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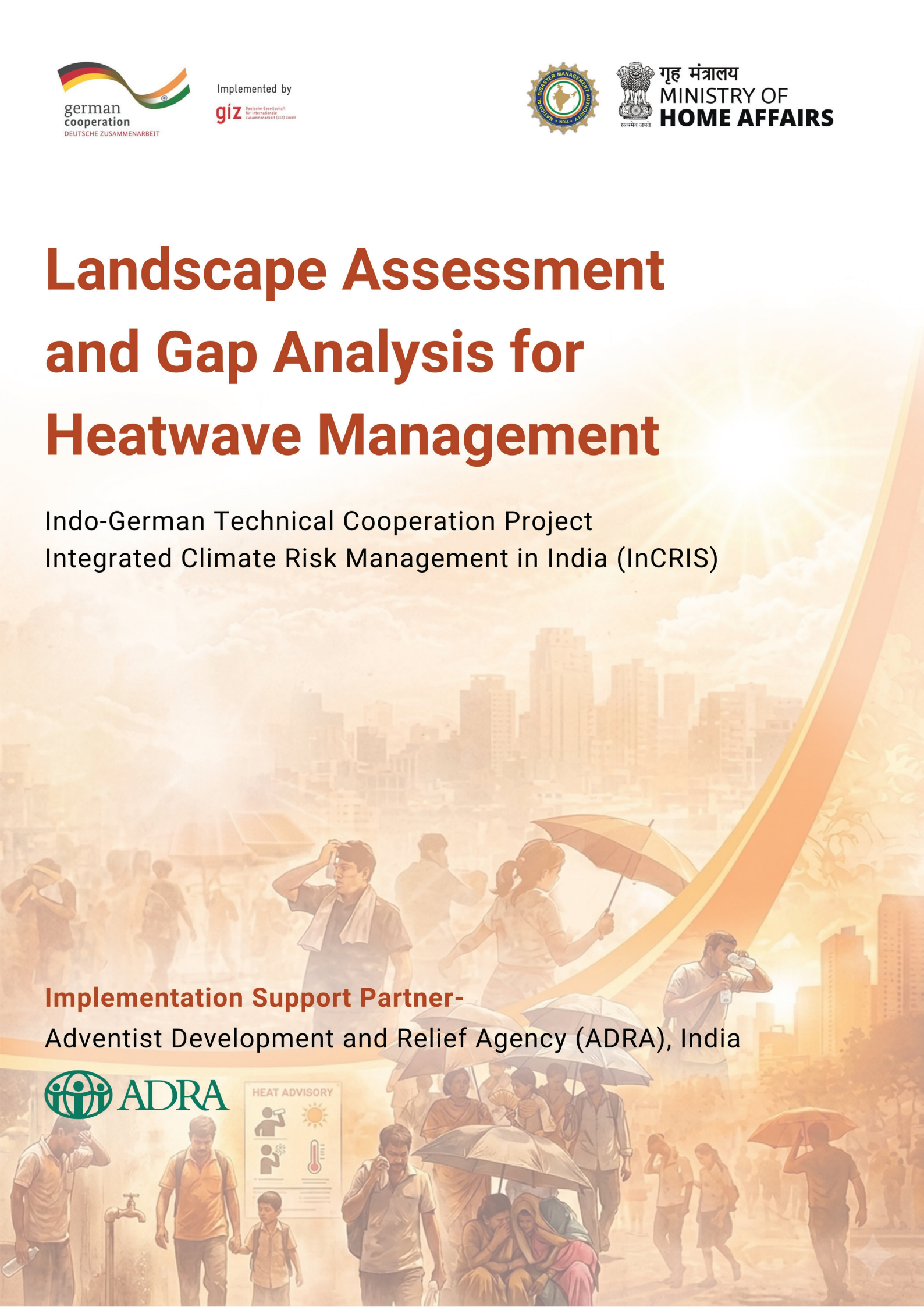
Landscape Assessment and Gap Analysis for Heatwave Management

Indo-German Technical Cooperation Project
Integrated Climate Risk Management in India (InCRIS)



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CONTENTS

GLOSSARY

AB PM-JAY	Ayushman Bharat Pradhan Mantri Jan Arogya Yojana
ASHA	Accredited Social Health Activists
AWW	Anganwadi Workers
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
DDMA	District Disaster Management Authority
DRR	Disaster Risk Reduction
DUSIB	Delhi Urban Shelter Improvement Board
EV	Electric Vehicles
GESI	Gender Equality and Social Inclusion
GigWA	Gig Workers' Association
HAP	Heat Action Plan
HfH	Habitat for Humanity
IGSSS	Indo-Global Social Service Society
ILO	International Labour Organization
IMD	India Meteorological Department
InCRIS	Integrated Climate Risk Management in India
IPCC	Intergovernmental Panel on Climate Change
KII	Key Informant Interview
MFI	Microfinance Institutions
MHA	Ministry of Home Affairs
MHT	Mahila Housing Trust
MOEFCC	Ministry of Environment, Forest and Climate Change
MoHFW	Ministry of Health and Family Welfare
MoLE	Ministry of Labour & Employment
NCDC	National Centre for Disease Control
NDMA	National Disaster Management Authority
NDMF	National Disaster Mitigation Fund
NDRF	National Disaster Response Fund
NDRMF	National Disaster Risk Management Fund
NGO	Non-Governmental Organisations
NPCCHH	National Programme for Climate Change and Human Health
ORS	Oral Rehydration Solution
PHC	Public Health Centres
PMAY (U)	Pradhan Mantri Awas Yojana (Urban)
RAWU	Rajdhani Workers' Unions
RWA	Resident Welfare Association
SDG	Sustainable Development Goal
SDMF	State Disaster Mitigation Fund
SDRF	State Disaster Response Fund
SDRMF	State Disaster Risk Management Funds
SEEDS	Sustainable Environment and Ecological Development Society
SEWA	Self-Employed Women's Association
SHC	Sub-Health Centres
SHW	Severe Heat Wave
UHIE	Urban Heat Island Effect
WMO	World Meteorological Organisation

MESSAGE

National Disaster Management Authority (NDMA)

India's increasing exposure to extreme heat highlights the urgent need for strengthened preparedness and climate risk management strategies. NDMA has been working closely with States, Districts, and partners to enhance resilience to heatwaves through improved planning, coordination, and capacity building.

The Indo-German Bilateral Cooperation project "Integrated Climate Risk Management in India", implemented by GIZ in cooperation with NDMA under the aegis of the Ministry of Home Affairs (MHA) and supported by ADRA India, aims to strengthen institutional and technical capacities for integrated climate risk management with a focus on heatwaves.

As part of this initiative, a comprehensive landscape assessment and gap analysis on heatwave management was conducted in selected locations in Delhi and Amravati, Maharashtra looking at the historical heat stress data and climate vulnerability.

The findings presented in this report highlight critical vulnerabilities, institutional gaps, and opportunities to strengthen heatwave preparedness, particularly for vulnerable groups such as gig workers, construction workers, residents of informal settlements and farmers. The insights aim to inform evidence-based decision-making and advance inclusive, climate-resilient heatwave management in India.

MESSAGE

GIZ India

India's growing climate vulnerability and increasing intensity of heatwaves require integrated approaches that link climate adaptation, disaster risk reduction, and sustainable development.

The Indo-German Bilateral Cooperation project "Integrated Climate Risk Management in India", implemented by GIZ in cooperation with NDMA under the aegis of the Ministry of Home Affairs (MHA) and supported by ADRA India, aims to strengthen institutional and technical capacities for integrated climate risk management with a focus on heatwaves.

The project has conducted a comprehensive landscape assessment and gap analysis on heatwave management in selected locations in Delhi (Shalimar Bagh, Model Town, Wazirpur Industrial Area, Haiderpur, Adarsh Nagar) and in Amravati, Maharashtra covering 3 block and 6 villages Amravati (Rural) – Pusda, Yawali, Rohankhed, Shirala, Bhatkuli - Kholapur, and Daryapur – Darapur).

The report presents key insights from field assessments, stakeholder consultations, and evidence-based analysis, highlighting critical challenges, opportunities, and practical solutions to strengthen heatwave preparedness and resilience, particularly for vulnerable communities.

We extend our sincere appreciation to National Disaster Management Authority (NDMA), State and District Disaster Management Authorities, ADRA India, technical institutions, and community stakeholders whose collaboration and openness made this work possible. It is our hope that the knowledge generated through this initiative will serve as a practical resource for policymakers, practitioners, and development partners working towards an integrated heatwave management in India.

MESSAGE

ADRA India

Over time, heatwaves have become increasingly pronounced in urban areas, primarily as a result of the Urban Heat Island Effect (UHIE)[1] in conjunction with various demographic factors and strained critical public infrastructure. It disproportionately affects the low-income population engaged as outdoor workers due to their direct exposure to elevated temperatures, as well as self-employed individuals, particularly women, working from home, experiencing heightened indoor heat and humidity. Additionally, residents of informal settlements, particularly in slums, are significantly impacted. These communities usually lack access to resilient housing, potable water, and adequate shade, exacerbating their susceptibility to the adverse effects of extreme heat.

In early 2025, as India experienced record-breaking temperatures, ADRA India launched an Anticipatory Heatwave Response Plan to mitigate health and livelihood impacts in Delhi-NCR, Gujarat, Maharashtra, and Madhya Pradesh. Collaborating with the NDMA and District Disaster Management Authorities (DDMA), this initiative marked a shift towards proactive intervention before heat-related emergencies occurred. It aligned with the Government of India's disaster risk reduction priorities, particularly the Delhi Heat Action Plan, to enhance preparedness and response in vulnerable urban areas.

ADRA India is honoured to serve as the project implementation support partner for GIZ India in the Landscape Assessment and Gap Analysis for Heatwave Management under the Indo-German Technical Cooperation Project on Integrated Climate Risk Management in India (InCRIS). This assessment report offers significant insights into the effects of heatwaves on the most exposed and inadequately equipped sections, namely the construction labourers, gig workers, farmers, and residents of informal settlements. The assessment progressed from analysing the pre-existing vulnerabilities that impede resilience among these groups to identifying actionable solutions at the community, governmental, and policy levels to achieve sustainable, long-term outcomes.

ADRA India is committed to strengthening coordination, disaster risk reduction practices, and knowledge partnerships for heatwave prepared, resilient and well-equipped urban communities throughout India.

1 The phenomenon when cities become significantly warmer than rural areas due to human activity, buildings, and surfaces made of heat-absorbing materials (asphalt, concrete), less greenery, and human activities, leading to higher energy use, heat stress, and pollution creating hotter urban zones that impact health and energy use.

ACKNOWLEDGEMENTS

As the NDMA, GIZ India and ADRA India, we would like to specially acknowledge the considerable support received from the District Disaster Management Authority (DDMA) of Amravati, Government of Maharashtra and District Disaster MAnagement Authority (DDMA) Delhi, in enabling field visits and facilitating discussions with farmers, officials from panchayats, and block-level representatives for the purpose of conducting a thorough assessment.

We extend our appreciation to the communities, local administration, health professionals, non-governmental organizations, community-based organizations, and all other stakeholders who participated in the assessment. Their invaluable insights on heat stress, local strategies for managing heatwaves, and suggestions for effective, localised heatwave management and risk mitigation have considerably shaped the actionable recommendations. The time dedicated and willingness exhibited by these actors to engage in the assessment have ensured that this report is grounded in real-life experiences, providing insights for community-driven initiatives that reflect their vulnerabilities and actual needs.

The project team also expresses appreciation to our knowledge collaborators and disaster risk reduction (DRR) practitioners, including SEWA, SEEDS India, IGSSS, Habitat for Humanity, Rajdhani Workers' Unions (RAWU), and the Gig Workers' Association (GigWA), as well as Mr. Aravind Unni, Independent Urban Practitioner and Policy Researcher. Their experiences and insights have significantly enriched the assessment design and its subsequent recommendations. The organizations representing gig workers have been particularly instrumental in facilitating discussions across diverse gig worker groups.

