



9TH ASIA-PACIFIC CLIMATE CHANGE ADAPTATION FORUM

India's Actions on Extreme Heat: Driving Subnational Action & Financing for Heat Mitigation

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CO-ORGANIZERS



Disaster Management in India - Milestones



- Until 2001 – Responsibility with **Agriculture Ministry**.
- Responsibility Transferred to **MHA in June 2002**.
- National Centre for DM upgraded to **NIDM** in October 2003
- **NDMA** constituted with Executive Order in May 2005.
- **Disaster Management Act** enacted in December 2005.
- National Disaster Response Force (**NDRF**) Constituted in 2006
- **National DM Policy** in 2009
- **National Disaster Management Plan** (Prepared in 2016 and then revised in 2019)

Disaster Management System



Disaster Management in India is Governed by:

- Disaster Management Act (DM Act) 2005
- National Policy on Disaster Management (NPDM) 2009
- National Disaster Management Plan (NDMP) 2019

Guiding Frameworks:

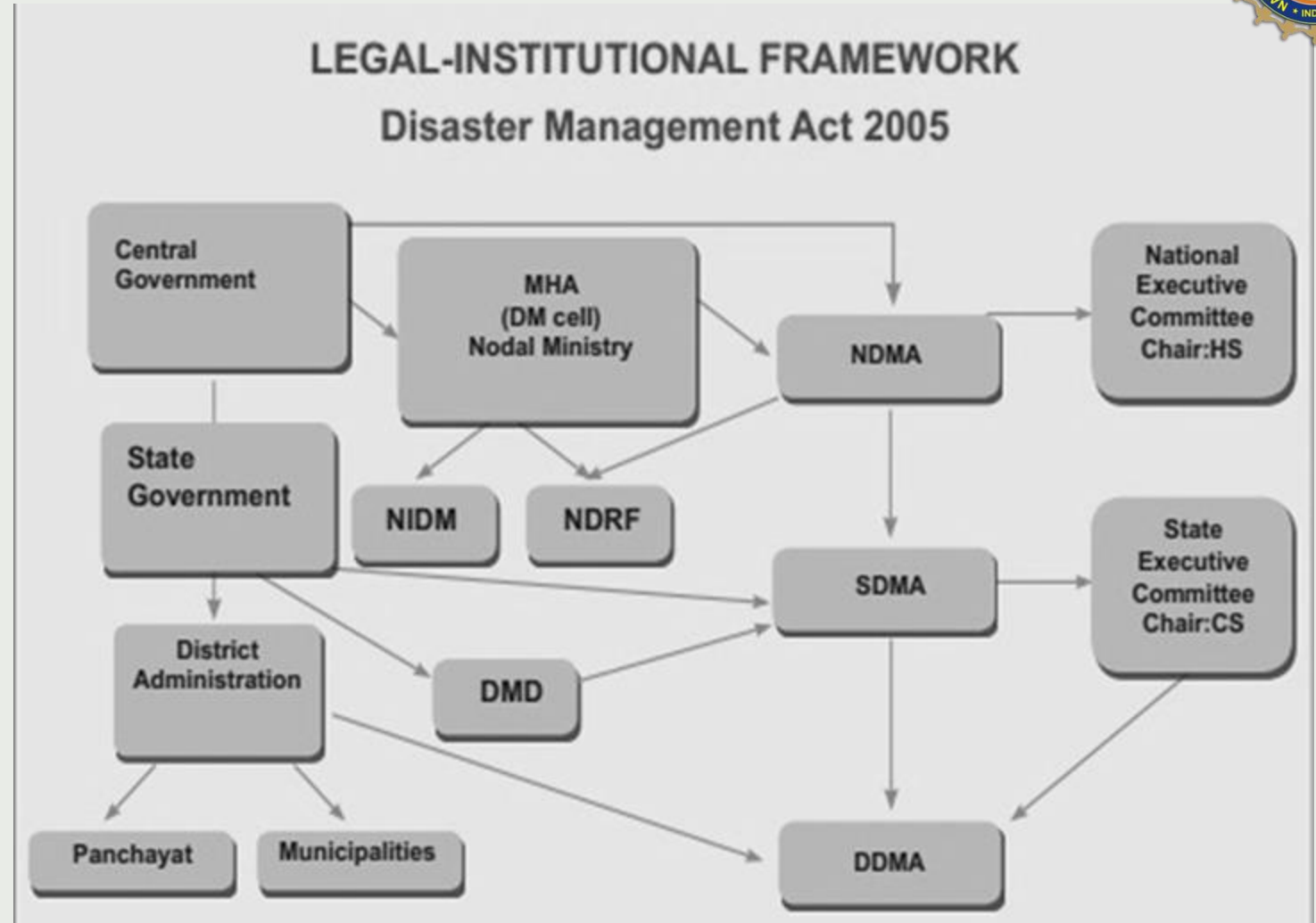
- Sendai Framework for Disaster Risk Reduction (SFDRR)
- Prime Minister Ten Point Agenda for Disaster Risk Reduction
- National Guidelines issued by NDMA



Disaster Management Institutional Set-up



**NDMA –
Hon'ble PM
(Chairperson)**





India's Heat Challenge: Recent Heat Trends and Risks

Definition of Heatwave in India



Criteria 1: Heat wave is only considered if maximum temperature of a station reaches



