moderate exposure	0.1465	Very low vulnerability	0.0055	Very low risk
417	Manipur	Churachandpur	0.2318	High hazard	0.5838	Very high exposure	0.2600	Low vulnerability	0.0352	High risk
418	Manipur	Imphal East	0.1199	Very low hazard	0.3841	Moderate exposure	0.1801	Very low vulnerability	0.0083	Very low risk
419	Manipur	Imphal West	0.1650	Low hazard	0.3162	Very low exposure	0.2962	Low vulnerability	0.0155	Low risk
420	Manipur	Jiribam	0.2958	Very high hazard	0.4125	High exposure	0.1901	Very low vulnerability	0.0232	Moderate risk
421	Manipur	Kakching	0.3068	Very high hazard	0.3897	Moderate exposure	0.2258	Very low vulnerability	0.0270	High risk
422	Manipur	Kamjong	0.1209	Very low hazard	0.3856	Moderate exposure	0.1546	Very low vulnerability	0.0072	Very low risk
423	Manipur	Kangpokpi	0.2230	High hazard	0.4134	High exposure	0.2593	Low vulnerability	0.0239	Moderate risk
424	Manipur	Nonei	0.1068	Very low hazard	0.4037	High exposure	0.1310	Very low vulnerability	0.0056	Very low risk
425	Manipur	Pherzawl	0.1686	Low hazard	0.3999	Moderate exposure	0.1341	Very low vulnerability	0.0090	Very low risk
426	Manipur	Senapati	0.1971	Moderate hazard	0.4363	High exposure	0.3811	High vulnerability	0.0328	High risk
427	Manipur	Tamenglong	0.0922	Very low hazard	0.3626	Low exposure	0.1844	Very low vulnerability	0.0062	Very low risk
428	Manipur	Tengnoupal	0.1610	Low hazard	0.3494	Low exposure	0.1383	Very low vulnerability	0.0078	Very low risk
429	Manipur	Thoubal	0.1986	Moderate hazard	0.4194	High exposure	0.1761	Very low vulnerability	0.0147	Low risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
430	Manipur	Ukhrul	0.1979	Moderate hazard	0.3828	Moderate exposure	0.1024	Very low vulnerability	0.0078	Very low risk
431	Meghalaya	East Garo Hills	0.3966	Very high hazard	0.3340	Low exposure	0.3279	Moderate vulnerability	0.0434	Very high risk
432	Meghalaya	East Jaintia Hills	0.0886	Very low hazard	0.3934	Moderate exposure	0.1531	Very low vulnerability	0.0053	Very low risk
433	Meghalaya	East Khasi Hills	0.2476	High hazard	0.2920	Very low exposure	0.3253	Moderate vulnerability	0.0235	Moderate risk
434	Meghalaya	North Garo Hills	0.3157	Very high hazard	0.3428	Low exposure	0.1694	Very low vulnerability	0.0183	Low risk
435	Meghalaya	Ri-Bhoi	0.1609	Low hazard	0.4160	High exposure	0.2617	Low vulnerability	0.0175	Low risk
436	Meghalaya	South Garo Hills	0.2701	Very high hazard	0.3009	Very low exposure	0.1582	Very low vulnerability	0.0129	Very low risk
437	Meghalaya	South West Garo Hills	0.1199	Very low hazard	0.4254	High exposure	0.2139	Very low vulnerability	0.0109	Very low risk
438	Meghalaya	South West Khasi Hills	0.2204	High hazard	0.3610	Low exposure	0.1219	Very low vulnerability	0.0097	Very low risk
439	Meghalaya	West Garo Hills	0.3358	Very high hazard	0.3859	Moderate exposure	0.2219	Very low vulnerability	0.0288	High risk
440	Meghalaya	West Jaintia Hills	0.1009	Very low hazard	0.3592	Low exposure	0.2026	Very low vulnerability	0.0073	Very low risk
441	Meghalaya	West Khasi Hills	0.1358	Very low hazard	0.2986	Very low exposure	0.1765	Very low vulnerability	0.0072	Very low risk
442	Mizoram	Aizawl	0.1771	Moderate hazard	0.2385	Very low exposure	0.3228	Moderate vulnerability	0.0136	Low risk
443	Mizoram	Champhai	0.1722	Low hazard	0.2866	Very low exposure	0.2096	Very low vulnerability	0.0103	Very low risk
444	Mizoram	Kolasib	0.1935	Moderate hazard	0.3160	Very low exposure	0.4871	Very high vulnerability	0.0298	High risk
445	Mizoram	Lawngtlai	0.1486	Low hazard	0.3373	Low exposure	0.2581	Low vulnerability	0.0129	Very low risk
446	Mizoram	Lunglei	0.0217	Very low hazard	0.3545	Low exposure	0.2611	Low vulnerability	0.0020	Very low risk
447	Mizoram	Mamit	0.1040	Very low hazard	0.4142	High exposure	0.3057	Moderate vulnerability	0.0132	Very low risk
448	Mizoram	Saiha	0.2976	Very high hazard	0.3806	Moderate exposure	0.5522	Very high vulnerability	0.0625	Very high risk
449	Mizoram	Serchhip	0.1822	Moderate hazard	0.4103	High exposure	0.2065	Very low vulnerability	0.0154	Low risk
450	Nagaland	Dimapur	0.2004	Moderate hazard	0.3639	Low exposure	0.2421	Low vulnerability	0.0177	Low risk
451	Nagaland	Kiphire	0.2866	Very high hazard	0.2846	Very low exposure	0.2130	Very low vulnerability	0.0174	Low risk
452	Nagaland	Kohima	0.1704	Low hazard	0.2555	Very low exposure	0.2395	Low vulnerability	0.0104	Very low risk
453	Nagaland	Longleng	0.1086	Very low hazard	0.2975	Very low exposure	0.2293	Low vulnerability	0.0074	Very low risk
454	Nagaland	Mokokchung	0.1571	Low hazard	0.3609	Low exposure	0.2358	Low vulnerability	0.0134	Low risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
455	Nagaland	Mon	0.1965	Moderate hazard	0.3975	Moderate exposure	0.1672	Very low vulnerability	0.0131	Very low risk
456	Nagaland	Paren	0.2402	High hazard	0.3367	Low exposure	0.2436	Low vulnerability	0.0197	Moderate risk
457	Nagaland	Phek	0.1056	Very low hazard	0.3527	Low exposure	0.2358	Low vulnerability	0.0088	Very low risk
