Reimagining Heat Action and Cooling Strategies in Nagpur

Multisectoral Pathways for a Heat-Resilient Nagpur:
Insights from the Sub-City Heat Action Roundtable 2026

Policy White Paper

The Metropolitan Institute

NRDC

Acknowledgements

Suggested Citation: Kartik Saboo, Roshni Nair, *Reimagining Heat Action in Nagpur through a Sub-city lens*, The Metropolitan Institute (Nagpur, 2026).

Illustrations: Nishtha Gosewade

Disclaimer: This white paper synthesises insights and discussions from a closed-door stakeholder roundtable held on 25 June 2026. The convening was conducted strictly under the Chatham House Rule to encourage open and candid dialogue. While this document reflects the major themes and recommendations that emerged from the discussion, the views expressed are those of the authors and do not necessarily represent the official positions, policies, or endorsements of any individual participant or their affiliated organisations.

Peer Reviewers: Amitosh Gautam, Sujata Saunik, Tanya Jha

Publication Teams: NRDC, The Metropolitan Institute

The Metropolitan Institute is an Indian think-and-do tank committed to building aspirational and resilient regions through context and evidence-based research, policy innovation, capacity and incentive-conscious implementation, and knowledge production.

NRDC (Natural Resources Defense Council) is an international non-profit environmental organisation with more than 3 million members and online activists. Since 1970, its lawyers, scientists, and other environmental specialists have worked to protect natural resources, public health, and the environment. NRDC's India Program on Climate Change and Clean Energy, launched in 2009, works with local partners to support a low-carbon, sustainable economy.

Statement of Gratitude

The findings, discussions, and recommendations captured throughout this document are drawn from the inputs shared at the Nagpur Sub-City Heat Action Roundtable, held at the Centre of Excellence on Heat Resilience and Sustainable Cooling (CEHSC), IIM Nagpur, on 25 June 2026, co-convened by The Metropolitan Institute and NRDC. This round table, and the collective insights that emerged from it, reflect a shared commitment across sectors to building a more resilient, equitable, and heat-safe Nagpur.

We extend our sincere appreciation to IIM Nagpur for graciously hosting the round table and for providing an enabling space for meaningful dialogue and knowledge exchange among diverse stakeholders.

Maharashtra's journey in developing Heat Action Plans (HAPs) started in Nagpur and launched in 2016, supported by NRDC and a government resolution was issued by the Public Health Department, and several HAPs were made in the state *(Government of Maharashtra, 2015).* We extend our sincere gratitude to Ms. Sujata Saunik (IAS Retd.), former Chief Secretary of Maharashtra, for delivering the keynote address that framed the urgency and scope of this round table. Her call to move beyond conventional heat action metrics, coupled with her emphasis on cross-departmental collaboration, set the tone for a genuinely constructive and forward-looking discussion.

We are equally grateful to all the government officials, academic researchers, NGO leaders, and several technical experts who contributed their time, expertise, and on-ground insights to this convening, including representatives from Nagpur Municipal Corporation (NMC), Visvesvaraya National Institute of Technology (VNIT), Centre for Sustainable Development (CFSD), Institute for Technology and Development Policy (ITDP India), International Forum for Environment, Sustainability and Technology (iFOREST), the Nagpur Divisional Commissionerate, and the Nagpur District Administration, among others. Their willingness to share data, field experience, and candid perspectives made possible the evidence base and recommendations presented in this white paper.