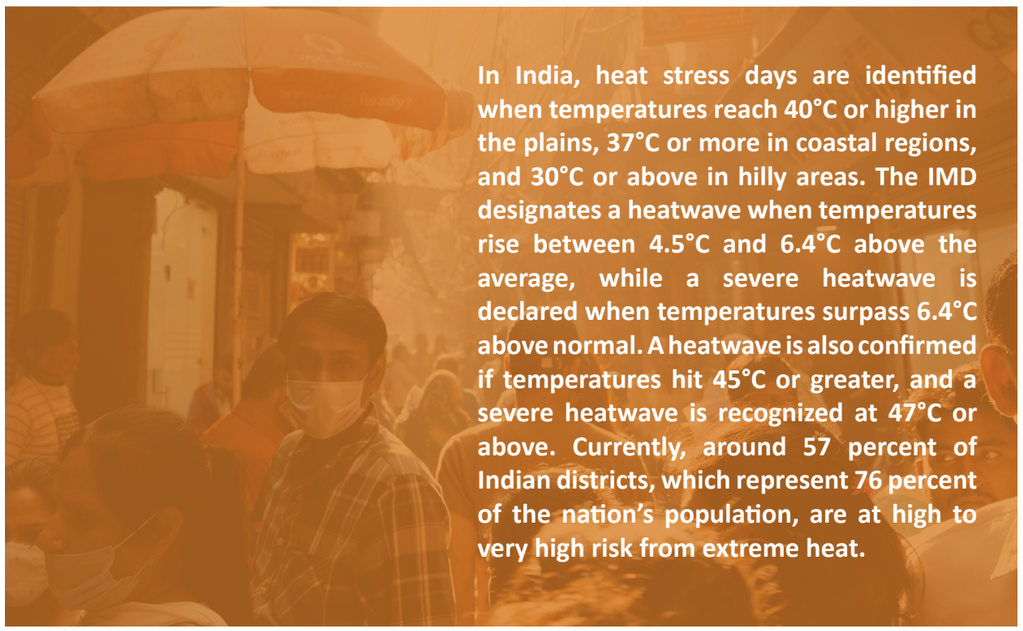
The assessment highlights the commitment and collaboration among the government, communities, and practitioners in DRR and development to enhance the preparedness and resilience of communities and cities in India against heatwave risks and impacts. The insights gained from this assessment are expected to pave the way for more comprehensive and localized evaluations, which can be utilized by state authorities, DRR and Climate Change professionals, development organizations, and community groups across critical sectors. This collaborative approach will help bolster targeted and effective actions that strengthen heatwave resilience in both rural and urban areas.

EXECUTIVE SUMMARY

Each year, nearly 200 million individuals are affected by natural disasters. The World Meteorological Organisation warns that one of the next five years will exceed 2024's temperature records, with Asia warming twice the global average. The Indian subcontinent is facing rising temperatures and longer heat waves, with 23 heat-prone states identified in 2019. Many areas have recorded temperatures over 46°C, and both hot days and warm nights are more frequent. Mortality rates related to heat waves have increased by 62.2% in the last 40 years.

Communities in the Global South with limited resources face significant challenges. Impoverished communities often live in hazard-prone areas and cannot invest in risk-reducing measures. Without access to insurance and social protection, they use their scarce assets to cover disaster losses, leading to deeper poverty. In South Asia, nearly all (99.1%) of the 380 million poor are vulnerable to climate hazards, with 91.6% (about 351 million) facing multiple risks, the highest among regions. The Indian subcontinent is facing rising temperatures and longer heat waves, with 23 heat-prone states identified in 2019. Many areas have recorded temperatures over 46°C, and both hot days and warm nights are more frequent. Mortality rates related to heat waves have increased by 62.2% in the last 40 years.

Heatwaves worsen drought conditions, increase the prevalence of wildfires, and contribute to water shortages, disproportionately affecting vulnerable populations. These groups often lack the financial resources required to secure adequate housing or invest in passive cooling solutions, which further limits their capacity to cope with extreme heat. High nighttime temperatures increase daytime heat, exacerbating urban air pollution and affecting infrastructure. This assessment confirms that poverty drives vulnerable and ultra resource-poor communities, especially women facing gender and social inequalities, to rely on harmful coping strategies during severe weather events like heatwaves, floods and droughts. They often cut back on essential commodities, including drinking water and cooling solutions. Thus, integrating effective disaster risk reduction with climate adaptation is crucial for building resilient societies and essential public infrastructure.



In India, heat stress days are identified when temperatures reach 40°C or higher in the plains, 37°C or more in coastal regions, and 30°C or above in hilly areas. The IMD designates a heatwave when temperatures rise between 4.5°C and 6.4°C above the average, while a severe heatwave is declared when temperatures surpass 6.4°C above normal. A heatwave is also confirmed if temperatures hit 45°C or greater, and a severe heatwave is recognized at 47°C or above. Currently, around 57 percent of Indian districts, which represent 76 percent of the nation's population, are at high to very high risk from extreme heat.

The National Disaster Management Authority (NDMA) has established national heatwave management guidelines leading to decentralized Heat Action Plans (HAPs). The IMD forecasts temperatures for over 447 cities, while the National Centre for Disease Control (NCDC) issues health advisories during heat waves. These efforts draw from the Prime Minister's Ten-Point Agenda on Disaster Risk Reduction to strengthen resilience in India.

State Governments can allocate up to 10% of SDRF funds for immediate assistance during localized disasters, including heatwaves. In 2024, heatwaves became eligible for project-based funding from the State Disaster Mitigation Fund, which can be used for cooling shelters, early warning systems, and green infrastructure. Detailed risk assessments are essential for planning these projects. The central and state governments also implement various schemes to address heat risks, such as the Rashtriya Krishi Vikas Yojana, Pradhan Mantri Awas Yojana – Urban, and CAMPA.

Parametric insurance programs are being developed to protect informal workers and farmers from climate-related income losses by providing automatic payouts based on real-time temperature and rainfall data. The State Government and NGOs are implementing risk transfer solution for heatwaves and floods, albeit on a smaller scale.

Stakeholder discussions, especially with the officials, highlighted the necessity to enhance and integrate heat risk management across all government levels. They stressed the need to utilise digital platforms, improve evidence-based decision-making, and strengthen institutional capacities for timely, coordinated and anticipatory responses to heat risks.

The assessment outlines a comprehensive and integrated approach to strengthen planning and preparedness for heatwaves. It focuses on building capacities across national, state, and district levels, implementing pilot interventions, and developing financial products to support vulnerable populations. Additionally, it emphasizes the design and deployment of digital decision-support tools to enable timely, informed, and effective responses to heat-related risks.

1. INTRODUCTION

1.1. Global Context

The planet is currently experiencing a pivotal transitional period characterised by notable changes in climate and the resulting adverse effects on natural and human systems. In response to these escalating challenges, individuals and organisations worldwide are actively engaging in measures to mitigate and to adapt to these impacts through targeted actions, policies, and collaborative initiatives, all under the framework of disaster risk reduction. Due to the increasing frequency and intensity of climate-induced disasters, DRR strategies are essential in assisting communities to adapt and enhance their resilience in the face of climate-related challenges.

DRR is a multifaceted exercise which enables communities to effectively prepare for and respond to extreme events and hazards. Externalities such as climate change, population growth, urban expansion in vulnerable areas, and alterations in land use are all contributing to increased risks.[2] As these increased risks combine and contribute to complex and cascading extreme events, it is prudent to implement DRR which is climate-smart and has an integrated approach.

The World Meteorological Organisation has warned that at least one of the next five years will exceed the temperature records set in 2024, which is currently the hottest year. Asia is warming at twice the global average.[3] The Global Multidimensional Poverty Index report 2025 emphasizes that a significant number of individuals residing in poverty are subjected to at least one climate hazard, with many facing multiple hazards simultaneously. The key findings state that globally, 1.1 billion out of 6.3 billion people endure acute multidimensional poverty, with over half being children. Prevalent deprivations include insufficient access to adequate housing, sanitation, nutrition, clean cooking fuel, and electricity. Approximately 887 million multidimensionally poor people globally live in areas vulnerable to climate hazards, with 608 million exposed to high heat (2025 Global Multidimensional Poverty Index (MPI):Overlapping Hardships: Poverty and Climate Hazards, 2025).

The IPCC's Sixth Assessment Report (AR6) highlights that human-induced climate change has intensified heatwaves since the 1950s, and further warming will continue to increase their frequency and severity. Heatwaves amplify the impact of drought, wildfires, smoke hazards, water shortages, power shortages, and agricultural losses, impacting communities globally. The severe heatwaves experienced in India and Pakistan in 2022 were rendered 30 times more probable as a consequence of climate change. As temperatures rise, more people will face heatwave risks, especially vulnerable populations, unless effective measures are taken.[4]

In South Asia, nearly all (99.1%) of the poor population – around 380 million – are prone to climate hazards, with 91.6% (about 351million) facing multiple risks, surpassing other regions. Despite progress in poverty reduction, South Asia and sub-Saharan Africa remain hotspots where deep poverty intersects with extreme weather events. Disadvantaged groups often have limited assets and coping abilities, leading to a "triple or quadruple burden" from various shocks (Ibid).

The recognition that disasters are not inherently natural phenomena has been well-established and continues to be reinforced through research. The experiences of communities who possess limited coping mechanisms, knowledge, and resources, particularly in the Global South, warrant close examination. Impoverished people are more likely to live in hazard-exposed areas and are less able to invest in risk-reducing measures. The lack of access to insurance and social protection means that people in poverty are often forced to use their already limited assets to buffer disaster losses, which drives them into further poverty.[5]

2 https://www.ifrc.org/our-work/disasters-climate-and-crises/climate-smart-disaster-risk-reduction
3 https://www.ceew.in/blogs/adopting-heatwave-solutions-for-building-resilience-to-extreme-heatwave-risks-in-indian-cities
4 https://wmo.int/content/climate-change-and-heatwaves
5 https://www.preventionweb.net/understanding-disaster-risk/risk-drivers/poverty-inequality

This assessment confirms that poverty often forces people into inadequate and harmful coping strategies. Individuals – particularly those already facing gender and social inequalities, including many women – experiencing severe weather events, such as floods, cyclones, droughts, and heatwaves, may find themselves compelled to decrease their consumption and expenditures on essential commodities and cooling solutions, including basic necessities such as drinking water.

It is important to note that shocks and hazards do not inherently result in catastrophe. Nevertheless, each year, approximately 67,000 individuals lose their lives, 26 million are plunged into poverty, and nearly 200 million people worldwide are affected by natural hazards. Therefore, the integration of effective disaster risk reduction strategies with climate adaptation is essential for fostering resilient societies that encompass the most vulnerable populations, critical public infrastructure, and equitable climate and disaster governance[6].

1.2 Heatwaves in India

The Indian subcontinent is currently experiencing a significant rise in temperatures, characterized by earlier onset and prolonged duration of heat waves. The NDMA identified 23 heat-prone states in 2019, an increase from 19 in 2018[7]. In India, heat stress days occur when temperatures hit 40°C or above in plains, 37°C or above in coastal areas, and 30°C or above in hilly regions. The IMD declares a heatwave when temperatures are 4.5°C to 6.4°C above normal and a severe heatwave when they exceed 6.4°C above normal. A heatwave is also declared if temperatures reach 45°C or more, and a severe heatwave at 47°C or more[8].

Approximately 57 percent of Indian districts, which account for 76 percent of the nation's population, face a high to very high risk from extreme heat at present. The leading ten states and Union Territories with the greatest overall heat risk are Delhi, Maharashtra, Goa, Kerala, Gujarat, Rajasthan, Tamil Nadu, Andhra Pradesh, Madhya Pradesh, and Uttar Pradesh[9].

Temperatures over 46°C have been recorded in many parts of the country in the past, especially over north and central India. The frequency of hot days (>90 percentile) has significantly increased during the pre-monsoon season across the east and west coasts of India, as well as in the interior peninsula. Additionally, warm nights have become more frequent on the east coast, (comprising West Bengal, Odisha, Andhra Pradesh, and Tamil Nadu), west coast (with Gujarat, Maharashtra, Goa, Karnataka, and Kerala), and in north-west India (including the states of Punjab, Haryana, Rajasthan, Himachal Pradesh, Uttarakhand, and often Uttar Pradesh, plus Union Territories like Delhi, Jammu & Kashmir, and Ladakh). On an average these regions have experienced ≥8[10] HW Days. SHW days of 1-3 days were mainly experienced over northwest, north and eastern parts of the country (MOEFCC, 2024).

By 2040–2069, summer heatwave frequency is projected to increase to about 2.5 events per season, potentially reaching 3.0 events by 2070–2099, under the IPCC RCP4.5/SSP2 scenario[11]. The average length of these heatwaves is expected to extend to approximately 15 days by 2040–2069 and 18 days by 2070–2099. Consequently, heatwaves are expected to become more intense, frequent, and widespread. Understanding night-time temperatures is crucial for analysing urban heat islands and addressing overlapping risks like humidity, rainfall deficits, wildfires, and air pollution (Koll, 2024).

