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NAVIGATING INDIA'S URBAN HEAT LANDSCAPE

From Challenges to Driving Action

NAVIGATING INDIA'S URBAN HEAT LANDSCAPE – FROM CHALLENGES TO DRIVING ACTION

We are grateful to the H T Parekh Foundation for its support towards this pivotal landscape study. We also thank all individual contributors for their valuable insights on India's evolving heat landscape, which informed and shaped this report.

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ABOUT SATTVA CONSULTING

Sattva Consulting is a global impact consulting firm from India. Since 2009 we have been engaging with communities, business and government to achieve societal impact at scale. We believe that Civil society, Business and Government all have a critical role to play in building an equitable and sustainable world, and we actively partner with all stakeholders to enable impact through our advisory & orchestration services, knowledge and data platforms which we have built as public goods for the ecosystem and collaborative solutions and partnerships.

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ABOUT THE H T PAREKH FOUNDATION

The H T Parekh Foundation (HTPF) was established in 2012 to commemorate the birth centenary of the Founder Chairman of HDFC Limited (erstwhile). HTPF began its journey in 2014, acting as the primary implementing agency for HDFC's CSR efforts, supporting ~150 non-profit organizations across Education, Healthcare, Disability and Environment.
Following the merger of HDFC Limited with HDFC Bank on July 1, 2023, the Foundation now operates as an independent, domestic philanthropy. Our flagship programme ReVIVE, is an urban climate change initiative, with a focus on Urban Heat stress, primarily across Tier 2 & 3 Indian cities. Drawing from the strong inter linkages of urban heat to air pollution, solid waste management, urban ecology and water, ReVIVE aims to be community centric and solution driven, whilst building resilience at both the city and community level.

For more information, please visit: www.htparekhfoundation.com

Source: Pexels

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LIST OF ABBREVIATIONS

AMRUT	Atal Mission for Rejuvenation and Urban Transformation
ATREE	Ashoka Trust For Research In Ecology And The Environment
Bn	Billion
CAP	Climate Action Plan
CEEW	Council on Energy, Environment and Water
CEPT	Centre for Environment Planning and Technology
CO2e	Carbon dioxide equivalent
CSEP	Centre for Social and Economic Progress
CSO	Civil society organisation
CSR	Corporate Social Responsibility
DFI	Development Finance Institution
ECBC	Energy Conservation Building Code
GDP	Gross Domestic Product
GHG	Greenhouse gases
GIS	Geographic Information System
HAP	Heat Action Plan
HRI	Heat-related illnesses
ICAP	India Cooling Action Plan
IIT Madras	Indian Institute Of Technology, Madras
IIT-B	Indian Institute of Technology, Bombay
ILO	International Labour Organization
IMD	India Meteorological Department
INR	Indian Rupee
IRADe	Integrated Research and Action for Development
LNEMT	Latent, Nascent, Emerging, Mainstream, Transformed Framework.
M&E	Monitoring and Evaluation
MDB	Multilateral development banks
Mn	Million
MoEFCC	Ministry of Environment, Forest and Climate Change
MoHFW	Ministry of Health and Family Welfare, Government of India
MSME	Micro, Small and Medium Enterprises
NAPCCHH	National Action Plan for Climate Change and Human Health
NDMA	National Disaster Management Authority
NIUA	National Institute of Urban Affairs
NMSKCC	National Mission on Strategic Knowledge for Climate Change
OPD	Outpatient Department
PHFI	Public Health Foundation of India
PM SVANidhi	Prime Minister Street Vendor's AtmaNirbhar Nidhi
PM10	Particulate Matter 10
PM2.5	Particulate Matter 2.5
PMAY	Pradhan Mantri Awas Yojana
PPP	Public-Private Partnership
RWA	Resident Welfare Association
SDMA	State Disaster Management Authority
SDRF	State Disaster Response Fund
SEIAA	State Environment Impact Assessment Authority
SEWA	Self Employed Women's Association
SFC	Sustainable Futures Collaborative
SHC	Suspected heatstroke cases
SMS	Short Message Service
SPV	Special Purpose Vehicles
TERI	The Energy and Resources Institute
UHI	Urban Heat Island
ULB	Urban Local Body
UNEP	United Nations Environment Programme
UPSDMA	Uttar Pradesh State Disaster Management Authority
USD	United States Dollar
UTI	Urinary Tract Infection
WRI	World Resources Institute

LIST OF FIGURES

Source: Pexels

EXECUTIVE SUMMARY

As climate change intensifies, urban centres around the world are grappling with rising temperatures and extreme heat events. In 2024, India witnessed more than 500 heatwave days, with over 1.05 billion people exposed to prolonged periods of extreme heat stress, showcasing that rising urban temperatures are visibly one of the most pressing climate challenges of our time. The tenfold increase in heat stroke cases since 2022, intersecting with heat's growing impact on health, livelihoods and the environment, underscores the need for immediate, coordinated and proactive action. The current ecosystem in India, with its various actors like the government, civil society and the market, are in their siloed ways, attempting to develop pathways to address this issue; but the absence of collective action poses barriers to a systemic response to the crisis.

This preliminary report delves into the insights of a 6-month long landscape study undertaken by Sattva Consulting with support from the H T Parekh Foundation. It aims to understand the critical dimensions of India's urban heat ecosystem and identify actionable pathways for developing heat-resilient cities. It is structured around nine key insights that move from identifying core challenges to offering practical solutions. While acknowledging that heat-related challenges affect all urban areas, this report strategically focuses on India's Tier-2 and Tier-3 cities, as these cities are projected to absorb more than half of the country's growing urban population. The findings presented are based on insights from extensive secondary research and interviews with 42 experts in the ecosystem.

KEY INSIGHTS AND RECOMMENDATIONS

Insights	Recommendations
Heat as an under-recognised crisis With each passing year, heatwaves are becoming increasingly frequent, acute, and prolonged. As temperatures rise, Indian cities and their inhabitants struggle to cope with extreme heat, facing consequences as severe as those of natural disasters. The growing urban heat stress warrants immediate and urgent attention.	State governments can recognise heat as a state-specific disaster to unlock critical funding under the State Disaster Response Fund (SDRF), while think tanks and research organisations build the data and evidence needed for policy change.
The health cost of heat Extreme heat significantly affects human wellbeing, with certain vulnerable groups experiencing heightened risk. The surging cases of heat-related illnesses put enormous pressure on public health systems. Strengthening health infrastructure to recognise and tackle this escalating crisis becomes inevitable.	Health ministries and state departments can upgrade public health infrastructure, while academic medical institutions support capacity-building initiatives for emergency preparedness at public health facilities for first responders.
Risk to India's workforce Three-fourths of the Indian workforce is severely impacted by heat stress. Extreme heat substantially reduces worker productivity and endangers livelihoods. Women are particularly vulnerable, as the heat crisis reinforces and exacerbates gender inequalities in urban livelihoods, especially outdoor work.	Urban Local Bodies (ULBs), insurance regulators, and research institutions can support informal and vulnerable workers by piloting climate insurance schemes, promoting heat-adjusted work policies, and developing frameworks to track heat-related economic losses.
Cascading environmental effects In a domino effect, heat leads to many environmental issues, disturbing the intricate balance of ecological systems. It negatively impacts biodiversity, worsens air pollution, strains water resources, and creates climate disruptions, leading to flash floods and unseasonal heavy rain.	Research institutions and ULBs can co-develop blue-green infrastructure toolkits incorporating nature-based solutions and adaptation measures to enhance ecological resilience in urban planning.
Stakeholders in the heat ecosystem Addressing the complex issue of urban heat requires coordinated efforts and collaboration amongst diverse stakeholders. In India, the government, civil society, and market forces can collectively play a crucial role in advancing heat resilience, although current efforts are nascent and remain fragmented.	Philanthropy can establish multisectoral platforms to enable knowledge exchange, foster cross-sectoral collaboration, and build ecosystems for effective heat resilience, while ULBs share best practices to enhance implementation and accountability.

Strategic heat action investments

Allocation of funds from the Centre to states and ULBs is steadily increasing, along with growing private sector funding, including philanthropy. However, there is far more scope for optimal utilisation and channeling of these resources toward addressing the urban heat crisis versus rural heat.

Central and state governments can leverage schemes like AMRUT and PMAY-Urban to integrate heat resilience into infrastructure planning, while philanthropy and CSR funds can provide enabling capital to co-invest in scalable solutions through public-private models targeting high-risk urban areas.

The need for more action-oriented frameworks

National and state-level initiatives, as well as city-level Heat Action Plans (HAPs), intend to tackle heat-related challenges. While frameworks are generally advisory in nature, HAPs developed in recent years have been instrumental in translating guidelines into on-ground action.

ULBs should anchor the development and implementation of HAPs to turn policy into practice, while ministries and apex bodies such as MoEFCC and NITI Aayog could drive a national real-time heat data platform for coordinated, evidence-based heat action.

Evaluating vulnerability

Tailoring heat action to specific contexts and needs of vulnerable groups is essential for effectively building resilience in urban centres. This can be done through collecting hyperlocal data, conducting vulnerability assessments, and mapping heat hotspots.

ULBs and research institutions can integrate vulnerability assessments as a core component of HAP development, by using hyperlocal data to design targeted interventions for vulnerable groups such as informal workers, women, children, and the elderly.

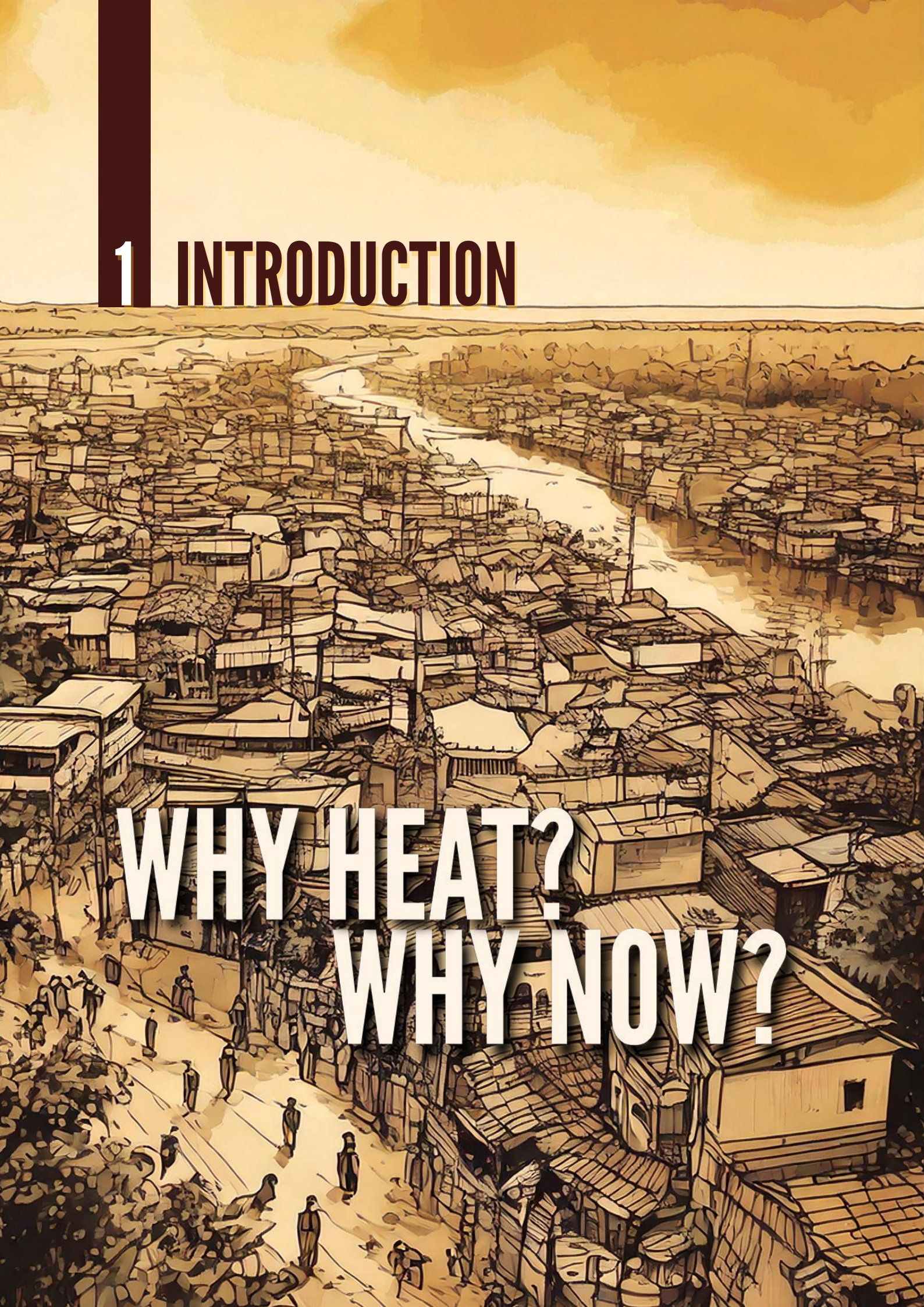
An emerging gamut of solutions

An array of solutions for heat adaptation and mitigation do exist in India. Although still in their formative stages, these interventions have the potential to mature and scale. There is growing interest amongst different stakeholders to drive innovation and enhance our ability to respond to the heat crisis.

Innovators and incubators can pilot and scale context-specific solutions for thermal comfort through dedicated heat innovation hubs in academic institutions, while philanthropy and state initiatives could provide the necessary funding, regulatory support, and incentives to accelerate these efforts.

Addressing the urban heat crisis in India demands immediate, systemic, and collaborative action across all levels of governance and sectors. As this report outlines, whilst solutions exist, the ecosystem requires stronger institutional support, targeted investments, and coordinated implementation to reach people across all socio-economic strata, especially vulnerable communities. By integrating ecological resilience, health preparedness, innovative financing, and data-driven planning, India's cities can lead the way in building an inclusive and heat-resilient future.

1 INTRODUCTION



WHY HEAT? WHY NOW?

1. INTRODUCTION
WHY HEAT, WHY NOW?

Global average temperatures have been increasing demonstrably, with 2024 being documented as one of the warmest years on record, exceeding pre-industrial levels by over 1.5°C.[1] However, the rise in global temperatures is not uniform worldwide, with some regions experiencing significantly higher warming than the global average.[2] Even if temperature increases stay within the Paris Agreement's target of 2°C, the prevalence of hazardous Heat Index levels — which account for both temperature and humidity — is expected to increase by 50–100% in tropical countries.[3] South and Southeast Asia are particularly among the most vulnerable regions, due to their high population density and dependence on farming.[4] Studies indicate that heatwaves in South Asia have been increasing in both duration and severity, exacerbated by climate change and urbanisation.[5]

As an emerging, rapidly growing economy situated in the Global South, India faces critical risk from rising heat, marked by a 0.3°C rise in average temperature in a 30-year period in between 1985 and 2014.[6] In light of its fast-paced growth, India ranks third in the list of large emitters of greenhouse gases (GHG) in the world, following China and the United States, with a 94% increase in the nation's GHG emissions between 2000 and 2020 (Figure 1).[7] Under this high emissions scenario, the average temperature is projected to increase further by 5.1°C in the next 75 years.[6] The heat crisis is unprecedented in urban India, with the frequency and intensity of heatwaves increasing in recent years. By the middle of this century, heatwave days in cities could increase four- to sevenfold, with peak temperatures rising from around 40°C to nearly 49°C, far outpacing rural areas.[8]

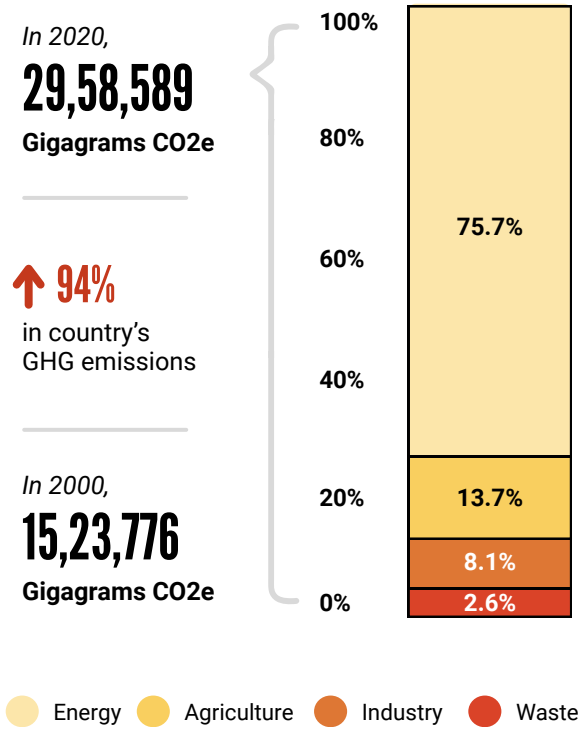


Figure 1: *Growth in greenhouse gas emissions since 2000, major emission sources in 2020*[7]

In emerging Tier-2 and Tier-3 cities, growing urbanisation could compound the risk, adding to land-use transitions, construction emissions, and air conditioning needs.[9,10] For the average urban resident, this translates into declining quality of life, as extreme heat intensifies health risks, disrupts daily life, and hampers livelihoods, especially for those without reliable access to cooling.

