



DISASTER RISK MANAGEMENT AND CLIMATE ADAPTATION IN INDIA

**STRENGTHENING INSTITUTIONS FOR
CLIMATE-RESILIENT DEVELOPMENT**

Introduction

India is experiencing a clear rise in the frequency and intensity of extreme weather events such as heatwaves, cyclones, floods, and droughts. Evidence suggests that the country faced about 250 major extreme events in the 35 years before 2005, but roughly 310 events in only the following 15 years. Flood-affected districts increased from 69 in 2005 to 151 in 2019, while drought-affected districts and associated crop losses have also risen sharply. Recent climate assessments indicate that almost every day of 2024-2025 saw some extreme event in India, and deaths from extreme weather rose by nearly 50% between 2020 and 2024. These events intersect with India's structural vulnerabilities. Around 12% of the land area is flood-prone, and nearly two-thirds of cultivable land is drought-prone. A coastline of 7,516 km exposes dense settlements and infrastructure to cyclones and storm surges, while the Himalayas are subject to landslides, avalanches, and glacial lake outburst floods. High population density, informal housing, infrastructure deficits, and livelihood dependence on climate-sensitive sectors such as agriculture and fisheries mean that even moderate climatic shocks can produce large socio-economic impacts. India consistently features among the most climate-vulnerable countries in global indices.

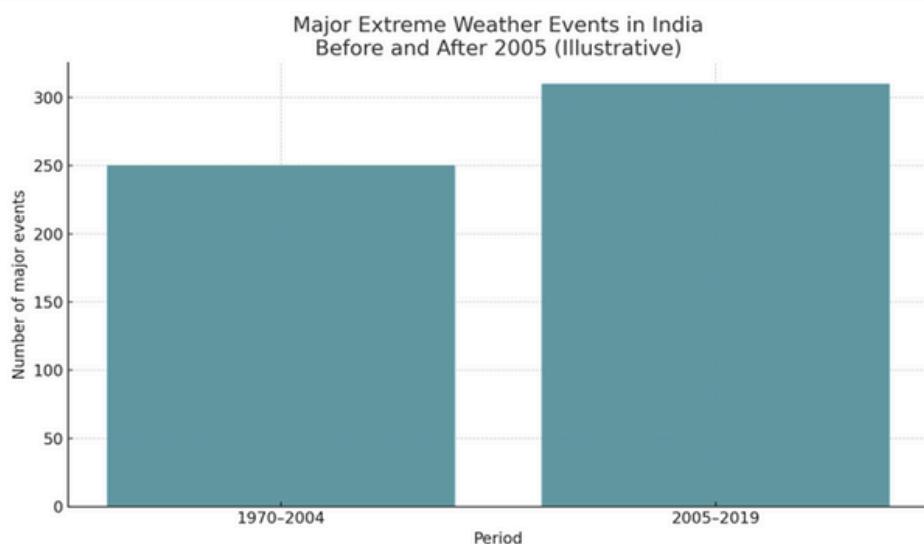


Fig.: *Extreme Weather Events Before and After 2005*, Chaturvedi, V., Koc, S., Singh, A., & Mallya, A. (2020)

India has built a formal disaster management architecture under the Disaster Management Act, 2005. The National Disaster Management Authority (NDMA) provides policy guidance, while State Disaster Management Authorities (SDMAs) and District Disaster Management Authorities (DDMAs) are meant to plan and implement risk reduction and response. Yet, multiple reviews highlight that this framework has not kept pace with the emerging climate reality. NDMA has limited financial and administrative powers, SDMAs are often under-resourced, and local governments struggle to integrate risk reduction into everyday planning. As a result, India is better at responding to disasters than preventing them. This report examines how public policy can better prepare India for the increasing frequency of extreme weather. It first sets out key concepts in disaster risk and climate adaptation, then summarises India's main vulnerability clusters and institutional gaps, draws lessons from international practice, and finally proposes a set of concrete policy reforms. The focus is on using evidence-based, implementable policy levers rather than purely technical or descriptive approaches.