6 https://www.ifrc.org/our-work/disasters-climate-and-crises/climate-smart-disaster-risk-reduction
7 https://unfccc.int/sites/default/files/resource/India%20BUR-4.pdf
8 https://ndma.gov.in/Natural-Hazards/Heat-Wave
9 https://www.ceew.in/publications/mapping-climate-risks-and-impacts-of-extreme-heatwave-disaster-in-indian-districts
10 ≥ indicates greater than or equal to
11 RCPs, or Representative Concentration Pathways, are scenarios introduced in the IPCC's Fifth Assessment Report (AR5). They are used to model future climate change by projecting greenhouse gas and aerosol emissions. Shared Socioeconomic Pathways (SSPs) outline five potential scenarios for global development considering factors like population, economic growth, education, urbanization, and technology. They also explore how to achieve climate change mitigation by combining Representative Concentration Pathways (RCPs) with SSPs.

1.3 Heatwave Risks, Vulnerabilities & Effects

According to the NDMA, the heatwave related mortality has reduced from 2040 deaths in 2015 to 1111 deaths in 2016 and further reduced to 384 deaths in 2017 and 25 deaths in 2018. During 2019 to 2021 there were no loss of life reported due to heatwave. However, the heatwave related mortality reported for the year 2022 and 2023 are 30 and 169 respectively (MOEFCC, 2024).

Ministry of Earth Sciences in India reports a 62.2% increase in mortality rates associated with heat waves over the past four decades. While most people can generally cope during low-intensity heatwaves, those who are more vulnerable, or who have pre-existing health conditions, need warnings to protect themselves as intensity increases[12]. The minimum temperature holds equal importance to the maximum temperature, as cooler nights enable the body to recuperate; when nights are unreasonably warm, higher temperatures are reached sooner in the day and persist for longer periods. Extreme heat events, like heatwaves, have become more severe in urban areas, exacerbating air pollution problems and hindering the functionality of essential infrastructure.[13]

Heatwaves amplify many risks, such as health-related or economic risks, including increased human mortality, drought and water quality, flash floods, wildfire and smoke, power shortages and agricultural losses, all of which have compounding impacts for people and nature, affecting those with the least resources and without additional interventions and adaptation. According to the NDMA, these groups—including women, indigenous populations, and those engaged in informal sectors—often encounter significant challenges during climate-related disasters, leading to higher mortality rates in events such as heatwaves.[14]

By age/health
- Elderly
- Young children
- Pregnant women
- Individuals with chronic conditions

By social context
- Marginalised communities*
- Slum dwellers

By occupation
- Gig workers / Delivery riders
- Police personnel
- Agricultural labourers
- Construction workers

Source: CEEW, May 2025

Note: 'Marginalised communities' refers to Scheduled Caste (SC) and Schedule Tribe (ST) Groups, based on the data aggregated at the district level

1.4. Institutional Measures for Heatwave Risk Management in India

Policy Framework

The NDMA sets policy direction through the National Guidelines for Heat Wave Action Plans and supports state-level plans. Over 250 cities and districts across 23 heat-prone states have operational Heat Action Plans, supported by NDMA's advisory, technical, and institutional mechanisms.[15] These cities and states include Ahmedabad, Delhi, Mumbai, Nagpur, Thane, Surat, Bhubaneswar, Patna, Jodhpur, and Hyderabad, with newer plans in Varanasi and Churu. These plans prioritize early warnings, public awareness, and decreasing heat-related deaths to address rising temperatures.[16] The respective State Governments are

12 https://wmo.int/topics/heatwave
13 Ibid
14 https://ndma.gov.in/sites/default/files/IEC/Booklets/HeatWave%20A5%20BOOK%20Final.pdf
15 https://www.pib.gov.in/PressReleasePage.aspx?PRID=2134746&reg=3&lang=2#:~:text=%E2%80%9COver%20250%20cities%20and%20districts,significantly%20reduced%20heatwave%2Drelated%20mortality.
16 https://www.sustainablefutures.org/publication/is-india-ready-for-a-warming-world-how-heat-resilience-measures-are-being-implemented-for-11-of-indias-urban-population-in-some-of-its-most-at-risk-cities/

responsible for the implementation and monitoring of the heat action plan.

The HAPs aim to (1) establish early warning systems for high temperatures; (2) train local healthcare professionals to recognize and handle heat-related illnesses; (3) raise public awareness about protection during heat waves; (4) collaborate with NGOs to improve temporary shelters and water delivery; (5) identify vulnerable populations and their specific health risks; (6) develop effective strategies and agency coordination for heat health risks; (7) create a Heat Health Information Surveillance System to assess heat wave impacts; and (8) reduce heat exposure and promote adaptive measures like mapping high-risk areas and providing access to drinking water and cooling spaces (Ibid., p. 230).

The strategies to address heatwaves, concentrating on prevention, preparedness, response, and recovery encompass state and district-specific HAPs, assessments of urban heat islands, the promotion of cool roofs, and the augmentation of green spaces. These guidelines help stakeholders create effective Heat Wave Action Plans by addressing heat-related illnesses and necessary response measures.

The National Centre for Disease Control (NCDC), under the Ministry of Health and Family Welfare (MoHFW), issues guidelines and advisories to state health departments during extreme heat seasons. Under the National Programme for Climate Change and Human Health (NPCCHH), the State nodal officers under the must (i) share the national action plan on heat related illnesses and NDMA guidelines with all districts; (ii) Implement the Heat-Health Action Plan; (iii) convene meetings with State and District Task Forces on Climate Change and Human Health; (iv) report heat-related illnesses and deaths; (v) disseminate early warnings and health advisories; (vi) plan information, education, and communication (IEC) activities; (vii)conduct sensitization and capacity-building efforts; (viii) ensure health facility preparedness for severe heat-related illnesses; and (ix) prepare for mass gatherings and sporting events focused on heat-related issues. The public health advisories elucidating the dos and don'ts are also issued under the NPCCHH.[17]

Heatwave Forecast and Warning

IMD issues a daily heat wave bulletin, featuring color-coded impact indicators (Green, Yellow, Orange, Red) and specific guidance according to NDMA guidelines. Currently, state governments facing heat wave crises have developed Heat Action Plans (HAP) and guidelines with Do's and Don'ts to reduce the impact of heat waves. The IMD provides essential seasonal outlooks and daily temperature forecasts for over 447 cities, and the forecasts are a critical trigger for prompting early warning for extreme heat by city officials (Ibid., p.36). It has also introduced new platforms and strategies for sharing forecast and warning services through print, electronic media, and email. Heat wave information is shared via daily and weekly video messages and social media platforms to disseminate warnings effectively. A dedicated state website provides localized heat wave information, along with sector-specific bulletins for health and agriculture to mitigate risks.

These initiatives are guided by the Prime Minister's Ten-Point Agenda on Disaster Risk Reduction, launched in 2016, aims to strengthen resilience against natural disasters in India. It focuses on integrating DRR into all development sectors, ensuring risk coverage, and encouraging innovative insurance for weather-related events. Key measures include promoting women's leadership in disaster management, investing in global risk mapping, utilizing technology for effective disaster response, and enhancing university collaboration on disaster research. The agenda also emphasizes community-level capacity building, lessons learned studies, and fostering international cooperation for coordinated disaster response.

Digital Platforms and Systems

Digital platforms and evidence generation are becoming vital aspects of managing heatwaves in India, revolutionizing the way heat risks are monitored, predicted, and addressed. In addition to the IMD Heatwave Portal and GIS Platform which provides daily color-coded heatwave alerts based on maximum and minimum temperature, relative humidity, and wind data to predict potential impacts, other digital platforms for monitoring heatwaves in India encompass the following:

17 https://ncdc.mohfw.gov.in/wp-content/uploads/2024/03/Advisory-for-State-Health-Department-on-heat-wave-season-2024_NPCCHH.pdf

- The Climate Hazards and Vulnerability Atlas, a tool developed by IMD, offers district-specific maps on a web platform that display monthly and annual occurrences of 13 types of heatwave hazards and vulnerabilities, aimed at identifying regions with a high risk.

- The NCDC employs the Integrated Health Information Platform (IHIP) to digitise data regarding heat-related illnesses. By 2023, the Ministry of Health and Family Welfare (MoHFW) has implemented IHIP for the digital monitoring of heat-related illnesses, enabling the tracking of heatstroke incidents, fatalities, and emergency room statistics from Primary Health Centres (PHCs) nationwide.

- Thermal Hotspot Mapping through satellite data analysis tools like LANDSAT 8, are utilised to generate Land Surface Temperature (LST) maps that facilitate the identification of urban heat hotspots, including areas within Delhi.

The digital tools, including social media, allow for faster, targeted interventions and enhance heatwave responses. Alerts and warnings are rapidly shared through the Common Alert Protocol (CAP) and apps such as MAUSAM, UMANG, SACHET, and Damini. Digitised real-time weather information is also the backbone of the parametric insurance solutions that provide timely compensation for heat-related losses, especially for outdoor workers. However, these digital tools are still underused.

Hence, a systems-thinking approach is crucial, integrating digital innovation into heat action plans and standard operating procedures (SOPs). Furthermore, it is essential to ensure the accessibility of unified information on hazards, for instance the high-risk areas (hotspots), vulnerable population, and public resources, etc. Such a digital repository would gather important disaster data in one place and enable disaster preparedness and anticipatory actions. This will improve coordination across sectors and enhance emergency responses and resilience to climate risks.

Existing learning formats for integrated heatwave management

Implementing digital resources needs to be paired with practical training and ongoing capacity-building for officials and community workers, including those in local governance. The current capacity-building approaches for managing heatwaves in India integrate national and state policies, community engagement, and digital learning methodologies, all primarily informed by Heat Action Plans. The primary formats for learning and training encompass training manuals and workshops designed for state and district nodal officers, with a focus on critical subjects such as data reporting, management of heat-related illnesses, and simulation exercises aligned with the training materials provided by the National Centre for Disease Control (NCDC).

The National Institute of Disaster Management (NIDM) conducts training programmes on heatwaves throughout India, which include several important elements, such as early warning and communication, in collaboration with the IMD; vulnerability assessments to identify high-risk groups and areas; measures for medical preparedness; as well as roof painting, public awareness initiatives, and the application of structural cooling solutions.[18]

The Ministry of Health and Family Welfare (MoHFW), through the National Programme on Climate Change and Human Health (NPCHH), has developed a training manual specifically designed for state and district nodal officers, healthcare professionals, and frontline workers (ASHA) on implementing the heat health action plans, addressing, and overseeing heat-related illnesses.[19]

In 2021, the Gujarat Institute of Disaster Management (GIDM) introduced a Training Module on Extreme Heat Prevention and Management. This module addresses the risks of extreme heat, outlines planning and management strategies, and includes post-training evaluations. It is intended for government and non-government personnel involved in protecting public health during the summer months. The training is conducted as a residential program that includes interactive learning methods, such as engagement and

18 https://nidm.gov.in/PDF/pubs/NDMA/27.pdf
19 https://ncdc.mohfw.gov.in/wp-content/uploads/2024/05/4-Training-Manual-for-State-And-District-Nodal-Officers-For-Implementation-of-Heat-Health-Action-Plan.pdf

feedback, to ensure effective learning and enhance readiness.[20]

These initiatives aim to bridge scientific predictions with localized activities, thereby enhancing stakeholders' capacity to address heat-related risks by promoting improved coordination and understanding. Participants in the assessment, including health professionals, community health workers, PRI members, revenue officials, and community members, emphasized the need for structured training and materials to understand heatwaves, their impacts, guidelines and advisories, and community-based gender-responsive heat mitigation strategies. Additionally, they sought financial tools and solutions to mitigate heatwave impacts.

While existing training efforts provide a strong foundation, there is a growing need to further structure these into clearly defined, outcome-oriented learning modules that translate knowledge into actionable responses. This includes developing standardized modules that cover core areas such as understanding heatwave risks and impacts, roles and responsibilities across departments, gender-differentiated vulnerabilities, and inclusive community-based mitigation strategies. In particular, there is a need to strengthen gender-responsive heat risk planning by equipping stakeholders to identify and address the specific vulnerabilities, exposure patterns, and adaptive capacities of women and other marginalized groups. Additionally, greater emphasis is required on building capacities to use climate data, early warning systems, and digital tools for informed decision-making and anticipatory action. Integrating financial risk mitigation approaches and linking them with Heat Action Plans can further strengthen preparedness and response, particularly for vulnerable populations.

A more structured and modular approach to capacity building can lead to improved role clarity among stakeholders, stronger inter-departmental coordination, and more effective implementation of heat action measures at district and local levels. It can also support the integration of community needs, gender considerations, and financing mechanisms into Heat Action Plans, ultimately enhancing the overall effectiveness and sustainability of heat risk management efforts.