The situation necessitates immediate, multisectoral action, positioning urban heat resilience as a critical developmental imperative. This report is a preliminary findings report, and seeks to cover the urban heat landscape in India for multiple stakeholders. These include urban local bodies, state governments, philanthropic funders and impact investors, non-profit implementers, researchers and innovators, each vital to building resilience against the impact of heat, ranging from public health crises to economic disruption.

India's urban population is expected to double to over 800 million by 2050.[11] Although challenges persist across all urban areas, this report strategically focuses on India's Tier-2 and Tier-3 cities, as they are expected to absorb much of the country's urban growth. Integrating heat resilience into their planning is both timely and essential. These emerging urban centres present great opportunities for preemptive intervention due to their growth dynamics, willingness to adopt new strategies, significant scope for demonstrating impactful solutions, and the possibility of developing scalable models applicable to similar cities nationwide.

The findings presented are grounded in a robust methodology combining extensive secondary research followed by primary research to validate the findings (Figure 2). This multipronged approach ensures that the report integrates established knowledge with diverse and contemporary expert perspectives.

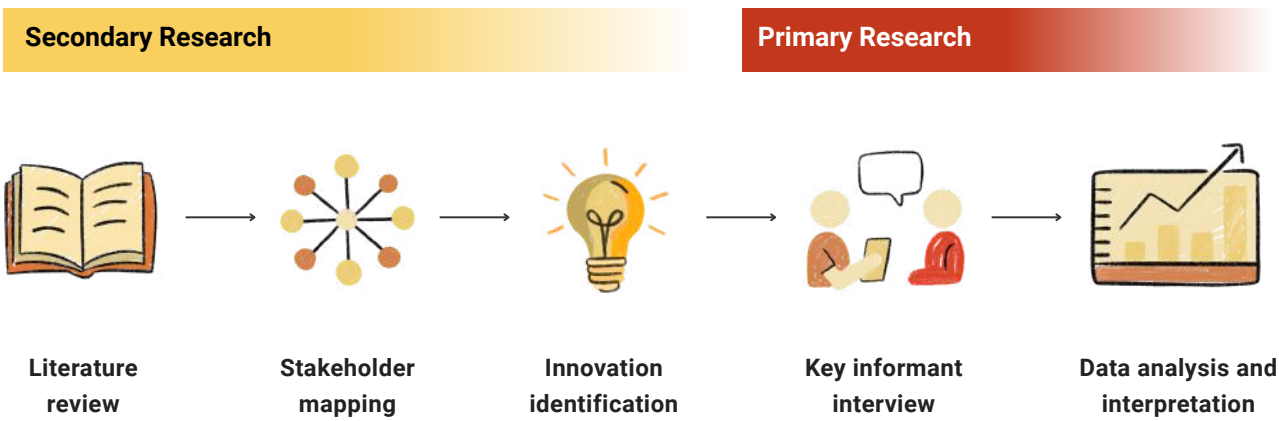


Figure 2: *Methodology contributing to report insights*

42 stakeholders interviewed from 26 organisations across 6 archetypes

1. Government Bodies

- Building Materials & Technology Promotion Council
- Ministry of Environment, Forest and Climate Change (MoEFCC)
- National Institute of Urban Affairs (NIUA)
- NITI Aayog

2. Academic Institutions

- Indian Institute of Technology Bombay
- Public Health Foundation of India

3. Implementing CSOs

- Indus Action
- Praja Foundation
- Reap Benefit
- Self-Employed Women's Association (SEWA)
- Udhyam Foundation

4. Think Tanks and Research Institutions

- Artha Global
- Council on Energy, Environment and Water (CEEW)
- Centre for Social and Economic Progress (CSEP)
- Integrated Research & Action for Development (IRADe)
- Sustainable Futures Collaborative
- The Energy and Resources Institute (TERI)
- WELL Labs
- World Resources Institute (WRI)

5. Innovators (Startups and Private companies)

- Innpact Solutions
- Paving+
- Resilience AI
- Villgro Innovations Foundation
- Zerund

6. Urban Local Bodies (ULBs)

- State Urban Development Agency, Odisha
- Urban Development & Municipal Affairs Department, Government of West Bengal

INSIGHT 1

HEAT AS AN UNDER-RECOGNISED CRISIS

WITHOUT FORMAL RECOGNITION OF HEAT AS A NATIONAL DISASTER, INDIA LACKS THE MANDATE FOR COORDINATED ACTION

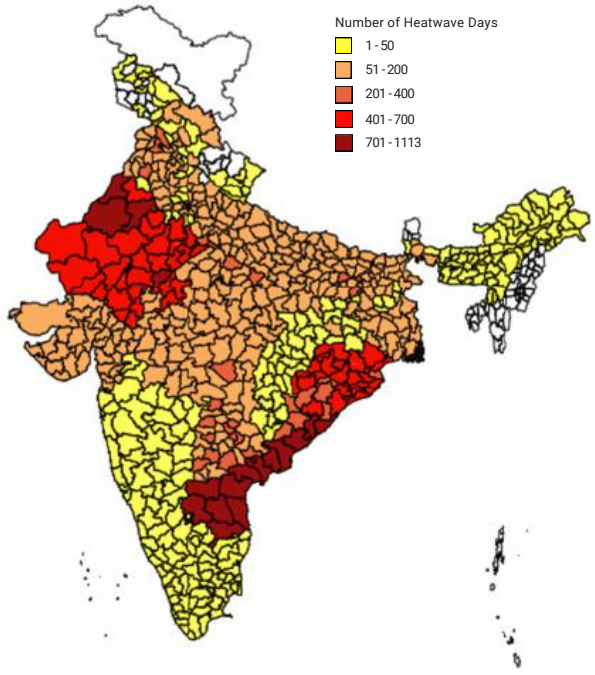


Figure 3: *Total number of disastrous heatwave days annually (1969 to 2019)*[14]

India is facing a growing, yet often underestimated crisis — the rising severity and frequency of heat waves (Figure 3). In 2024 alone, the nation experienced a staggering 554 regional heatwave days. Analysis indicates that 1.05 billion people faced high heat stress for over 300 hours during an 80-day period.[12,13] Furthermore, current heatwave warning criteria, based on air temperature thresholds such as ≥40°C for the plains,[15] do not account for the impact of humidity and wet-bulb temperature, potentially under-representing risks in humid conditions (Figure 4).

WHAT IS A HEATWAVE?

Heatwaves are periods of unusually high temperatures relative to a region's normal climate. As a result, the threshold for declaring a heatwave varies by location. Their impact can intensify due to factors like high humidity, strong winds, and prolonged duration.[15]

Criterion for declaring a heatwave defined by IMD (based on Air Temperature)[15]

% of districts under 'high to very high exposure to extreme heat waves[16]

Blind spot in the current criteria

IMD's heatwave thresholds overlook wet-bulb temperatures, a vital metric combining heat and humidity. For high-humidity states like Goa, even 35°C with 70% humidity can be deadly, yet no alert would be issued under the current criteria.

The Urban Heat Island (UHI) effect causes cities to be markedly warmer than surrounding rural areas, often by 2–3°C.[17] Contributors include:

Dense built environments	Use of heat-absorbing and retaining materials like concrete and asphalt	Reduced vegetation cover	Vehicular emissions	Heat released from energy use, particularly from industries

Nighttime temperature disparities can be particularly pronounced, averaging 1.3°C higher in cities, but reaching peak differences of up to 6°C.[18] The specific drivers influencing UHI intensity vary regionally, necessitating localised assessments and tailored adaptation and mitigation strategies. While data on the UHI effect is well-documented for Tier-1 cities (Figure 5), evidence from Tier-2 and Tier-3 cities remains limited and is only beginning to emerge. In addition to the UHI effect, the process of urbanisation itself accelerates local warming.

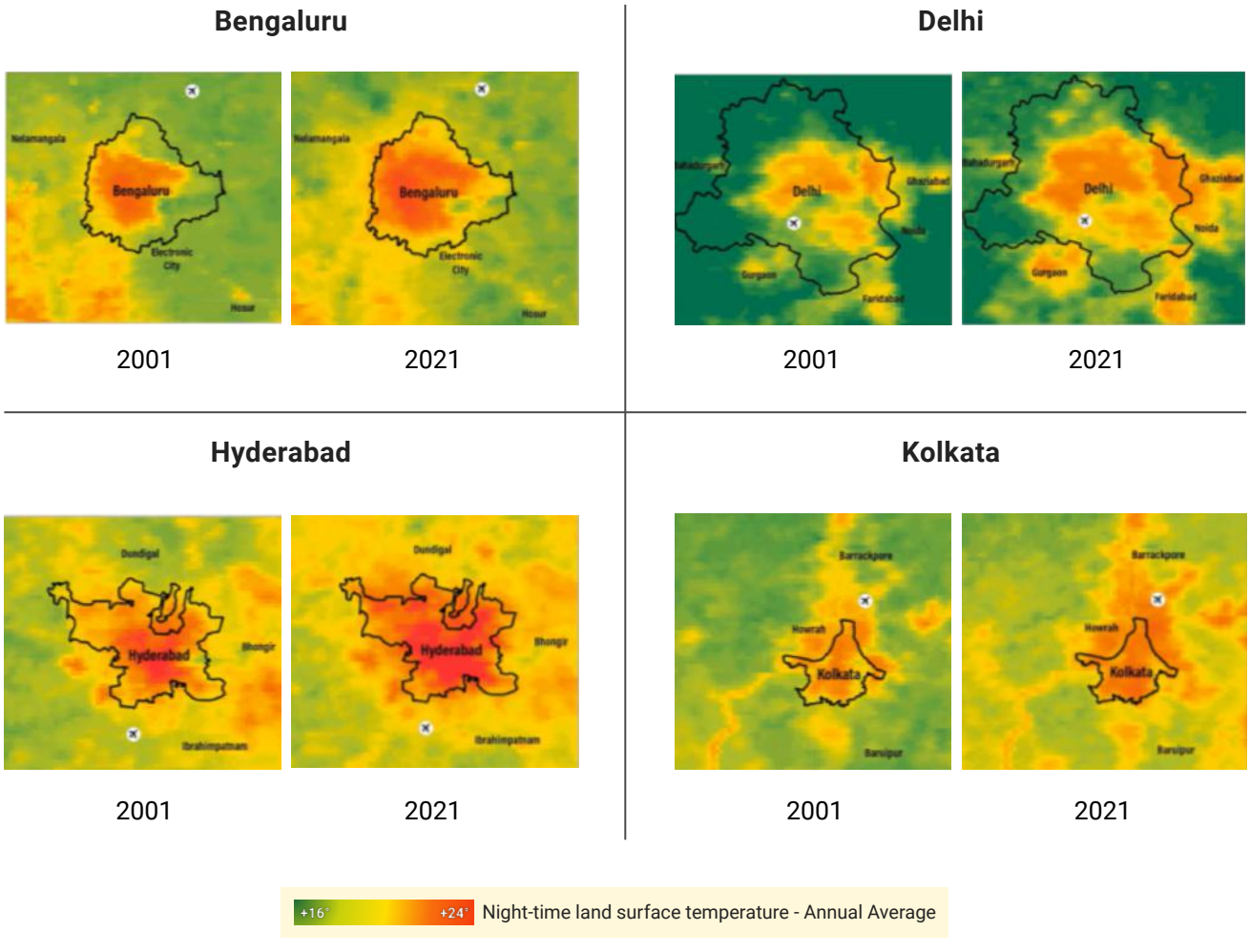


Figure 5: *UHI effect in Bengaluru, Delhi, Hyderabad and Kolkata*[19]

Analysis of 141 Indian cities over 17 years from 2003 to 2020 indicates an approximate 60% increase of the overall observed nighttime warming, specifically attributable to urban development factors.[11] This is particularly evident in rapidly growing Tier-2 and Tier-3 cities, especially in northern and central India, highlighting these areas as critical zones for heat-informed planning.[20]

Challenges and opportunities

There are significant hurdles to addressing urban heat risks. Heat is viewed as a recurring, manageable issue, rather than as an escalating crisis. Elevating the importance of heat stress requires focused policy engagement. The lack of a formal national disaster notification for heat limits dedicated funding for crisis periods. Establishing this notification would further help unlock specific financial mechanisms for heat resilience initiatives.

Policy initiatives are often implemented with limited enforcement mechanisms. National frameworks like the India Cooling Action Plan (ICAP) recommend the construction of climate-responsive buildings, though they frequently operate without specific targets or enforcement procedures. The adaptation of frameworks like the Energy Conservation Building Code (ECBC) for mass housing, where affordability is key, and providing clear implementation guidelines for state and local bodies are critical areas for action.

Finally, process efficiencies can strengthen implementation and learning cycles. Streamlining processes could accelerate the formulation of Heat Action Plans (HAPs). Strengthening monitoring and evaluation (M&E) is crucial to assess impact, while investing in better analysis of interventions can generate both the scientific and anecdotal evidence needed to scale successful models effectively. Addressing these interconnected aspects through targeted institutional, policy, and procedural reforms is vital for improving urban heat resilience.


2 THE HUMAN FACE OF HEAT
VULNERABILITY AND IMPACT

2. THE HUMAN FACE OF HEAT
VULNERABILITY AND IMPACT

The effects of rising temperatures are felt in all aspects of human life. Along with its impact on individual and community health, heat also affects people's productivity, their ability to earn a living, and by extension, the larger economy. The effects of heat on the natural environment also cascade into risks for human and animal populations.

In urban centres, certain groups are more susceptible to the adverse effects of rising heat due to biological and demographic factors such as age, sex, pregnancy, and chronic illness. This is further compounded by the nature of their work—particularly outdoor, fixed-hours, or unregulated and informal work, and socioeconomic context, including gender.

INSIGHT 2 THE HEALTH COST OF HEAT

RISING CASES OF HEAT-RELATED ILLNESSES SIGNAL AN URGENT NEED TO STRENGTHEN OUR STRETCHED HEALTH SYSTEMS ESPECIALLY FOR THE HIGH RISK VULNERABLE GROUPS.

Heat poses an escalating threat to public health in India. Prolonged exposure to hot weather or physical exertion leads to heat-related illnesses (HRIs), which include mild impacts like heat cramps, heat exhaustion, heat rash, heat oedema to more severe conditions like heat syncope and heatstrokes. While under-reported, HRIs and deaths linked to heat show a rising trend.[1] The scale of the problem is stark: in two years, there has been a tenfold increase in suspected heatstroke cases (SHC), from 4,481 SHCs reported in 2022 to 48,156 in 2024.[2]

Source: PTI

This surge burdens public health infrastructure, with healthcare facilities reporting significant increases in outpatient department (OPD) visits — a centre in Lucknow, for instance, registered around 50 patients daily for heat-related complaints.[3]

Heat also has a documented impact on mental wellbeing, contributing to conditions like anxiety, depression, and bipolar disorder. Some reports indicate a significant increase in hospital admissions for mental health conditions during heatwaves in cities like Ranchi, Delhi, and Bikaner.[4]

Heat can also cause long-term neurological impact: heatstroke survivors suffer persistent brain damage, leading to reduced cognitive function, impaired consciousness and memory deficit, an area that warrants further investigation within the Indian context.[5] Heat-driven livelihood losses, described further in this report, can also deepen mental distress in specific sectors where prolonged exposure and income security are closely linked.