458	Nagaland	Tuensang	0.2832	Very high hazard	0.3838	Moderate exposure	0.0981	Very low vulnerability	0.0107	Very low risk
459	Nagaland	Wokha	0.3832	Very high hazard	0.3536	Low exposure	0.3240	Moderate vulnerability	0.0439	Very high risk
460	Nagaland	Zunheboto	0.1300	Very low hazard	0.3765	Moderate exposure	0.2117	Very low vulnerability	0.0104	Very low risk
461	Odisha	Anugul	0.1496	Low hazard	0.4173	High exposure	0.3209	Moderate vulnerability	0.0200	Moderate risk
462	Odisha	Balasore (Baleshwar)	0.3248	Very high hazard	0.3727	Moderate exposure	0.2806	Low vulnerability	0.0340	High risk
463	Odisha	Baragarh	0.1086	Very low hazard	0.4124	High exposure	0.2397	Low vulnerability	0.0107	Very low risk
464	Odisha	Baudh (Bauda)	0.2576	Very high hazard	0.4475	Very high exposure	0.5509	Very high vulnerability	0.0635	Very high risk
465	Odisha	Bhadrak	0.2658	Very high hazard	0.3871	Moderate exposure	0.4338	High vulnerability	0.0446	Very high risk
466	Odisha	Bolangir (Balangir)	0.3199	Very high hazard	0.3649	Low exposure	0.4471	High vulnerability	0.0522	Very high risk
467	Odisha	Cuttack	0.2132	High hazard	0.4254	High exposure	0.2811	Low vulnerability	0.0255	Moderate risk
468	Odisha	Deogarh	0.1332	Very low hazard	0.4492	Very high exposure	0.1970	Very low vulnerability	0.0118	Very low risk
469	Odisha	Dhenkanal	0.3891	Very high hazard	0.4574	Very high exposure	0.3337	Moderate vulnerability	0.0594	Very high risk
470	Odisha	Gajapati	0.1209	Very low hazard	0.3013	Very low exposure	0.2716	Low vulnerability	0.0099	Very low risk
471	Odisha	Ganjam	0.1889	Moderate hazard	0.2684	Very low exposure	0.3936	High vulnerability	0.0200	Moderate risk
472	Odisha	Jagatsinghpur	0.3714	Very high hazard	0.3757	Moderate exposure	0.3542	Moderate vulnerability	0.0494	Very high risk
473	Odisha	Jajapur	0.1579	Low hazard	0.5231	Very high exposure	0.2107	Very low vulnerability	0.0174	Low risk
474	Odisha	Jharsuguda	0.1648	Low hazard	0.4795	Very high exposure	0.2396	Low vulnerability	0.0189	Low risk
475	Odisha	Kalahandi	0.2148	High hazard	0.2933	Very low exposure	0.2113	Very low vulnerability	0.0133	Low risk
476	Odisha	Kandhamal	0.0696	Very low hazard	0.3833	Moderate exposure	0.2359	Low vulnerability	0.0063	Very low risk
477	Odisha	Kendraparha	0.1861	Moderate hazard	0.4626	Very high exposure	0.2888	Low vulnerability	0.0249	Moderate risk
478	Odisha	Keonjhar (Kendujhar)	0.2560	High hazard	0.2690	Very low exposure	0.3383	Moderate vulnerability	0.0233	Moderate risk
479	Odisha	Khordha	0.2363	High hazard	0.3034	Very low exposure	0.2752	Low vulnerability	0.0197	Moderate risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
480	Odisha	Koraput	0.2155	High hazard	0.3592	Low exposure	0.2744	Low vulnerability	0.0212	Moderate risk
481	Odisha	Malkangiri	0.1501	Low hazard	0.4379	High exposure	0.2205	Very low vulnerability	0.0145	Low risk
482	Odisha	Mayarbhanj	0.1755	Moderate hazard	0.4531	Very high exposure	0.3440	Moderate vulnerability	0.0274	High risk
483	Odisha	Naaparha	0.1945	Moderate hazard	0.2802	Very low exposure	0.5361	Very high vulnerability	0.0292	High risk
484	Odisha	Nabarangapur	0.1727	Low hazard	0.3703	Low exposure	0.3010	Moderate vulnerability	0.0193	Low risk
485	Odisha	Nayagarh	0.2632	Very high hazard	0.2795	Very low exposure	0.5128	Very high vulnerability	0.0377	High risk
486	Odisha	Puri	0.2104	High hazard	0.4498	Very high exposure	0.2900	Low vulnerability	0.0275	High risk
487	Odisha	Rayagarha	0.1481	Low hazard	0.3122	Very low exposure	0.1919	Very low vulnerability	0.0089	Very low risk
488	Odisha	Sambalpur	0.2817	Very high hazard	0.4138	High exposure	0.3616	High vulnerability	0.0421	Very high risk
489	Odisha	Subarnapur	0.1563	Low hazard	0.4656	Very high exposure	0.1665	Very low vulnerability	0.0121	Very low risk
490	Odisha	Sundargarh	0.2358	High hazard	0.3286	Very low exposure	0.2596	Low vulnerability	0.0201	Moderate risk
491	Puducherry	Karaikal	0.1369	Low hazard	0.4058	High exposure	0.5016	Very high vulnerability	0.0279	High risk
492	Puducherry	Mahe	0.0817	Very low hazard	0.4713	Very high exposure	0.2880	Low vulnerability	0.0111	Very low risk
493	Puducherry	Puducherry	0.1009	Very low hazard	0.4597	Very high exposure	0.3606	High vulnerability	0.0167	Low risk
494	Puducherry	Yanam	0.1866	Moderate hazard	0.3686	Low exposure	0.1963	Very low vulnerability	0.0135	Low risk
495	Punjab	Amritsar	0.1532	Low hazard	0.4761	Very high exposure	0.3161	Moderate vulnerability	0.0231	Moderate risk
496	Punjab	Barnala	0.3239	Very high hazard	0.3876	Moderate exposure	0.3964	High vulnerability	0.0498	Very high risk
497	Punjab	Bathinda	0.1184	Very low hazard	0.4595	Very high exposure	0.3797	High vulnerability	0.0207	Moderate risk
498	Punjab	Faridkot	0.2132	High hazard	0.4285	High exposure	0.3535	Moderate vulnerability	0.0323	High risk
499	Punjab	Fatehgarh Sahib	0.2101	High hazard	0.4234	High exposure	1.0000	Very high vulnerability	0.0890	Very high risk