Climate Risk Financing in India

State Governments are authorised to allocate up to 10 percent of the annual funds designated for the State Disaster Response Fund (SDRF) to provide immediate assistance to victims of localised disasters, including heatwaves. These disasters are not currently included in the category of disasters eligible for comprehensive funding from the SDRF and the National Disaster Response Fund (NDRF). Collectively, these funds account for 80 percent of the country's overall disaster management budget (MHA, Rajya Sabha Unstarred Question No. 691 Declaring Heatwave and Coldwave as Natural Disasters, 2023).

The 15th Finance Commission established the National Disaster Risk Management Fund (NDRMF) and State Disaster Risk Management Funds (SDRMF) for disaster mitigation and response, premised on Disaster Management Act 2005. The Act outlines a framework for disaster prevention, preparedness, and response. Section 47 requires the creation of the National Disaster Mitigation Fund (NDMF), separate from the National Disaster Response Fund (NDRF). NDRMF and SDRMF funds allocate 20 percent for mitigation activities through the National Disaster Mitigation Fund (NDMF) and State Disaster Mitigation Fund (SDMF). The Central Government contributes 75 percent for all States and 90 percent for North-Eastern and Himalayan States.[21] In 2024, heatwaves were recognized as eligible for project-based funding under the SDMF. States can use these funds for cooling shelters, early warning systems, and green infrastructure, and as per guidelines, detailed risk assessments are crucial for planning.[22]

In addition to these dedicated funding streams, the central and state governments implement various schemes that incorporate measures to address and mitigate heat risks. For instance, the Rashtriya Krishi Vikas Yojana provides provisions for shelter and water to alleviate heat stress in livestock, while the Pradhan Mantri Awas Yojana (Urban) facilitates the construction of green, heat-resilient homes, and the

20 https://ncdc.mohfw.gov.in/wp-content/uploads/2024/05/4-Training-Manual-for-State-And-District-Nodal-Officers-For-Implementation-of-Heat-Health-Action-Plan.pdf
21 https://ndmindia.mha.gov.in/ndmi/response-fund
22 https://www.ceew.in/publications/mapping-climate-risks-and-impacts-of-extreme-heatwave-disaster-in-indian-districts

Compensatory Afforestation Fund Management and Planning Authority (CAMPA) Fund are leveraged for afforestation and nature-based solutions. The 16th Finance Commission incorporates vulnerability-related parameters as a variable in establishing the criteria and formula for allocating funds to state governments. The HAPs require state and local departments to allocate funds for effective implementation, and their integration with these current programs has the potential to release substantial financial resources aimed at building adaptive capacities among the target groups and improving heat resilience.[23]

23 https://www.climatepolicyinitiative.org/financing-indias-heat-resilience/

2. THE LANDSCAPE ASSESSMENT

2.1. About the Landscape Assessment

The landscape assessment aims to examine the impacts of heatwaves and the risks and response mechanisms associated with heatwaves. This entails identifying vulnerabilities across various sectors and target groups within selected areas, Furthermore, the study adopts a gender-responsive approach, which involves addressing gender-specific vulnerabilities, risks, responses, and needs. The process included a thorough review of current preparedness and response strategies, encompassing policies, initiatives from both governmental and private sectors, financial mechanisms, stakeholders, and available resources and technologies that facilitate effective heatwave management. analysing existing resources, identifying gaps, and determining areas of improvement.

The assessment draws on Prime Minister's Ten-Point Agenda for Disaster Risk Reduction, particularly, the need for inclusive risk coverage that addresses poor households, small and medium enterprises, multinational corporations, and nation states (Agenda point 2); women's leadership and involvement in disaster risk management (Agenda point 3); investing in global risk mapping to enhance the overall understanding of nature and disaster risks (Agenda point 4); and building local capacities to strengthen DRR efforts (Agenda point 8).

Since December 2024, the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH has been implementing the project titled "Integrated Climate Risk Management (InCRIS) in India," on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ). This initiative is being implemented with the National Disaster Management Authority (NDMA), Ministry of Home Affairs, Government of India.

2.2. Aim & Objectives

The objective of the landscape assessment is to establish a thorough understanding of the risks associated with heatwaves and the corresponding response mechanisms. To achieve this aim, the assessment analyses the impacts of heatwaves by considering factors such as vulnerabilities, levels of exposure, and the capability of systems to manage extreme heat. Furthermore, it evaluates the current state of heatwave preparedness and response management, including relevant policies, initiatives from both government and private sectors, financial mechanisms, infrastructure, stakeholders, and available resources that contribute to heatwave management. This comprehensive analysis identifies existing capacities, gaps, and highlight areas that require intervention and enhancement, leading to the formulation of targeted recommendations.

2.3. Scope of Assessment

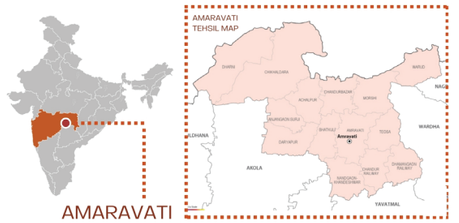
The assessment identifies heatwave-related risks and response mechanisms for vulnerable populations, living in informal settlements, particularly the slums; construction workers, gig workers, and women farmers. It focuses on the sectors of housing, health, water, and green spaces. The assessment highlights the specific challenges these groups face and proposes short-term and long-term strategies to improve risk management and response capacities among the communities and authorities, considering the current preparedness strategies, policies, and resources for managing heatwaves. The assessment did not encompass the evaluation of vulnerabilities within these sectors independently of the target population.

2.4. Coverage & Target Groups

The assessment covered target groups across multiple locations in Delhi, specifically Model Town, Wazirpur Industrial Area, Haiderpur, Adarsh Nagar, and Shalimar Bagh. In Maharashtra's Amravati district, farmer groups from six villages in the Amravati (Rural), Bhatkuli, and Daryapur blocks were included.

Amravati, Maharashtra

Geography:



03 Blocks 06 Villages

- Amravati (Rural): Pusda, Yawali, Rohankhed, Shirala
- Bhatkuli: Kholapur
- Daryapur: Darapur

Demographic Participation:

- **134 Farmers** 92 Females and 42 Males
- **39 Health Workers** and Professionals
- **20 Anganwadi Workers**
- **2 PRI Functionaries & RDC Office** and 2 Revenue Officers

Delhi

Geography:

- CA Block (I) Slum, Shalimar Bagh
- Ambedkar Basti, U&V Colony, Shalimar Bagh
- Wazirpur Industrial Area
- Haiderpur, Shalimar Bagh
- Labour Chowk, Adarsh Nagar, Shalimar Bagh
- Labour Chowk, Shalimar village, Shalimar Bagh
- Labour Chowk, Bade bagh, Model Town

Demographic Participation:

- **64 Construction Workers**
- **16 Women Factory Workers**
- **23 Slum Residents/domestic help**
- **24 Gig workers**

Who is included within the scope of assessment?

The assessment focuses on residents of informal settlements, specifically those living in slums commonly referred to as jhuggies. Additionally, the evaluation encompasses a diverse range of platform-based gig workers. This includes both male and female delivery agents, often termed delivery partners or riders, as

well as female cab drivers, women offering home-salon services, and female logistics personnel operating within dark stores or warehouses. All of these individuals are classified as platform-based workers who provide specific services through digital or online platforms affiliated with various companies and aggregators.

Urban Informal & Gig Economy

- Slum/"Jhuggi" residents
- Delivery partners riders
- Female cab drivers
- Home-salon workers

Rural / Agricultural Stakeholders

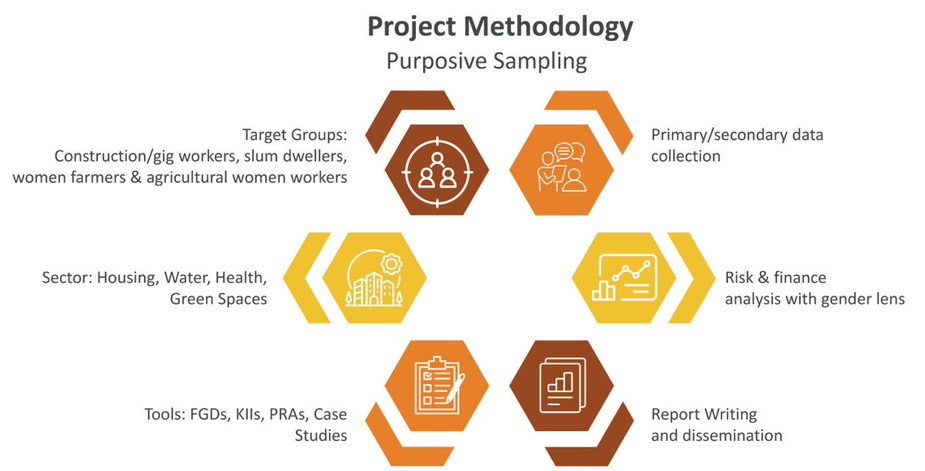
- Small & marginal farmers
- Agricultural labourers
- Tenants/harecroppers/lease cultivators
- Agroforestry (MGNREGS participants)

The assessment in Amravati focused on marginal and smallholder farmers, renters, lease cultivators, agricultural workers, and participants in agroforestry projects under MGNREGA. This aligns with the definition of 'farmer' from the National Policy for Farmers (2007), which includes cultivators, labourers, sharecroppers, tenants, livestock rearers, fishers, beekeepers, gardeners, non-corporate planters, and those involved in farming-related occupations like sericulture and agroforestry.

3. DATA COLLECTION AND REVIEW

3.1 Methodology and Tools

The assessment was conducted using purposive sample technique to finalise the assessment participants. It applied a mixed-methods approach to gather information, encompassing both primary data collection and a review of secondary literature. Primary data collection was conducted through focus group discussions (FGD) and key informant interviews (KII) in local languages with both male and female participants. In order to examine access to structural and nonstructural heatwave mitigation measures, the assessment employed five indicators on gender equality and social inclusion (GESI), namely, access, decision-making, participation, systems, and the well-being of women throughout the research inquiries.



FGD Participants

Medical professionals at the Public Health Centres (PHC) and Sub-Health Centres (SHC), frontline health workers, known as Accredited Social Health Activists (ASHA), and Anganwadi Workers (AWW).

KII Participants

Officials from state and local authorities–representatives from the Delhi Disaster Management Authority (DDMA), and DDMA, revenue officials at the block levels, and elected representatives from panchayats in Amravati; NGOs and civil society organizations, such as SEEDS India, SEWA Delhi, IGSSS, Habitat for Humanity, GigWA, and RAWU, along with independent practitioners.

Literature review

Concentrated on the primary heatwave policy framework in India, with particular emphasis on Delhi and Maharashtra, including heatwave advisories by the NDMA; parliamentary inquiries; NGO and CSO studies, reports from public consultations, and relevant media coverage.

3.2 Ethical Considerations

Informed consent was obtained in writing prior to conducting interviews with the groups. Additionally, permission to digitally record the discussions, as deemed necessary, was requested and granted by all participants involved in the assessment.

3.3 Limitations

The assessment targeted delivery agents because of their exposure to heatwaves. It found that most delivery agents are male, leading to a reliance on a few female cab drivers and home-salon service providers for insights on reducing heat risks. Additionally, given the rainy season of July-August, increased service demand limited gig workers' availability to respond to inquiries. Moreover, some construction workers opted out of the assessment due to the lack of financial incentives, especially after unproductive past interviews by others. Similarly, residents of the Shalimar Bagh informal settlement/slum expressed some reservations about participating in the assessment. They noted that while they had welcomed outreach from various groups discussing the issue of heatwaves in the past, they had not observed substantial changes in their circumstances as a result. Many women, mostly domestic workers, struggled to engage in discussions due to their busy schedules filled with household responsibilities, restricting the depth of conversations with the residents.

4. VULNERABLE GROUPS AND SECTORS FINDINGS

Heatwaves in Delhi and Amravati, Maharashtra

Delhi's weather is characterized by significant variability due to its distinct climatic conditions, which encompass extreme temperature fluctuations. The city experiences a tropical steppe climate, resulting in pronounced seasonal changes. The summer season typically begins in mid-April and extends until July. During this period, continental air currents significantly influence the local weather, rendering it notably dry and excessively hot. Summer temperatures can soar to nearly 45 degrees Celsius, creating conditions of intense heat that are often deemed unbearable. In contrast, the winter months, which span from December to January, are characterized by severe cold, with temperatures plunging to approximately 5° Celsius (Delhi Heat Action Plan, 2025).