Source: PTI

Impact on vulnerable groups

Certain populations face considerably higher risks, both in terms of exposure to and the impact of heat (Figure 6). Physiological characteristics lead to increased susceptibility among children and the elderly, while pregnancy also introduces additional risks. For instance, higher temperatures are associated with greater risk of adverse birth outcomes. Pre-existing health conditions and certain occupations further heighten sensitivity and exposure to heat stress. Socioeconomic disparities, particularly in urban low-income settings, create environments of significantly increased heat burden. Tangible consequences such as rising heatwave exposure for infants, greater risk of dangerous heat for elderly slum dwellers, higher rates of comorbidity in heatstroke patients, and increased demand for heat-related medical treatment for outdoor workers underscore the urgent need for targeted interventions. Further, nighttime heat poses distinct risks: it reduces the body's ability to recover from daytime heat stress, worsens sleep quality, and increases vulnerability across groups.

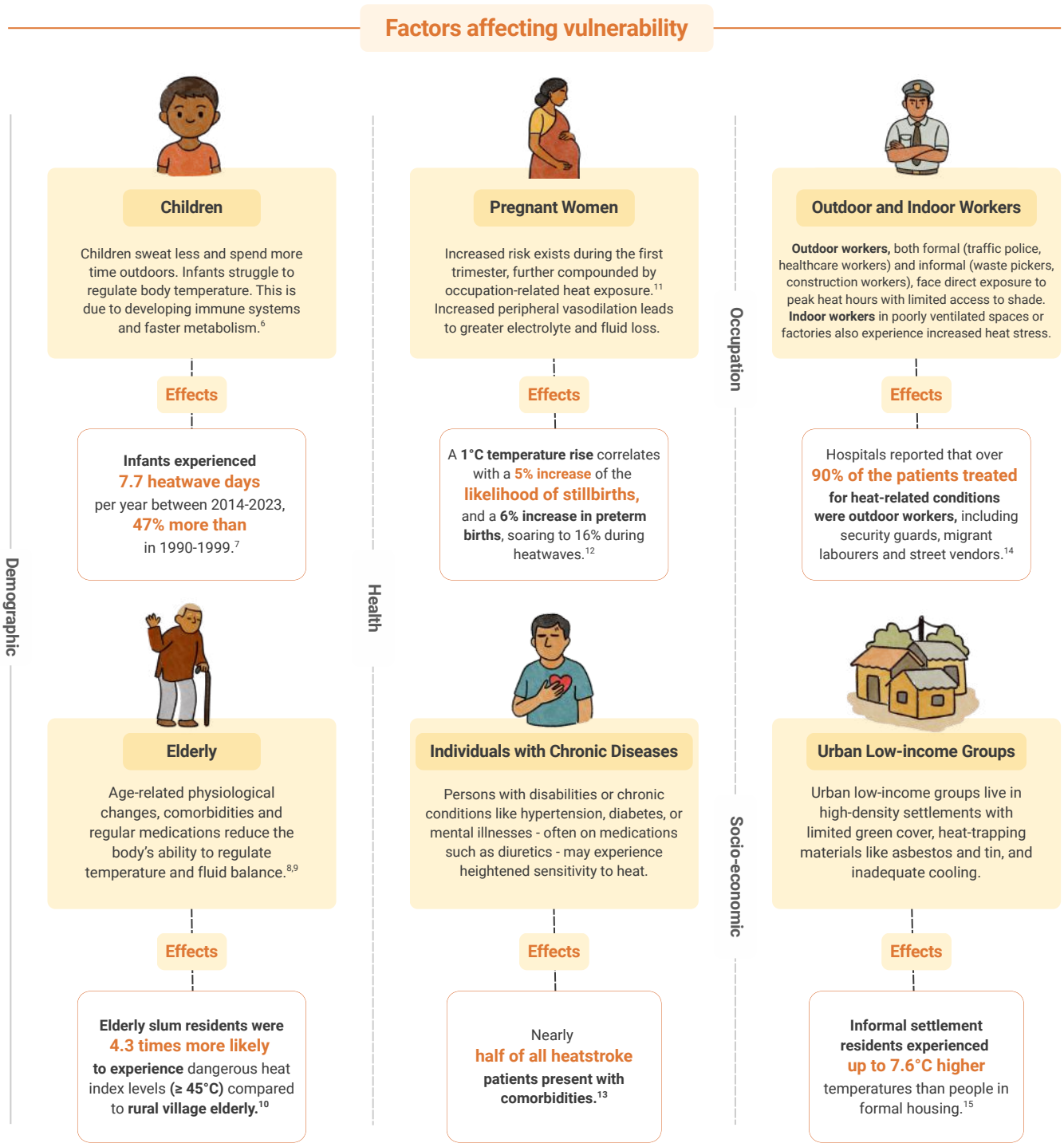


Figure 6: *Factors affecting vulnerability and their health effects in select groups*

In addition to heightened vulnerability under certain conditions such as menstruation and pregnancy, women's health is disproportionately affected by heat due to physiological responses.[16] A majority of women who work in the informal sector face issues such as limited access to sanitation, cooling systems, and healthcare in general, aggravating the risk that heat poses to their health. Studies also point to a direct link between rising ambient temperature and an increase in domestic violence.[17]

Challenges and opportunities

A primary challenge is the overstretched healthcare infrastructure; a recent assessment revealed that only 6% of over 5,600 surveyed health facilities have cooling systems, and nearly half lack essential diagnostic tools for heatstroke.[2] Access barriers further widen this gap, as workers' schedules often clash with clinic hours.

Another key challenge is the lack of comprehensive data on HRIs and death. Inconsistent reporting and under-counting, particularly among marginalised populations, make it difficult to accurately assess the full impact of the crisis. Compared to other disasters, heat often remains under-represented in surveys, limiting insights into its long-term impacts, particularly on mental and maternal health. Focused research investments can bridge this gap by building a robust evidence base and a repository of tested, adaptable urban solutions.

In most municipalities, dedicated mechanisms to translate heat-health recommendations into tangible action need further strengthening. Establishing heat action governance within urban bodies and municipalities, and embedding heat considerations in urban planning is critical.

INSIGHT 3

RISK TO INDIA'S WORKFORCE

EXTREME HEAT THREATENS PRODUCTIVITY AND LIVELIHOODS FOR 75% OF WORKERS, ESPECIALLY MIGRANT WORKERS IN HIGH-RISK JOBS.

Rising temperatures pose a growing challenge to livelihoods across India. An estimated 75% of the country's workforce, numbering 380 million people, engages in labour performed in heat-exposed conditions.[18] Available estimates indicate that between 2001 and 2020, India lost over 101 billion labour hours annually due to heat and humidity — representing the highest heat exposure impact on heavy labour in Southeast Asia.[19] This reduction in labour capacity directly impacts India's economic health, as approximately half of the nation's GDP originates from heat-exposed work.[20] According to the International Labour Organization (ILO), nearly 4.5% of India's GDP will face heat-related risks by 2030.[21]

While the economic consequences of heat stress are already substantial, this trend is projected to continue, impacting labour productivity significantly. Global forecasts suggest heat stress could lead to loss of working hours equivalent to 80 million job losses worldwide by 2030.[21] Notably, India is projected to account for a large portion of this figure, potentially facing 43% of the global total i.e. equivalent to 34 million job losses (Figure 8).

380 MILLION

People engaged in heat-exposed labour

50%

of India's GDP dependent on heat-exposed work

101 BILLION

Labour hours lost to heat and humidity in heavy outdoor labour, 2001-2020

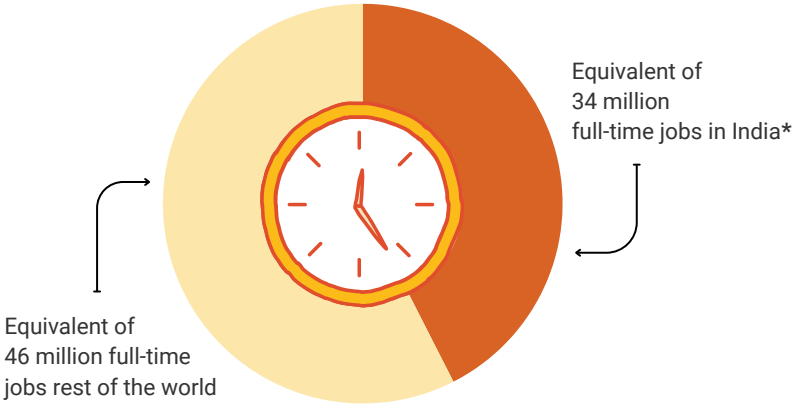
Figure 7: *Key statistics - economic impacts of heat*[18-20]

By 2030, heat stress could lead to **loss of working hours equal to**

80 MILLION

full-time jobs with India alone accounting for

43% of the global total.



**Note: This is pan-India data, with effects predominantly seen in rural areas*

Figure 8: *Productivity loss from heat in terms of full-time jobs by 2030, global and India*[21]

These impacts stem directly from the physiological effects of heat on work capacity. Labour productivity starts to decline when ambient temperatures exceed 24–26°C. Under more intense conditions (33–34°C), a worker's capacity for moderate physical activity reduces by half.[21] For businesses, reduced productivity affects profitability – lower worker output contributes to missed production targets and associated revenue losses. Heat-related impacts on infrastructure can also disrupt supply chains, leading to delivery delays and increased costs from rerouting or storage issues. Even informal businesses like those of street vendors face reduced foot traffic and spoilage.

Greenpeace India's study of Delhi street vendors found that nearly 80% of vendors saw reduced footfall on extreme heat days, and 50% reported loss of income while running their businesses during extreme heat conditions.[22]

Vulnerability of workers

Urban centres rely heavily on a diverse workforce engaged in both formal and informal roles, working most often in heat-exposed settings. These include last-mile delivery executives, street vendors and small service entrepreneurs, police officers and public transport workers, road and construction workers, and sanitation and waste workers. Work for these groups is marked by high exposure to direct sunlight and heat, physically-intensive tasks, constant mobility, and limited access to shade, water, or medical support (Figure 9). Unsurprisingly, outdoor workers make up the majority of the patients treated for heat-related conditions.[13]

Indoor workers in establishments such as manufacturing units are also prone to heat-related illnesses, aggravated by their proximity to hot machines, furnaces/ovens, and molten materials. Many industrial facilities in India are not equipped with adequate ventilation or cooling systems, amplifying these risks. This is particularly concerning in regions with high baseline temperatures, where workers often operate in poorly regulated environments and lack adequate occupational health safeguards.

Source: PTI

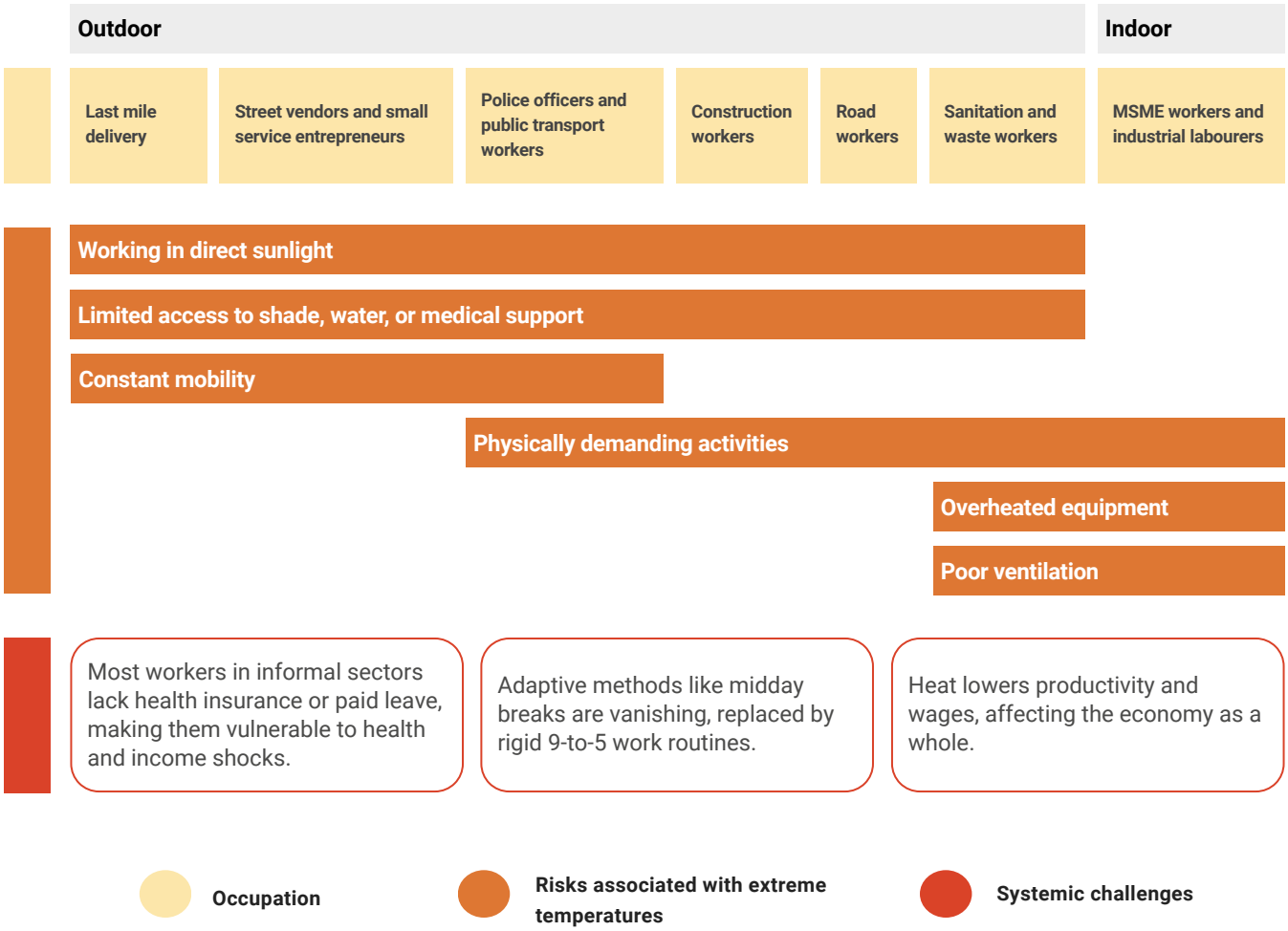


Figure 9: *Risks and challenges associated with specific occupations*

Irrespective of the sector of work, migrant labourers are disproportionately affected by high-heat conditions. Many work in sectors such as construction, but remain unregistered under relevant welfare legislation; this prevents their access to health, safety, and welfare benefits designed to reduce occupational hazards, including those related to heat stress.

Extreme heat deepens gender inequalities in livelihoods, and existing gender gaps at work make the impact of heat even more severe for women.

Women in the workforce lose 19% of their paid working hours due to heat, contributing to an estimated annual economic cost of USD 67 billion for India.[23] Rising heat is expected to make household tasks more taxing, pushing the burden of unpaid domestic work — mostly shouldered by women — from 6.1 to 8.3 hours per day by 2050, representing a 26% increase in time spent on household chores. A significant gender pay gap compounds this situation. In key heat-affected sectors such as agriculture, construction, and services, women earn 35% less than men, heightening their economic vulnerability to heat.

Underlying gender inequities result in aggravated effects of heat on women

Occupational hazard

Women are over-represented in industries with poor conditions (e.g. textile manufacturing), and in physically demanding, unskilled jobs (e.g. construction and domestic work).

Missing infrastructure

Poor sanitation in workplaces and public transit causes women to avoid drinking water, increasing dehydration, UTIs, and kidney problems, hindering their work capacity.

Economic vulnerability

Wage gaps hinder women labourers' access to heat protection. Heat-related productivity losses in manufacturing disproportionately impact women's earnings.

Unpaid labour

Heatwaves increase women's domestic workload (e.g., water fetching, caregiving), adding to unpaid labour and limiting time for paid work or rest.

Figure 10: *Heightened effects of heat on women's livelihoods due to gender inequity*

Challenges and opportunities

Systemic factors, such as fixed schedules in urban formal employment, limit flexibility — especially for those working in the informal sector — to adjust work timings and avoid peak heat. Providing heat adaptation support and social safety nets necessitates comprehensive, integrated interventions that prioritise vulnerable workers across infrastructure, policy, finance, and technology.

A major challenge for all stakeholders is also the lack of hyperlocal data and targeted research on the productivity impacts of heat across India's diverse sectors. Without this evidence base, urban planning, policy formulation, intervention design, and funding decisions remain poorly informed, highlighting the need to prioritise data generation and sector-specific research.