40°C or more
for Plains



37°C or more
for Coasts

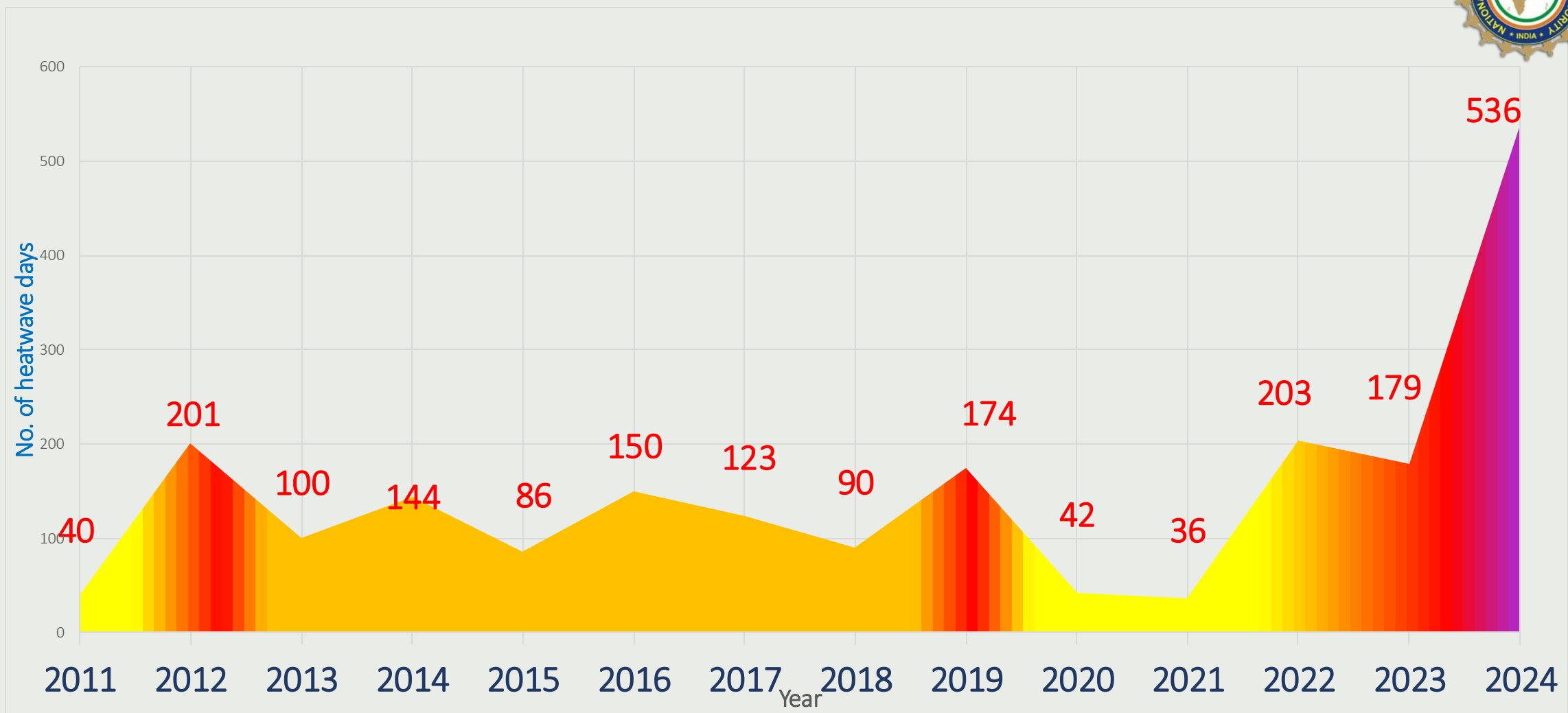


30°C or more for
Hilly Regions

Criteria 2: Once criteria 1 is satisfied, the departure from normal (calculated based on 1981-2010) should be
Between 4.5 °C to 6.4 °C for a heatwave day
More than 6.4 °C for a severe heatwave day

Criteria 3: If the maximum temperature is $\geq 45^{\circ}\text{C}$ and $\geq 47^{\circ}\text{C}$, a heatwave and severe heatwave is directly declared

Heatwave Incidences





DAYTIME CLIMATE HEATING UP

Hot days have been more common in the last 30 years
1994–2023 compared to 1951–1980

Change in average **number of days** > 40 °C

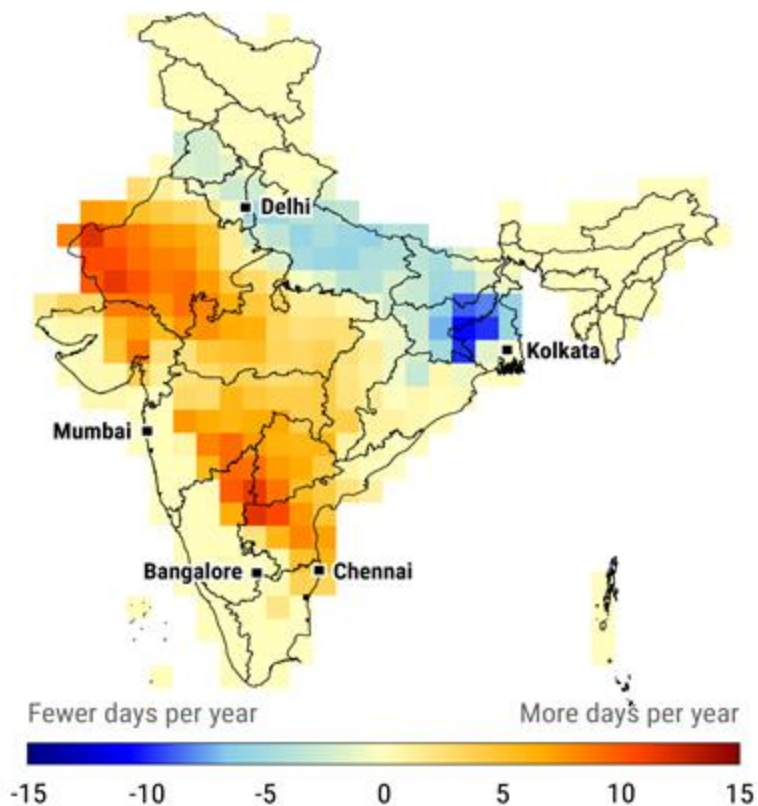


CHART: Chirag Dhara, Krea University & James Goldie,
360info. DATA: Indian Meteorological Department



NIGHTTIME CLIMATE HEATING UP

Hot nights have been more common in the last 30 years
1994–2023 compared to 1951–1980

Change in average **number of nights** > 28 °C

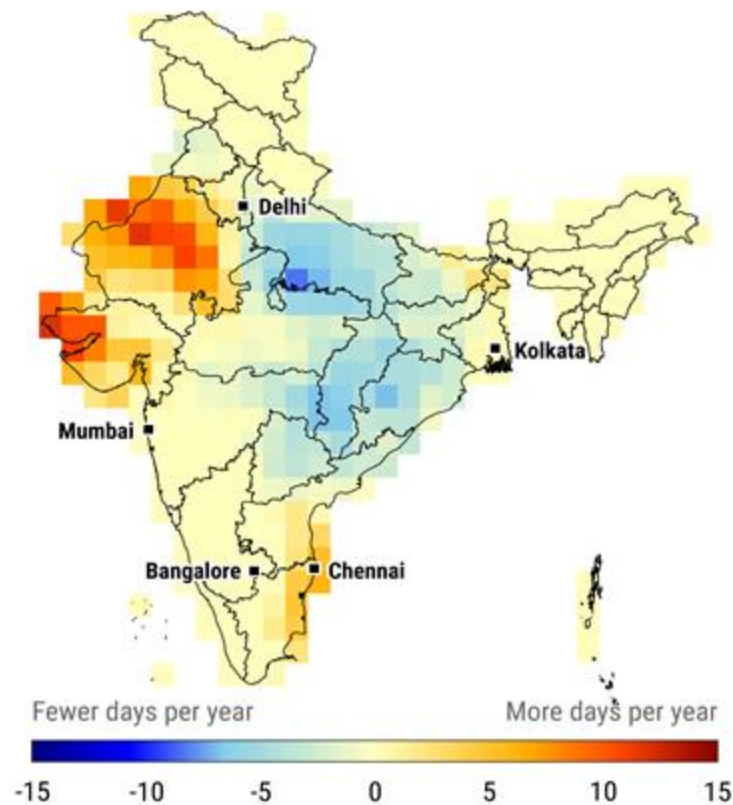


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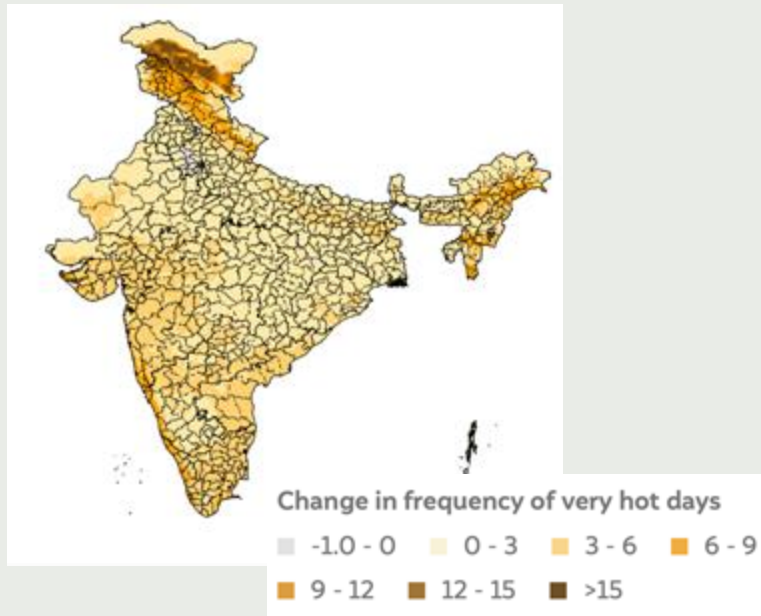