500	Punjab	Fazilka	0.1688	Low hazard	0.5077	Very high exposure	0.3635	High vulnerability	0.0312	High risk
501	Punjab	Firozpur	0.2938	Very high hazard	0.4850	Very high exposure	0.3154	Moderate vulnerability	0.0449	Very high risk
502	Punjab	Gurdaspur	0.1342	Very low hazard	0.4864	Very high exposure	0.2870	Low vulnerability	0.0187	Low risk
503	Punjab	Hoshiarpur	0.2311	High hazard	0.3840	Moderate exposure	0.4383	High vulnerability	0.0389	Very high risk
504	Punjab	Jalandhar	0.1530	Low hazard	0.4328	High exposure	0.2662	Low vulnerability	0.0176	Low risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
505	Punjab	Kaparthala	0.1633	Low hazard	0.5184	Very high exposure	0.6629	Very high vulnerability	0.0561	Very high risk
506	Punjab	Ludhiana	0.0914	Very low hazard	0.4589	Very high exposure	0.3439	Moderate vulnerability	0.0144	Low risk
507	Punjab	Mansa	0.1292	Very low hazard	0.4854	Very high exposure	0.3990	High vulnerability	0.0250	Moderate risk
508	Punjab	Moga	0.1489	Low hazard	0.5017	Very high exposure	0.3214	Moderate vulnerability	0.0240	Moderate risk
509	Punjab	Pathankot	0.1569	Low hazard	0.4572	Very high exposure	0.2889	Low vulnerability	0.0207	Moderate risk
510	Punjab	Patiala	0.3335	Very high hazard	0.5042	Very high exposure	0.4877	Very high vulnerability	0.0820	Very high risk
511	Punjab	Rapnagar	0.1755	Moderate hazard	0.4762	Very high exposure	0.4402	High vulnerability	0.0368	High risk
512	Punjab	Sangrar	0.1735	Low hazard	0.3528	Low exposure	0.3432	Moderate vulnerability	0.0210	Moderate risk
513	Punjab	Sas Nagar (Sahibzada Ajit Singh Nagar)	0.2112	High hazard	0.3771	Moderate exposure	0.2097	Very low vulnerability	0.0167	Low risk
514	Punjab	Shahid Bhagat Singh Nagar	0.1045	Very low hazard	0.3228	Very low exposure	0.2582	Low vulnerability	0.0087	Very low risk
515	Punjab	Sri Muktsar Sahib	0.0735	Very low hazard	0.3984	Moderate exposure	0.2901	Low vulnerability	0.0085	Very low risk
516	Punjab	Tarn Taran	0.1209	Very low hazard	0.5143	Very high exposure	0.4411	High vulnerability	0.0274	High risk
517	Rajasthan	Ajmer	0.2514	High hazard	0.5047	Very high exposure	0.1956	Very low vulnerability	0.0248	Moderate risk
518	Rajasthan	Alwar	0.2514	High hazard	0.3884	Moderate exposure	0.2485	Low vulnerability	0.0243	Moderate risk
519	Rajasthan	Bandi	0.1240	Very low hazard	0.3715	Moderate exposure	0.1925	Very low vulnerability	0.0089	Very low risk
520	Rajasthan	Banswara	0.2099	High hazard	0.3462	Low exposure	0.4099	High vulnerability	0.0298	High risk
521	Rajasthan	Baran	0.2076	Moderate hazard	0.3253	Very low exposure	0.3619	High vulnerability	0.0244	Moderate risk
522	Rajasthan	Barmer	0.2068	Moderate hazard	0.4301	High exposure	0.3673	High vulnerability	0.0327	High risk
523	Rajasthan	Bharatpur	0.3375	Very high hazard	0.4219	High exposure	0.2290	Low vulnerability	0.0326	High risk
524	Rajasthan	Bhilwara	0.1819	Moderate hazard	0.3402	Low exposure	0.3260	Moderate vulnerability	0.0202	Moderate risk
525	Rajasthan	Bikaner	0.2207	High hazard	0.4137	High exposure	0.5381	Very high vulnerability	0.0491	Very high risk
526	Rajasthan	Charu	0.1765	Moderate hazard	0.2594	Very low exposure	0.4904	Very high vulnerability	0.0225	Moderate risk
527	Rajasthan	Chittaurgarh	0.1404	Low hazard	0.3151	Very low exposure	0.2783	Low vulnerability	0.0123	Very low risk
528	Rajasthan	Dangarpur	0.1973	Moderate hazard	0.3875	Moderate exposure	0.2120	Very low vulnerability	0.0162	Low risk
529	Rajasthan	Dausa	0.3186	Very high hazard	0.4895	Very high exposure	0.2736	Low vulnerability	0.0427	Very high risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
530	Rajasthan	Dhaulpur	0.2781	Very high hazard	0.3639	Low exposure	0.2380	Low vulnerability	0.0241	Moderate risk
531	Rajasthan	Ganganagar	0.4453	Very high hazard	0.4199	High exposure	0.2482	Low vulnerability	0.0464	Very high risk
532	Rajasthan	Hanumangarh	0.2045	Moderate hazard	0.4504	Very high exposure	0.3523	Moderate vulnerability	0.0324	High risk
533	Rajasthan	Jaipur	0.2383	High hazard	0.5103	Very high exposure	0.4427	High vulnerability	0.0538	Very high risk
534	Rajasthan	Jaisalmer	0.3084	Very high hazard	0.4416	Very high exposure	0.1844	Very low vulnerability	0.0251	Moderate risk
535	Rajasthan	Jalor	0.2130	High hazard	0.4681	Very high exposure	0.2069	Very low vulnerability	0.0206	Moderate risk
536	Rajasthan	Jhalawar	0.1706	Low hazard	0.3817	Moderate exposure	0.2827	Low vulnerability	0.0184	Low risk
537	Rajasthan	Jhunjhunan	0.2351	High hazard	0.3877	Moderate exposure	0.2734	Low vulnerability	0.0249	Moderate risk
538	Rajasthan	Jodhpur	0.2022	Moderate hazard	0.5609	Very high exposure	0.2168	Very low vulnerability	0.0246	Moderate risk
539	Rajasthan	Karauli	0.2316	High hazard	0.3922	Moderate exposure	0.2331	Low vulnerability	0.0212	Moderate risk
540	Rajasthan	Kota	0.1707	Low hazard	0.4005	Moderate exposure	0.2062	Very low vulnerability	0.0141	Low risk
541	Rajasthan	Nagaur	0.2563	High hazard	0.4134	High exposure	0.5928	Very high vulnerability	0.0628	Very high risk