Key Concepts: Disaster Risk and Climate Adaptation

Disaster risk depends on the hazard, who or what is exposed to it, and how vulnerable they are. The same event can cause very different impacts based on population density and resilience. **Disaster management** reduces these impacts through **mitigation** (like safe buildings and protective ecosystems), **preparedness** (early warning and planning), and **effective response and recovery** once a disaster occurs.



Climate Adaptation overlaps with these ideas but emphasises longer-term adjustment of systems to a changing climate. The Intergovernmental Panel on Climate Change defines adaptation as the process of adjustment to actual or expected climate and its effects to moderate harm or exploit beneficial opportunities. Adaptation can involve physical measures (such as climate-resilient infrastructure or drought-resistant crops) and institutional reforms (such as revising land-use plans or social protection programmes) so that societies remain functional under new climatic conditions.

A further distinction is between Rapid-Onset and Slow-Onset Events. Public policy must support both emergency systems for sudden shocks and long-term adaptation for creeping stresses. Rapid-onset events like earthquakes or cyclones require strong early warning systems, quick mobilization of response teams, and robust evacuation planning. Slow-onset processes such as droughts or sea-level rise call for continuous monitoring, climate-resilient development, and long-term resource management. Effective governance must integrate both approaches to build comprehensive and sustainable disaster resilience.

- **Rapid-onset hazards** strike suddenly with little warning. They require swift emergency response systems, including rescue services, medical aid, and rapid coordination among institutions.
- **Slow-onset processes** evolve gradually over months or years. They demand long-term policy attention, continuous monitoring, and sustained adaptation measures to reduce cumulative and often irreversible impacts.

RAPID-ONSET EVENTS



CYCLONES

FLASH FLOOD

SLOW-ONSET EVENTS



DROUGHT

SEA-LEVEL RISE



EARTHQUAKE

GLACIER MELT



CHRONIC HEAT STRESS

India's Vulnerability Clusters

India's exposure to hazards is national in scale, but certain vulnerability clusters stand out because of the combination of high hazard, high exposure, and governance deficits. Four clusters are particularly important from a public-policy perspective, described in the table below.

Coastal districts host large urban centres, ports, energy infrastructure, and fishing communities. Several severe cyclones in the last decade, such as Phailin (2013), Fani (2019), and Amphan (2020), caused major economic losses despite improved evacuations. Sea-level rise of around 3 mm per year along many parts of the Indian coast increases the risk of permanent inundation and amplifies storm surges.

A key policy problem is unplanned and often illegal coastal development. The 2019 Coastal Regulation Zone (CRZ) notification relaxed no-development buffers near tidal waterbodies, despite expert warnings that this would expose more settlements to storms and erosion. Mangroves and dunes, which naturally protect against surges, continue to be cleared for real estate and tourism. Building codes for cyclone-resistant construction are weakly enforced. While response capacities have improved, prevention through strict coastal land-use regulation and ecosystem protection remains inadequate.

Cluster	Key Hazards	Main Policy Gap
1. Coastal regions	Cyclones, storm surges, sea-level rise	Relaxed CRZ norms, weak ecosystem protection
2. Major cities	Urban floods, heatwaves	Poor land-use control, fragmented governance
3. Drought-prone agrarian regions	Meteorological and agricultural drought	Reactive relief, limited long-term water, and livelihood planning
4. Himalayan belt	Cloudbursts, landslides, GLOFs	Over-building, weak enforcement of environmental safety norms

Table: Four Clusters Important from a Public Policy Perspective

Urban flooding has emerged as a recurrent crisis in cities such as Mumbai, Chennai, Bengaluru, and Hyderabad. Short, intense cloudbursts now routinely exceed the capacity of ageing drainage systems. For instance, parts of Mumbai recorded more than 300 mm of rainfall in six hours in July 2024, inundating large areas and disrupting transport and services. Uncontrolled urbanization over wetlands, lakes, and floodplains means that natural sinks for rainwater have been paved over, leaving water with nowhere to go. From a policy angle, urban flooding reflects fragmented governance and failure to integrate risk into spatial planning.

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NDMA issued guidelines on urban flood management in 2010, but implementation has been slow. Multiple agencies, municipal corporations, development authorities, and irrigation departments share responsibility without strong coordination. Development control regulations are routinely violated, and most master plans do not treat flood plains or drainage corridors as no-build zones. Recent central support for city-level flood mitigation is a positive step, but deeper regulatory reform and enforcement at the municipal level are needed. Drought and rainfall variability pose chronic risks to agrarian livelihoods.