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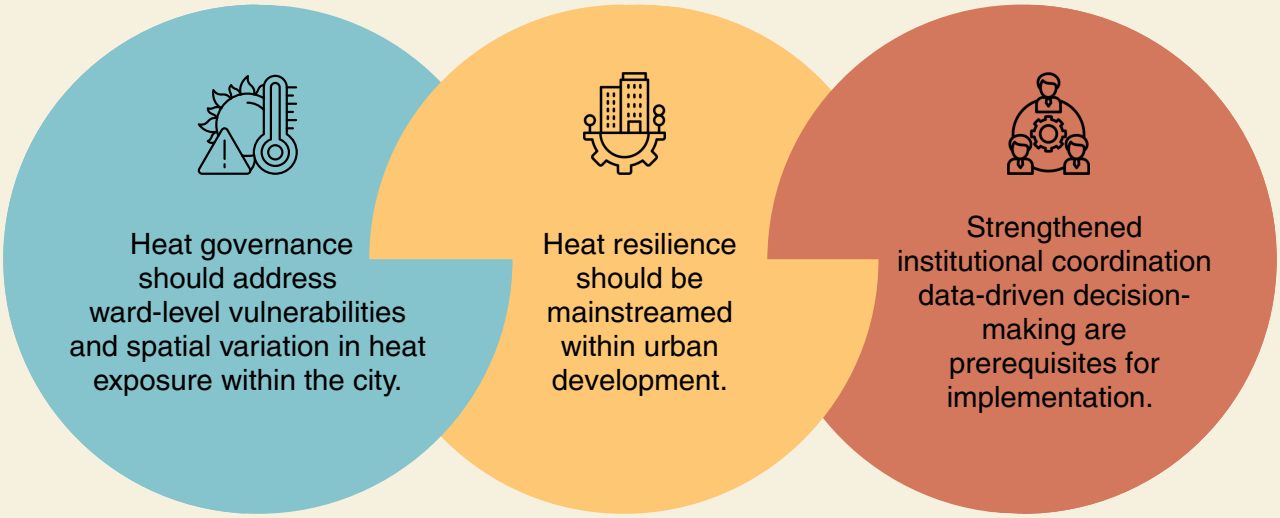
Executive Summary

Extreme heat has emerged as one of the most significant climate risks confronting urban India, with cascading impacts on public health, infrastructure, labour productivity, ecosystems, and economic development. Rising temperatures, coupled with rapid urbanisation, changing land-use patterns, and the Urban Heat Island (UHI) effect, are increasing both the frequency and intensity of heat exposure across Indian cities, disproportionately affecting vulnerable populations and placing growing pressure on urban systems. *(IPCC, 2023; World Meteorological Organisation, 2023; Lancet Countdown, 2024).*

HAPs have substantially strengthened heat preparedness by institutionalising early warning systems, public advisories, interdepartmental coordination, and emergency response mechanisms within municipal governance. However, most HAPs continue to operate at the city scale, relying on uniform temperature thresholds and standardised interventions that do not capture the considerable spatial heterogeneity in heat exposure, socioeconomic vulnerability and adaptive capacity within cities. Consequently, neighbourhoods facing the greatest heat stress often remain underserved by existing planning approaches. *(NDMA, 2019; NRDC IMD, 2019; CEEW, 2024).*

Severe heat waves in Nagpur are increasing by 0.06 days annually *(Bhawna, Singh, and Kanaujiya, 2024)*, **adding roughly 1 hour and 26 minutes of extreme thermal exposure to the city's baseline each year.** Against this backdrop, the Nagpur Sub-City Heat Action Roundtable was convened. They keynote address by Ms. Sujata Saunik, former Chief Secretary, Government of Maharashtra, revealed that heat severely impacts both the health and livelihoods of citizens thus pressing the need to think beyond generic responses like water stations, cool roofs and open parks.

Key Takeaways



Introduction: The Rising Heat Threat

Extreme heat operates as a compounding stressor across public health, infrastructure, and livelihoods simultaneously. On public health, evidence notes that, cardiovascular disease mortality **rises to 2.1% for every 1°C increase in temperature, translating to an 11.7% higher overall mortality risk during heatwave periods** *(Liu et al., 2022)* with the burden falling earliest and hardest on the most exposed and the least protected sections of our society.

The heat threat looms over our next generation as children are physiologically more vulnerable to heat, leading to severe dehydration and exacerbated congenital conditions, with spikes in infant mortality rates.

UNICEF (2026) reported that nearly 392 million children, i.e., 92% of India's child population, are now exposed to extreme heat, and 234 million children, i.e. **55% of the child population, face the brunt of at least three overlapping climate hazards**, most commonly the combination of drought and extreme heat, that simultaneously threaten crop yields, water access, and nutrition. Heatwaves also force widespread school closures, disrupting learning for millions of students and compounding into lasting educational gaps.

Economically, the toll is equally severe. India is projected to lose approximately **5.8% of total working hours to heat stress by 2030**, the equivalent of 34 million full-time jobs *(ILO, 2019)*.

The burden falls disproportionately on the informal and outdoor workforce, for whom immediate income collapse, layered with rising medical costs and household cooling expenses, is largely unaffordable. This is an area of study that deserves more of research attention, especially with rising risk for gig workers, construction workers and daily wage workers.