542	Rajasthan	Pali	0.3009	Very high hazard	0.2420	Very low exposure	0.1621	Very low vulnerability	0.0118	Very low risk
543	Rajasthan	Pratapgarh	0.2143	High hazard	0.3770	Moderate exposure	0.7142	Very high vulnerability	0.0577	Very high risk
544	Rajasthan	Raj Samand	0.1394	Low hazard	0.4851	Very high exposure	0.3145	Moderate vulnerability	0.0213	Moderate risk
545	Rajasthan	Sawai Madhopur	0.2763	Very high hazard	0.3912	Moderate exposure	0.2582	Low vulnerability	0.0279	High risk
546	Rajasthan	Sikar	0.1684	Low hazard	0.3258	Very low exposure	0.5222	Very high vulnerability	0.0286	High risk
547	Rajasthan	Sirohi	0.1579	Low hazard	0.3507	Low exposure	0.2311	Low vulnerability	0.0128	Very low risk
548	Rajasthan	Tonk	0.2419	High hazard	0.4232	High exposure	0.2077	Very low vulnerability	0.0213	Moderate risk
549	Rajasthan	Udaipur	0.1985	Moderate hazard	0.3405	Low exposure	0.2417	Low vulnerability	0.0163	Low risk
550	Sikkim	East	0.1655	Low hazard	0.2880	Very low exposure	0.0923	Very low vulnerability	0.0044	Very low risk
551	Sikkim	North	0.1858	Moderate hazard	0.4763	Very high exposure	0.1103	Very low vulnerability	0.0098	Very low risk
552	Sikkim	South	0.2624	Very high hazard	0.4157	High exposure	0.1302	Very low vulnerability	0.0142	Low risk
553	Sikkim	West	0.1270	Very low hazard	0.4131	High exposure	0.0727	Very low vulnerability	0.0038	Very low risk
554	Tamil Nadu	Ariyalar	0.2200	High hazard	0.4298	High exposure	0.6574	Very high vulnerability	0.0622	Very high risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
555	Tamil Nadu	Chengalpattu	0.2145	High hazard	0.5262	Very high exposure	0.3199	Moderate vulnerability	0.0361	High risk
556	Tamil Nadu	Chennai	0.1296	Very low hazard	0.3960	Moderate exposure	0.2952	Low vulnerability	0.0152	Low risk
557	Tamil Nadu	Coimbatore	0.2403	High hazard	0.3771	Moderate exposure	0.3724	High vulnerability	0.0337	High risk
558	Tamil Nadu	Cuddalore	0.4063	Very high hazard	0.4344	High exposure	0.3469	Moderate vulnerability	0.0612	Very high risk
559	Tamil Nadu	Dharmapuri	0.3063	Very high hazard	0.4382	High exposure	0.6029	Very high vulnerability	0.0809	Very high risk
560	Tamil Nadu	Dindigul	0.1751	Moderate hazard	0.4338	High exposure	0.3984	High vulnerability	0.0303	High risk
561	Tamil Nadu	Erode	0.2355	High hazard	0.3346	Low exposure	0.4036	High vulnerability	0.0318	High risk
562	Tamil Nadu	Kallakkurichi	0.1517	Low hazard	0.4642	Very high exposure	0.2702	Low vulnerability	0.0190	Low risk
563	Tamil Nadu	Kanchipuram	0.1989	Moderate hazard	0.3515	Low exposure	0.4164	High vulnerability	0.0291	High risk
564	Tamil Nadu	Kanyakumari	0.0938	Very low hazard	0.3123	Very low exposure	0.5117	Very high vulnerability	0.0150	Low risk
565	Tamil Nadu	Karar	0.1573	Low hazard	0.4710	Very high exposure	0.4527	High vulnerability	0.0335	High risk
566	Tamil Nadu	Krishnagiri	0.1240	Very low hazard	0.4280	High exposure	0.3431	Moderate vulnerability	0.0182	Low risk
567	Tamil Nadu	Madurai	0.2198	High hazard	0.4502	Very high exposure	0.4971	Very high vulnerability	0.0492	Very high risk
568	Tamil Nadu	Nagapattinam	0.2453	High hazard	0.3642	Low exposure	0.3483	Moderate vulnerability	0.0311	High risk
569	Tamil Nadu	Namakkal	0.1866	Moderate hazard	0.4880	Very high exposure	0.4421	High vulnerability	0.0403	Very high risk
570	Tamil Nadu	Nilgiris	0.1753	Moderate hazard	0.2917	Very low exposure	0.3885	High vulnerability	0.0199	Moderate risk
571	Tamil Nadu	Perambalar	0.1642	Low hazard	0.5115	Very high exposure	0.6366	Very high vulnerability	0.0535	Very high risk
572	Tamil Nadu	Pudukkottai	0.1240	Very low hazard	0.3988	Moderate exposure	0.1240	Very low vulnerability	0.0061	Very low risk
573	Tamil Nadu	Ramanathapuram	0.1086	Very low hazard	0.4858	Very high exposure	0.4740	Very high vulnerability	0.0250	Moderate risk
574	Tamil Nadu	Ranippettai	0.2025	Moderate hazard	0.3951	Moderate exposure	0.3978	High vulnerability	0.0318	High risk
575	Tamil Nadu	Salem	0.1317	Very low hazard	0.3338	Low exposure	0.5436	Very high vulnerability	0.0239	Moderate risk
576	Tamil Nadu	Sivaganga	0.2296	High hazard	0.4358	High exposure	0.5543	Very high vulnerability	0.0555	Very high risk
577	Tamil Nadu	Teni	0.2695	Very high hazard	0.3895	Moderate exposure	0.7591	Very high vulnerability	0.0797	Very high risk
578	Tamil Nadu	Tenkasi	0.3506	Very high hazard	0.4305	High exposure	0.3824	High vulnerability	0.0577	Very high risk
579	Tamil Nadu	Thanjavar	0.2986	Very high hazard	0.4406	High exposure	0.5559	Very high vulnerability	0.0731	Very high risk
580	Tamil Nadu	Thiruvarar	0.1351	Very low hazard	0.4613	Very high exposure	0.6717	Very high vulnerability	0.0418	Very high risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
581	Tamil Nadu	Tiruchirapalli	0.2284	High hazard	0.3965	Moderate exposure	0.5032	Very high vulnerability	0.0456	Very high risk
582	Tamil Nadu	Tirunelveli	0.2457	High hazard	0.4419	Very high exposure	0.6288	Very high vulnerability	0.0683	Very high risk