Around half of India's net sown area remains rainfed, and these lands contribute roughly 40% of national food production. Multi-year droughts in 2009, 2012, and 2015–2016 affected hundreds of districts and an estimated 330 million people, leading to severe water stress and distress migration. Empirical studies link drought years to higher farmer suicide rates, underlining the social cost of inadequate risk management. Policy has largely been reactive: drought declarations trigger relief, water tankers, and ad-hoc employment schemes, but there is no comprehensive national drought policy that combines early warning, climate-smart agriculture, and long-term water security. Groundwater has been over-extracted in many drought-prone blocks, and watershed development or diversification away from water-intensive crops remains patchy. Crop insurance coverage has expanded, but delays and low payouts have limited its effectiveness for risk sharing.

The Himalayan and sub-Himalayan belts are prone to cloudbursts, flash floods, landslides, and glacial lake outburst floods. The 2013 Kedarnath disaster in Uttarakhand and the 2023 monsoon floods in Himachal Pradesh, which killed around 200 people and destroyed roads and bridges, illustrate the high stakes of development in fragile mountain terrain. Glacier retreat and changing monsoon patterns are likely to increase such risks. Policy failures here relate to over-building and weak environmental governance. Hill towns and pilgrimage corridors have expanded rapidly on unstable slopes and riverbanks, often in violation of land-use rules. Large hydropower, road, and tunnel projects sometimes proceed with inadequate geological assessment.

Institutional Gaps and Governance Challenges

Disaster Management Challenges
Weaknesses in India's Disaster Management Framework

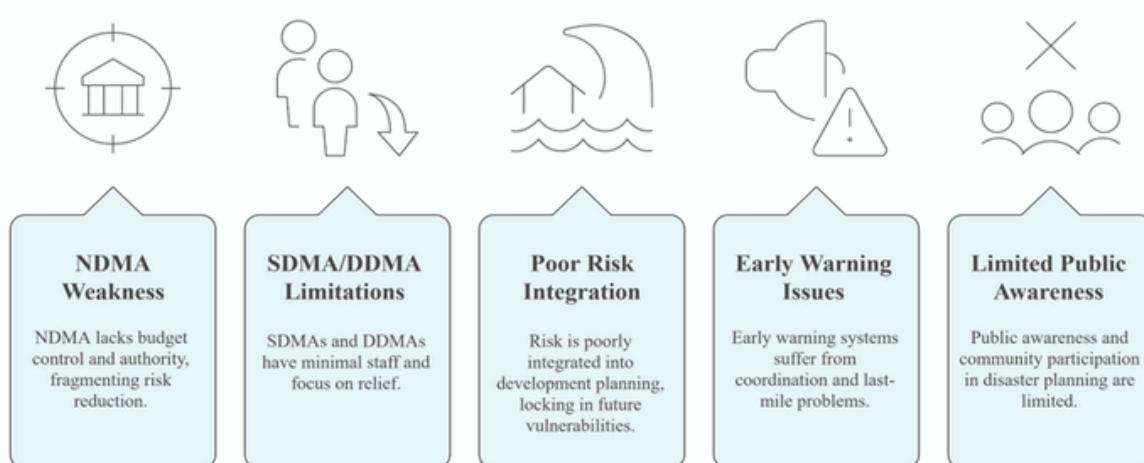


Fig.: Disaster Management Challenges in India

International Lessons

International experience demonstrates that policy-driven approaches can substantially reduce disaster losses. Together, these examples highlight three principles India can adopt:

1. **Community-centered preparedness**
2. **Continuous learning and drills**
3. **Regulatory mainstreaming of climate risk**



Bangladesh, once notorious for catastrophic cyclone deaths, has transformed outcomes through a community-based Cyclone Preparedness Programme. The country has built more than 5,500 cyclone shelters and trained over 56,000 volunteers in coastal districts to disseminate warnings and support evacuations. During Cyclone Bulbul in 2019, about 2.1 million people were evacuated and only 19 fatalities were recorded, orders of magnitude lower than similar storms in the 1970s.