In May, night-time temperatures in Delhi and its surrounding areas can differ by as much as 20°C between urban and rural settings, attributable to high-rise buildings that trap heat. This vulnerability is exacerbated by the city's harsh climatic conditions, the Urban Heat Island (UHI) phenomenon, and socioeconomic factors that impact residents' capacity to adapt.[24] Shalimar Bagh, located in a densely populated metropolitan area, experiences heightened health risks during heatwaves. The concentration of buildings and pavements in this area contributes to elevated temperatures, even at night. Additionally, rising summer humidity levels in Delhi impede the body's natural cooling mechanisms through perspiration, thereby exacerbating the risk of heat stress. Residential structures constructed from low-quality materials, particularly in informal settlements, offer inadequate insulation, rendering them more susceptible to extreme heat. Moreover, limited access to essential utilities, notably consistent water and electricity, impedes residents' ability to maintain cool environments and stay adequately hydrated.

Amravati, located in the Vidarbha region of Maharashtra, serves as the administrative centre for both Amravati District and the larger Amravati Division, which comprises five districts: Akola, Buldhana, Washim, Yavatmal, and Amravati. The decade of 2011-2020 has been the warmest on record in the region, with a peak temperature of 49.1°C recorded on May 25, 2013. It experiences hot and dry summers from March to June, followed by the monsoon season from July to October and winter from November to February. The month of May consistently registers the highest average number of heatwave days.

The Maharashtra State Action Plan on Climate Change (MSAAPCC) indicates that Amravati division is facing significant challenges related to climate change, with projected temperature increases of 1.4°C to 1.6°C by the 2030s, and potentially exceeding 3°C by the 2070s. Such temperature rises heighten the city's vulnerability to heat stress, adversely affecting public health, agriculture, and livestock management. While monsoon rainfall is anticipated to increase, it is expected to occur in shorter, more intense bursts, resulting in flooding and water shortages, as excess precipitation runs off quickly rather than replenishing groundwater reserves. This changing climate underscores the need for integrated solutions across agriculture, water management, and public health sectors to enhance climate resilience (Global Evolutionary Energy Design, 2025).

NDMA advisories address the protection of informal workers[25], and gig workers[26], includes street vendors, drivers, delivery personnel, sanitation and construction workers, domestic workers, and home-based workers as particularly vulnerable to heatwaves. Others at risk encompass waste pickers, security guards, caregivers, Anganwadi and ASHA workers and others across various sectors. The advisory on Heatwave Protection in Housing and Human Settlements highlights that the effects of heat are most severe in low-income, densely populated areas, such as informal settlements[27], slums, and rural regions.

24 Ibid
25 https://ndma.gov.in/sites/default/files/PDF/Reports/NDMA_Advisory_for_Protecting_Informal_Workers_during_Heatwave.pdf
26 https://ndma.gov.in/sites/default/files/PDF/Reports/Advisory_for_Informal_and_Gig_Workers.pdf
27 https://ndma.gov.in/sites/default/files/PDF/Reports/Advisory-Housing.pdf

4.1 Residents of Informal Settlements

The Context–Environmental, Social and Economic factors of Heat Stress Vulnerability

Air Pollution and Extreme Heat

Urban informal settlement / slums are often located in proximity to waste disposal sites, typically on government-owned land. This heightens residents' concerns about the possibility of eviction and displacement, impacting their sense of security and stability. The assessment sites, namely CA Block (Unit I) as well as Ambedkar Colony, U&V Block, in Shalimar Bagh, are also such informal settlements situated adjacent to a stagnant water stream, referred to locally as 'nala', which is heavily polluted with litter and waste, posing a considerable health risk to the inhabitants of the area. The odour emanating from this site intensifies during the summer months. Moreover, there is an increase in mosquito infestation during the summer and monsoon seasons, attributed to the blockage of drainage systems. Additionally, the presence of blocked sewage systems and the accumulation of stagnant, contaminated water on both sides of the stream further exacerbate the environmental and public health concerns in the area. Municipal garbage collection reportedly occurred irregularly, typically once a month or even once every two months.

The issue of extreme heat is intricately linked to broader environmental concerns. As temperatures escalate, air pollution levels may also increase, a phenomenon acknowledged in the IPCC Sixth Assessment Report (AR6), underscoring the interconnectedness of climate-related challenges. The increasing frequency of heat waves further exacerbates the issue of waste pollution, as they accelerate the breakdown of refuse in landfills, leading to elevated greenhouse gas emissions and a heightened risk of spontaneous combustion. These rising temperatures may also contribute to more frequent wildfires, which release particulate matter and other pollutants, thus increasing the formation of ground-level ozone, a harmful air pollutant. Moreover, extreme heat can complicate waste management efforts, potentially resulting in challenges related to odours and pest control. In summary, as temperatures rise, it is likely that levels of air pollution will also increase (Beatriz Cardenas, 2024)

Eviction and Heatwaves

In the targeted settlements, men often work as rickshaw pullers, painters, or casual labourers, while women primarily serve as domestic workers. For many families, the earnings of female domestic workers are crucial, especially given the instability of male employment. The women's focus group participants mentioned that they live in rental accommodations (jhuggis), with monthly rents ranging from ₹1,500 to ₹3,000. The rental for one-room dwellings exhibits considerable variation, primarily influenced by the size of the rooms rather than the availability of amenities. Families and seasonal migrant workers engage in tenancy agreements with the owners of jhuggis, who themselves do not possess legal ownership of these housing units. Furthermore, periodic eviction drives in Delhi cause anxiety among participants, who worry about losing support systems and local livelihoods, often leading to more expensive housing. They expressed concerns over insecure housing tenure and view evictions as a more serious risk than any natural hazard.

While individual states may have their own housing policies, a cohesive national policy is still necessary. According to Aravind Unni, Independent Urban Practitioner and Policy Researcher, informal settlements currently lack a clear pathway to formalisation, which compromises their climate resilience. The formalisation of housing for informal settlements is essential to encourage investment by residents in heat risk reduction measures. For instance, Odisha has successfully formalised informal settlements through the Beneficiary Led Component of the PMAY(U), providing land titles and implementing resilience-building measures. There is a pressing need to incentivise heat management solutions for these communities, particularly in the short term.

The Delhi Rehabilitation and Resettlement Policy 2015 and the Delhi Urban Shelter Improvement Board Act 2010 include provisions for improving settlements and providing toilet facilities; however, other essential services such as water and roads are managed by different departments and service providers. Consequently, heatwave resilience in informal settlement requires interdepartmental integrated planning,

programming, and budget allocations within a comprehensive heatwave resilience strategy specifically designed for informal settlements.

Current housing programs tend to focus exclusively on housing units—such as those outlined in the Pradhan Mantri Awas Yojana (PMAY) but often disregard essential services and community infrastructure. It is imperative to consider the development of community neighbourhoods that provide adequate infrastructure, including proper streets, shade, tree cover, and civic facilities to enable the residents to maintain comfortable living conditions in blistering heat. Moreover, these communities must be included in these discussions. Therefore, elements of climate resilience and adaptation must be incorporated into the building codes and designs, while heat management and ventilation must be integrated into urban poor housing strategies that address settlement-level actions, stated Arvind Unni.

Housing and Cooling Solutions

In Delhi, the prevailing challenges associated with current housing designs in informal settlement areas regarding ventilation and insulation against heat include several critical factors. These encompass extremely congested living conditions and high population density, as well as the presence of in-situ businesses, such as tea stalls and blacksmith shops. The slums comprise small 15'x15' and even smaller one-room housing units, with some families making use of an additional story for extended family members. These houses lack windows for ventilation and evacuation routes due to wall-to-wall construction and congested lanes. The roofing is composed of cement sheets, concrete slabs, or asbestos, frequently covered with tarpaulin, jute, galvanized iron sheets, or plastic sheeting due to the unavailability of affordable and durable roofing materials. Additionally, only a negligible number of houses utilise green shade nets or roofing fibre sheets. Only a limited number of roofs were observed to be painted white. Participants reported that this practice provides a marginal reduction in indoor heat.

Indoor Heat and Challenges for Women

Specific elements of these housing structures contribute to elevated indoor temperatures during heatwaves. Typical characteristics include single-room dwellings that also serve as kitchens, often accommodating an average of six to seven individuals in a single room. Indoor cooking is prevalent, particularly with the use of traditional smoked chullahs. The types of housing range from temporary or semi-permanent structures, and the use of tin roofing exacerbates indoor temperatures, while asbestos presents significant health hazards.

These roofs trap heat and circulate it with ceiling fans, making indoor conditions difficult for women cooking, working, or resting. Most households do not have a designated kitchen area, and these houses function simultaneously as living, sleeping, and cooking spaces, aggravating these difficulties for women. Women frequently find themselves compelled to spend time outdoors, even during hot weather, due to insufficient space, inadequate ventilation, and the absence of verandas. Cultural norms also impose additional challenges during heatwaves, particularly for married women who must veil themselves (ghoonghat) in the presence of elder family members. This practice extends to cooking while covering their faces in confined spaces.

According to Habitat for Humanity (HfH), a non-profit organisation dedicated to providing adequate and affordable shelter for all, the current state of informal settlement housing–encompassing both Government notified and unrecognised housing structures, there exists a significant limitation on potential design enhancements due to the wall-to-wall housing construction. These dwellings are not resilient to natural disasters due to inadequate plinths, walls, and structures, resulting in thermal indoor air pollution that increases water and electricity consumption and heat retention. The opportunities for design improvement are constrained, resulting in environments that lack adequate natural ventilation and natural light. However, the application of reflective paint or the installation of white tiles on the rooftops, extra shading or coverings may reduce thermal exposure in the short term. A transition to solar-based solutions, as opposed to generators, is advisable. Moreover, retrofitting initiatives within the existing dwellings could enhance their overall strength and liveability in high temperatures. However, these solutions require periodic maintenance and reapplication.

Indoor Heat and Challenges of Self-Employed Women

SEWA, a national movement advocating for the rights and livelihoods of informal women workers highlighted how the women workers in densely populated settlements face critical heat stress issues. Many are self-employed or work for contractors on a piece-rate basis, lacking formal recognition and social security. For example, women using sewing machines struggle with productivity due to high temperatures, while rising electricity costs during peak heat affect home-based workers financially. These workers earn as little as 40 rupees a day, making it challenging to afford essentials like ice for cooling. The rising operational costs and need for safety equipment further burden them. Women daily wage workers in factories face similar difficulties, with inadequate amenities like fans and water. Commuting during peak heat intensifies their challenges, and they often have to buy their own water and food to get through the day. Health risks also plague workers in manual waste segregation, who are exposed to methane gas and suffer from prolonged heat exposure leading to sickness and wage loss.

In 2022-23, IGSSS launched a pilot project in four Delhi slums to combat heat waves by installing low-cost Agri-bio panels on the walls and roofs of homes, enhancing liveability for the urban poor. These panels, made from straws, are organic, non-flammable, and waterproof, with a lifespan of about twenty years without maintenance, but costs may arise if distortions occur. While the panels are still costly and installation is time-consuming, IGSSS promotes training for masons, youth, and women to create heat insulators from recycled agricultural stubble. The project was implemented in partnership with Elrha, and biopanels were supplied by Strawcture Eco (IGSSS, 2023)

Affordability of Passive Cooling Solutions

In the focus group discussions, which comprised two exclusive groups of women and a mixed group, participants reported that the highest levels of heat are typically experienced between the hours of 12:00 PM and 3:00 PM. However, individuals indoors indicated that this period may extend from 12:00 PM until midnight. Individuals often seek respite outside under shaded areas, such as trees, due to the intolerable indoor heat. Lack of power subsidy during peak summer and heatwave periods leads to additional costs for the residents.

To cope with the heat, some households use room coolers alongside fans and small to medium-sized refrigerators. However, the majority only rely on ceiling fans. Due to rising electricity bills, many people feel compelled to seek shade under trees during heatwaves, even during the day. The participants also indicated to manipulation of electricity bills by the house owners. Failure to settle these bills may lead to power disconnection, thereby aggravating the challenging conditions of heat exposure, both indoors and outdoors.

The city of Ahmedabad in Gujarat incorporated a cool roofs initiative into its 2017 Heat Action Plan, notably by providing access to affordable cool roofs for the city's slum residents and urban poor, i.e. those who are most vulnerable to the health effects of extreme heat. The initiative aimed to turn the roofs of at least 500 slum dwellings into cool roofs, improve the reflectivity of roofs on government buildings and schools, and raise public awareness (ILO, 2019).

Availability and Access to Water

Water supply is generally adequate, available during the mornings and evenings, although most households use the same water sourced from common points for drinking and various domestic purposes. Those without refrigerators rely on earthen water pots and often purchase ice to keep their drinking water cool during the summer months. When possible, they borrow ice from the families for whom they work. Although the consumption of cold water is prevalent, it is undertaken with caution as it may lead to illness.