Extreme Heat in India

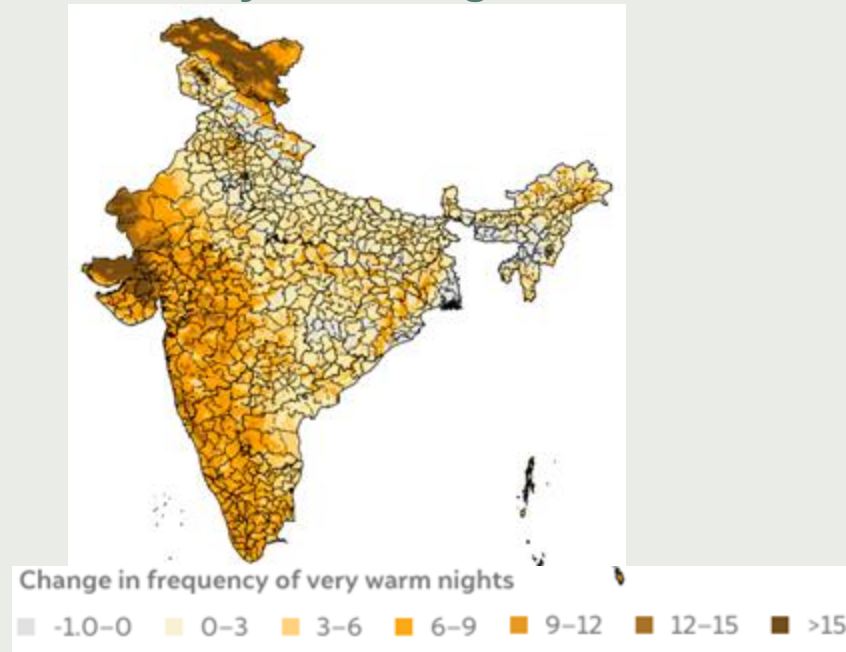


- In India, Year 2024 was the **second warmest year** on record since 1901
- **13 out of the 15 warmest years** were during the recent 15 years (2009-2024).
- The **past decade was the warmest** decade on record

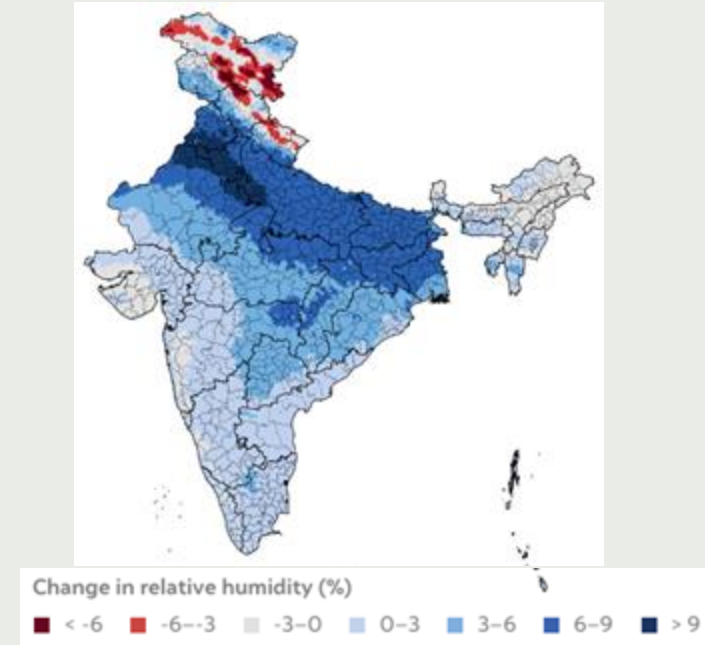
Very Hot Days



Very Warm Nights



Relative Humidity

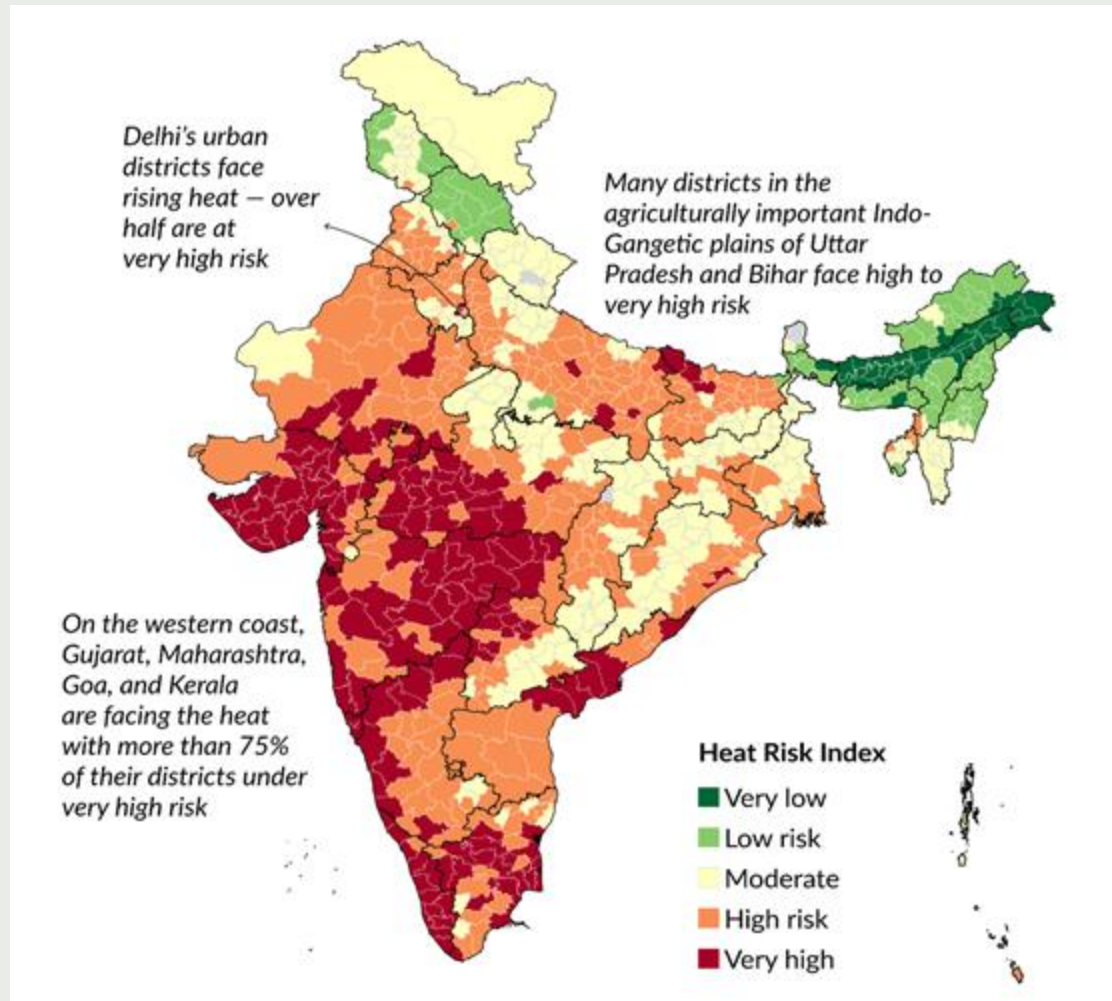


The conundrum of extreme heat in India: Current situation

More 'very hot days', but even more 'very warm nights' — raising serious health concerns

North India is experiencing significant increase in summer relative humidity (Source : CEEW)

Heat Risk Index



~ 57% of Indian districts, home to 76% of total Indian population are in high to very high heat risk category

Category	Number of districts
Very High	151
High	266
Moderate	201
Low	78
Very low	36

Top ten states and UTs: Delhi, Maharashtra, Goa, Kerala, Gujarat, Rajasthan, Tamil Nadu, Andhra Pradesh, Madhya Pradesh, and Uttar Pradesh

Source : CEEW

Urban Heat in Indian Cities: Disproportionate Impacts



Cities are warming faster, staying hotter at night, and becoming more humid—exposing urban populations disproportionately to climate risks.