As vegetation, soil, and water bodies are replaced by concrete and asphalt, cities lose natural cooling while gaining heat-absorbing surfaces that intensify the urban heat island effect. In India, built-up land has expanded by 31% from 2005-2022 *(National Remote Sensing Centre, 2024)*, contributing to higher land surface temperatures and increasing heat exposure in dense urban areas.

A possible solution for exposed hot zones is Waste segregation: source-segregated, drier feedstock increases the calorific value and conversion efficiency of waste-to-energy (WtE) plants *(Soni et al., 2025)*, and the thermal output from these facilities can, in turn, be integrated into district cooling networks *(Rezaie and Rosen, 2012)*.

Directing this cooling capacity towards low-income and informal settlements that lack access to mechanical cooling would align waste management practices with Swachh Bharat's source-segregation goals while delivering the co-benefit of cooler and more heat-resilient neighbourhoods.

Introduction: Heat Threat in Nagpur

Nagpur, specifically exemplifies this case of rapid urbanization and how it manufactures heat risk. The city's built-up area has grown sharply in the last two decades, **expanding from 72.85 sq. km in 2000 to 185.4 sq. km in 2023,** doubling, systematically replacing natural cooling capacity with heat-retaining infrastructure. This growth has come directly at the expense of the city's **water bodies, which shrank from 12.2 sq. km to just 2.29 sq. km** over the same period *(Diwate et al., 2025)*, reflecting the steady encroachment of impervious surfaces onto natural buffers.

The city's green space deficit is severe, with per-capita availability ranging from **0.27 to 2.32 sq. m per capita across its wards against a national guideline of 10–12 sq. m** per capita under the URDPFI Guidelines, 2014 *(CSIR-NEERI study, cited in The Hitavada, 2021)*. Citywide vegetation cover stands at only approximately **15.9%, falling as low as 7% in the city's most heat-vulnerable, low-greenness zones** *(Lahoti et al., 2025).*

Wetlands, which would support groundwater replenishment and natural temperature regulation, are being steadily suffocated by encroaching impervious concrete surfaces: decadal analysis (2000–2020) confirms significant loss of wetland structure and area across the city, weakening its flood resilience and heat resilience *(Shukla et al., 2024).*

The shrinking green space and the increase in built-up area are perhaps reflected in the number of heatwave days the city is experiencing, shifting from single-digit annual heatwave days between 1970 and 2000 to **double-digits over the last two decades with severe heat wave frequency increasing by 0.06 days annually** *(Bhawna et al., 2024),* ranking Nagpur as the 4th most heat-at-risk city globally out of the 205 cities assessed *(Kariyawasam et al., 2026)*.

Further, heat risk is not distributed evenly across Nagpur; it is concentrated in specific, identifiable pockets shaped by urban form and socio-economic status. Dense, concretised neighbourhoods such as **Itwari, Mahal, and Lakadganj run 4–5°C hotter than surrounding rural regions due to the Urban Heat Island effect,** a localised amplification driven directly by built density and lost green cover.

Research led by Dr. Rajashree Kotharkar shows that **compact, densely built commercial and residential areas experience higher nighttime heat stress** because urban materials absorb heat during the day and release it slowly after sunset. This nocturnal heat retention suppresses the city's ability to cool overnight, making compact neighbourhoods significantly warmer than open or vegetated areas *(Kotharkar et al., 2018; Kotharkar Dongarsane, 2024)*

Policy Gaps Identified by the Round Table

India's existing heat governance framework of district-level heat action plans introduced early warning systems, public alerts, and basic mitigation measures like shade provision and hydration points into municipal planning for the first time.

But the evidence emerging from this round table makes clear that this mode of planning has reached its structural limits as it operates as a city-wide instrument, with multiple standardised features like a single temperature threshold, a uniform alert protocol, and standardised interventions applied evenly across an entire municipal boundary, regardless of the vast differences in built form, population density, and vulnerability that exist within that boundary.

This broad-brush design of heat action plans also creates critical blind spots. Nagpur's Heat Action Plan misses developing solutions for informal, unregistered dump-yard workers and similarly exposed populations. They represent some of the most heat-vulnerable residents in the city as it is calibrated for the "average" citizen of the city rather than the most vulnerable one. This uneven exposure maps closely onto underserved sectors, where residents face intersectionality of disadvantage, which highlights the need for a sub-city, ward-level heat action because only granular, spatially targeted planning can address risk that is this unevenly distributed.