583	Tamil Nadu	Tiruppar	0.2442	High hazard	0.4388	High exposure	0.6054	Very high vulnerability	0.0649	Very high risk
584	Tamil Nadu	Tiruppattar	0.3108	Very high hazard	0.4260	High exposure	0.3582	Moderate vulnerability	0.0474	Very high risk
585	Tamil Nadu	Tiruvallar	0.2488	High hazard	0.4307	High exposure	0.3006	Moderate vulnerability	0.0322	High risk
586	Tamil Nadu	Tiruvannamalai	0.1579	Low hazard	0.4408	Very high exposure	0.3169	Moderate vulnerability	0.0220	Moderate risk
587	Tamil Nadu	Tuticorin	0.3314	Very high hazard	0.4188	High exposure	0.3373	Moderate vulnerability	0.0468	Very high risk
588	Tamil Nadu	Vellore	0.1471	Low hazard	0.4714	Very high exposure	0.5490	Very high vulnerability	0.0381	High risk
589	Tamil Nadu	Villupuram	0.2089	Moderate hazard	0.4657	Very high exposure	0.5205	Very high vulnerability	0.0506	Very high risk
590	Tamil Nadu	Virudhunagar	0.3102	Very high hazard	0.4361	High exposure	0.5630	Very high vulnerability	0.0762	Very high risk
591	Telangana	Adilabad	0.1484	Low hazard	0.4568	Very high exposure	0.5040	Very high vulnerability	0.0342	High risk
592	Telangana	Bhadradri Kothagudem	0.2863	Very high hazard	0.4436	Very high exposure	0.3671	High vulnerability	0.0466	Very high risk
593	Telangana	Hyderabad	0.2793	Very high hazard	0.4522	Very high exposure	0.1222	Very low vulnerability	0.0154	Low risk
594	Telangana	Jagtial	0.2145	High hazard	0.4888	Very high exposure	0.3821	High vulnerability	0.0401	Very high risk
595	Telangana	Jangaon	0.1812	Moderate hazard	0.4514	Very high exposure	0.3536	Moderate vulnerability	0.0289	High risk
596	Telangana	Jayashankar Bhupalapally	0.1837	Moderate hazard	0.4812	Very high exposure	0.4574	Very high vulnerability	0.0404	Very high risk
597	Telangana	Jogulamba Gadwal	0.3009	Very high hazard	0.3195	Very low exposure	0.4669	Very high vulnerability	0.0449	Very high risk
598	Telangana	Kamareddy	0.1383	Low hazard	0.3713	Moderate exposure	0.4568	High vulnerability	0.0235	Moderate risk
599	Telangana	Karimnagar	0.1163	Very low hazard	0.4043	High exposure	0.5321	Very high vulnerability	0.0250	Moderate risk
600	Telangana	Khammam	0.2760	Very high hazard	0.4747	Very high exposure	0.5911	Very high vulnerability	0.0774	Very high risk
601	Telangana	Kumuram Bheem	0.1450	Low hazard	0.3889	Moderate exposure	0.2737	Low vulnerability	0.0154	Low risk
602	Telangana	Mahabubabad	0.1917	Moderate hazard	0.4327	High exposure	0.5774	Very high vulnerability	0.0479	Very high risk
603	Telangana	Mahabubnagar	0.2222	High hazard	0.3963	Moderate exposure	0.5001	Very high vulnerability	0.0440	Very high risk
604	Telangana	Mancherial	0.1637	Low hazard	0.3593	Low exposure	0.2063	Very low vulnerability	0.0121	Very low risk
605	Telangana	Medak	0.1948	Moderate hazard	0.4316	High exposure	0.2552	Low vulnerability	0.0215	Moderate risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
606	Telangana	Medchal-Malkajgiri	0.2358	High hazard	0.4810	Very high exposure	0.4717	Very high vulnerability	0.0535	Very high risk
607	Telangana	Mulugu	0.3876	Very high hazard	0.4411	Very high exposure	0.1429	Very low vulnerability	0.0244	Moderate risk
608	Telangana	Nagarkurnool	0.1922	Moderate hazard	0.4223	High exposure	0.6759	Very high vulnerability	0.0549	Very high risk
609	Telangana	Nalgonda	0.2345	High hazard	0.3495	Low exposure	0.4469	High vulnerability	0.0366	High risk
610	Telangana	Narayanpet	0.1935	Moderate hazard	0.2746	Very low exposure	0.2685	Low vulnerability	0.0143	Low risk
611	Telangana	Nirmal	0.1945	Moderate hazard	0.3725	Moderate exposure	0.6458	Very high vulnerability	0.0468	Very high risk
612	Telangana	Nizamabad	0.1007	Very low hazard	0.3965	Moderate exposure	0.4831	Very high vulnerability	0.0193	Low risk
613	Telangana	Peddapalli	0.2122	High hazard	0.3962	Moderate exposure	0.4489	High vulnerability	0.0377	High risk
614	Telangana	Rangareddy	0.2159	High hazard	0.4946	Very high exposure	0.4982	Very high vulnerability	0.0532	Very high risk
615	Telangana	Ranjanna Sircilla	0.0953	Very low hazard	0.4445	Very high exposure	0.4362	High vulnerability	0.0185	Low risk
616	Telangana	Sangareddy	0.1709	Low hazard	0.4095	High exposure	0.3606	High vulnerability	0.0252	Moderate risk
617	Telangana	Siddipet	0.2853	Very high hazard	0.2820	Very low exposure	0.2171	Very low vulnerability	0.0175	Low risk
618	Telangana	Suryapet	0.0963	Very low hazard	0.4548	Very high exposure	0.4396	High vulnerability	0.0193	Low risk
619	Telangana	Vikarabad	0.2270	High hazard	0.4612	Very high exposure	0.3598	Moderate vulnerability	0.0377	High risk
620	Telangana	Wanaparthy	0.1942	Moderate hazard	0.4513	Very high exposure	0.4332	High vulnerability	0.0380	High risk
621	Telangana	Warangal (Rural)	0.2019	Moderate hazard	0.4575	Very high exposure	0.3198	Moderate vulnerability	0.0295	High risk
622	Telangana	Warangal (Urban)	0.1363	Low hazard	0.4886	Very high exposure	0.7282	Very high vulnerability	0.0485	Very high risk