- Climate change alone is not making Indian cities hotter—**Urbanization is a major contributor (UHI)**
- Indian cities are warming at ~2X the rate of the rest of the country, with **urbanization alone responsible for 60% of the trend**
- Urbanization and regional climate change have **increased night-time temperatures across 141 cities in the past two decades**

Study: IIT Bhubaneswar (MODIS Aqua Satellite NLST data, 141 cities, past 20 years)

- Delhi's 'core,' with the higher built-up area and population, is **2.9 °C hotter than its peripheries**.
- The analysis said Delhi is **"not cooling down at night"**. During the summers of 2001-10 and 2014-23, the land surface temperature would fall by 12.3 and 11.2° C, respectively on average from the daytime peak to the night time low. It has been even lower in recent year – 9.8°C in 2023.
- The last 10 summers (2014-23) in Delhi have been **8% more humid** on average compared to the average relative humidity from 2001-2010.

CSE analysis of data from six major cities – Delhi, Mumbai, Kolkata, Hyderabad, Chennai and Bengaluru— over a period of 23 years (2001-2024)

Impact of Heatwave on Different Sectors

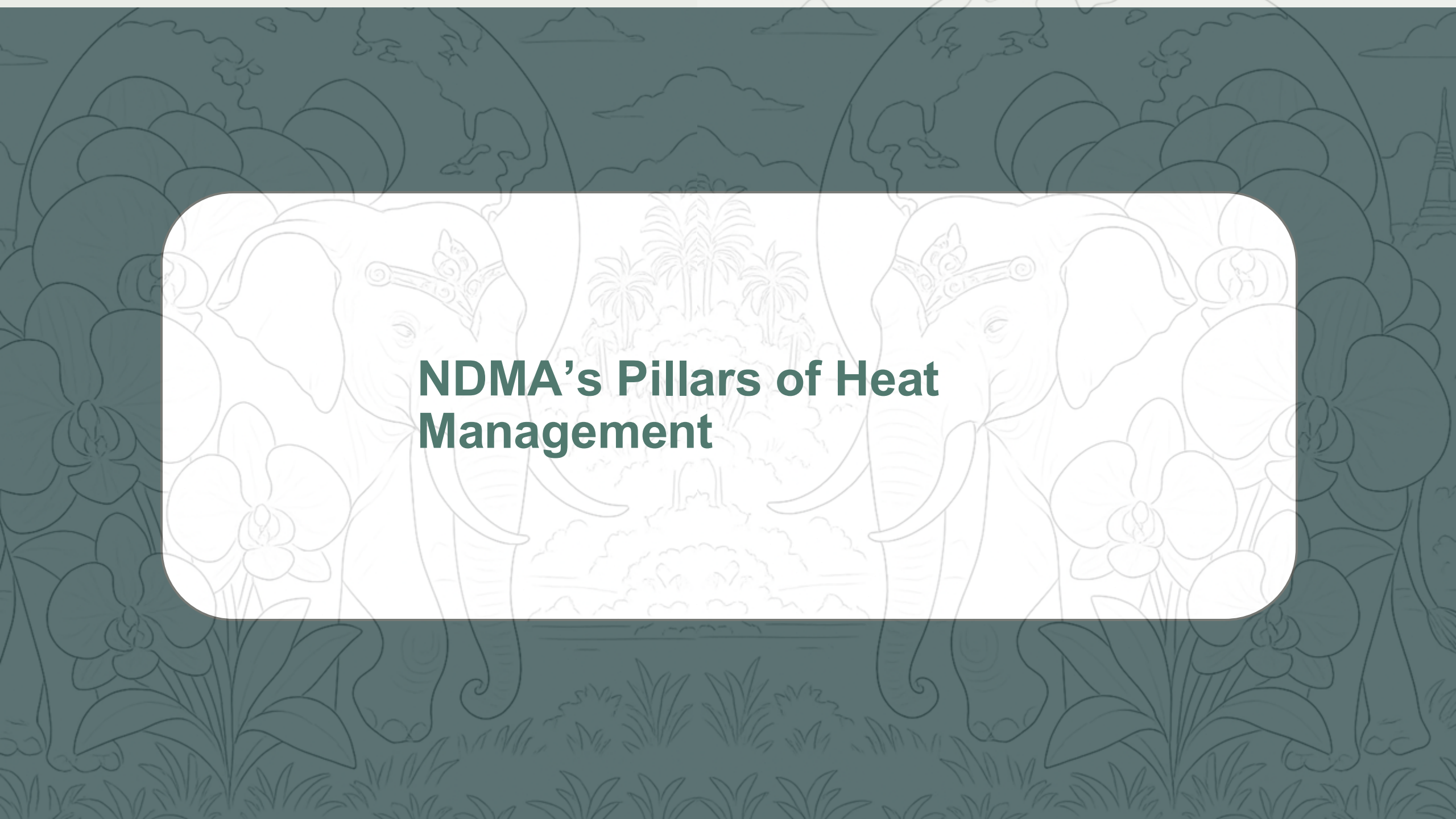


Sector	Impact
Health	Heat waves pose serious risks, especially to the elderly, children, and those with chronic conditions, Pregnant women,
Infrastructure	Stress on power grids; extreme heat damages roads, bridges, and railway tracks
Agricultural /Forest /Livestock	Affects crop yields and livestock, birds & wildlife health, forest fire
Water	Worsens drought conditions, affecting drinking water supplies, agricultural irrigation, ground water depletion and hydroelectric power generation.



Groups Vulnerable to Extreme Heat

Economically weaker sections	Low-income urban poor or slum dwellers; shelter-less individuals; people staying in informal settlements
Heat-exposed occupations	Farm labour, indoor and outdoor workers with high heat exposure such as construction workers, street vendors, traffic police personnel, gig workers.
Population with high health risks	People with comorbidities such as hypertension, cardiac, and kidney ailments; people with disabilities; infants; women; pregnant and lactating mothers; children; and the elderly



NDMA's Pillars of Heat Management



India Reviews Heatwaves at the Highest Level

- Hon'ble PM
- National Executive Committee
- National Crises Management Committee
- Election Commission of India
- Chief Minister/ Chief Secretaries of States