The Delhi Urban Shelter Improvement Board (DUSIB) has implemented separate public toilets for women and men. However, a significant issue remains concerning the lack of adequate bathing facilities,

particularly for women and girls. In the absence of designated bathing areas, women often experience feelings of insecurity and unease, especially when considering bathing during late-night hours due to prevailing nighttime temperatures and humidity. Besides, most domestic workers face restrictions on using bathrooms while at work, restricting fluid intake in peak summers.

Heat-related Illnesses and Healthcare

The women participants in Delhi are predominantly engaged as domestic workers in the local vicinity and falling ill to heat-related issues or otherwise can result in immediate suspension from their employment. They frequently encounter health-related issues during the summer months, viz., nosebleeds, nausea, fluctuating blood pressure, skin rashes, weakness, fatigue, dizziness, headaches, heat exhaustion or heatstroke. A noticeable drain on energy and fatigue adversely affects their productivity levels. These symptoms align with the ILO's findings, recommending rest, breaks or modified work schedules to limit or avoid exposure to excessive heat, including the ability to self-pace.[28]

The irregular availability of medicines and the prolonged wait times, discourage many individuals from utilising public health facilities. Moreover, the potential for extended waiting periods often necessitates the consideration of forfeiting a day's work, further complicating their access to necessary healthcare. Healthcare services are sought primarily from the local Ambedkar hospital or mohalla clinics, though many resort to private healthcare practitioners. Illness can lead to significant loss of income, prompting many to seek generic medication that allows them to continue working or recover more rapidly. Residents also seek healthcare services at the nearby Deep Chand Bandhu Hospital, which provides free treatment.

> *"In the peak summer months of 2024, my husband survived a heart attack while working in a drycleaning establishment, where he was also involved in dyeing garments. This role required prolonged exposure to heat from the stove. Since the incident, he has been unable to return to work."*
>
> **Sunita Tayde**
> Resident of U&V Block, Shalimar Bagh

IGSSS highlights the need for community-led vulnerability mapping to identify hotspots for evacuation routes in informal settlements. Improving housing conditions requires limiting combustible materials and promoting eco-friendly, low-maintenance building options. Cost-effective insulation and heat-resistant paints can help with extreme temperatures. Despite the distribution of cool roofing solutions, local participation coupled with community leadership remains limited, hindering decision-making and acceptance and maintenance of these solutions. This situation complicates investments in areas with uncertain land tenure. Tenancy status and home ownership affect residents' willingness to invest in heatwave-resistant housing, especially with unstable incomes. For climate resilience initiatives aligned with SDGs 11 and 13, it's essential to ensure community participation, strong local leadership, and adequate municipal budget allocations.

28 ilo.org/sites/default/files/2024-07/ILO_OSH_Heatstress-R16.pdf?

Adaptation strategies for heat-resilient housing for the urban poor should include the following:

1. Participatory, community-led vulnerability mapping that focuses on impact, coping strategies, and resource availability, engaging various vulnerable groups directly.
2. Engaging the community to create practical, people-centred housing solutions that blend traditional knowledge and practices with modern design and materials.
3. Partnerships between government and NGOs, including CBOs, for effectively communicating heat wave preparedness measures to urban poor populations
4. Formal notification of unrecognized slums and provision of basic amenities by the USIB to secure land tenure, encouraging long-term investments.
5. Subsidising essential cooling solutions, such as dependable electricity and water supply to motivate residents to adopt suitable innovations.

The Odisha State Disaster Management Authority (OSDMA) initiated a Heat Action Plan 2022 to address extreme heat. The plan includes installing cool roofs using solar-reflective white paint to decrease indoor temperatures by 2-4°C, which reduces electricity bills and benefits home-based livelihoods, especially for women. In Bhubaneswar, organizations like MHT are training women from low-income households in these cooling solutions. Additionally, in April 2024, Jodhpur Nagar Nigam North (JNNN) and MHT launched a Net-Zero Cooling Station in Kabir Nagar, followed by another in Magra Punjala in June 2025. These community cooling stations, located in vulnerable areas, use passive cooling, solar power, and reflective roofing, providing essential services like drinking water and first aid for outdoor workers and daily wage earners, and serve as a model for urban community cooling infrastructure (Council on Energy, Environment and Water, 2025; Council on Energy, Environment and Water, 2025).

Recommendations

INFORMAL SETTLEMENT RESIDENTS

Heatwave Impact	Heatwave Preparedness	Heatwaves Response	Heatwave Resilience Measures (Long-Term)
HOUSING			
• Wall-to-wall construction, lack natural ventilation and light, hinders both structural improvements and investment opportunities. • Unavailability of affordable and durable roofing materials • Challenging indoor conditions for women when cooking, working, or resting, who must veil themselves, even while cooking in confined spaces. • Insecure housing tenure and view evictions considered more serious risk than heatwaves that pushes them to expensive rentals, and demotivates investment and collective actions.	• Engaging the community to create practical, people-centred housing solutions that blend traditional knowledge and practices with modern design and materials. • Programs to build skills for local youth and women to prepare and install heat insulators using recycled agricultural stubble • Establish local community warehouses for locally produced organic heat insulators at low costs, creating income opportunities for women and youth	• Provide solar power and subsidise installation and repair rates for cool roofing solutions under PMAY (U) Scheme as incentives • Incentivise small group insurance for residents to enable adoption of cost-effective roofing solutions • Promote/explore SHG-like CBOs for women living in urban slums for community actions, besides financial inclusion.	• Policy measures to mainstream unnotified settlements in resilience planning and incentivise heat management solutions • Policy measures to recognise unregistered slum areas and resolve tenancy and ownership issues to create heatwave-resilient cities, emulating the model set by the Odisha Government • Adopt State sponsored installation of cool roofs using solar-reflective white paint for informal settlements in hotspots • Integrated planning, programming, and budget allocations within a comprehensive heatwave resilience strategy for informal settlements/ slums • Incorporate heat-resilience elements into the building codes for urban poor housing schemes and strategies.
HEALTH			
• Nosebleeds, nausea, fluctuating blood pressure, skin rashes, weakness, fatigue, dizziness,	• Promote emergency helpline, preparedness and first aid in Government schools	• Implement regular garbage collection in informal settlements to combat rising	• Explore government-supported parametric and other financial solutions for informal sector

headaches, and heat exhaustion causing a significant drain on energy and reduced productivity. • Extreme heat and lack of waste management resulting in pest and pollution	through campaigns and Do-It-Yourself initiatives to reach families • Set up mobile health clinics in informal settlements and areas with high outdoor worker traffic, such as labour chowks.	temperatures, pollution, emissions, and mosquito infestations. • Mobile clinics	workers by examining existing models from NDMA/SDMA and NGOs. • Inclusion of heat-related illnesses under PM-JAY and other state health insurance policies.
GREEN SPACES			
• Lack of awareness about heatwave and mitigation measures.	• Partnerships between government, NGOs, CBOs, and youth groups for communicating heat wave preparedness measures to urban poor populations • Train women and youth on HW risks and mitigation measures • Integrate heatwave preparedness topics into Jan Sunwais with local NGOs to encourage public participation and grievance redress.	• Adopt the model of urban community cooling centres using passive cooling, solar power, and reflective roofing, providing essential services like drinking water and first aid for outdoor workers and daily wage earners.	• Annual budget for the maintenance of community cooling centres in /around informal settlements under the SDMF • Under the housing program for urban poor, develop community neighbourhoods with adequate infrastructure, including proper streets, shade, tree cover, public water points, to regulate ambient temperature.
WATER & COOLING SOLUTIONS			
• Lack of designated bathing areas make women feel insecure about bathing at night despite high nighttime temperatures and humidity. • Lack of power subsidy in summer forces people to seek shade under trees during heatwaves	• Awareness creation and mobile health vans prepositioned	• Water stations and shaded areas at suitable locations overseen by women's collectives • Separate bathing facilities for females and males in informal settlements for safety, especially during nighttime bathing in high temperatures. • Reintroduce cooling tablets for earthen pots in Anganwadi Centres and oral rehydration solutions for children in government schools. • Subsidised cooling appliances like exhaust fans • Implement electricity subsidies during March to June	• DUSIB to provision bathing facilities for both genders in informal settlements.

4.2 Construction Workers

Context—Prevailing social and economic vulnerabilities to heatwave impacts

Working and Living Conditions

A substantial portion of construction workers operates within the informal sector, where they are engaged for immediate labour assistance. They typically work across different locations and construction projects on a daily basis unless secured for the entire duration of a project by intermediaries or contractors. The lack of formal contractual agreements places these workers at risk of wage denial by contractors, significantly diminishing their capacity to negotiate minimum wages, which may be weak or entirely absent. Wages are consistently lower, and employment is more precarious, often dependent on daily availability. During periods of limited work availability, workers are often necessitated to accept the lowest possible wages in exchange for work.

The construction workers at Labour Chowks, located in and around Shalimar Bagh, comprising localities of Azadpur, and the adjoining Model Town, rely predominantly on daily wages as their primary source of income. A significant proportion of these workers are migrants hailing from Uttar Pradesh, Maharashtra, Bihar, and Madhya Pradesh, residing in slums and informal settlements at Wazirpur, Wasaipur, and Pushp Vihar. The workforce comprises individuals who have resided in Delhi for generations while also returning to their native regions to engage in agricultural activities. The construction workers lack formal documentation from Delhi; however, they possess bank accounts and documentation pertinent to those locations.

Consequently, the absence of work for a single day result in the loss of essential food or rent resources. Employers, primarily contractors exhibit varying degrees of sensitivity towards their workers and expect a full eight to ten hours work for lower wages while failing to provide basic amenities such as drinking water or adequate rest breaks, particularly during intense heatwaves. The choice to self-pace or cease work due to heat conditions is often made solely based on personal health indicators rather than government heatwave alerts or advisories.

Uneven Social Protection Coverage and Worker Protection

There exists a pronounced lack of awareness regarding available worker protection schemes. A significant number of workers lack labour cards and possess limited awareness regarding worker welfare schemes beyond the ration card. Many encounter obstacles in applying for or renewing labour cards, including denials and costly online applications, often requiring a fee of at least ₹300, which puts financial strain on daily wage earners. For instance, in Delhi, the registration fee is ₹25, and the annual renewal fee is ₹20, but arbitrary sums are often requested. The e-Shram[29] card is also inadequately comprehended; even individuals who hold one are often unaware of its functionalities and report a lack of tangible advantages.

Women are notably underrepresented among those with labour cards, with very few possessing them. Given the inherent uncertainties and diminished availability of construction work, they are compelled to borrow from friends, relatives, or contacts in their home villages. Their spouses frequently take on roles as domestic workers to supplement family earnings.

> *“Heatwaves incur additional costs, contributing to increased poverty and domestic conflicts over financial resources needed for food, education, and other essential services. Even when we are unable to secure work or are incapacitated due to heat-related illnesses, our needs remain consistent while the available resources fail to align” - a male FGD participant*

29 e-Shram is India’s national portal for unorganized workers. It creates a database to provide welfare benefits, social security, and job opportunities. Workers can access schemes like pensions and insurance via Aadhaar-linked Universal Account Number (UAN) through online/Common Service Centre (CSC) registration. The initiative focuses on financial inclusion and supporting informal workers, including migrants, gig, and domestic workers.

Housing Conditions & Cooling Solutions

Workers within the construction sector often engage in seasonal migration to Delhi for six months and subsequently return to their home states during the agricultural seasons. In Delhi, these construction workers typically rent one-room units in informal settlements, which have tin sheds and asbestos roofing, along with tarpaulin or other mixed materials. These arrangements are funded out of their own resources as a means to address the extreme heat conditions prevalent during the summer months. The monthly rent in Banjara Gali, Haiderpur area ranges from ₹2,500 to ₹4000. Although most residences are walled, concrete structures, they feature a lack of windows and ventilation relying solely on fans.

Eviction and Heatwaves

As described earlier, eviction is another reality faced by these workers living in informal settlements. The rental costs are often affordable relative to their income. Previously, rental costs ranged from ₹2,500 to ₹2,700 but evictions push migrant and seasonal workers to seek more stable accommodation, which incurs higher expenses, typically falling between ₹3,000 and ₹4,000. Furthermore, as observed these new locations often lack adequate water supply, making it difficult to bathe even twice during peak summers for family members, and meet daily household requirements.