623	Telangana	Yadadri Bhuvanagiri	0.2866	Very high hazard	0.4672	Very high exposure	0.5878	Very high vulnerability	0.0787	Very high risk
624	Tripura	Dhalai	0.1789	Moderate hazard	0.2135	Very low exposure	0.2194	Very low vulnerability	0.0084	Very low risk
625	Tripura	Gomati	0.2025	Moderate hazard	0.2497	Very low exposure	0.2691	Low vulnerability	0.0136	Low risk
626	Tripura	Khowai	0.1386	Low hazard	0.2602	Very low exposure	0.2250	Very low vulnerability	0.0081	Very low risk
627	Tripura	North Tripura	0.2865	Very high hazard	0.3511	Low exposure	0.2585	Low vulnerability	0.0260	Moderate risk
628	Tripura	Sepahijala	0.1076	Very low hazard	0.3637	Low exposure	0.2677	Low vulnerability	0.0105	Very low risk
629	Tripura	South Tripura	0.1938	Moderate hazard	0.3342	Low exposure	0.2150	Very low vulnerability	0.0139	Low risk
630	Tripura	Unokoti	0.1517	Low hazard	0.3459	Low exposure	0.1697	Very low vulnerability	0.0089	Very low risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
631	Tripura	West Tripura	0.1092	Very low hazard	0.2593	Very low exposure	0.1895	Very low vulnerability	0.0054	Very low risk
632	Uttar Pradesh	Agra	0.2707	Very high hazard	0.4652	Very high exposure	0.3033	Moderate vulnerability	0.0382	High risk
633	Uttar Pradesh	Aligarh	0.2550	High hazard	0.3587	Low exposure	0.4102	High vulnerability	0.0375	High risk
634	Uttar Pradesh	Ambedkarnagar	0.2371	High hazard	0.3442	Low exposure	0.6578	Very high vulnerability	0.0537	Very high risk
635	Uttar Pradesh	Amethi	0.2014	Moderate hazard	0.3347	Low exposure	0.4839	Very high vulnerability	0.0326	High risk
636	Uttar Pradesh	Amroha	0.1914	Moderate hazard	0.3414	Low exposure	0.3033	Moderate vulnerability	0.0198	Moderate risk
637	Uttar Pradesh	Auraiya	0.2171	High hazard	0.3525	Low exposure	0.4969	Very high vulnerability	0.0380	High risk
638	Uttar Pradesh	Ayodhya	0.2406	High hazard	0.3873	Moderate exposure	0.3270	Moderate vulnerability	0.0305	High risk
639	Uttar Pradesh	Azamgarh	0.1963	Moderate hazard	0.3535	Low exposure	0.6992	Very high vulnerability	0.0485	Very high risk
640	Uttar Pradesh	Baghpat	0.1706	Low hazard	0.4081	High exposure	0.2970	Low vulnerability	0.0207	Moderate risk
641	Uttar Pradesh	Bahraich	0.1366	Low hazard	0.3442	Low exposure	0.3357	Moderate vulnerability	0.0158	Low risk
642	Uttar Pradesh	Ballia	0.2545	High hazard	0.4410	Very high exposure	0.4172	High vulnerability	0.0468	Very high risk
643	Uttar Pradesh	Balrampur	0.1968	Moderate hazard	0.3904	Moderate exposure	0.3881	High vulnerability	0.0298	High risk
644	Uttar Pradesh	Banda	0.2179	High hazard	0.4505	Very high exposure	0.4224	High vulnerability	0.0415	Very high risk
645	Uttar Pradesh	Barabanki	0.1804	Moderate hazard	0.3940	Moderate exposure	0.2515	Low vulnerability	0.0179	Low risk
646	Uttar Pradesh	Bareilly	0.2976	Very high hazard	0.5419	Very high exposure	0.2217	Very low vulnerability	0.0358	High risk
647	Uttar Pradesh	Basti	0.0722	Very low hazard	0.4941	Very high exposure	0.1283	Very low vulnerability	0.0046	Very low risk
648	Uttar Pradesh	Bhadohi	0.1607	Low hazard	0.3687	Low exposure	0.6077	Very high vulnerability	0.0360	High risk
649	Uttar Pradesh	Bijnor	0.1704	Low hazard	0.4939	Very high exposure	0.2836	Low vulnerability	0.0239	Moderate risk
650	Uttar Pradesh	Budaun	0.4300	Very high hazard	0.3342	Low exposure	0.5839	Very high vulnerability	0.0839	Very high risk
651	Uttar Pradesh	Bulandshahr	0.1199	Very low hazard	0.4111	High exposure	0.3112	Moderate vulnerability	0.0153	Low risk
652	Uttar Pradesh	Chandauli	0.1312	Very low hazard	0.3765	Moderate exposure	0.5152	Very high vulnerability	0.0254	Moderate risk
653	Uttar Pradesh	Chitrakoot	0.3120	Very high hazard	0.3334	Low exposure	0.2908	Low vulnerability	0.0302	High risk
654	Uttar Pradesh	Deoria	0.3719	Very high hazard	0.3739	Moderate exposure	0.4636	Very high vulnerability	0.0645	Very high risk
655	Uttar Pradesh	Etah	0.1835	Moderate hazard	0.3553	Low exposure	0.5638	Very high vulnerability	0.0368	High risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
656	Uttar Pradesh	Etawah	0.1096	Very low hazard	0.3851	Moderate exposure	0.5825	Very high vulnerability	0.0246	Moderate risk
657	Uttar Pradesh	Farrukhabad	0.0979	Very low hazard	0.3511	Low exposure	0.2406	Low vulnerability	0.0083	Very low risk
658	Uttar Pradesh	Fatehpur	0.1020	Very low hazard	0.4525	Very high exposure	0.4989	Very high vulnerability	0.0230	Moderate risk
659	Uttar Pradesh	Firozabad	0.0943	Very low hazard	0.4104	High exposure	0.3575	Moderate vulnerability	0.0138	Low risk
660	Uttar Pradesh	Gautambudh-nagar	0.2565	High hazard	0.3442	Low exposure	0.3127	Moderate vulnerability	0.0276	High risk
661	Uttar Pradesh	Gazipur	0.2489	High hazard	0.3738	Moderate exposure	0.5492	Very high vulnerability	0.0511	Very high risk
662	Uttar Pradesh	Ghaziabad	0.2602	Very high hazard	0.4103	High exposure	0.3546	Moderate vulnerability	0.0379	High risk
663	Uttar Pradesh	Gonda	0.2017	Moderate hazard	0.3547	Low exposure	0.4940	Very high vulnerability	0.0353	High risk