National Heatwave Framework: Key Goals & Principles

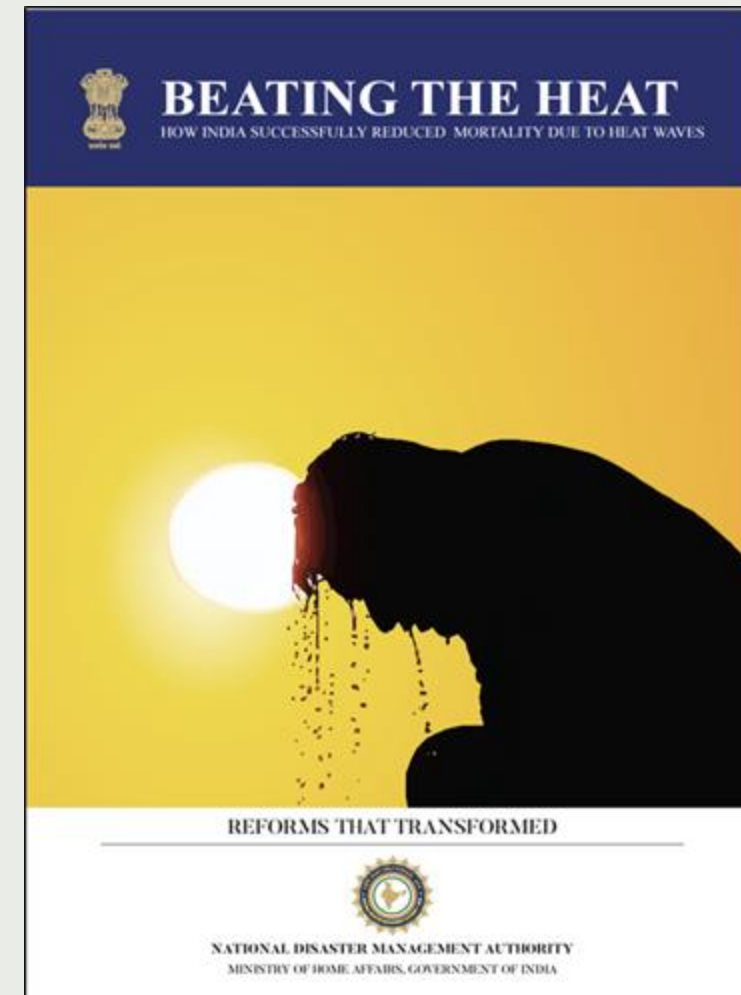


Goals -

- **From planning to action:** Shift India's heatwave response from preparation to proactive implementation
- **Empower local governments:** Encourage ownership and adaptation of heat action plans by local authorities
- **Establish national standards:** Define baseline processes for consistent and effective heatwave mitigation

Principles -

- **Decentralized and localized planning:** Tailoring solutions to local climates, vulnerabilities, and capacities
- **Community participation:** Involving communities ensures sustainability and responsiveness
- **Collaborative implementation:** Engaging governments, private sector, and civil society in unified efforts





India Accelerating Heatwave Mitigation Efforts

- **2019:** National Guidelines for Preparation of Action Plans.
- **2024:** NDMF/SDMF is allowed for mitigation projects in respect of Heatwaves
- **2025:** NDMF/SDMF Guidelines for Heatwave Mitigation Projects to be funded by local Governments
- **2025:** Cooling Centres Guidelines for local authorities

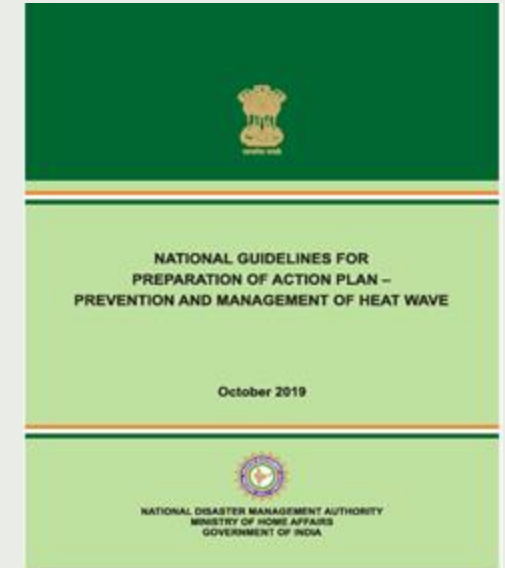
These efforts are made in collaboration with various departments and knowledge partners



3. NDMA Initiatives



- **National Guidelines** for Preparation of Action Plan- Prevention and Management of Heatwaves-2016, Revised in 2019
- **Coordination** with Department/ Ministries/ States/ SDMAs/ Municipalities
- **Advise States** for preparation/ updation of District & City HAP's
- In collaboration with Knowledge Partners, organize **annual Heatwave Workshop** for preparedness of states, Central Ministries /Departments since 2017
- **NDMA Imparts training to most vulnerable states** for preparation of City HAPs

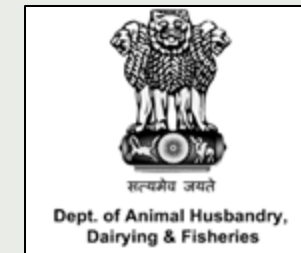


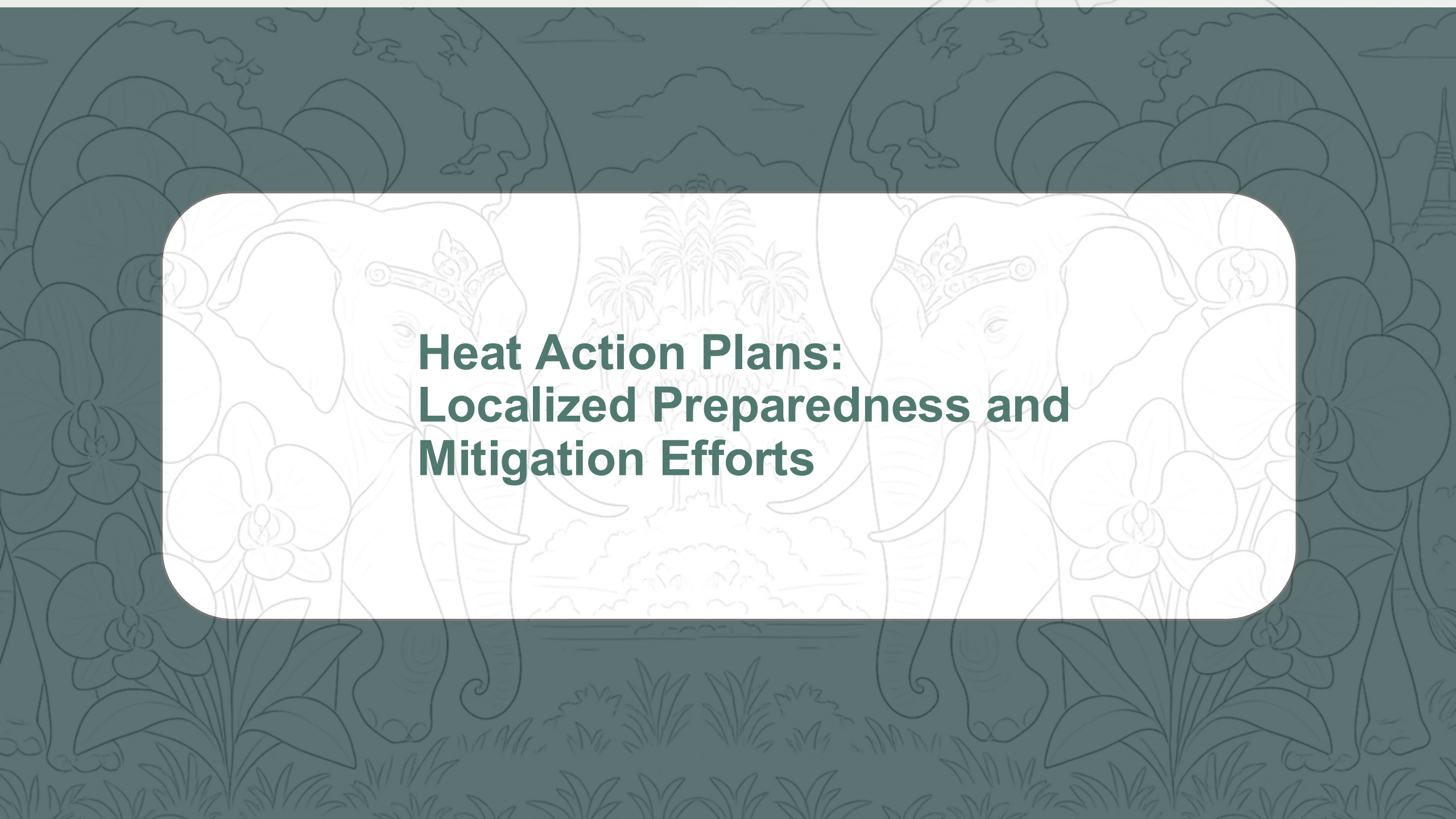
4. Building an Effective Institutional Mechanism