The direct impact of heat on worker capacity, economic costs, and the heightened vulnerabilities of outdoor, migrant, and women workers adds to the complexity of the issue. This presents the opportunity for targeted action through practical solutions such as upgrading informal work infrastructure like sanitation and drinking water, expanding last-mile cooling access, improving urban mobility for women, and developing climate adaptation finance for micro-entrepreneurs.

INSIGHT 4

CASCADING ENVIRONMENTAL EFFECTS

HEAT WORSENS AIR POLLUTION, WATER SCARCITY, AND BIODIVERSITY–DIMENSIONS THAT WARRANT GREATER ATTENTION IN POLICIES AT VARIOUS LEVELS.

Rising global temperatures have unforeseen and far-reaching consequences due to the interconnectedness of ecological systems. From extreme weather events to rapid glacial melts and frequent, intensified wildfires, the impacts of heat are apparent, demanding our understanding and attention.

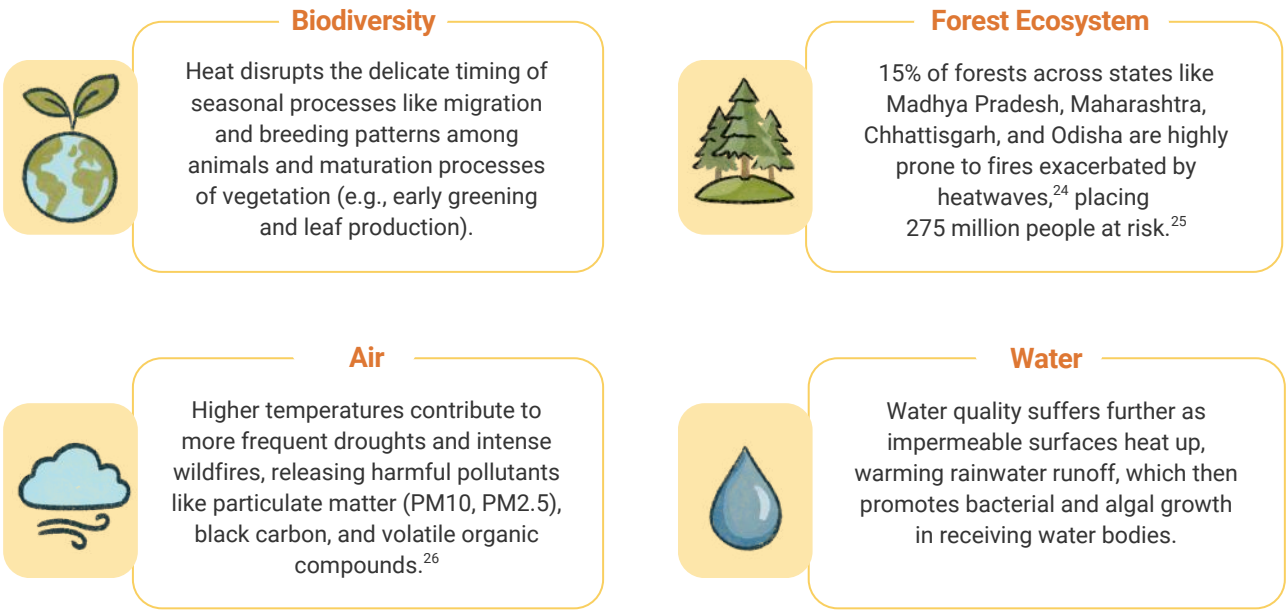


Figure 11: *Impact of heat on the environmental ecosystem*

Urban environmental vulnerabilities

Diminishing blue-green infrastructure intensifies the environmental impact of heat in urban areas. This infrastructure includes natural and semi-natural elements that provide vital cooling through shade, evapotranspiration from plants, and evaporative cooling from water bodies.

Urban green spaces themselves suffer as thermal stress on trees reduces photosynthesis and growth, potentially leading to rapid die-offs during heatwaves, dwindling this natural cooling capacity.[27] Urban biodiversity, including birds and aquatic life, are also significantly affected, with NGOs in cities such as Delhi, Hyderabad, and Gurgaon reporting a surge in heat-related instances among birds.

BLUE-GREEN INFRASTRUCTURE

Blue-green infrastructure can be defined as an "interconnected network of natural and designed landscape components, including water bodies and green and open spaces."[28] It is usually distinguished from gray infrastructure which refers to built infrastructure like pipes, treatment plants, reservoirs, or wells.

Heat and sunshine worsen ground-level air pollution by interacting with nitrous oxide gases to create ozone, which is detrimental to health, especially for individuals with respiratory and cardiovascular conditions. Heat also compounds air pollution in cities. Heat generated during waste processing produces methane, leading to recurring landfill fires that release toxic emissions causing respiratory problems for nearby residents. At the same time, higher temperatures drive up electricity demand by about 2% for every 1°C rise,[29] largely due to increased use of air conditioning. This could add 120 million metric tonnes of emissions by 2050.[30]

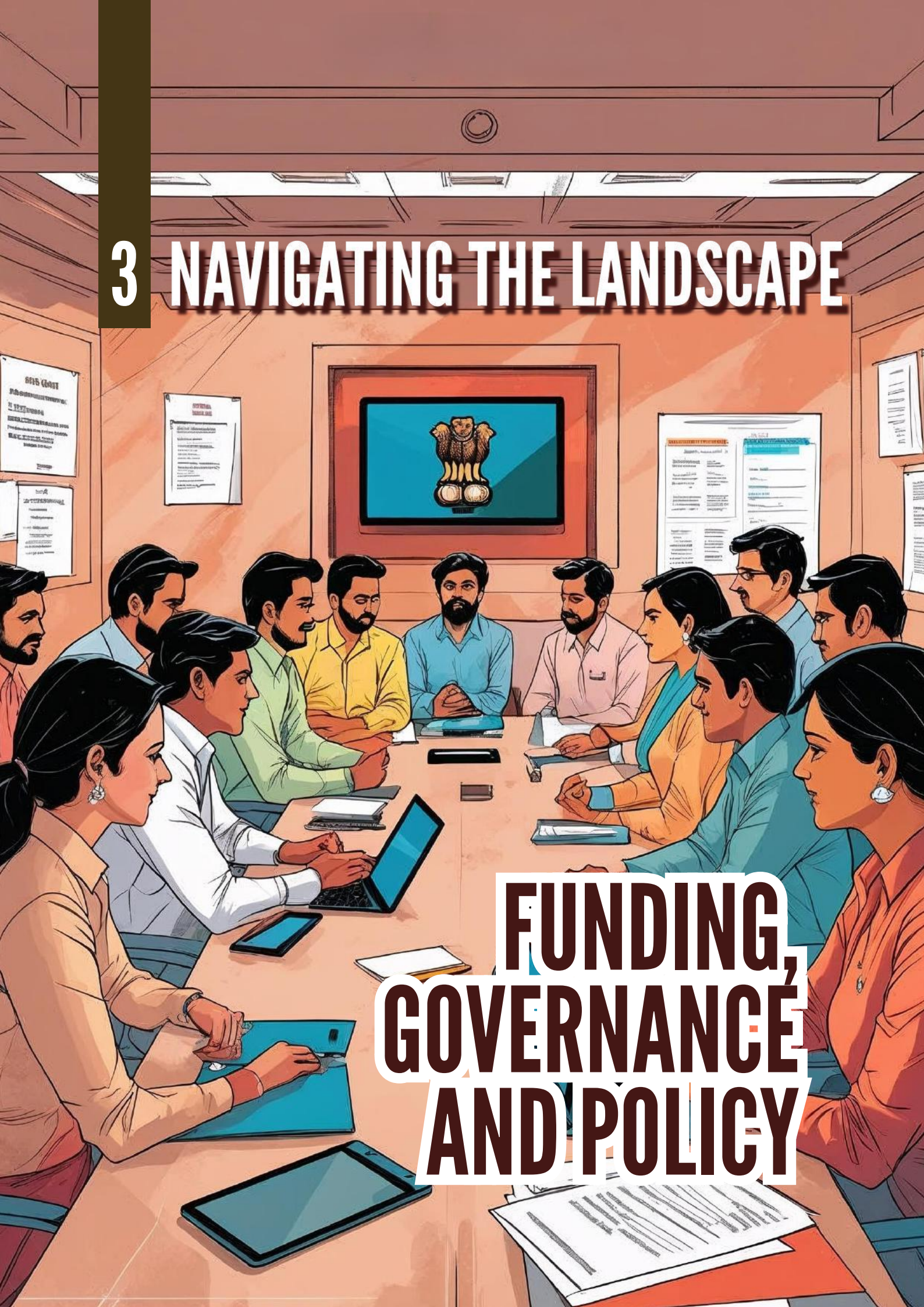
Urban areas already face a worsening water crisis, estimated to have affected over 330 million people in India in 2024, with cities like Chennai and Bengaluru nearing 'Day Zero'.[31] Over-extraction of groundwater, driven by scarcity, also leads to increased salinity and mineral contamination. Coastal regions face the additional, severe danger of flooding due to projected sea-level rise.[32]

Challenges and opportunities

Urban heat mapping remains fragmented, with limited adoption of standardised platforms and weak cross-sector collaboration impeding effective response. This fragmentation presents an opportunity to leverage standardised GIS tools (e.g. Samāj Data) for heat mapping, and facilitate cross-sector collaboration to create open-access data dashboards on heat and its environmental impacts.

Furthermore, urban planning should provide for funding and strengthening blue-green infrastructure within its rubric. Scaling investments in urban greening and restoration, revitalising critical water-based cooling infrastructure, and embedding these vital nature-based solutions firmly within climate-resilient urban planning frameworks are key areas for action.

3 NAVIGATING THE LANDSCAPE



FUNDING, GOVERNANCE AND POLICY

3. NAVIGATING THE LANDSCAPE
FUNDING, GOVERNANCE, AND POLICY

Addressing the urban heat crisis requires navigating a complex ecosystem of actors, systems and resources. Clear roles, adequate funding, and effective policy mechanisms are necessary for efficient, coordinated action among the diverse stakeholders.

INSIGHT 5 STAKEHOLDERS IN THE HEAT ECOSYSTEM

COLLECTIVE, COORDINATED ACTION IS GAINING MOMENTUM; WHILE CROSS-SECTOR COLLABORATION REMAINS NASCENT, IT IS STEADILY EMERGING AS A KEY CONSIDERATION.

India's heat resilience efforts are driven by the combined strengths of government, civil society, and market actors (Figure 12).

Government

Government bodies play a key role in planning and stewarding efforts through **Heat Action Plans,** inter-departmental coordination, supporting public infrastructure, and targeted public financing and subsidies through schemes for heat-resilient structures.

- Central ministries (e.g. MoEFCC)
- Apex bodies (e.g. NDMA, SEIAA, NITI Aayog)
- State ministries
- District departments (e.g. District Disaster Management Authority)
- Special Purpose Vehicles (SPVs)
- ULBs

Civil society

Civil society organisations and philanthropic ecosystem organisations are central to
a. Implementing via working with communities, co-designing and demonstrating solutions, ensuring last-mile delivery of heat-related interventions and creating evidence and
b. Funding and policy engagement for advancing heat ecosystem.

- Think tanks
- Implementing CSOs
- International Non-profits
- Global foundations
- Philanthropic funders (CSR, Global and Domestic Foundations, Family foundations, Multilaterals and DFI)
- Impact investment ecosystem
- Academic institutions
- RWAs

Market

For-profit market actors contribute through innovation, catalytic capital, capacity building and scalable solutions.

- Corporations
- Incubators and accelerators
- Startups
- MSMEs

Abbreviations
MoEFCC - Ministry of Environment, Forest and Climate Change; NDMA - National Disaster Management Authority; SEIAA - State Environment Impact Assessment Authority; SPV - Special Purpose Vehicle; CSR - Corporate Social Responsibility; DFI - Development Finance Institution; RWA - Resident Welfare Association; MSME - Micro, Small and Medium Enterprises

Figure 12: *Stakeholders in India's heat ecosystem*

National and state organisations establish the foundational framework for urban climate action by providing crucial financing mechanisms, developing evidence-based policies and governance structures, and building local-level capacities. In contrast, ULBs are primarily responsible for leveraging these resources and frameworks to develop context-specific Heat Action Plans (HAPs) and Climate Action Plans (CAPs), implement these plans on the ground, and monitor their effectiveness within local jurisdictions.

The civil society and philanthropic ecosystem, comprising think-tanks, academic institutions, implementing CSOs, and the funding ecosystem, play complementary roles. Implementing organisations, academic institutions, philanthropic funders help identify local vulnerabilities, co-design solutions, and ensure equitable last-mile delivery. The role of CSOs in building awareness and fostering community participation is key to the success of any intervention. At the same time, market actors, including corporations, startups, MSMEs, and incubators, drive innovation, demonstrate and embed solutions in viable market models solutions, and bring private capital to the table. Their agility and technical expertise enable the development and deployment of cutting-edge technologies and business models tailored to address extreme heat.

Urban heat mitigation increasingly demands collaborative strategies due to its complex interplay with climate change, urban development, economic activities, infrastructure and lived realities of communities. This is evidenced by the Tamil Nadu Heat Mitigation strategy, which leveraged expertise from academic institutions such as CEPT University and the Indian Institute of Technology Madras (IIT-M), a multilateral agency, the United Nations Environment Programme, and a policy think tank, the World Resources Institute (WRI).[1]

Challenges and opportunities

The urban heat ecosystem, while benefiting from a diverse range of public and private action that spans policy to implementation, remains fragmented due to siloed operations and coordination deficits among stakeholders, hindering a unified and equitable response. These gaps are particularly acute in Tier-2 and Tier-3 cities, which often lack the climate finance, research partnerships, and donor attention afforded to metropolitan areas. Fostering collaboration is vital to building heat resilience in these rapidly expanding urban centres.

Conversely, this diverse stakeholder ecosystem presents opportunities for leveraging varied expertise through enhanced collaboration, and the development of more public-private partnerships, as seen in the Tamil Nadu example. The increasing integration of heat action into broader development frameworks promises more mainstreamed, sustainable, and impactful solutions.

INSIGHT 6

STRATEGIC HEAT ACTION INVESTMENTS

UNLOCKING UNDER-UTILISED PUBLIC FUNDS AND LEVERAGING PRIVATE CAPITAL FOR URBAN RESILIENCE ARE PIVOTAL TO SCALING ACTION.

State funding for urban bodies under environmental, disaster management, and urban development schemes has increased notably since 2021-22 (Figure 13).[2-5] In parallel, the utilisation of funds released by the Centre to States under the State Disaster Response Fund (SDRF) has steadily improved from 36% in 2021–22 to 62% in 2023–24, indicating a growing responsiveness to disaster-related vulnerabilities.