Spatial Scale Gap

Existing Heat Action Plans operate at the city scale, applying uniform temperature thresholds and interventions despite significant variations in heat exposure across neighbourhoods. This masks local heat hotspots and limits the ability to prioritise high-risk areas. Sub-city planning enables targeted, location-specific interventions based on granular spatial data.

Vulnerability Identification Gap

Current HAPs identify vulnerable populations using broad categories but often fail to capture the spatial concentration and overlapping nature of social, health, environmental, and economic vulnerabilities. As a result, resources may not reach the communities most at risk.

Intervention Design Gap

A one-size-fits-all approach limits the effectiveness of adaptation measures. Context-specific interventions tailored to local conditions can significantly improve heat resilience and implementation outcomes.

Key Insights from the Round Table

The roundtable was designed as a structured, multi-stakeholder consultation to critically examine the limitations of existing city-level Heat Action Plans (HAPs) and explore the need for a more localised, ward-level approach to heat resilience in urban India.

Bringing together senior government officials, municipal authorities, technical institutions, academia, industry representatives, and civil society organisations, the consultation sought to facilitate evidence-based discussions on advancing sub-city heat action planning in Nagpur.

The discussions were anchored by a keynote address by Ms. Sujata Saunik, Former Chief Secretary, Government of Maharashtra, on developing a sub-city heat resilience framework.

The proceedings commenced with welcome remarks from representatives of the Natural Resources Defense Council (NRDC), The Metropolitan Institute, and the Government of Maharashtra, establishing the importance of collaborative and cross-sectoral action in addressing escalating urban heat risks.

Building on this foundation, the consultation featured a series of thematic presentations from key stakeholder institutions, including municipal authorities, technical and research organisations and academic institutions.

"India has a spectrum of heating needs and cooling solutions. Some of these interventions have broken links, while some are islands of excellence. We need to bring them all together."

- Ms. Sujata Saunik

These presentations provided sector-specific perspectives on urban heat governance, data availability, streets and public infrastructure, public health, ecosystem services, and implementation challenges.

Participants highlighted cost as a key barrier to scaling heat-resilient solutions, and identified industry funding (particularly through CSR mechanisms as a promising lever to offset this barrier) as a promising means to address this challenge, given the scale of untapped corporate obligation spending relative to public climate finance.

Beyond this, the session sought to consolidate existing knowledge on the subject, showcase solutions like the Healthy Street initiative, while mapping institutional strengths, identifying operational gaps, and uncovering opportunities for cross-sector collaboration.

Sectoral Perspectives

Mr. Kartik Saboo
Founder-CEO,
The Metropolitan Institute

Mr. Kartik called for multi-pronged responses to heat risk, including proactive planning for vulnerable regions and strict, graded protocols that automatically trigger a red alert at various heat levels, activating immediate public health interventions. He also urged a radially identified zero-concretisation buffer around urban wetlands, allowing these water bodies to function as natural rain gardens. On green infrastructure, he recommended decentralised, site-sensitive planning to extend green corridors into underserved areas.

For fast-sprawling, high-density areas where horizontal greening isn't feasible, he proposed mandatory green rooftops and vertical gardens on high-rises as a scalable alternative.

Ms. Sujata Saunik (IAS Retd)
Former Chief Secretary,
Government of Maharashtra

Ms. Saunik highlighted that given the scale, complexity, and internal heterogeneity of Indian cities, heat governance must move decisively towards a sub-city planning approach that recognises the uneven spatial distribution of heat exposure, vulnerability, and adaptive capacity.

She mentioned that heat action must expand beyond its conventional boundaries to identify neighbourhoods and localities where heat risks are disproportionately concentrated and where priority interventions are most urgently required. Future heat governance must therefore evolve towards more targeted, integrated, and locally responsive interventions that account for variations in exposure and socio-economic vulnerability within cities.

Sectoral Perspectives

Ms. Dipa Singh Bagai
Country Director, NRDC India

Ms. Dipa mentioned established Centre of Excellence for Heat Resilience and Sustainable Cooling (CEHSC) will act as the institutional vehicle through which accumulated learnings can be embedded, advocating for a dedicated team of experts to convert academic research into sustained, cross-sectoral action spanning infrastructure, health, and the labour sector; develop readiness to plan ahead of the following summer, positioning Nagpur as a potential demonstration model for other Indian cities.