- Notifying heat as a **state-specific disaster**
- Notifying **Chief Heat Officer**
- Clarity in **responsibility** for HAP Preparation and Implementation
- Establishing a **Coordination** mechanism
- Ensuring that there are **incentives** for the implementation of longer-term mitigation actions
- **Updating** HAPs periodically
- Using **monitoring** systems to refine the HAP
- Establishing **data collection** processes
- Conducting periodic **evaluations**
- Create viable **financing options**
- HAP **Training**



4. Institutional Structure: Knowledge Partners





Heat Action Plans: Localized Preparedness and Mitigation Efforts

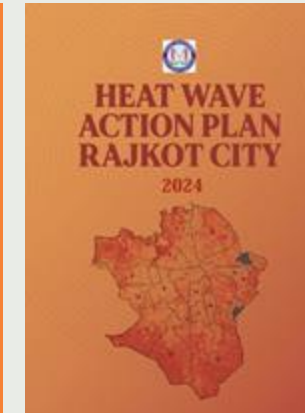


Heat Action Plans: Localized Preparedness and Mitigation Efforts

Over 250 cities and districts with operational HAPs, supported by NDMA's technical guidelines and funding instruments.

HAPs cover:

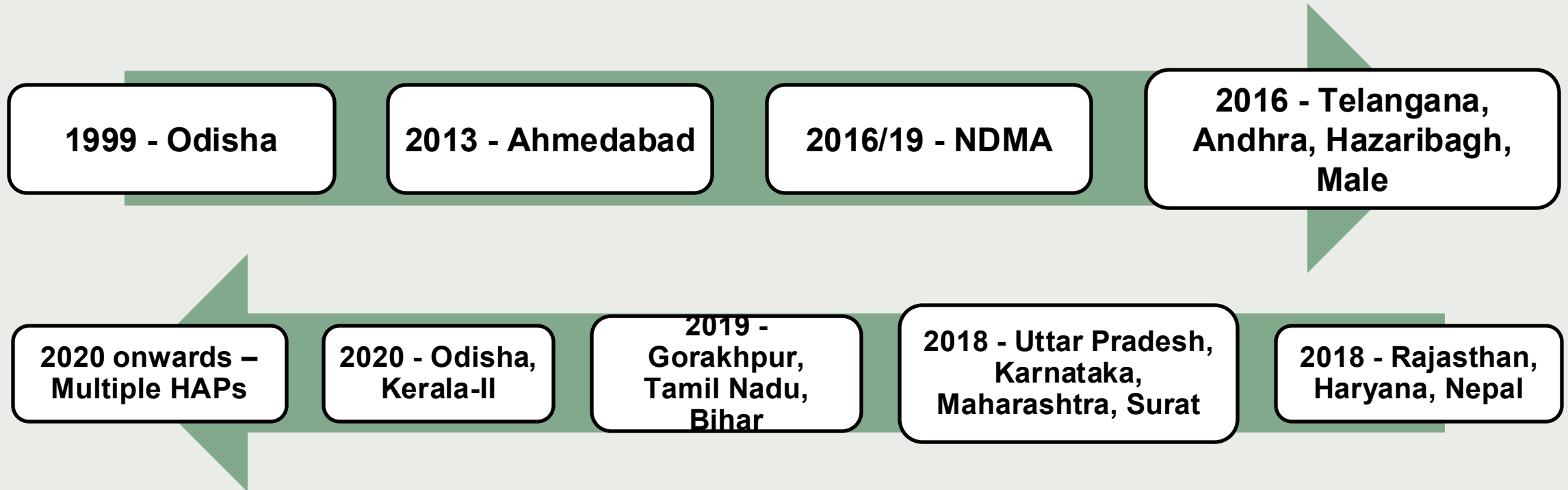
- **Comprehensive situational analysis** - Assessing variables like location, climate, economy, and infrastructure.
- **Historical climatological data** - Using IMD records for trend analysis and future heat projections.
- **Early warning systems** - Leveraging IMD forecasts to develop effective alerts and precautions.
- **Global Examples**-Lessons from international heatwave management practices



Heat Policy



1. Coordination - CoDRR (Committee on Disaster Risk Reduction)
2. Guidelines- 2016, revised in 2019
3. HAPs – 23 States, 200+ districts and Cities





Guiding Principles for HAPs

- Focus on **Vulnerable Communities**
- Use **Local Risk Assessments**
- **Localised Temperature/Heat Index**
Thresholds for Warnings
- Balanced **Structural and Non-Structural**
Actions

- UHI Assessment
- Promote Nature-Based Solutions
- Design Flexible, Locally Relevant
Solutions
- Encourage Women's Participation
- Building Institutional Framework