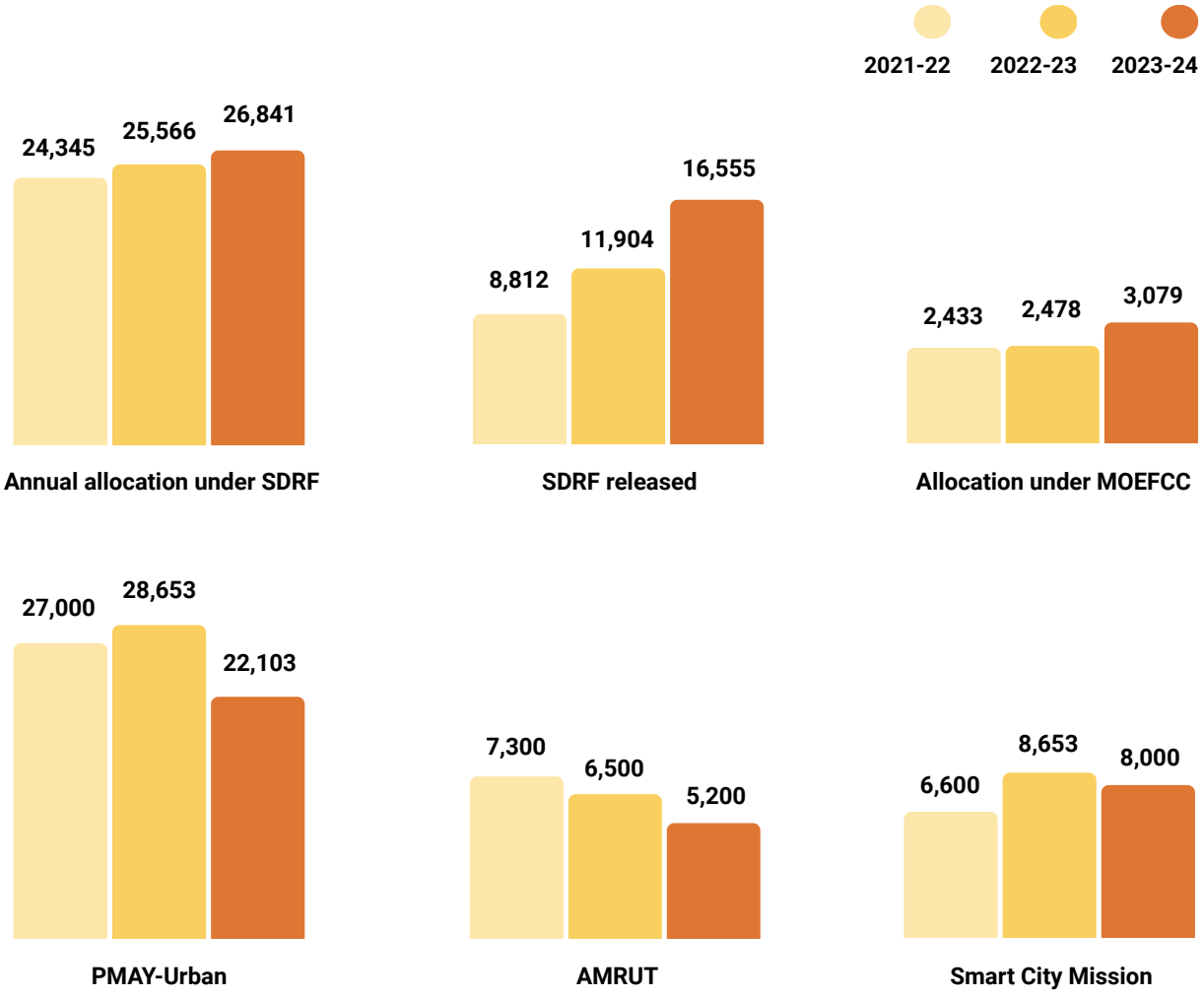


Figure 13: *Fund allocation under key heat-related central government schemes (INR crores)*[2-7]

For comprehensive urban planning measures that build heat resilience, cities can also leverage allocations from national flagship programmes such as the Atal Mission for Rejuvenation and Urban Transformation (AMRUT), and the Pradhan Mantri Awas Yojana - Urban (PMAY-Urban).

The Prime Minister Street Vendor's AtmaNirbhar Nidhi scheme (PM SVANidhi), designed for street vendors, offers a potential avenue for adaptation, providing targeted support to informal entrepreneurs and outdoor workers who are disproportionately affected during heatwaves. Concurrently, private funding for climate resilience via Corporate Social Responsibility (CSR) and philanthropy is also growing, with a 37% increase in CSR spending on environmental sustainability over the last five years.[8] There are only a few organisations including domestic foundations, multilateral organisations, development financial institutions (DFIs), and international foundations that fund climate solutions which indirectly address heat-related issues.

Challenges and opportunities

Although fund utilisation trends have been on the rise, approximately 38% of SDRF allocations continue to remain underutilised in 2024-25.[4] This unspent share presents a significant opportunity to strengthen urban resilience, particularly to emerging climate risks such as extreme heat. If more states were to formally recognise urban heat as a 'disaster', these funds could be strategically channelled towards proactive heat response measures. Similarly, national flagship programmes like AMRUT and PM SVANidhi offer avenues, but lack explicit heat resilience targets, hindering focused action.

Dedicated funding for urban heat remains scarce globally. Only one-fifth of multilateral development banks' (MDB) climate resilience funds for low- and middle-income countries are specifically directed towards urban areas.[9] Often, heat action is enveloped within broader environmental initiatives, diluting its impact. Underlying these, is the scarcity of specific data on funding allocated to urban heat issues, making it difficult to ascertain current investment and measure progress. However, the growing interest of the private climate finance sector — such as CSR and philanthropy — in funding urban heat initiatives presents a substantial opportunity to catalyse innovations, enabling the integration of heat-stress programming into existing initiatives and the pilot of landscape-level interventions.

INSIGHT 7 THE NEED FOR MORE ACTION-ORIENTED FRAMEWORKS

NATIONAL FRAMEWORKS REMAIN LARGELY ADVISORY, WITH AN URGENT NEED FOR ENFORCEABLE MANDATES AND SAFEGUARDS FOR VULNERABLE COMMUNITIES.

Two key Indian government initiatives, the National Action Plan for Climate Change and Human Health (NAPCCHH) and the ICAP, aim to tackle the challenges posed by rising temperatures, each with a distinct primary focus. The NAPCCHH addresses the health-related aspects of climate change through a multi-pronged approach. Its key areas of focus include air pollution, heat-related illnesses, and the development of green and climate-resilient healthcare facilities.[10]

The ICAP, one of the first national cooling action plans globally, provides an integrated, long-term vision to address cooling requirements across sectors by reducing cooling demand, transitioning to environment-friendly refrigerants, and enhancing energy efficiency to ensure sustainable cooling for all.[11]

While these national frameworks encourage collaborations - for instance, the NAPCCHH with the MoEFCC to mitigate the UHI[10] effect - their perspectives frame heat primarily through health, environmental, or technological lenses. Consequently, such strategies may not fully integrate or emphasise the severe repercussions of heat on the livelihoods and economic stability of vulnerable groups.

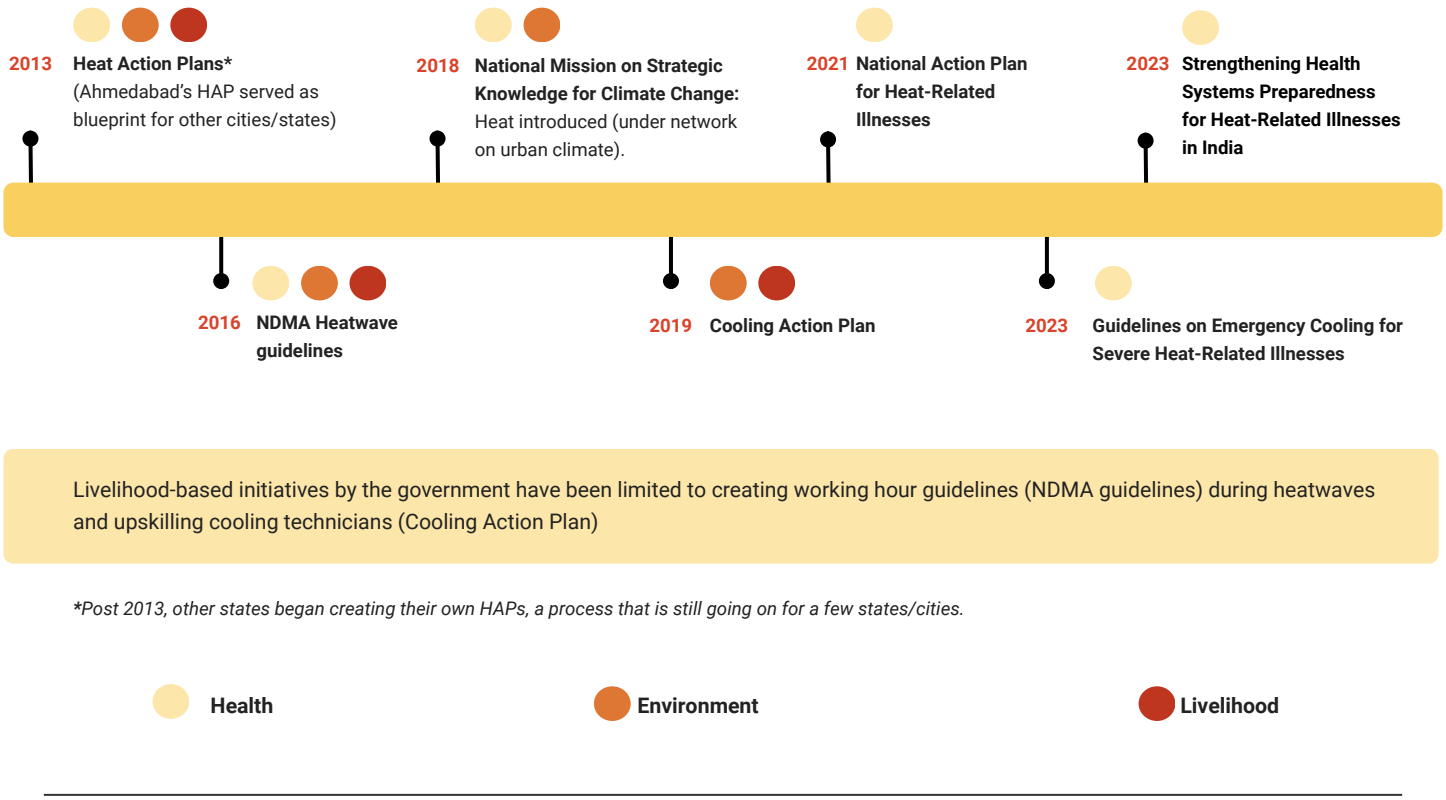


Figure 14: *Heat-related policy tailwinds*

Recent years, however, have witnessed several positive shifts in this landscape (Figure 14). National Disaster Management Authority's (NDMA's) revised heatwave management guidelines (2019) and the ICAP emphasise the importance of conducting detailed vulnerability assessments before developing state- or city-level HAPs. Demonstrating proactive localisation, the Uttar Pradesh government has developed heat thresholds for all 75 districts within the Uttar Pradesh State Disaster Management Authority (UPSDMA).[12] A few other states (Odisha, Tamil Nadu, Rajasthan, and Kerala) have taken the decisive step of notifying heat as a state-specific disaster, a move that has successfully enabled them to leverage necessary state-level resources, and implement robust response mechanisms. These developments signal a gradual transition towards effective heat mitigation.

Within the heat policy ecosystem, city-level HAPs have emerged over the past decade as locally tailored instruments for combating heat risks in Indian urban areas. In contrast to national or state-level frameworks, which are often advisory and lack dedicated funding, city-level HAPs are better positioned to directly leverage municipal capacities, local data streams, and inter-departmental coordination to protect vulnerable groups. In 2013, Ahmedabad became the first South Asian city to develop a HAP, which established key strategies for immediate and long-term action to reduce the health impacts of extreme heat on the city's most vulnerable groups.[13] A key advantage of city HAPs over national advisories is their potential to embed monitoring and review committees, often with clear execution mandates, thereby strengthening accountability within ULBs. Similarly, cities, districts, or states may even form regional CAPs that utilise baseline GHG emission inventories and urban climate vulnerability assessments to prioritise actions for both climate adaptation, including heat, and emission reduction.

Our analysis of six CAPs/HAPs revealed significant variation in the comprehensiveness of the indicators and solutions covered (Figure 16). The HAPs for Thane, Bhubaneswar, and Surat, in particular, offer valuable blueprints that can inform the development of similar plans in cities with comparable topological and demographic profiles.

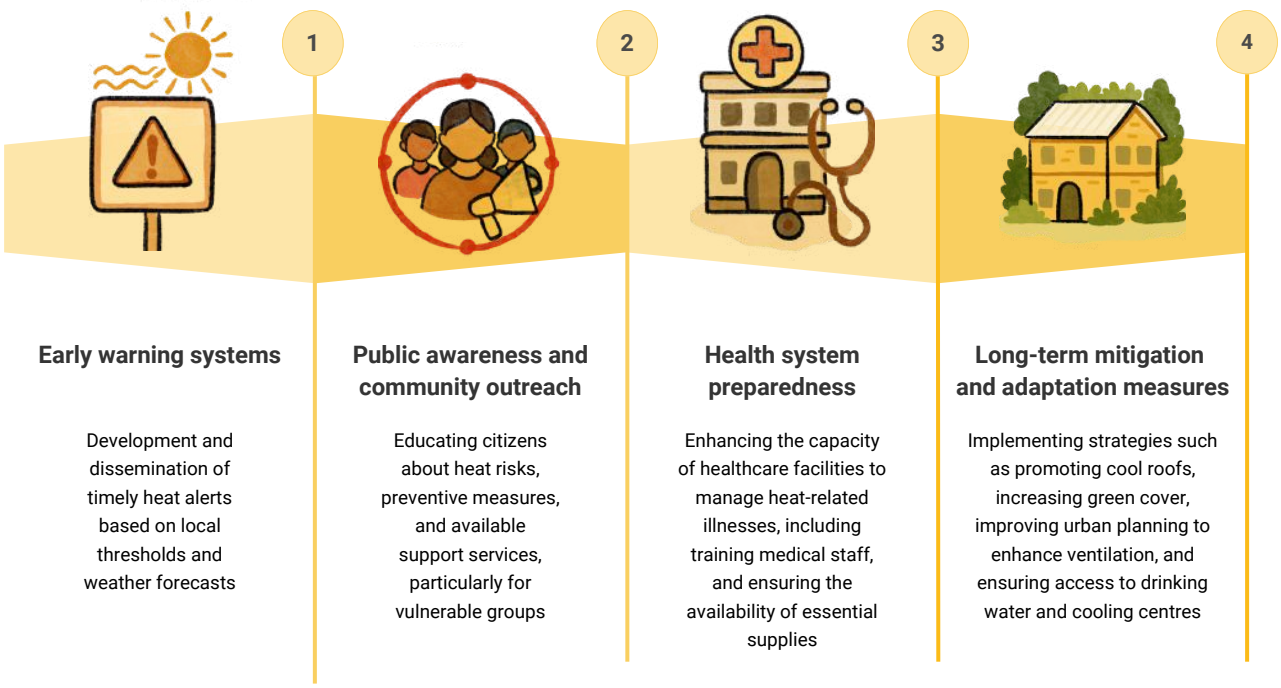


Figure 15: *Four typical pillars of city HAPs*

	← Heat Action Plans →				← Climate Action Plans →	
Indicators	**Thane (2024)**	**Bhubaneswar (2020)**	**Surat (2023)**	**Gujarat (2020)**	**Bhopal (2023)**	**Madhya Pradesh (2022)**
Hazard Indicator	Yes	Yes	Yes	Yes	Maybe	No
Wet-Bulb Temperature Used	No	No	No	No	No	No
Vulnerability Assessment	Yes	Yes	Yes	No	Maybe	No
Health Risk Identification	No	Yes	Maybe	Maybe	No	Yes
Livelihood Risk Identification	No	Yes	Yes	No	Maybe	No
Environment Risk Identification	Maybe	No	Maybe	No	Yes	Yes
Clearly Defined Roles for Different Departments	Maybe	Yes	Yes	Yes	Maybe	Yes
Indication Of Budgets	Maybe	No	No	No	Maybe	Yes
Collaboration	Yes	Yes	Yes	No	Yes	Maybe
Types of solution discussed						
Urban Planning and Built Environment	Yes	Yes	Yes	Yes	Yes	Yes
Restoration and Conservation Based Approaches	Yes	Yes	Maybe	No	Yes	No
Health and Social Protection Mechanism	Yes	Yes	Yes	Yes	No	Yes
Behavioral and Community Based Interventions	Yes	Yes	Yes	Yes	Maybe	Maybe
Cooling Technologies	Yes	Yes	Yes	Maybe	No	Yes
Resource Efficiency	Maybe	Maybe	No	Yes	Yes	Yes
Data and Information Systems	Yes	Yes	Yes	Yes	Yes	Yes

Yes No Maybe

Figure 16: *Refer to Annexure for a detailed analysis*

Best practices across HAPs are detailed in the table below.

Best Practice	Description	Example in action
Comprehensive vulnerability assessment	Understand who is most at risk and why, considering socio- demographics, occupation, and granular hazard indicators	The HAP for Thane conducted extensive vulnerability assessments that took into account residents' gender, age, and disabilities. It also integrated hazard indicators like the frequency of hot days, and land surface temperature.
Detailed livelihood and economic impact analysis	Analyse the effects of heat on income and productivity for indoor and outdoor worker groups	The Surat HAP offered a detailed analysis of the specific challenges and vulnerabilities faced by indoor and outdoors workers. The Bhubaneswar HAP also included wage loss analysis and livelihood-specific vulnerability mapping.
Assessment of health impacts and compounding vulnerabilities	Analyse direct health effects of heat, and how factors like poor housing and unequal resource access exacerbate them, particularly for vulnerable groups	The Surat HAP discussed the impacts of heat on health with specific reference to those living in poor housing conditions, and the disproportionate burden of water scarcity on women and children. Bhubaneswar's HAP also covered physiological effects of heat on health.
Technology for hazard identification and hotspot mapping	Utilise tools like remote sensing for precise identification of high-temperature areas	The Bhubaneswar HAP employed satellite imagery to identify city-level hotspots between 2017 and 2019. Surat also implemented a similar practice with remote sensing-based hazard mapping.
Delineation of institutional roles and responsibilities	Define specific roles, responsibilities, and timelines for involved municipal departments and officials	The Bhubaneswar and Surat HAPs featured a delineation of season-wise roles and responsibilities for officials within the municipal corporations.
Financial allocation and municipal accountability	Earmark specific funds and establish clear responsibility within the municipality for HAP implementation	A key strength of the Thane HAP was its outline for the provision of dedicated funds from the Thane Municipal Corporation specifically for implementation, thereby ensuring municipal accountability for its execution.