Japan illustrates the value of a strong safety culture embedded in education and local governance. Annual nationwide disaster drills, mandatory school training on earthquakes and tsunamis, and continuous updating of building codes have kept fatality rates relatively low despite frequent high-magnitude events. Community volunteer groups manage local fire stations and emergency supplies, allowing neighbourhood-level response when major disasters occur.



The European Union, meanwhile, has integrated climate and disaster risk into regulation. Companies are legally required to disclose climate-related risks and adaptation measures under sustainability reporting rules, and EU-funded infrastructure must undergo “climate-proofing” to ensure it remains functional under future climate scenarios. These measures push both the public and private sectors to systematically identify and manage climate risks rather than treating them as externalities.

Policy Recommendations

Based on the above analysis, at least six policy reforms stand out as priorities for India’s disaster risk management and climate adaptation. Together, these reforms shift India’s approach from reactive relief towards proactive risk reduction and adaptation.

- Strengthen NDMA’s mandate and resources. Amendments to the Disaster Management Act should give NDMA clearer financial powers, an independent professional cadre, and the authority to review and direct risk-sensitive planning across ministries and states. A dedicated National Disaster Mitigation Fund could support multi-state projects, such as coastal ecosystem restoration or multi-hazard early warning systems. Build state and local capacity for risk-informed planning.
- Performance-linked grants from the Finance Commission could incentivise states to maintain updated district plans, establish State Disaster Response Forces, and institutionalise school and community preparedness exercises.

- Mandate climate and disaster risk screening for major infrastructure and urban plans. All large public investments should include a climate-risk assessment section in their detailed project reports, drawing on climate projections and hazard maps. Urban master plans should legally be required to map floodplains, drainage corridors, and seismic risk zones, and to designate no-build or low-density zones accordingly. This would align India with emerging international practice on “climate-proofing” infrastructure.
- Reform land-use regulation in high-risk zones. Coastal, riverine, seismic, and mountain regulations need to be enforced and, where necessary, tightened to reflect climate change. Restoring stronger CRZ buffers, protecting mangroves and wetlands, restricting construction on unstable slopes, and making risk maps publicly accessible would significantly reduce exposure. Incentive schemes could reward states and municipalities that successfully restore ecological buffers and relocate highly vulnerable settlements.
- Scale up multi-hazard early warning systems with impact-based, last-mile communication. Investments in radar coverage, dense weather and river-level monitoring, and digital data integration should be combined with user-friendly alerts that specify likely impacts (for example, expected water depth in specific localities) rather than just hazard parameters. Partnerships with telecom operators, community radio, self-help groups, and local volunteers can improve warning reach, especially to informal settlements and remote villages.
- Expand locally appropriate adaptation measures for heat and drought. Heat action plans, modelled on Ahmedabad’s experience, should be made mandatory for all heat-prone districts, linked to labour regulations on working hours and to public health protocols. In drought-prone regions, policy should prioritise watershed development, rainwater harvesting, diversification into less water-intensive crops, and reliable social protection floors. Crop insurance and relief schemes must be simplified to ensure timely payouts to smallholders.

Conclusion

Climate change has turned extreme weather into a structural, not occasional, challenge for India. Rising losses from floods, cyclones, droughts, and heatwaves are already visible in lives lost, livelihoods disrupted, and public budgets strained (Banerjee, 2025; Chaturvedi et al., 2020). Yet these impacts are not inevitable. When policy integrates risk into planning, strengthens institutions, and empowers communities, disaster losses can be dramatically reduced, as the experiences of Bangladesh, Japan, and the European Union show.

India’s disaster management system has made important gains in early warning and response, but must now evolve into a comprehensive climate-risk governance framework. This requires giving NDMA and SDMAs the mandate and means to drive risk-informed development; embedding climate and hazard screening into all major plans and projects; protecting and restoring ecosystems that buffer hazards; and investing in local capacity for preparedness, adaptation, and recovery. In short, public policy must treat disaster risk management and climate adaptation as core development functions rather than specialised technical add-ons. Doing so will not only save lives and assets in the face of escalating extremes but also support a more resilient and sustainable development pathway for India.

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