Understanding Community Vulnerabilities

Identifying At-Risk Groups

Local temperature thresholds

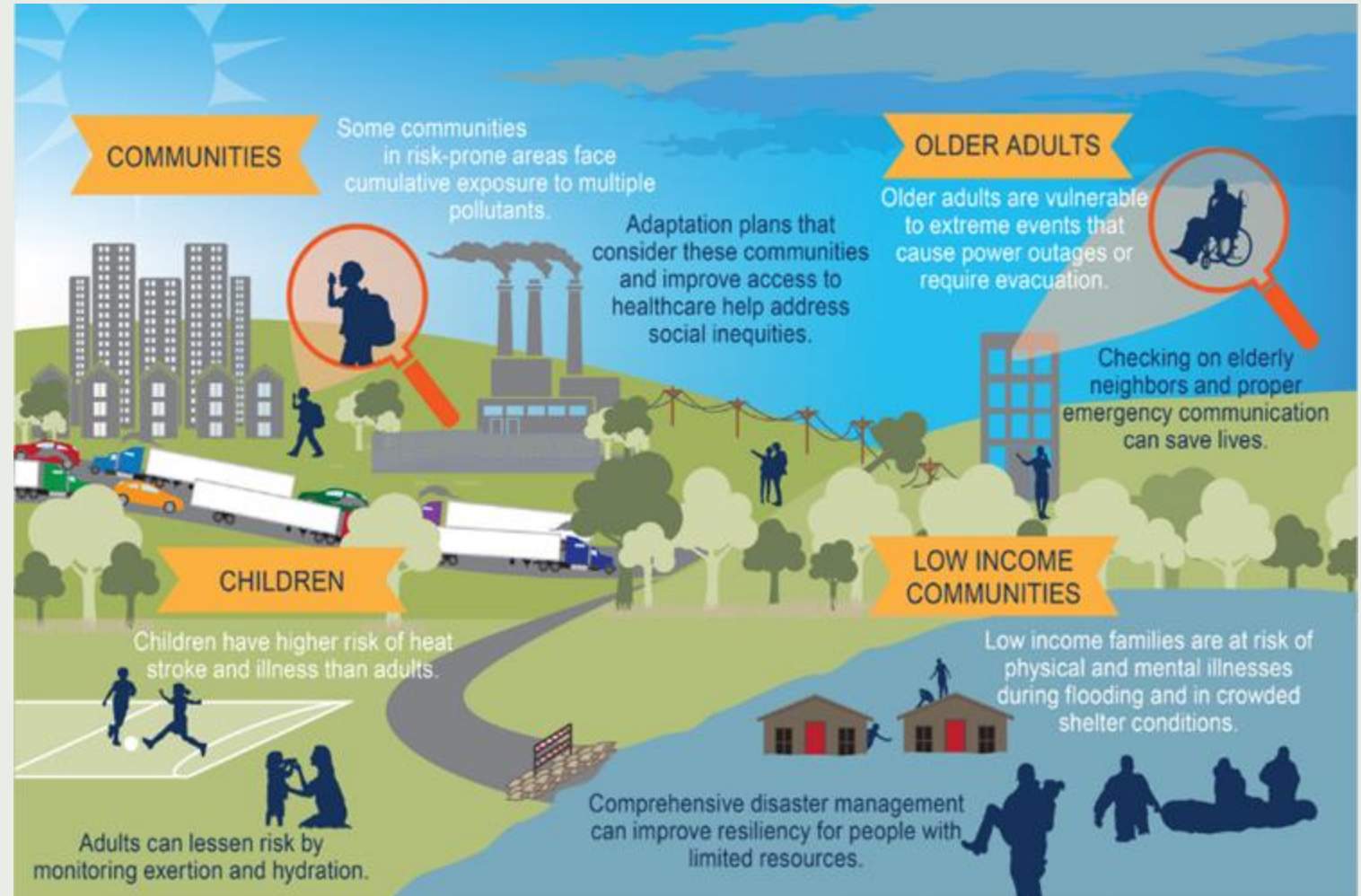
Define region-specific heat thresholds for targeted action.

Vulnerability assessments

Map sectors, occupations, and populations most at risk.

Heat vulnerability mapping

Develop ward-level maps to pinpoint hotspots.





1. Preparedness Measures

01

General public preparedness

- Cooling stations
- Temporary or permanent drinking water points at public places

02

Heat-exposed groups (such as construction workers, street vendors, informal sector workers)

- Change in working hours
- Cool vests/jackets for outdoor personnel
- IEC campaigns for vulnerable groups
- Targeted awareness campaigns for occupationally heat-exposed
- Enhancing passenger comfort at railway stations (adequate cooling provisions, AC waiting rooms, water points etc)
- Passenger health and safety measures in buses and bus terminals (adequate cooling provisions, AC waiting rooms, water points etc)

03

Transport sector preparedness

- Prepare healthcare facilities (Ice-pack dispensers, readiness etc)
- Health emergency services (Displays on ambulances, identify vulnerable areas)
- Set up cooling wards in hospitals and health centres

04

Health sector preparedness



1. Preparedness Measures

05

School preparedness

- Modify school operational guidelines
- Preparedness of schools (adequate stocks of ORS, first-aid kits, water)

06

Infrastructural preparedness

- Repair/maintain cooling systems
- Repair/maintain electrical grid component

07

Agriculture sector preparedness

- Repair/maintain irrigation systems
- Shelters for livestock

08

Water sector preparedness

- Repair/maintain mechanical and electrical faults at tube wells, ponds
- Ensure water supply

2. Mitigation Measures



01

Household measures

- Cool roofs, green roofs
- Rooftop rainwater harvesting

02

Community measures

- Artificial water storage structures for agriculture and livestock
- Greening initiatives

03

Sectoral measures

- Creating ambient indoor work conditions
- Awareness building programmes for farmers
- Community cooling action plan
- Multi-sectoral institutional capacity building
- Community health preparedness
- Electricity resilience programme
- Improving public transport

04

City/District-wide measures

- Establishing regional information/training centres
- Shading and low-albedo pavements
- Establishing a local weather network
- Localised climate projections
- Updating building bye-laws
- Capacity building in government
- Capacity building for relevant community institutions such as ASHA centres, schools

2. Mitigation Measures

1. **Cool Roof** : House Owners' Guide to alternate roof cooling solutions-2021
2. Passive **Cooling Centers**
3. Expansion of **green areas, greening of pathways**
4. Revival of **water bodies**



Urban Forest: Jadeshwar Forest- built on a 'dumping site



Before



After

Ramnagar Block - Lilaaur Lake (38 hectares), which was extinct for many years, was revived in Gram Panchayat Lilaaur Buzurg of Ramnagar





Gaps in HAPs

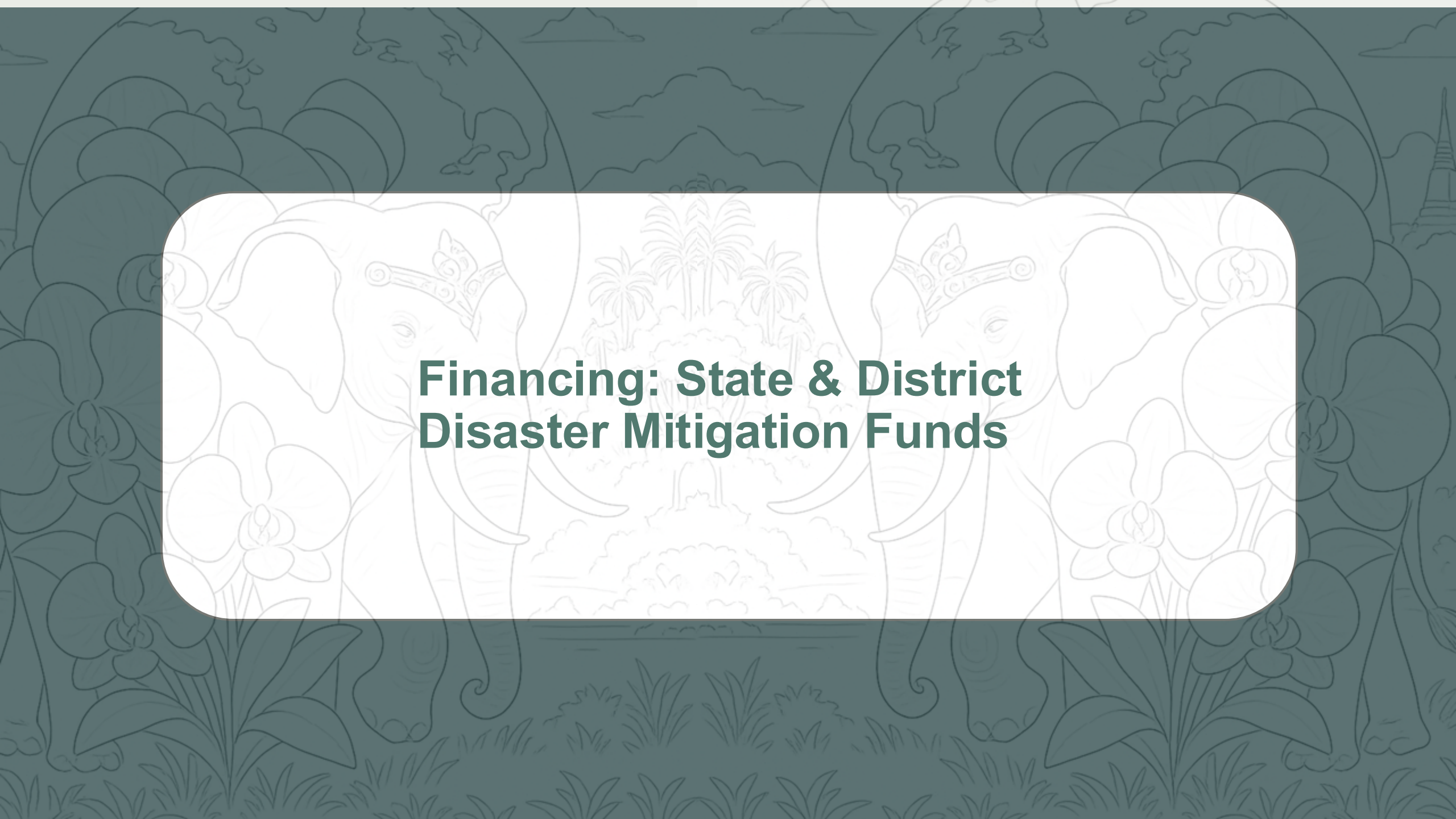
38 HAPs surveyed (SFC):