Challenges and opportunities

While national climate and cooling frameworks exist in India, their advisory nature, absence of legal mandates, and limited focus on vulnerable groups limit their effectiveness. However, a significant opportunity lies in the emerging trend of localised heat governance. The development of state-specific disaster declarations and district-level heat thresholds, as demonstrated by Uttar Pradesh, holds significant potential if emulated by other high-risk regions.

INSIGHT 8

EVALUATING VULNERABILITY

EFFECTIVE ACTION PLANS CALL FOR HYPERLOCAL AND DETAILED RISK AND VULNERABILITY ASSESSMENTS

Effective urban heat action hinges on hyperlocal data - information collected at the micro-levels, rather than at city level. This includes critical specifics such as local micro-climates, population vulnerabilities, land use patterns, and urban form characteristics such as building density and green cover distribution. These specifics can reveal granular insights like significant temperature variances between different parts of a city.

Cities like Mumbai, which have diverse microclimates ranging from cooler coastal peripheries to hotter, concrete-intensive inland parts, illustrate the limitations of uniform interventions. Effective action plans leverage hyperlocal data and detailed vulnerability mapping to accurately identify and prioritise at-risk communities and specific locations for targeted support.

Hyperlocal data enables clear demarcation of high-risk areas and vulnerable groups, supporting efficient resource allocation and tailored actions. Furthermore, robust local data streams are essential for tracking heat risks, and measuring the impact of response efforts.

Source: Pexels

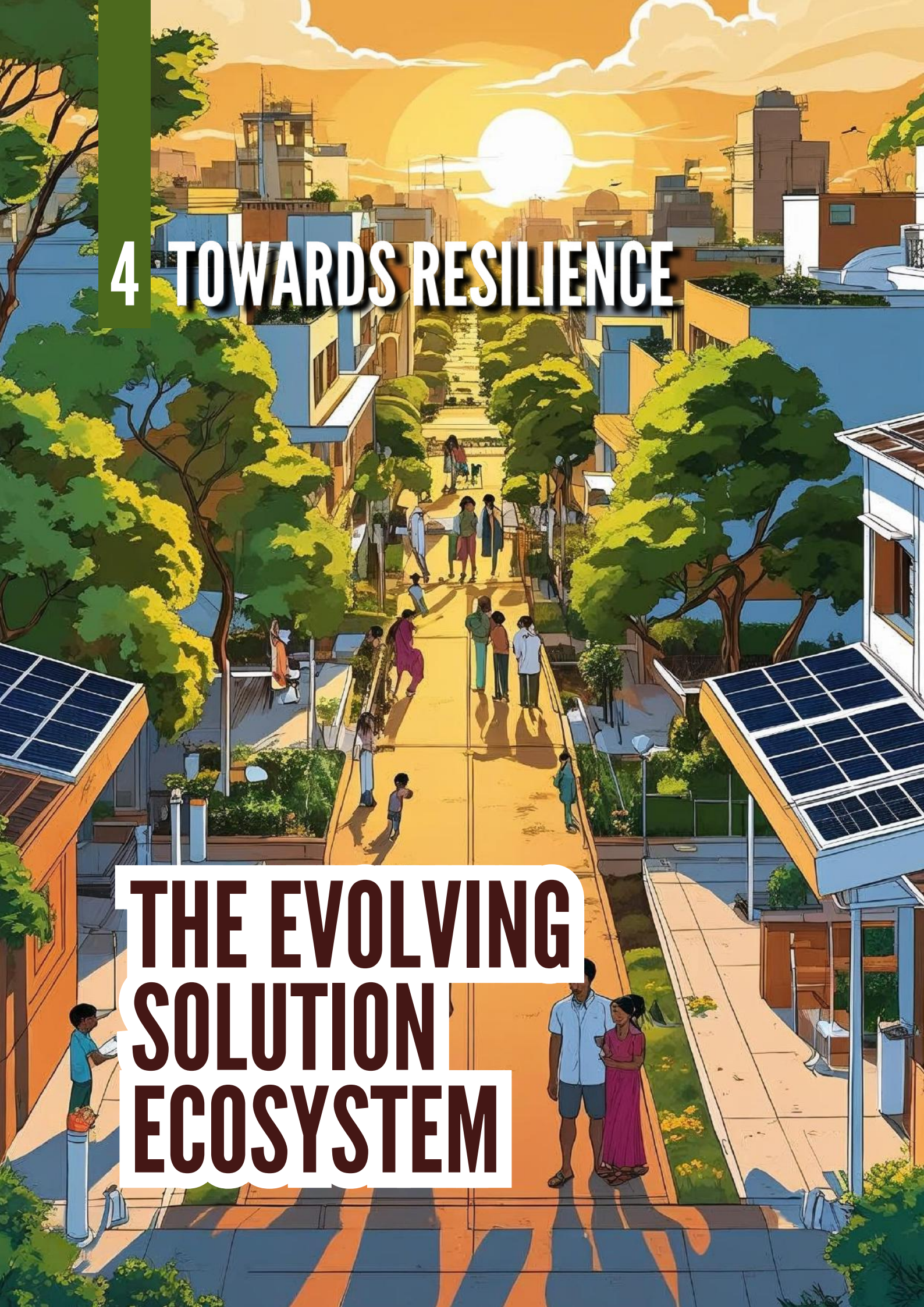
Challenges and opportunities

Our analysis of city-level HAPs indicates that many plans rely on broad demographic categories and lack the granular insights necessary to design and drive targeted interventions. Without detailed vulnerability assessments, groups such as informal workers, women, children, the elderly, and residents of informal settlements remain under-served - despite being among the most affected by extreme heat.

Encouragingly, cities like Bhubaneswar have introduced context-sensitive responses such as cooling vests for traffic police and shaded public areas for outdoor workers. Thane has integrated heat stress awareness into regular health checkups conducted in under-served communities. Meanwhile, Rajkot, Jodhpur, and Surat have incorporated detailed vulnerability assessments to inform targeted action.

While such examples remain limited, they illustrate a significant opportunity. ULBs, research institutions, philanthropic funders, and implementing partners can catalyse more equitable and effective heat response strategies by supporting comprehensive vulnerability assessments. Investing in local data systems and analytical capacity offers a valuable opportunity to ensure that interventions are well-targeted, resource-efficient, and impactful.

4 TOWARDS RESILIENCE



THE EVOLVING SOLUTION ECOSYSTEM

4. TOWARDS RESILIENCE
THE EVOLVING SOLUTION ECOSYSTEM

With the growing traction in climate action and the developing innovation ecosystem in India, a promising array of solutions is beginning to emerge. These solutions are diverse, including nature-based interventions, data and technology tools, behaviour change campaigns, infrastructure innovations, and financing models, and vary widely in terms of maturity, scalability, and contextual fit. Understanding this landscape - its diversity, maturity levels, and potential impact - is essential for effectively prioritising investments and aligning efforts toward more targeted, inclusive, and resilient urban environments.

INSIGHT 9 AN EMERGING GAMUT OF SOLUTIONS

INDIA'S HEAT ADAPTATION AND MITIGATION SOLUTIONS ARE PREDOMINANTLY IN NASCENT OR EMERGING STAGES.

India's portfolio of heat adaptation and mitigation solutions is steadily expanding but remains in its formative phase, with most interventions yet to reach maturity. Nevertheless, it holds considerable promise, supported by a growing and diverse ecosystem of actors actively innovating and scaling interventions. This study adopted a systematic approach to identify and classify a wide array of these solutions. Sixty six distinct solutions were identified through secondary research and inputs from experts, and mapped into seven archetypes (Figure 17), based on their primary use cases.*

Source: Indian Express: Sankhadeep Banerjee

**It is worth noting that most solutions demonstrate a cascading effect, influencing multiple pathways that address heat. For example, solutions categorised under resource efficiency often inherently include elements of conservation. However, the solutions were based on their primary use cases.*

1
Urban Planning and Built Environment Adaptations

Focus on modifying the physical aspects of urban areas to combat heat

- **Green infrastructure -** Urban afforestation, green corridors
- **Blue infrastructure -** Artificial lakes, ponds etc.
- **Grey infrastructure -** Cool roofs, pavements
- **Climate-resilient urban design -** Ventilated, green buildings
- **Sustainable building materials -** Bamboo, recycled plastic

2
Restoration and Conservation-Based Approaches

Focus on reviving and protecting natural ecosystems to mitigate heat effects

- **Waterbody rejuvenation -** Lake restoration
- **Conservation of natural landscape -** Wetlands, forests, and mangroves

3
Health and Social Protection Mechanisms

Aim to safeguard human health and provide support systems against heat stress

- **Healthcare infrastructure -** Strengthening clinics and hospitals to handle heat-related illnesses
- **Social safety nets -** Heatwave insurance, targeted support for vulnerable groups

4
Behavioural and Community-Based Interventions

Focus on empowering local communities and individuals to prepare for heat-related challenges

- **Awareness Campaigns -** Public education on heat stress prevention, hydration and first aid
- **Resilience Training -** Preparing local communities for heat-related emergencies

5
Cooling Technologies

Encompass technological solutions to reduce temperatures and provide cooling

- **Technological solutions -** Cooling innovation labs, personal cooling garments
- **Others -** Natural cooling solution, rest points

6
Resource Efficiency

Aim to optimise the use of resources to combat heat and its impacts

- **Energy-efficient Appliances -** Eco-friendly cooling devices
- **Water Management Strategies -** Prevention of water evaporation and wastage

7
Data and Information Systems

Focus on leveraging data and information for better heat management and response

- **Early warning systems** (heat monitoring and alert systems)

Figure 17: *Solution archetypes within India's urban heat solution ecosystem*

Source: Reuters

Solution Archetypes

To comprehensively understand approaches to addressing urban heat, the identified solutions were grouped into seven key archetypes. The first, Urban Planning and Built Environment Adaptations, focuses on physical urban changes like green and blue infrastructure such as parks and water bodies, cool surfaces, climate-resilient building design, and sustainable construction materials. Complementing this, Restoration and Conservation-based Approaches emphasise restoring and preserving natural landscapes such as wetlands and forests through nature-based solutions.

Further archetypes address human and technological aspects. Health and Social Protection Mechanisms aim to strengthen healthcare readiness and provide safety nets, such as health insurance, that specifically address heat-related care. Behavioural and Community-based Interventions promote public awareness and capacity building for communities to enable heat resilience. Cooling Technologies include both advanced technological innovations and simpler solutions, such as shaded bus stops. Finally, two cross-cutting archetypes, Resource Efficiency, which focuses on energy and water, and Data and Information Systems, which include early warning systems, support the effective implementation and monitoring of heat adaptation and mitigation efforts.

The study assessed the solutions using the Latent, Nascent, Emerging, Mainstream, Transformed (LNEMT) Framework — a maturity framework developed by Sattva and Omidyar Network India - to help funders achieve and measure long-term impact while remaining responsive to the evolving nature of systemic challenges.[1] This framework has been widely used to assess the maturity level of thematic areas in terms of key inflection points and contributing solutions, making it a valuable tool for gauging the overall development of the solution ecosystem. For heat-related challenges, the study used the framework to evaluate solutions based on their stage of development, ranging from early-stage research (Latent) to widespread adoption and impact (Transformed). This classification helps build appropriate, contextual strategies to combat urban heat based on the maturity level of solutions.

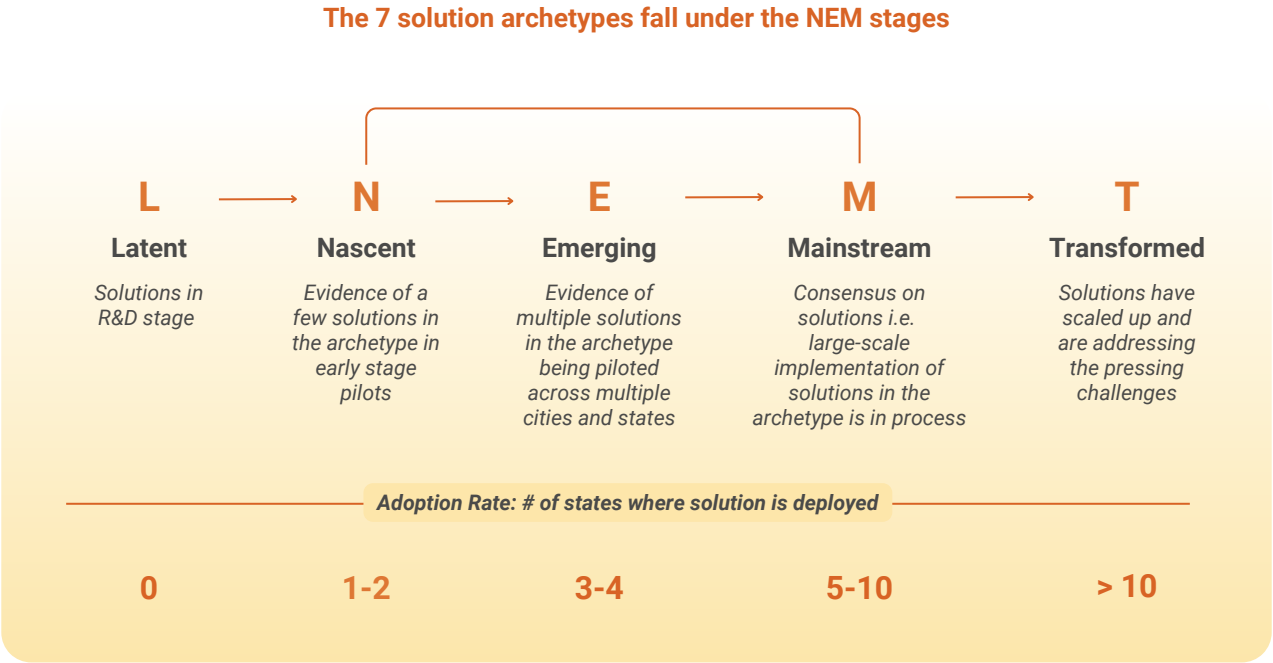


Figure 18: *Evaluation criteria for the solution archetype using LNEMT framework*

Maturity of the urban heat solution ecosystem

Analysis using the LNEMT framework revealed that the urban heat solution ecosystem in India is predominantly at a nascent and emerging stage (Figure 18).

Within Urban Planning & Built Environment, green infrastructure, such as urban afforestation, shows signs of moving towards mainstream adoption while blue and grey infrastructure, climate-resilient design, and sustainable materials are still largely nascent or emerging. This suggests that while nature-based solutions like tree planting are gaining momentum, engineered and material-based urban adaptations are less widespread. Restoration and Conservation efforts, such as rejuvenation of water bodies, are also typically in the emerging phase.

Health and Social Protection Mechanisms, including strengthening of healthcare systems and safety nets like heat insurance, are primarily at the nascent stage, as are Behavioural and Community-based Interventions like awareness campaigns and resilience training. This suggests that systems that directly protect and prepare communities against heat are still in the early stages of development and rollout. Cooling Technologies, Resource Efficiency, and Data and Information Systems, including Early Warning Systems, are mostly categorised as emerging. This shows that the capabilities in technological solutions and information dissemination are improving, although their reach and sophistication have yet to be fully realised. Notably, no archetypes have reached the transformed stage, underscoring significant potential for growth and scaling across all heat solution categories.