Affordability of Passive Cooling Solutions

The living conditions in these informal settlements are exceedingly cramped, leaving insufficient outdoor space for occupants to sit or sleep at night, thereby necessitating that all individuals rest indoors. During the summer months, the houses, constructed from asbestos, exacerbate the heat by circulating hot air. Electricity costs escalate during the summer months. They do not possess metered electricity connections; instead, they pay a variable amount as determined by the landlord. This amount is often elevated during the summer months due to increased usage of fans or coolers. Most houses have only small fans, and workers express a pressing need for subsidies for more effective cooling solutions.

Availability and Access to Water in Residential and Occupational Settings

The provision of water supply is complimentary for all households; however, the workers are required to purchase drinking water frequently for drinking and cooking purposes, which results in a financial burden. Provision of cold drinking water and ice during peak heat days is reliant on daily purchases by their families, who do not possess refrigerators. Additionally, there are areas with restricted water supply. Workers at the Lal Bagh Labour Chowk in Azadpur have expressed concerns about the inconsistency of their water supply. As a result, many landlords have turned to submersible pumps to ensure that tenants have access to water. Additionally, the lack of overhead water tanks in these rented accommodations poses significant challenges for water storage.

The availability of water is inconsistent at worksites, as some owners are amenable to offering water supplies while others are not. In situations where water is not provided, workers must resort to purchasing bottled water or sourcing it from tankers. This can present challenges, particularly as they are often outsiders and local residents typically utilise these tankers for their own needs.

During peak heat seasons, workers frequently encounter difficulties in accessing public toilets. Public toilet facilities impose a fee for each use by men, in addition to a supplementary charge of ₹20 for bathing services leading to financial strain. Women workers often limit water intake to reduce the need for frequenting toilets, even during the peak summer months, compounded by inadequate sanitation facilities and additional financial constraints. Many participants expressed concerns about the implementation of fees for public toilets and bathing facilities, which often forces them to choose between paying for these services or limiting water consumption.

The presented scenario elucidates the strain on public water supplies and the inadequacy of these resources in meeting the heightened demands of informal settlement dwellers, particularly construction workers seeking cooling solutions during heatwaves. This situation worsens financial burdens amid uncertainties regarding wage labour and the challenges posed by low wages.

Heat-related Illnesses & Healthcare

Even when experiencing heat-related illness, viz, fatigue, vomiting, weakness, dizziness, fainting, headache and diarrhoea they feel compelled to pursue work opportunities, as choosing to rest results in the forfeiture of potential earnings for the day. They typically adhere to a nine-hour work schedule, accommodating an hour-long break between 1:00 PM and 2:00 PM; however, this break is not consistently guaranteed. Construction workers lack awareness of the Public Health Advisory regarding Extreme Heat and Heatwaves[30], or the Helpline 108/102, resulting in heat-related illnesses being perceived as routine health issues. Consequently, these conditions are frequently addressed with a casual attitude.

While they visit local Mohalla clinics for medical care, some also seek over-the-counter medicines, and treatment from private practitioners, as public healthcare facilities often involve longer wait times. This extends their absence from work, which they cannot afford. The availability of free medications is limited, and more costly medications must often be procured externally. The expenses associated with the treatment are solely covered by the individuals, and the contractors do not provide financial assistance. They do not possess insurance coverage and are excluded from any welfare and labour protection schemes. The public hospitals in proximity are Ambedkar Hospital, Hindu Rao Hospital, and Jagjeevan Hospital.

Green spaces: Availability, Awareness and Access

At the labour chowks situated in Shaheed Udham Singh Marg, Shalimar Bagh Main Road, Grand Trunk Road, Lal Bagh in Azadpur, and Model Town, construction workers expressed a significant concern regarding the absence of shaded rest areas that are equipped with access to drinking water during periods of elevated temperatures. Additionally, they highlight the necessity of working in heavy rainfall during monsoon seasons without shaded protection.

The dependence of workers on daily wages restricts their ability to modify work schedules or remain indoors, particularly in the absence of cooperation from employers. Workers are unable to follow the guidance of the Ministry of Labor and Employment (MoLE) regarding the implementation of two shifts to minimize exposure during peak heat periods. This recommendation is frequently overlooked by contractors and companies, who prioritise the timely completion of projects over the welfare of workers, resulting in potential wage deductions for those who do not fulfil the mandated eight-hour workday.

MoLE recommends regular health check-ups, the provision of emergency ice packs, and materials aimed at preventing heat-related illnesses. The workers indicated a lack of access to these resources and a general unawareness of such protective measures. On days characterised by extreme heat, workers confront the difficult decision of forgoing wages if they choose to abstain from work, jeopardising their financial stability.

In light of these circumstances, the FGD participants have urged the government to establish a monetary assistance package for a minimum number of days, aimed at compensating for the loss of wages incurred during periods of extreme heat. This would allow them to prioritise their health and well-being without the fear of monetary penalties, thereby alleviating the pressures associated with variable and often unstable wages in the unorganised construction sector.

There is also a significant gap in understanding the severity of the heatwave and the risks involved, as well as issues with the accessibility of early warning systems. Workers primarily rely on their physiological responses to gauge heat stress. Additionally, many migrant and seasonal workers lack access to television, and the removal electricity subsidies has increased their financial strain.

30 https://ncdc.mohfw.gov.in/wp-content/uploads/2024/03/NPCCHH_Public-health-advisory_Extreme-heat_Heatwave_2024.pdf

Recommendations

CONSTRUCTION WORKERS

Heatwave Impact	Heatwave Preparedness	Heatwaves Response	Heatwave Resilience Measures (Long-Term)
HOUSING (also refer to the measures for the informal settlements earlier)			
• Eviction affects workers in informal settlements forcing migrant and seasonal workers into costly rentals, with inadequate water supply for bathing and daily needs in summers.	• Zone-wise Heatwave awareness programs for construction workers in public areas/labour chowks, focusing on women		
HEALTH			
• Inability to self-pace/ adjust work schedules as per MoLE advisories due to wage deductions and insensitive contractors. • Lack of awareness and access to advisories and resources on HW and related illness prevention • Informal workers lack insurance coverage and are excluded from welfare and labour protection schemes.	• Mass awareness campaigns and sensitisation of the registered building and construction contractors with DDA, DJB, Municipal Corporations, etc. • HW symptom and first-aid training for young construction workers and women with local organisations. • Tailored IEC materials and visuals in public places for effectively communicating heat wave preparedness measures	• Preposition mobile health clinic mandatorily at work sites • Distribution of first-aid kits and targeted IEC materials at labour chowks and high footfall locations for construction workers.	• Registration of informal construction workers on e-shram and financial aid for wage loss during extreme heat. • Enforcement of MoLE advisories and supervision of local construction works by the concerned authority • Monetary assistance package for a minimum number of days, aimed at compensating for the loss of wages incurred during periods of extreme heat
GREEN SPACES			
• Absence of shaded rest areas that are equipped with access to drinking water during periods of elevated temperatures		• Mandate sheds for ventilation, childcare, and sanitation for construction permits. • ULBs must enforce heatwave advisories, requiring employers to set up canopies with water, sanitation, ORS, coolers, and fans in rest areas.	• Model community cooling centres using passive cooling, solar power, and reflective roofing, providing essential services
WATER & COOLING SOLUTIONS			
• Inconsistent water availability at worksites • Women workers limit fluid intake to minimise the cost of toilet visits and risk heat stress	• Enforce heatwave risk mitigation standards with first-aid kits and guidelines for employers and contractors via the “Construction Board.”	• Install canopies with water points /tankers at work sites, bus stations, terminals, roadside areas, community parks, and labour chowks.	• Issue public order directing employers to ensure adequate facilities for workers failing to which would attract penalties.

• Electricity costs increase in summer, discouraging usage of cooling appliances over financial stress.		• Install mobile toilets at worksites and inspections for worker safety by municipalities or development authorities during building projects. • Implement electricity subsidies during severe heat period	• Include power subsidy into the heat action SOP for the concerned Ministry/department

4.3 Gig workers and Heatwaves

Context—Pre-existing Vulnerabilities that Exacerbate Heatwave Impact

A large portion of the gig workforce frequently shifts between platforms and takes on additional work. This fluidity, combined with legal uncertainties, leads to a lack of minimum wage protections, job security, and regulations on working hours. As a result, gig workers often miss out on income protection, social security, and health benefits, making them vulnerable to climate change impacts. The challenges they face arise from both the informal nature of their work and the limited regulatory oversight in this sector. Unlike construction jobs that may halt during health emergencies, gig work frequently persists and can even increase during crises, such as the COVID-19 pandemic and extreme weather events, including heavy rains and heatwaves. Addressing these issues within a regulatory framework is thus essential for fostering climate resilience in the gig economy.

Existing and evolving regulatory frameworks and initiatives

The Code on Social Security, 2020 aims to offer some protections for "gig" and "platform workers," but these new regulations are not yet fully implemented. The Code statutorily recognises gig workers under labour laws for the first time, acknowledging their engagement in temporary or project-based roles. This development facilitates the establishment of social security schemes, which may encompass life and disability insurance, accident coverage, as well as health and maternity benefits.

In July 2024, Rajasthan became the first state in India to legislate for gig workers' welfare. Karnataka has also introduced a draft Gig Workers Bill to provide social security benefits. In May 2025, the Delhi government announced to constitute a welfare board for gig and platform workers and develop specialized schemes for this growing workforce.[31] In October 2025, the Ministry of Labour and Employment signed an MoU with Zomato to enhance access to flexible jobs through the National Career Service (NCS) platform. This partnership supports the Pradhan Mantri Viksit Bharat Rozgar Yojana (PM-VBRY) focusing on formal employment and social security for all workers.[32]

Economic Pressures

Heatwaves pose significant challenges for gig workers due to their prolonged exposure to outdoor environments. Gig workers, particularly delivery personnel, often experience a minimal fixed portion of their income, with the majority being contingent upon incentives linked to longer working hours or showing up to work during harsh weather conditions. This reliance on incentives results in significant exhaustion, particularly when faced with adverse environmental conditions such as heat and rain.

Electric bikes are rented from third party providers, with weekly fees up to ₹1,600, while daily rentals for electric scooters cost ₹300, totalling ₹9,000 monthly. Riders also pay a one-time joining fee of ₹1,200 to ₹1,700 to receive identification cards. However, essential protective gear, such as raincoats and windcheaters for heat have to be purchased by the riders. This financial burden necessitates a stable daily income, even during inclement weather. Furthermore, a significant number of electric vehicles (EVs) are currently not classified under existing motor vehicle regulations. As a result, there are no requirements for driving licenses or the use of helmets, which raises important safety concerns for individuals under the

31 https://www.tribuneindia.com/news/delhi/govt-to-set-up-welfare-board-for-gig-platform-workers-10-cr-allocated/
32 https://www.pib.gov.in/PressReleasePage.aspx?PRID=2179001

age of 18 engaged in this sector.

Heat-related Health Impact and Healthcare

The ILO states that heat stress occurs at temperatures above 35°C in high humidity, and heat stroke above 40°C. Gig workers are particularly vulnerable during heatwaves due to long working hours, as they are exposed to extreme temperatures while cycling or riding motorbikes (ILO, 2019). Between the hours of 12 PM and 4 PM, various platforms provide delivery incentives that conflict with the advisories issued by the NDMA concerning work hours during periods of extreme heat.

The Advisory for Informal and Gig Workers, issued on 29 July 2025,[33] recommends the restructuring of work shifts during heatwaves, suspending mandatory work hours from 11 AM to 4 PM and implementing shorter, two-hour shifts with cooling breaks, and allowing workers to opt out of shifts without penalties. It also includes provisions for at least two emergency leave days in summer, searchable cooling shelters on Workers' App, partnerships with NGOs for shelters, and the use of public spaces for cooling. Additionally, it emphasizes barrier-free infrastructure, public awareness, first-aid education, and including gig workers in Heat Action Plans. However, implementation varies across platforms, and many riders remain unaware of these advisories and heatwave safety protocols.

Riders reported experiencing symptoms such as dizziness, nosebleeds, vomiting, and skin issues during the heatwave. A gradual decrease in their incentives during severe weather, pressures them to work continuously regardless of conditions. Resultantly, many riders may find themselves needing to work longer hours in order to achieve a viable income, given that their earnings are closely linked to the number of deliveries they complete. For instance, fulfilling 15 deliveries yields an income of ₹110. Additionally, during peak heatwave hours (from 1 to 4 PM), the drop in order volume can lead to decreased earnings, and pressure to work extra hours to make up for the loss.

Deliveries to higher floors during high temperatures pose health risks, especially when housing societies restrict gig workers from using elevators or when elevators are out of service. As a result, riders take the stairs, leading to exhaustion and health concerns in peak temperatures.

Currently, there is a noticeable lack of on-call medical support for emergencies during deliveries, particularly in the context of heatwave conditions. The gap persists despite the initiatives offered by some platforms that also provide ambulance services in emergencies for their riders.