664	Uttar Pradesh	Gorakhpur	0.2035	Moderate hazard	0.3946	Moderate exposure	0.7066	Very high vulnerability	0.0567	Very high risk
665	Uttar Pradesh	Hamirpur	0.1971	Moderate hazard	0.3769	Moderate exposure	0.2514	Low vulnerability	0.0187	Low risk
666	Uttar Pradesh	Hapur	0.1384	Low hazard	0.2557	Very low exposure	0.4097	High vulnerability	0.0145	Low risk
667	Uttar Pradesh	Hardoi	0.1353	Very low hazard	0.3494	Low exposure	0.4640	Very high vulnerability	0.0219	Moderate risk
668	Uttar Pradesh	Hathras	0.2409	High hazard	0.4378	High exposure	0.4118	High vulnerability	0.0434	Very high risk
669	Uttar Pradesh	Jalaun	0.2109	High hazard	0.4150	High exposure	0.5730	Very high vulnerability	0.0502	Very high risk
670	Uttar Pradesh	Jaunpur	0.2361	High hazard	0.3232	Very low exposure	0.3024	Moderate vulnerability	0.0231	Moderate risk
671	Uttar Pradesh	Jhansi	0.1646	Low hazard	0.4723	Very high exposure	0.2753	Low vulnerability	0.0214	Moderate risk
672	Uttar Pradesh	Kannauj	0.1555	Low hazard	0.3146	Very low exposure	0.5014	Very high vulnerability	0.0245	Moderate risk
673	Uttar Pradesh	Kanpur	0.2035	Moderate hazard	0.2778	Very low exposure	0.4216	High vulnerability	0.0238	Moderate risk
674	Uttar Pradesh	Kanpur Dehat	0.2043	Moderate hazard	0.4649	Very high exposure	0.4941	Very high vulnerability	0.0469	Very high risk
675	Uttar Pradesh	Kasganj	0.1009	Very low hazard	0.3892	Moderate exposure	0.2884	Low vulnerability	0.0113	Very low risk
676	Uttar Pradesh	Kaushambi	0.2684	Very high hazard	0.4755	Very high exposure	0.5574	Very high vulnerability	0.0711	Very high risk
677	Uttar Pradesh	Kheri	0.2471	High hazard	0.3766	Moderate exposure	0.3876	High vulnerability	0.0361	High risk
678	Uttar Pradesh	Kushinagar	0.2088	Moderate hazard	0.4085	High exposure	0.3941	High vulnerability	0.0336	High risk
679	Uttar Pradesh	Lalitpur	0.3102	Very high hazard	0.4182	High exposure	0.4300	High vulnerability	0.0558	Very high risk
680	Uttar Pradesh	Lucknow	0.1271	Very low hazard	0.4317	High exposure	0.5150	Very high vulnerability	0.0283	High risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
681	Uttar Pradesh	Maharajganj	0.1596	Low hazard	0.3845	Moderate exposure	0.5941	Very high vulnerability	0.0365	High risk
682	Uttar Pradesh	Mahoba	0.2119	High hazard	0.4495	Very high exposure	0.4056	High vulnerability	0.0386	Very high risk
683	Uttar Pradesh	Mainpuri	0.2361	High hazard	0.3684	Low exposure	0.4843	Very high vulnerability	0.0421	Very high risk
684	Uttar Pradesh	Mathura	0.1925	Moderate hazard	0.4163	High exposure	0.4077	High vulnerability	0.0327	High risk
685	Uttar Pradesh	Mau	0.1878	Moderate hazard	0.4014	High exposure	0.2730	Low vulnerability	0.0206	Moderate risk
686	Uttar Pradesh	Meerut	0.1768	Moderate hazard	0.3520	Low exposure	0.5219	Very high vulnerability	0.0325	High risk
687	Uttar Pradesh	Mirzapur	0.1240	Very low hazard	0.3038	Very low exposure	0.5175	Very high vulnerability	0.0195	Low risk
688	Uttar Pradesh	Moradabad	0.4793	Very high hazard	0.3079	Very low exposure	0.4941	Very high vulnerability	0.0729	Very high risk
689	Uttar Pradesh	Muzaffarnagar	0.2673	Very high hazard	0.3069	Very low exposure	0.3876	High vulnerability	0.0318	High risk
690	Uttar Pradesh	Pilibhit	0.2672	Very high hazard	0.2888	Very low exposure	0.4018	High vulnerability	0.0310	High risk
691	Uttar Pradesh	Pratapgarh	0.2421	High hazard	0.3255	Very low exposure	0.2384	Low vulnerability	0.0188	Low risk
692	Uttar Pradesh	Prayagraj	0.2724	Very high hazard	0.4531	Very high exposure	0.5737	Very high vulnerability	0.0708	Very high risk
693	Uttar Pradesh	Raibeareli	0.2256	High hazard	0.4069	High exposure	0.6186	Very high vulnerability	0.0568	Very high risk
694	Uttar Pradesh	Rampur	0.1761	Moderate hazard	0.3321	Low exposure	0.5671	Very high vulnerability	0.0332	High risk
695	Uttar Pradesh	Saharanpur	0.2254	High hazard	0.3440	Low exposure	0.2432	Low vulnerability	0.0189	Low risk
696	Uttar Pradesh	Sambhal	0.1209	Very low hazard	0.4183	High exposure	0.5629	Very high vulnerability	0.0285	High risk
697	Uttar Pradesh	Santkabirnagar	0.2266	High hazard	0.4523	Very high exposure	0.4509	High vulnerability	0.0462	Very high risk
698	Uttar Pradesh	Shahjahanpur	0.0668	Very low hazard	0.4147	High exposure	0.6933	Very high vulnerability	0.0192	Low risk
699	Uttar Pradesh	Shamli	0.2240	High hazard	0.3028	Very low exposure	0.3726	High vulnerability	0.0253	Moderate risk
700	Uttar Pradesh	Shrawasti	0.2471	High hazard	0.3693	Low exposure	0.2206	Very low vulnerability	0.0201	Moderate risk
701	Uttar Pradesh	Siddharthnagar	0.2117	High hazard	0.3234	Very low exposure	0.0965	Very low vulnerability	0.0066	Very low risk
702	Uttar Pradesh	Sitapur	0.2311	High hazard	0.4345	High exposure	0.1819	Very low vulnerability	0.0183	Low risk
703	Uttar Pradesh	Sonbhadra	0.1489	Low hazard	0.3702	Low exposure	0.1171	Very low vulnerability	0.0065	Very low risk
704	Uttar Pradesh	Sultanpur	0.1614	Low hazard	0.3051	Very low exposure	0.5120	Very high vulnerability	0.0252	Moderate risk