Solution Archetypes	Sub-solution Archetypes	L Latent	N Nascent	E Emerging	M Mainstream	T Transformed
Urban Planning & Built Environment Adaptation	Green Infrastructure			●		
	Blue Infrastructure		●			
	Grey Infrastructure			● ●		
	Climate-resilient Urban Design			●		
	Sustainable Building Materials	●		●		
Restoration and Conservation-based Approaches	Waterbody Rejuvenation			●		
	Conservation of Natural Landscapes			●		
Health and Social Protection Mechanism	Healthcare Infrastructure		●			
	Social Safety Nets		●			
Behavioural and Community-based Interventions	Awareness Campaigns		●			
	Resilience Training		●			
Cooling Technologies	Technological Solutions	●		● ●		
	Others (Cooling Centres, Rest Points)	●		●		
Resource Efficiency	Energy-efficient Appliances	●		● ●		
	Water Management Strategies			●		
Data and Information Systems	Early Warning Systems			● ●		

● Current stage of the solution archetype basis the evaluation criteria

● Evidence of early stage innovations in the solution archetypes from conversations with IITs, CEPT, ATREE

Figure 19: *Categorisation of heat solutions across LNEMT framework*

Innovation plays a pivotal role in strengthening India's response to rising heat risks, enabling locally-relevant, cost-effective, and scalable solutions. Leading institutions such as the Indian Institute of Technology (IIT) and the Ashoka Trust for Research in Ecology and the Environment (ATREE) are actively contributing to a growing pipeline of technologies at various stages of readiness.

These technologies span thermal insulation coatings, solar-integrated systems, energy-efficient cooling solutions, and computational tools for building material selection. They are designed to reduce energy demand, enhance indoor thermal comfort, and improve the performance of grey and green infrastructure, with some already deployed in extreme environments.[2] Together, these reflect a diverse and dynamic ecosystem of scientific progress, ranging from experimental research to commercially viable solutions - critical for both heat mitigation and adaptation.

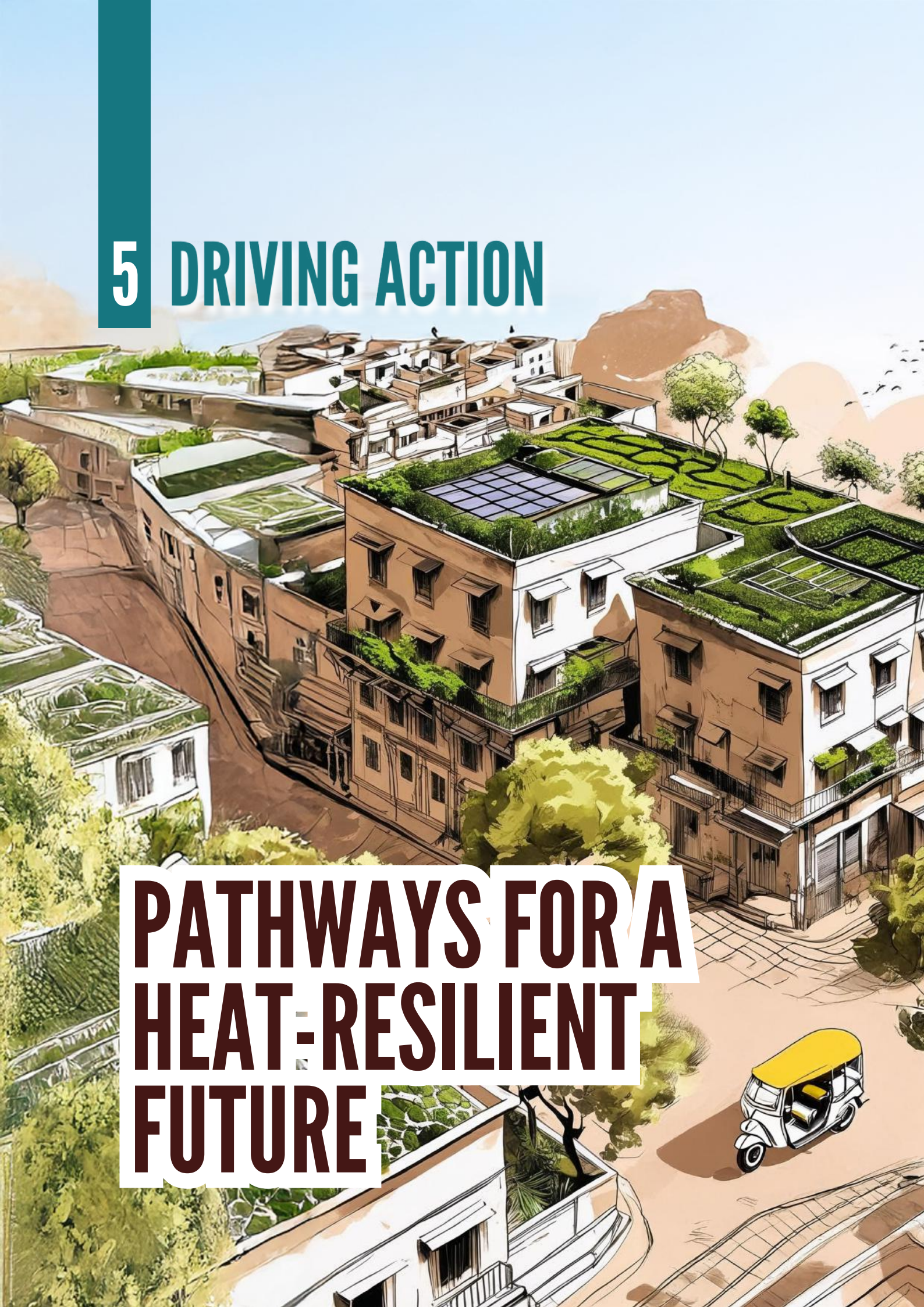
As India confronts increasing temperature variability, fostering an enabling environment for such innovation, through investment, infrastructure, and cross-sector collaboration, will be essential for long-term resilience.

Challenges and opportunities

Distinct challenges face India's predominantly nascent heat solutions ecosystem. Urban adaptation measures like cool infrastructure often remain confined to pilot projects, while health and social protections that could directly safeguard communities from heat impacts are slow to mainstream. Technological innovations many times struggle to move beyond the lab or pilot stage due to limited market pathways and fragmented demand. Additionally, the ecosystem lacks data on solution efficacy and scalability which limits evidence-based investments and policy prioritisations. With the right kind of support, these innovations can transition from isolated efforts to systemic solutions. Strategic funding and de-risking emerging solutions through multistakeholder collaboration, including industry, is key to unlocking this potential.

Advancing the innovation-to-market pipeline through shared learnings from early deployments and coordinated support are vital to building a more inclusive, evidence-based and impactful ecosystem for heat resilience in India.

5 DRIVING ACTION



PATHWAYS FOR A HEAT-RESILIENT FUTURE

5. DRIVING ACTION
PATHWAYS FOR A HEAT-RESILIENT FUTURE

Tier-2 and Tier-3 cities in India are fast emerging as the future engines of growth with a rapidly growing population, increased economic activity and high energy usage, which in turn places pressure on natural resources and intensifies climate risks. Being at an early stage in the development trajectory, these cities present an opportunity for timely interventions that can mitigate heat risks, while avoiding the challenges faced by Tier-1 and metropolitan cities. By learning from these experiences, state governments and ULBs, in collaboration with private sector partners, can apply insights and adopt strategies tailored to Tier-2 and Tier-3 cities. This strategic focus allows for the integration of heat resilience into urban development from the outset.

Given that Tier-2 and Tier-3 cities, along with metropolitan cities, are projected to house nearly half of India's population by 2050,[1] focusing adaptation efforts is not just strategic, but also essential for building urban resilience. Through this preliminary study, we explore multiple pathways for dedicated action through research partnerships, innovations for underserved communities supported by philanthropic capital, and collaborative alliances, such as the Heatwave Action Coalition and the India Cooling Coalition, to build lasting resilience in these upcoming urban centres.

Recommendations for partnerships and action

Building on its analysis of the urban heat landscape and potential roles that diverse stakeholders across public and private sectors can play, this study presents preliminary recommendations for partnerships and independent action to solve growing heat stress across urban centres, particularly in Tier-2 and Tier-3 cities.

The recommendations span five key functional domains — Policy and Research, Innovation and Incubation, Financing Mechanisms, Implementation and Capacity Building, and Data and Measurement. Each recommendation identifies primary and secondary actors to provide greater clarity on potential roles and contributions. Primary actors are positioned to take the lead in advancing specific interventions, leveraging their institutional mandate, reach, or influence, while secondary actors play a complementary role, offering technical expertise, resources, partnerships, or enabling mechanisms that can support and strengthen implementation. While primary actors may be best placed to drive an intervention, meaningful collaboration with secondary actors is essential to ensure that efforts are collectively impactful.

Source: cBalance

Primary Actors	Secondary Actors
Policy and Research	
State governments can formally recognise heat as a state-specific disaster to unlock SDRF resources, enabling proactive mitigation, preparedness, and focused planning.	**Civil society ecosystem partners** can advance evidence on the intersectionality of heat with health, livelihoods and the environment, especially focusing on vulnerable groups, to inform and advocate for policies including formal recognition of heat as a state-level disaster.
State bodies, such as State Urban Development Authorities, can establish mandates and robust implementation guidelines to embed heat action within urban planning processes. For example, they can mandate ULBs to anchor the development of HAPs and CAPs along with indicators for measurement, and integrate policy reforms that enable heat-adjusted work schedules.	To enable data-driven decision-making, **research institutions and think tanks** can develop a framework to track economic loss, quantifying the impact of heat on informal sectors, gig workers, and supply chains, to inform policy reforms and investment strategies. **National-level bodies like the National Institute of Urban Affairs (NIUA)** can assist state governments in strengthening heat-related measures by standardising planning procedures and building capacities for effective implementation.

Primary Actors	Secondary Actors
Innovation and Incubation	
Innovators can work closely with philanthropies and civil society to co-develop and pilot context-specific cooling technologies for vulnerable urban groups.	**Central and state governments** can provide essential regulatory support and incentivise innovation pilots through dedicated grants, innovation challenges, and awards for heat solutions, specifically targeting vulnerable groups.
Incubators can establish or strengthen dedicated urban heat innovation hubs within academic and research institutions to foster context-specific cooling solutions.	**Government actors,** such as public works departments, municipalities, and urban development agencies can actively partner with innovators and incubators to scale successful heat innovations through Memorandums of Understanding (MoUs) and subsidy benefits.
Financing Mechanisms	
Central and state urban development ministries may consider expanding the integration of heat resilience into flagship schemes such as AMRUT, PM SVANidhi and PMAY-Urban to ensure appropriate funding for cities. They could also embed climate-responsive planning and infrastructure in the schemes to address extreme heat.	**Philanthropic organisations and CSR initiatives** can provide catalytic capital for incubators and implementing organisations to pilot innovative heat solutions, translating research into implementation. **Financial institutions, including Non-Banking Financial Companies,** can explore the development of tailored financing instruments such as subsidised loans or pay-as-you-go models for heat-adaptation solutions, including access to cooling equipment, shaded infrastructure, and personal and mobility-based heat protection.
Disaster management authorities and finance commissions can strengthen disaster response financing by earmarking dedicated funds for heatwave preparedness in high-risk urban areas, enabling better capacities at urban health centres.	**Insurance regulators** can pilot targeted climate risk insurance schemes for informal workers, such as street vendors, gig workers, and small-scale service providers.
Government agencies and ULBs may enable partnership models, such as public private partnerships, to attract CSR and philanthropic funding for critical heat resilience initiatives.	**Philanthropic and CSR funders** can engage government-enabled partnerships by co-investing in and supporting the implementation of scalable heat resilience projects in critical sectors like affordable housing, cooling shelters, urban waterbody restoration and greening.

Primary Actors	Secondary Actors
Data and Measurement	
MoEFCC and NITI Aayog can consider developing a national integrated heat data platform to collate, analyse, and disseminate real-time heat data and the effectiveness of interventions, thereby informing policy adjustments and resource allocation.	**Research organisations and think tanks** can conduct rigorous impact assessments of their heat resilience initiatives, share findings to inform best practices and attract further investment, as well as build a knowledge repository.
Implementation and Capacity Building	
ULBs can accelerate HAP implementation by institutionalising collaborative platforms with private sector actors and CSOs, focused on knowledge exchange, capacity building, and on-ground implementation support.	**Implementing organisations,** along with **philanthropy and CSR funders,** can support the implementation of heat action strategies by conducting controlled pilots of nascent solutions, deepening adoption of emerging solutions in diverse geographies, and ensuring comprehensive coverage through state partnerships. For example: Pilot cool roof technologies in arid cities like Ahmedabad, humid urban areas like Chennai and flood-prone regions like Guwahati to assess performance across different conditions and enable statewide or national scale-up. **Research institutions and think tanks** can support ULBs with vulnerability assessments, hyperlocal data, stakeholder consultations, and tools and frameworks essential for developing actionable and community-centric heat resilience strategies.
ULBs and Disaster management authorities can establish hyperlocal early warning systems for informal workers, disseminated via accessible platforms such as WhatsApp and SMS, for timely adaptive action at the community	**The Indian Meteorological Department (IMD)** can provide high-resolution heat-mapping data, using GIS and remote sensing, to enable the development, targeting, and accuracy of hyperlocal weather alert systems.
The Ministry of Health and Family Welfare (MoHFW), in partnership with state health departments, can upgrade public health infrastructure to address location-specific heat risks, including enhanced HRI diagnostics, training and capacity building of healthcare personnel for enhanced emergency preparedness at urban health centres.	**Academic institutions and professional associations** can develop and disseminate standardised training modules for healthcare personnel on the correct diagnosis, treatment, and prevention of heat-related illnesses, and support capacity-building initiatives for emergency preparedness at public health facilities.

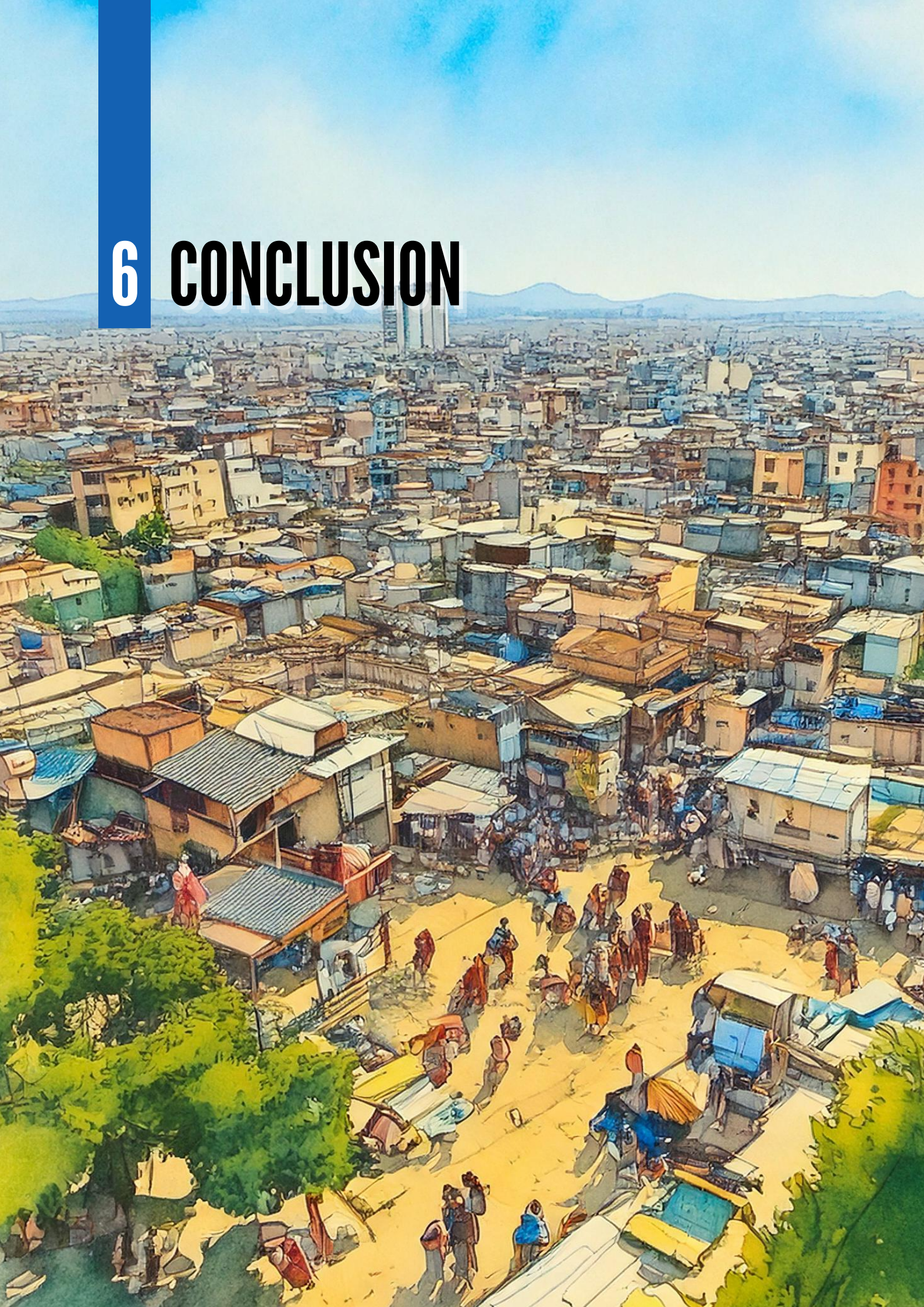
Source: Unsplash

The urban heat ecosystem in India currently lacks coordinated action in Tier-2 and Tier-3 cities, presenting an opportunity for philanthropy and CSR to lead the formation of a multistakeholder alliance focused on urban heat resilience. This alliance would foster diverse partnerships and drive targeted interventions beyond Tier-1 and metropolitan cities. The alliance would catalyse collective action by mobilising resources, advocating for policy reforms, and facilitating knowledge-sharing among cities, researchers, policymakers, and other stakeholders within the heat ecosystem.