1. Government and non-Government stakeholders increasingly working together seamlessly

1. Most HAPs lack

- Localized heat hazard mapping
- Humidity, warm night integration in EWS
- Heat vulnerability and risk assessments
- UHI assessment
- Granularity upto Ward-level
- Funding mechanism
- Legal Framework





Financing: State & District Disaster Mitigation Funds

FC-XV : Disaster funds at the national & state levels



National / State Disaster Risk Management Fund

- There are **four windows as per the DM Act**:

NDRF / SDRF: Response (40 percent)

Recovery and Reconstruction (30 percent)

Preparedness & Capacity-building (10 percent)

NDMF / SDMF: Mitigation (20 percent)

Contributory between the Centre and State. (75:25, 90:10)

Integrating NDMF and SDMF to HAP





Guidelines for the utilization of NDMF, SDMF for heatwave mitigation

- Recognizes the urgent **need to fund** and implement long-term heat solutions
- Aim to stimulate **heat leadership at subnational level**
- Inclusion of extreme heat in list of **disasters eligible for central mitigation funding**
- Focus on a **blended finance model**-Local government budgets, Integration of central and state schemes, Private finance, Grants and donor funding
- Funding linked to HAPs for **local heat planning**
- Can fund **national, multi-state projects** on extreme heat



Annual allocations for heatwave mitigation projects



Category*	Population range	No. of cities	No. of cities to be funded	Proposed annual allocation
Megapolis	More than 10 Million	3	3	0.6 M USD /city
Metropolitan_City II	5 Million to 10 Million	5	5	0.36 M USD/city
Metropolitan-City I	1 Million to 5 Million	45	25	0.12M USD /city
Large City	0.5 Million to 1 Million	43	20	60,000 USD/city
Medium Town & Small Town	Less than 0.5 Million	7839	100	30,000 USD/city
Large Districts	More than 0.40 Million	56	5	0.6 M USD /district
Medium Districts	0.20 Million to 0.40 Million	175	20	0.3 M USD /district
Small Districts	Less than 0.20 Million	409	40	0.12 M USD /district
Proposed annual outlay for heatwave mitigation				~ 25 M USD / year



Potential Solutions for Heat Resilience and Financing Resources



15 th Finance Commission	NDRMF/ SDRMF NDMF/ SDMF
Program and Schemes	Central Sector/ Sponsored Schemes State Program/ Schemes
Local resources	City taxes and duties Fee and Services
CSR Funds	Projects and program Public Sector Aid and Donation
Non-Government Organisation (NGOs)	Project and Program Private Donation



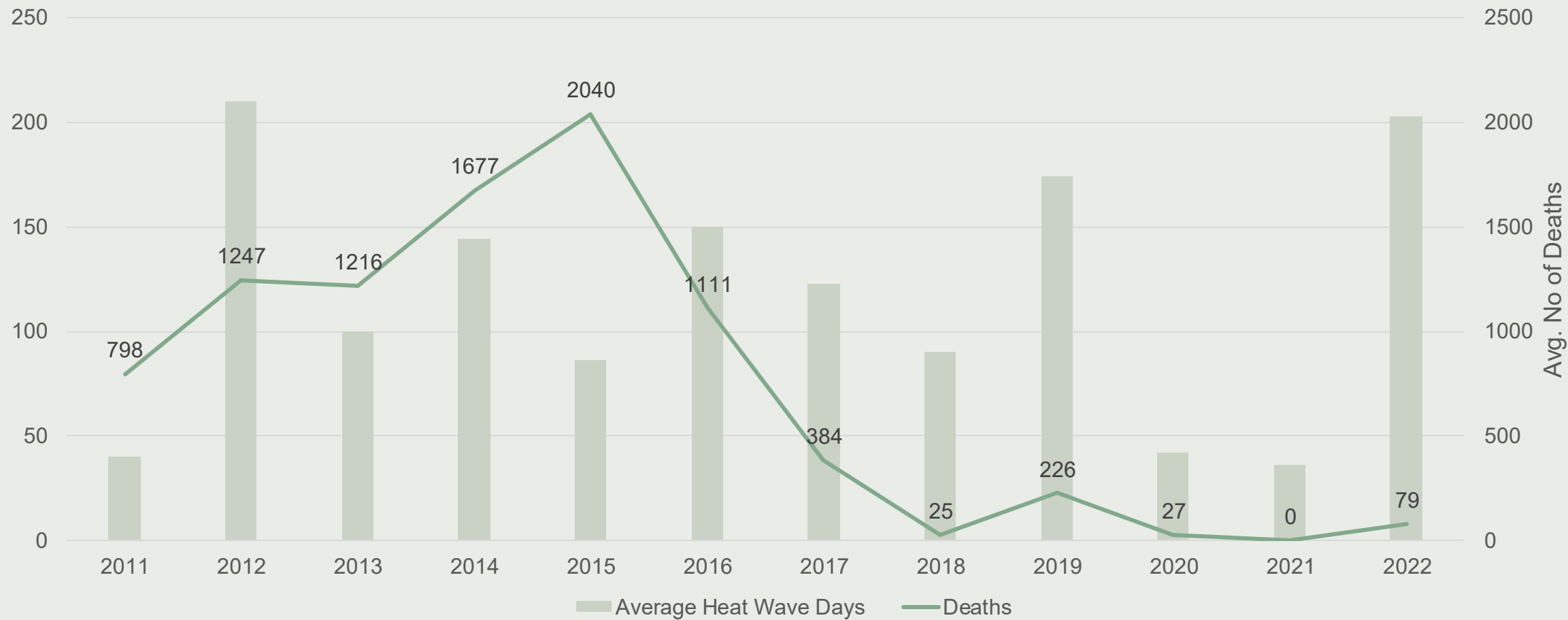


Way Forward



India Reducing Heatwave Mortality

Average Heat Wave Days and Related Mortality, India (2011-2022)





Future Efforts

- Revision of HAPs
- Addressing the Gaps in the HAPs
- Leveraging Knowledge Partners in scaling the efforts across 300 Districts and Cities.
- Co-create along with KPs, a template for the HAPs for ease of understanding and revision.
- Capacity Building of the officials.
- Lay out a calendar of operations for the Authorities to follow before the onset of summers.
- Explore levers to integrate cooling actions into the planning process.





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