Dr. Deepak Selokar,
Municipal Medical Health Officer, Nagpur Municipal Corporation (NMC)

Dr. Deepak noted that Nagpur's proximity to the Tropic of Cancer, combined with a strong urban heat island (UHI) effect caused by expanding concrete and asphalt surfaces and a decline in vegetation cover from 70% in 2003 to ~20% in 2023, has contributed to rising cases of heat exhaustion, heat stroke, and dehydration.

He mentioned the importance of early planning and strong inter-departmental coordination across the Nagpur Municipal Corporation, ensuring that health, disaster management, water supply, urban planning, and other relevant departments work in a coordinated manner before and during the heat season, which enables timely interventions, and plays a critical role in reducing heat-related illnesses and preventing avoidable deaths.

Sectoral Perspectives

Ms. Rutuja Nivate
Senior Associate, ITDP
India

Ms. Rutuja mentioned that shade produces dramatic cooling; most streets showed more than 20°C difference between shaded and unshaded sections (up to –25°C on Mata Mandir Road), recommending the need to recognise streets as climate infrastructure and formally integrate them into Heat Action Plans, prioritising corridors around schools, transit hubs, markets, and other areas with high pedestrian activity and vulnerable populations. Thermal comfort should be embedded into street design standards and performance indicators.

Dr. Rajashree Kotharkar
Professor, VNIT, Nagpur

Dr. Rajashree introduced the Local Climate Zone (LCZ) classification of Nagpur, demonstrating that heat risk varies sharply by neighbourhood rather than uniformly across the city. Her presentation evidenced that alert protocols and interventions must be timed and targeted to local conditions rather than applied on a single citywide schedule.

Her several analyses of urban morphology found building surface fraction, pervious surface fraction, vegetation-to-development ratio, aspect ratio, and sky view factor to be the dominant drivers of night-time heat retention, reinforcing the need for integration of heat resilience into Maharashtra's Unified Development Control Regulations (DCR).

Sectoral Perspectives

Ms. Srestha Banerjee,
Director, iFOREST

Ms. Srestha mentioned about iFOREST 's work with the Nagpur Municipal Corporation on an Integrated Heating and Cooling Action Plan, an approach that treats extreme heat and rising cooling demand as a single, self-reinforcing challenge recommending the need to address extreme heat and rising cooling demand as one integrated challenge, combining regulatory and infrastructural measures.

This approach includes working with the Energy Conservation Building Code (ECBC) and municipal building codes to promote energy-efficient buildings and appliances, alongside heat-resilient infrastructure such as cooling shelters, cool bus stops, cool/green roofs, nature-based solutions, and water body rejuvenation.

Ms. Leena Buddhe
Director, Centre for Sustainable Development

Ms. Leena highlighted gendered burdens and policy gaps in health infrastructure that become the most visible during summers. She recommended extending targeted protection to informal and waste-worker communities, including climate cash transfers during heatwave disruptions, improved landfill fire management (hydrants, shaded cooling shelters, water stations), and slum retrofitting through cool-roof paint and insulation, targeting a 3–5°C indoor temperature reduction.

She mentioned that these measures should be co-designed with waste picker unions at the municipal planning table to ensure interventions that reflect lived realities on the ground.

Key Recommendations

The open forum discussions in the round table brought in experts from administration, academia, think-tanks and civil society organisations. Synthesising across all stakeholder presentations, priority interventions fall into three interconnected action areas:

Built Environment and Cooling

Localised Heat-Health Interventions

Infrastructure and Urban Form

1. Built Environment and Cooling

1.1 Upgrading conditions in informal settlements and integrating accessible cooling technology emerged as the most urgent and least-addressed priority area

Nagpur's housing crisis disproportionately affects its most vulnerable populations, particularly waste pickers near the Bhandewadi dumping yard and residents of informal settlements like Pangul Basti. In these areas, tin-roofed housing regularly traps heat, pushing indoor temperatures above 50°C. This is further compounded by unsafe biomass cooking practices, creating a "dual-oven" effect in which residents are exposed to extreme heat from both the built environment and their cooking fuel simultaneously. *(CFSD, 2026)*

Recommended interventions span immediate and structural measures: targeted health screening for outdoor and landfill workers to enable early detection of heat-related illness; retrofitting of slum housing with cool-roof paint and insulation, targeting a 3–5°C reduction in indoor temperatures; and formal integration of informal workers into the National Action for Mechanised Sanitation Ecosystem (NAMASTE) scheme to close existing gaps in social protection coverage.