Philanthropic organisations may further support multistakeholder platforms and learning forums to foster cross-sectoral knowledge exchange, and accelerate collaborative solutions for urban heat resilience.

Ecosystem enablers that convene such partnerships play a vital role in bridging government and civil society, and in strengthening collaborative governance for urban heat resilience.

6 CONCLUSION



CONCLUSION

India's urban centres are at a critical juncture, facing an escalating heat crisis that intersects with public health, livelihood security, and environmental stability. The preceding analysis in the report has unpacked the multifaceted nature of this challenge, from the often overlooked health costs and disproportionate risks faced by vulnerable groups, to the cascading environmental effects such as rising air pollution and water scarcity, alongside systemic gaps in governance, funding, and policy.

At the same time, this juncture presents a powerful opportunity for both industry and philanthropy. A heat-resilient urban future is achievable provided there is collaborative action and intent from all stakeholders. Formally recognising extreme heat as a disaster risk would mark a critical step forward to navigate the complex heat landscape, unlocking dedicated funding and institutional convergence. Strategies must be rooted in hyperlocal, vulnerability-centred approaches, utilising detailed risk assessments to understand the specific impacts on diverse groups, and develop targeted, city-level, implementable HAPs.

Accelerating the solution ecosystem is equally vital, involving dedicated investment in the research and development of context-specific, scalable solutions. This includes promoting sustainable cooling technologies and advanced building materials, and the expansion and revitalisation of blue-green infrastructure such as parks, urban forests, and water bodies, which provide essential natural cooling. Furthermore, strengthening health system preparedness, enhancing early warning systems, and empowering communities through behavioural interventions are indispensable components of a comprehensive strategy.

This strategic action must involve a dedicated focus on India's rapidly expanding Tier-2 and Tier-3 cities, which offer a unique window for pre-emptive resilience measures. By integrating heat resilience into urban development from the outset, these cities can forestall risks that larger metropolitan regions now struggle to address retrospectively. Strengthened governance frameworks and innovative financing models must support proactive urban planning and building design, which would allow diverse actors — government, market and civil society — to collaborate effectively. This includes strategically tapping into underutilised public funds and catalysing private capital, including CSR and philanthropic resources, to support inclusive and locally-grounded heat resilience initiatives.

Rising urban heat levels pose a formidable challenge. But it can be overcome through collaborative action, embracing innovation, and committing to targeted, evidence-based action that recognises the deep interconnections between heat, health, livelihoods, and the urban environment, thereby impacting the nation's productivity and GDP growth. This also requires a paradigm shift from reactive crisis management to proactive, integrated planning and investment. The time to act is now for a cooler, safer, and more equitable urban future.

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CHAPTER 4

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ANNEXURE

CRITERIA USED FOR CAP/HAP ANALYSIS

Indicators	Thane (2024)	Bhubaneshwar (2020)	Surat (2023)	Gujarat (2022)	Bhopal (2023)	Madhya Pradesh (2022)
Hazard Indicator	Indicators include:More frequent very hot days/warm nightsHigher Land Surface Temperature (LST)Rising heat index	Thermal hotspots identified using Landsat 8 data (2017–2019); validated by IMD.	Hazard mapping conducted using 10 am LST data from Landsat 8; maps adapted for policy use.	Acknowledges IMD heat wave criteria; features color-coded heat alert system.	Conducted climate-specific sectoral assessments with focus on CSCAF; excludes heat-specific indicators for hazard mapping.	Lacks clarity on hazard indicators; no heat-specific indicators used.
Vulnerability Assessment	Conducted ward-level heat vulnerability assessment using indicators like sex ratio, disability prevalence, slum population, illiteracy, NDVI, and health care facilities per sq. km; data sourced from Thane Municipal Corporation departments.	Focused on wage loss and livelihood vulnerability mapping; identified ward-level and calamity-specific vulnerabilities; highlighted infants, children, women, and pregnant women as vulnerable groups.	Conducted hazard mapping using 10 am Landsat 8 LST data; maps tailored for policy use.Completed sector-wise vulnerability mapping of six locations based on IPCC's susceptibility and sensitivity criteria.Surveyed 60 households across wards 17, 24, 27, 28, 46, and 164.	Identifies vulnerable groups—children, pregnant women, and elderly—but lacks detailed vulnerability assessments for them.	Conducted composite vulnerability assessments combining environmental indicators like water and forest cover.	No district-specific vulnerability study conducted; vulnerable groups within the state lack identification.
Health risk identification	Mentions localized heat-health thresholds and heat-related death guidelines but lacks accompanying risk data.	Identified health risks among households and high-risk groups; detailed heat stress symptoms (e.g., sweating, dizziness).Provided valuable analysis of immediate impacts, though long-term complications were not addressed.	Mentions heat cramps and exhaustion, briefly linking poor housing to health impacts; no long-term heat-health effects identified.	Identifies heat rashes, cramps, exhaustion, and stroke as major heat-related health impacts; no long-term effects identified.	Mentions heat-related mortalities due to higher temperatures; does not mention any heat-related illnesses (HRIs).	Acknowledges heat stress worsens respiratory, cardiovascular conditions, and allergies; references WHO report on heat-related illnesses (HRIs).
Livelihood risk identification	Hazard identification notes livelihood impacts but lacks specific focus; key parameters like productivity loss and income effects are missing.	Comprehensive discussion on livelihood and wage loss, highlighting occupation- and gender-specific impacts and differences between men and women.	Discussed heat's impact on productivity and income loss for daily wage earners, differentiating indoor and outdoor workers.Summarized survey findings with key insights and inferences.	Identified vulnerable groups and recommended occupation-specific training/workshops; lacks detailed risk identification.	Identified outdoor workers as most impacted in terms of labour productivity due to rising temperatures.	Identified vulnerable groups, and recommended occupation specific trainings/ workshops.Heat specific risk identification absent.
Environment risk identification	Highlights water access as key to tackling heat stress; omits risks from worsening air quality and combined air-water effects.	No mention of access to water or compounded effect on air and water quality.	Post-surveys, water access—especially for women and children—is highlighted as a key heat stress prevention measure; compounded air and water effects are not mentioned.	No mention of water access or compounded effects of air and water quality.	Conducted water management and air quality assessments following CSCAF guidelines.	Discussed daily air and water risks, including food- and water-borne diseases; highlights key cities with peak vulnerability.
Clearly defined roles for different departments	Outlines stakeholder responsibility matrix for district and state authorities; state-district collaborations well defined.Lacks season-wise role allocation.	Discusses season-wise roles and responsibilities across departments, with duties assigned to BMC officers.	Details season-wise roles for Nodal and SMC Press officers across departments (Health, Labour Welfare) within the annual heat action plan; key service providers also briefed on roles and responsibilities.	Provides season-wise role allocation across departments—Health and Family Welfare, Emergency Services, Ports and Transport, and Nodal Officer.Details roles and responsibilities at village and taluka levels.	Lacks season-wise role allocation.Identifies sectoral climate actions with department-wise roles based on proposed solutions.Mentions implementing stakeholders alongside identified actions.	Includes season-wise role allocation with detailed responsibilities for State and District Nodal Officers, Block Health Officer, Medical Officers, and Panchayati Raj Institutions. Also provides department-wise roles and responsibilities.

Yes No Maybe

CRITERIA USED FOR CAP/HAP ANALYSIS

Indicators	Thane (2024)	Bhubaneshwar (2020)	Surat (2023)	Gujarat (2022)	Bhopal (2023)	Madhya Pradesh (2022)
Indication of budgets	Recognizes budgeting importance for HAP strategies; plans to leverage financing from existing TMC, state, or district budgets, ensuring municipal accountability.	No budget specific indicators.	No details on specific budgets. Recommends SMC develop a budgetary framework. Mentions department-wise budget collaboration.	No budget specific indicators.	Details implementation steps for a Bhopal City-level Climate Budget within municipal finance. Recommends integrating municipal budgets to ensure accountability and establish a City Climate Budget (CCB).	Provides activity-specific budget figures with state- and district-wise targets. Also details NPCCHH budget allocations for FY 2022-23.
Collaboration	Between Thane Municipal Corporation and CEEW.	Between IIPHG, IRADe, IDRC Canada and Bhubaneswar Municipal Corporation.	Between IRADe, UHCRCE. Additionally, supported by Asia Pacific Network for Global Change Research.	Singularly implemented by GSDMA with no private stakeholders involved.	Between the State Ministry of Environment, Madhya Pradesh and WRI.	Between NCDC, MohFW and NPCCHH with no private stakeholders involved.
Urban Planning and Built Environment	Sets guidelines to regulate construction features to have heat resilient characteristics. Additionally, recommends heat resilient cooling features like thermal roofs and cool roofs to reduce air temperature.	Issues mitigation measures like pilot project of painting roofs with white colour. Recommends the insulation and adoption of new building standards, along with improving by laws which are centered around building thermal comfort. Recommends promoting urban greeneries and improving existing energy systems.	Mentions cool roof campaigns and mitigation measures like white roof painting for cool roofs.Additionally, housing specific vulnerabilities have also been discussed. Planting of trees has been encouraged around urban hotspots to increase localised temperature reductions and, encouragement was made towards incentivising builders to plant more trees.	Recommends adopting initiatives like cool roofs and analysing health impacts in urban planning. Additionally, recommends initiatives like ModRoof, membrane cool roofs, green roofs and cool paving materials. Also recommends the usage of white paint (Chinii Mitti)/ white glazed tiles on rooftops for the refraction of Sun's rays in order to avoid heat waves.	There has been mention of cool roof and green roofs to ensure energy efficient cooling within residential areas. Additionally, encourages further adoption of building codes like ECBC.	Encourages climate resilient infrastructure, which include retrofitting at existing health care facilities. Specific guidelines for new buildings have been established, with directives like double glazing glass, STPs etc.
Restoration and Conservation based Approaches	Recommends the restoration of ponds and lakes and encourages the expansion of wetlands. These were highlighted as specific R&Rs to DEOC/DDMA DC or the Forest Departments respectively.	Recommends the restoration of water bodies, fountains in areas of mass presence as a long term measure. Additionally, an emphasis was placed upon the promotion of greeneries and green transport systems.	Document mentions the need to retrieve natural ecosystems but does not expand on the specific type of interventions that can be undertaken.	No mention has been made of any restoration or conservation based approaches.	Recommends the utilisation of the Miyawaki method to restore forests. Recommendations also issued to conserve Bhoj Wetlands. A unique facet of this may be how the plan recommends public consultations to understand the vested motives of community conservation.	No restoration or conservation based approaches have been identified, but a broad emphasis was placed on leveraging opportunities to restore the environment.
Health and Social Protection Mechanism*	Mentions solutions like camps for health checkups in slum areas and provide adequate quantity of life saving medicines across all health centres.	Recommends measures like stocking of ORS and cool packs st health centres. Additional measures like health camps on red alert days are also mentioned. Additionally, the plan recommends the creation of an inter agency response plan and coordination in field.	Issues guidelines on how SMC could collaborate with Primary Health Centres on effective diagnosis, management and reporting of HRIs. Recommends roping in ASHA workers to spread awareness about health insurance schemes.	Issues guidelines for dealing with HRIs through symptom wise first aid recommendations. Additionally, stringent recommendations for hospital preparedness have also been mentioned. Additional measures like the security of old age homes and orphanages also mentioned in R&Rs.	While there has been mention of inclusivity analysis over certain health specific recommendations, heat specific solutions or specific social interventions targeted towards heat were not found in the document.	Issues the creation of Heat Stress Corners in hospitals and recommends the issuance of health advisories during extreme heat events.

Yes No Maybe

CRITERIA USED FOR CAP/HAP ANALYSIS

Indicators	Thane (2024)	Bhubaneshwar (2020)	Surat (2023)	Gujarat (2022)	Bhopal (2023)	Madhya Pradesh (2022)
Behavioral and Community-based Interventions	Guides the issuance of health advisories for vulnerable groups and displays on ambulances to raise summer awareness.	Recommends occupation specific workshops for the ones who are habitually exposed to heat - traffic police, hawkers, etc.	Applauds the formation of a Mahila Arogya Samiti, which serves to be a bridge between the slums and SMC. Public messages through fliers, radio and SMSes were further encouraged.	Recommends community level awareness activities on cool roof building. Additionally, there are detailed R&Rs to NGOs and community based orgs for season specific activities. Recommends an increase in outreach for link and community health workers in at-risk neighbourhoods.	Recommends engaging citizens towards urban green cover implementation. Mapathons were were provided as an example but no heat specific measures recommended.	Recommends training initiatives to vulnerable populations - traffic police, children and women workers. Additionally, IEC campaigns were suggested for awareness building. These initiatives were not specific to heat.
Cooling Technologies	Recommends a hackathon, which could be announced to invite ideas for innovative solutions on affordable cooling technologies.	Suggests the distribution of cooling jackets to traffic police as a short term measure. Additionally, recommends the formation of cooling centers in areas of public interest.	Issues critical recommendations, such as the creation of cooling centers, distribution of cooling vests to traffic police.	Recommends cooling centers in temples, public buildings, malls during a heat alert but no mention of any innovative cooling technologies.	No mention of any specific cooling technologies which combat heat.	Recommends the identification of cooling centers and the barriers to accessing innovative cooling technologies.
Resource Efficiency (Energy and water efficiency)*	Recommends the promotion of energy efficiency and use of renewable energy for cooling and electricity needs by issuing R&Rs to DDMA in accordance to ECBC. However, no water management strategy was discussed.	Specific mention of water management activities were not mentioned. However, mention was made of improving existing energy systems.	No water or energy management specific solutions which were discussed.	Recommends the adoption of building codes like ECBC, and encourages energy conservation through awareness campaigns. Measures for ensuring adequate supply of water, with a focus on drinking water are also mentioned through the R&Rs provided to the various departments.	Recommends a water resource management plan with short, medium and long term actions. Additional energy audits to review the efficacy of existing water supply systems were suggested.	Assigns a water management plan to the HCF by establishing a team, ensure the conservation of water, setting goals, conducting water audits etc. Additionally, the plan also mandates energy audits.
Data and Information Systems	Mentions a framework for the collection of heat specific morbidity data, and throws light on utilising them for better policy making	Recommends the recording of ward wise heat stroke cases, along with monitoring of morning temperatures from AWS sites.	Guidelines for creating gender-specific HRIA databases and sharing gender-disaggregated data have been established. Additionally, sets up detailed season specific guidelines on the dissemination and collection of data points.	Recommends the establishment of heat mortality tracking systems and suggests the updation of existing datasets. Season Wise reviews on quantitative and qualitative data for a process evaluation have also been recommended, among other measures.	Recommends that the BMC should use ward level data to ensure an inclusive analysis. Additional recommends using the biodiversity index developed by ICLEI. The documents suggest that biodiversity planning should be inculcated unto local/ city specific plans.	Recommends the coordination with the meteorological department for analysing HRI death data with meteorological variables. Additionally, suggests measures like collecting AQI levels from hotspots and maintaining records.

Yes No Maybe

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