705	Uttar Pradesh	Unnao	0.1120	Very low hazard	0.4052	High exposure	0.4154	High vulnerability	0.0188	Low risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
706	Uttar Pradesh	Varanasi	0.2395	High hazard	0.3809	Moderate exposure	0.5737	Very high vulnerability	0.0523	Very high risk
707	Uttarakhand	Almora	0.1509	Low hazard	0.2790	Very low exposure	0.5092	Very high vulnerability	0.0214	Moderate risk
708	Uttarakhand	Bageshwar	0.1163	Very low hazard	0.2760	Very low exposure	0.4355	High vulnerability	0.0140	Low risk
709	Uttarakhand	Chamoli	0.1019	Very low hazard	0.3062	Very low exposure	0.5558	Very high vulnerability	0.0173	Low risk
710	Uttarakhand	Champawat	0.0973	Very low hazard	0.2078	Very low exposure	0.3421	Moderate vulnerability	0.0069	Very low risk
711	Uttarakhand	Dehradan	0.1930	Moderate hazard	0.3615	Low exposure	0.1958	Very low vulnerability	0.0137	Low risk
712	Uttarakhand	Haridwar	0.2527	High hazard	0.2942	Very low exposure	0.3293	Moderate vulnerability	0.0245	Moderate risk
713	Uttarakhand	Nainital	0.1999	Moderate hazard	0.2235	Very low exposure	0.3259	Moderate vulnerability	0.0146	Low risk
714	Uttarakhand	Pauri Garhwal	0.2163	High hazard	0.3133	Very low exposure	0.3747	High vulnerability	0.0254	Moderate risk
715	Uttarakhand	Pithoragarh	0.4466	Very high hazard	0.4793	Very high exposure	0.3313	Moderate vulnerability	0.0709	Very high risk
716	Uttarakhand	Rudraprayag	0.2527	High hazard	0.3859	Moderate exposure	0.6842	Very high vulnerability	0.0667	Very high risk
717	Uttarakhand	Tehri Garhwal	0.1645	Low hazard	0.2670	Very low exposure	0.6937	Very high vulnerability	0.0305	High risk
718	Uttarakhand	Udham Singh Nagar	0.1009	Very low hazard	0.3605	Low exposure	0.2966	Low vulnerability	0.0108	Very low risk
719	Uttarakhand	Uttarkashi	0.1766	Moderate hazard	0.4089	High exposure	0.3273	Moderate vulnerability	0.0236	Moderate risk
720	West Bengal	Alipur Duar	0.1438	Low hazard	0.2451	Very low exposure	0.2737	Low vulnerability	0.0096	Very low risk
721	West Bengal	Bankura	0.1902	Moderate hazard	0.3368	Low exposure	0.3647	High vulnerability	0.0234	Moderate risk
722	West Bengal	Birbham	0.2809	Very high hazard	0.3319	Low exposure	0.1740	Very low vulnerability	0.0162	Low risk
723	West Bengal	Dakshin Dinajpur	0.2786	Very high hazard	0.3902	Moderate exposure	0.3394	Moderate vulnerability	0.0369	High risk
724	West Bengal	Darjiling	0.3342	Very high hazard	0.2340	Very low exposure	0.2380	Low vulnerability	0.0186	Low risk
725	West Bengal	Haora	0.2158	High hazard	0.2667	Very low exposure	0.2346	Low vulnerability	0.0135	Low risk
726	West Bengal	Hugli	0.2268	High hazard	0.3854	Moderate exposure	0.2730	Low vulnerability	0.0239	Moderate risk
727	West Bengal	Jalpaiguri	0.1916	Moderate hazard	0.4435	Very high exposure	0.2405	Low vulnerability	0.0204	Moderate risk
728	West Bengal	Jhargram	0.3202	Very high hazard	0.3068	Very low exposure	0.3120	Moderate vulnerability	0.0307	High risk
729	West Bengal	Kalimpong	0.2573	High hazard	0.3021	Very low exposure	0.2632	Low vulnerability	0.0205	Moderate risk

Sl. no.	State	District	Hazard		Exposure		Vulnerability		Risk	
			Score	Category	Score	Category	Score	Category	Score	Category
730	West Bengal	Koch Bihar	0.1917	Moderate hazard	0.3621	Low exposure	0.2268	Very low vulnerability	0.0157	Low risk
731	West Bengal	Kolkata	0.2324	High hazard	0.4038	High exposure	0.1287	Very low vulnerability	0.0121	Very low risk
732	West Bengal	Maldah	0.1848	Moderate hazard	0.2240	Very low exposure	0.3867	High vulnerability	0.0160	Low risk
733	West Bengal	Murshidabad	0.0217	Very low hazard	0.3097	Very low exposure	0.4364	High vulnerability	0.0029	Very low risk
734	West Bengal	Nadia	0.1197	Very low hazard	0.3591	Low exposure	0.2349	Low vulnerability	0.0101	Very low risk
735	West Bengal	North Twenty-Four Parganas	0.1053	Very low hazard	0.2636	Very low exposure	0.2145	Very low vulnerability	0.0060	Very low risk
736	West Bengal	Paschim Barddhaman	0.3386	Very high hazard	0.2932	Very low exposure	0.1750	Very low vulnerability	0.0174	Low risk
737	West Bengal	Paschim Medinipur	0.2619	Very high hazard	0.3164	Very low exposure	0.3345	Moderate vulnerability	0.0277	High risk
738	West Bengal	Purba Barddhaman	0.2055	Moderate hazard	0.2941	Very low exposure	0.3127	Moderate vulnerability	0.0189	Low risk
739	West Bengal	Purba Medinipur	0.5184	Very high hazard	0.2994	Very low exposure	0.2486	Low vulnerability	0.0386	Very high risk
740	West Bengal	Puruliya	0.1645	Low hazard	0.3103	Very low exposure	0.1754	Very low vulnerability	0.0090	Very low risk
741	West Bengal	South Twenty-Four Parganas	0.0994	Very low hazard	0.2718	Very low exposure	0.2447	Low vulnerability	0.0066	Very low risk
742	West Bengal	Uttar Dinajpur	0.2151	High hazard	0.3095	Very low exposure	0.3428	Moderate vulnerability	0.0228	Moderate risk

(Annexure 2 to 12 can be accessed using this QR code)

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