1.2 Updating building regulations

Strengthening implementation of the Energy Conservation Building Code (ECBC) was identified as a key priority for reducing urban heat vulnerability. Participants emphasised integrating climate-responsive building design, passive cooling measures, and energy-efficient construction practices into both new developments and retrofitting initiatives to improve thermal comfort, lower cooling demand, and enhance long-term urban resilience.

2. Localised Heat-Health Interventions

2.1 Ward-level health interventions

Mortality risk thresholds vary meaningfully by Local Climate Zone, where some wards face peak risk during the day, others at night, depending on their urban form, underscoring the need for ward-specific heat warning thresholds, locally calibrated advisories, and time-sensitive public communication. *(Kotharkar and Bagade, 2018)*.

2.2 Prioritising heat-health infrastructure in hotspot wards

LST-based hotspot mapping identifies Kalmana Market (Ward 24), informal settlements in Taj Bagh (Ward 30), and the Bhandewadi Dumping Site (Ward 26) as persistent hotspots. *(GMO, 2026)*. These findings highlight the need to prioritise cooling infrastructure, healthcare outreach, access to drinking water, shaded public spaces, and emergency response capacity in the most heat-exposed wards.

3. Infrastructure and Urban Form

3.1 Blue Infrastructure: Nagpur's Underutilised Cooling Asset

Restoring the ecological health of the Nag river and other urban water bodies in the city was raised not just for environmental remediation, but as a direct heat mitigation strategy for healthy, functioning blue infrastructure that can meaningfully lower localized temperatures while simultaneously improving water quality, flood resilience, and biodiversity outcomes. Reframing river and wetland restoration as core heat resilience infrastructure measures.

3.2 Waste to Energy plants

Dumpsite decomposition generates substantial thermal output and has been shown to contribute directly to urban heat island intensity, of which Bhandewadi dumpsite is an example. Waste segregation practices are therefore identified as a key lever for reducing this effect *(Mayilsankar and Ramesh, 2025).*

Diverting municipal solid waste to waste-to-energy plants presents a viable opportunity for providing low-cost cooling options to underserved areas, thus creating a framework for the circular economy.

3.3 Shaded pathways

ITDP India's street-level assessments provide a finding that shaded footpaths run 20–25°C cooler than unshaded sections, while less than 40% of Nagpur's streets currently have adequate shade cover, positioning that street-level shading is one of the highest impact, lowest cost interventions available to the city.

Stakeholder Alignment

Translating the priority interventions outlined above into sustained, ward-level outcomes will not happen automatically; it depends on how clearly responsibilities are assigned and how effectively the different actors involved choose to work together.

The stakeholders convened at this round table represent a diverse ecosystem, each bringing distinct mandates, resources, and areas of expertise to the table.

In line with this collaborative mandate, The Metropolitan Institute, together with NRDC, has pledged to serve as the connecting organisation for this ecosystem, bridging government, academic, and civil society stakeholders, through the Centre of Excellence for Heat Resilience and Cooling Solutions to ensure that priorities identified through this round table translate into sustained, coordinated action rather than isolated efforts.

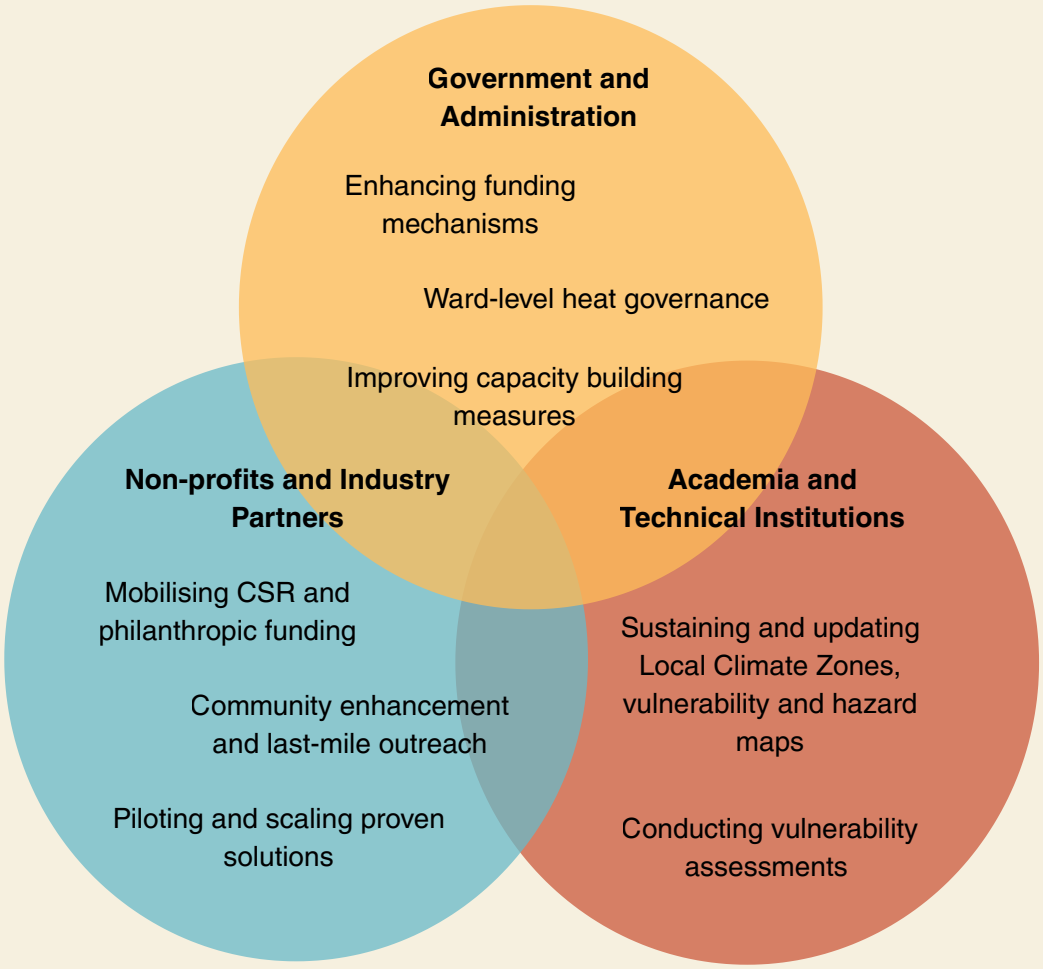


Fig 1: The roles and responsibilities identified for each partner through the stakeholder discussion

Conclusion

Image: Participants of the sub-city heat action roundtable

Nagpur stands at an inflexion point. Heat, which was earlier a seasonal inconvenience in the region, has now become a public health, economic, and social emergency, threatening the education and development of children and disproportionately devastating the city's most vulnerable residents.

The evidence presented throughout this round table showcased the need to shift from city-wide heat mitigation to sub-city, ward-level heat action. While the evidence and the institutional will to act exist, there needs to be technical capacity-building measures to connect these together.

The establishment of the Centre of Excellence on Heat Resilience and Sustainable Cooling (CEHSC) thus represents a critical point in the city's heat resilience trajectory; it is deemed to act as a connective institution capable of bridging the islands of research, policy, and grassroots excellence into a single, coordinated framework, and turning years of fragmented effort for a heat-resilient future of the city.

Once Nagpur demonstrates that this granular, evidence-based approach can be implemented in the sub-city, it can offer India's first replicable sub-city heat resilience model to other rapidly urbanising cities.

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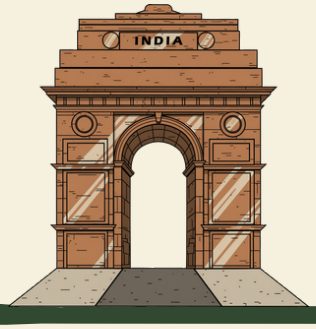

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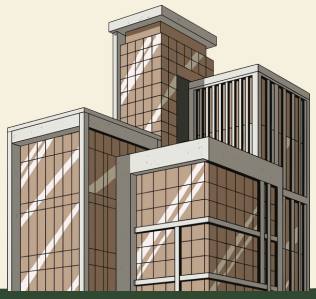

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