While riders acknowledge the importance of these insurance products provided by the platforms, they do not specifically address the challenges associated with heat-related illnesses or lost workdays resulting from such conditions during heatwaves. Some companies provide a day's sick leave with partial wages as support, but this policy is not specifically tailored to heatwave-related issues. It is noteworthy that some companies also provide insurance cover for the family members of the riders, in addition to general insurance and accident and life coverage. However, this provision does not exist across all aggregators. Moreover, among those interviewed, only a small number have utilised this benefit. FGD participants expressed concerns regarding the complexities of the claims process, which necessitates extensive documentation. These challenges often deter them from engaging with the policy, as they encounter potential claim rejections or experience lengthy processing times.

Thus, various aggregators are implementing a range of measures that are scalable and replicable for ensuring worker safety; but none of these measures is specifically designed to address the unique challenges posed by heatwaves. Therefore, the health support measures remain inconsistent across the platforms.

Additionally, whilst many delivery riders are covered under the Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (PM-JAY), facilitated by the platforms, the coverage does not adequately address immediate healthcare needs. The program specifically covers health issues that do not require hospitalisation, resulting in out-of-pocket medical expenses and potential loss of wages during days of absenteeism.

33 https://ndma.gov.in/sites/default/files/PDF/Reports/Advisory_for_Informal_and_Gig_Workers.pdf

Branch offices play a pivotal role by providing essential road safety training and sharing weather-related information, but do not yet provide awareness on heatwave advisories and dos and don'ts for workers. Many individuals are registered with e-Shram, but there appears to be a lack of awareness regarding its benefits.

Availability and Access to Water and Cooling Solutions

Cold water and oral rehydration salts (ORS) are currently unavailable for riders during hot seasons. While it is crucial to ensure access to water for cooling during heatwaves, it is also important to consider the provision of water supply for bathing and drinking in their residences. Such measures would greatly enhance their ability to effectively manage high daytime and nighttime temperatures. Many workers residing in the Zamrudpur area often live in rented accommodations or shared housing, where water supply can be inconsistent, and storage facility is absent. Although the government supplies water tankers, the timing of these deliveries often clashes with the working hours. This situation leads to the necessity of purchasing drinking water at a cost of ₹20 per litre, which typically lasts only a day during the peak summer months. Consequently, this increases their overall expenses and contribute to financial strain and reduced water intake.

Green spaces: Availability, Awareness and Access

During long-distance deliveries, riders face heat exhaustion and limited rest opportunities. This issue is worsened during peak office and school hours by elevated temperatures and heat from traffic, highlighting the need for better support for the riders. The limited availability of natural green cover along several routes, as well as the absence of designated shaded resting areas, forces them to frequently gather in public spaces under trees during their breaks between deliveries. This congregation in public areas often leads to complaints from locals and shop owners regarding traffic congestion and unauthorised parking.

Furthermore, the intense heat exposure contributes to overheating mobile phones, which can become sluggish or dangerously hot during peak temperature periods. It is imperative to recognise that riders generally acquire their own mobile sleeves, as well as their hydration supplies and protective clothing to guard against heat exposure. This requirement illustrates the additional financial burdens placed upon their already constrained budgets.

The dark stores[34] face challenges related to the consistent provision of drinking water, cooling appliances, and sanitation facilities. Workers' complaints about these issues often do not receive appropriate attention or timely resolution they deserve from their team leaders or store supervisors. Besides, the designated rest areas are sometimes used for storage, making them inaccessible for relaxation and driving workers to gather under trees in public areas.

Challenges of women gig workers and the cost of cooling solutions

FGDs with at-home salon service partners in New Delhi provided insights on occupational challenges and heat-related hazards experienced by the beauticians. At various locations, taxis or auto-rickshaws are unable to access customers' residences, necessitating the transport of heavy equipment by the workers themselves. Ascending multiple flights of stairs in elevated temperatures exacerbates physical strain. Work hours typically extend from 7 a.m. to 7 p.m.; however, taking breaks results in a loss of income, as workers are compensated on per-task basis. Concurrently, they experience a significant increase in electricity expenses during the summer months due to the use of cooling appliances at their residences, which further strains their unstable incomes.Health impacts for home salon service providers

Dehydration and low blood pressure disproportionately affect women during peak heat period compared to men, noted a focus group participant. There are no designated rest areas, water provisions, or summer-specific support measures (such as incentives or allowances) offered by the platform. Common symptoms associated with heat exposure include dizziness, skin rashes, and fatigue. Last-minute cancellations by

34 A dark store is a retail outlet used as a private fulfilment centre for online orders, not accessible to in-person shoppers. They are optimized for efficiently picking, packing, and delivering products and are typically found in densely populated urban areas to ensure faster delivery times.

customers, particularly following extensive travel in elevated temperatures, contribute to both physical exhaustion and financial losses for businesses.

Mental health is also adversely impacted as they frequently experience elevated levels of anxiety, irritability, and frustration when confronted by these conditions. Furthermore, urinary tract infections (UTIs) are prevalent due to limited access to sanitary restroom facilities, compounded by restrictive clothing choices and increased menstrual discomfort exacerbated by high temperatures. The sole indication of heat-related concerns they observed was the closure of schools due to elevated temperatures, which indirectly signalled the increasing rise in temperatures.

Shaded areas with access to cooling solutions

Pooja, a food delivery partner, reported significant challenges in accessing potable water during deliveries, particularly under extreme heat conditions. She expressed that the majority of customers do not provide water, intensifying the issue. Her platform currently does not provide any heat-specific support measures, including allowances, incentives, or designated rest breaks, to assist riders during periods of high temperature. Furthermore, there are no designated sitting areas available in proximity to stores. In instances where a seating is available, it is frequently occupied by male riders who may engage in smoking, thereby creating an uncomfortable environment for female riders. Additionally, some platform-based grocery outlets do not permit riders to utilise toilet facilities or water dispensers.

> *"Menstrual cycles, particularly during extreme heat days lead to increased weakness, cramps, and irritation. The lack of accessible washrooms makes this worse since many women's public restrooms are locked or poorly maintained. As a result, female riders often have to go home to use the bathroom, leading to lost orders and decreased income. Furthermore, even after prolonged outdoor work shifts, women often continue with household chores, thereby aggravating fatigue and heat-related stress."*
> -**Pooja**, *Food delivery partner*

Challenges faced by women cab drivers in extreme heat

While utilising air conditioning during active rides is feasible due to fare coverage of fuel costs, the situation becomes problematic during waiting periods without passengers. Mental stress increases in summer due to long wait times and high temperatures, leading to irritation and financial anxiety from reduced fares. In an effort to conserve fuel, they turn off the air conditioning, resulting in an intolerable heat in vehicles. The extended duration of summer months and the necessitated use of air conditioning for prolonged periods have further exacerbated the financial strain on drivers. Passengers demand air conditioning, even in traffic, which further strains fuel consumption and profit margins.

> *"Extreme heat reduces my appetite and motivation to eat or drive. I often suffer from urinary tract infections due to limited access to clean toilets, as female restrooms are frequently locked or labelled "no water. Menstruation leads to increased weakness and irritability during such hot days"*
> -**Rekha**, *platform-based cab driver.*

Recommendations

GIG WORKERS			
Heatwave Impact	**Heatwave Preparedness**	**Heatwaves Response**	**Heatwave Resilience Measures (Long-Term)**
HEALTH			
• Riders experience dehydration, dizziness, nosebleeds, vomiting, and skin issues during the heatwave.	• Platforms to educate workers on heatwave risks, symptom identification, preparedness, and first-aid response with a focus on gender considerations	• Enforce advisories: adjust schedules, decouple incentives, batch tasks, and support lost work hours triggered on meeting IMD thresholds (40℃ for plains and 30℃ for hilly regions).	• Provide financial aid for reduced deliveries in the HW period without penalties while the government formalises Gig sector.

• Lack of on-call medical support for emergencies during deliveries, especially during heatwaves. • Complicated claims process and extensive documentation discourage riders from using health policies. • Urgent and outpatient heat illness care is not covered by Ayushman Bharat, leading to out-of-pocket medical costs. • Women workers in dark store experience dehydration, low blood pressure, dizziness, discomfort with restricted clothing and unsuitable fabric. • Extreme heat reduces appetite; and lack of access to restrooms for women leads to UTIs; increased menstrual discomfort in high temperatures. • Companies are not yet offering heatwave advisories or incentives for workers. • Incentive-driven work pressure compromises ability to self-pace or adjust work schedules.	• Demography specific IEC in local languages • Training on the use of “Heat Emergency” feature by workers for real-time on-call support. • Digital platforms must facilitate worker registration under e-Shram and PM-JAY, and provide information on scheme benefits during onboarding. • Generate awareness about the NDMA advisory for informal and gig workers among platforms and workers. • Implement work schedule adjustments, safeguards and incentives for workers during heatwaves as part of the business model.	• Introduce health insurance for outpatient care and /or reimbursements through government health institution certifications, along with accident coverage and wage support for workers during heatwaves.	• Integrate “Heat Emergency” feature in Partner application for improved safety and on-call emergency support. • Companies publish data on heat-related health issues reported via “Heat Emergency” on their website. • National and State health authorities collaborate with digital platforms to create a real-time database of heatwave health emergencies for improved policy and interventions. • Compliance with heatwaves advisories of the Government. • Companies must integrate a DRR plan for workers into their policies, along with safety guidelines and orientation procedures.
GREEN SPACES			
• Designated rest areas in dark stores serve as storage, while workers gather in public spaces under trees; public complaints about congestion and parking. • Riders face heat exhaustion; women workers experience fainting at the warehouses due to heat, tight deadlines, and heavy workloads, especially during peak hours.	• Sensitise RWAs to allow gig workers to use common lifts when service lifts are down, and provide water stations and shaded seating in parks for deliveries. • Expand rest areas for riders with gender considerations with restrooms, hydration stations, and charging points through Government-Company-NGO collaboration.	• Platforms to ensure functional resting spaces with clean drinking water, hydration solutions, and first-aid supplies in mini stores, dark stores, and warehouses. • Set up ‘Rest Points’ along busy routes, with first aid supplies, cooling facilities, drinking water, sanitation, and sanitary napkins.	• Conduct regular inspections to ensure clean resting areas with drinking water, hydration solutions, and first-aid supplies in mini stores, dark stores, and warehouses during hot months, similar to Swachhta Abhiyan. • Explore feasibility of dedicated green corridors along long routes with public resting points within municipal /city infrastructure budget.

• The storeroom has heavy items above and light goods below, making it tiring for workers in dark stores in the heat. • Few sitting areas near the dark stores are often occupied by male riders.			• Implement greening initiatives along delivery routes and transform public spaces and bus stops into green, shaded rest areas with water access as business model
WATER / COOLING SOLUTIONS			
• Partner/riders need to buy their own essential protective gear, like windcheaters for heat and water. • Dark stores struggle with reliable access to drinking water, cooling appliances, and sanitation • Riders do not receive cold water or oral rehydration salts (ORS) during hot seasons.	• Awareness and safety kits comprising hydration solution and first-aid supplies to be provided free of charge to the partners	• Install water stations and canopies along busy routes • Platforms to offer essential protective gear (windcheaters, raincoats) and hydration aids (ORS, shikanji, nimbu pani) as well as first-aid supplies free at all dark stores.	

4.4 Farmers in Amravati

Context—Economic instability and Heat Stress

Farmers face significant financial burdens and livelihood insecurities that force them to endure extreme heat and unsafe conditions. Key issues include high costs of land leasing and agricultural inputs, low produce prices, and unreliable irrigation systems. Additionally, many lack income diversification and are affected by climate variability, leading to crop losses due to rising temperatures and unpredictable rainfall. Farmers migrating to Amravati from areas like Chikhaldara, Akola, and Madhya Pradesh often rely on seasonal agricultural labour, creating a cycle of dependence. Job opportunities during harvest seasons are limited because adapting work schedules is often difficult.

The rabi harvest season runs from March to May, offering limited income opportunities. Crop loans must be repaid on time, which puts a strain on smallholder farmers who face losses from high temperatures. Heatwaves can severely reduce crop yields and cause premature fruit drop, such as for orange growers, putting farmers’ financial stability at risk during this critical time. Inadequate power supply for irrigation adds to the problem, as farmers must be on-site to follow the cluster-level power distribution schedule. Crops like oranges, cotton, onions, and various vegetables require irrigation, which is only available during the day when temperatures are high. According to the participants, current solar-powered sprinkler systems are not strong enough to operate effectively at night.

Housing Conditions and Cooling Solutions

The residential structures in the Amravati region are primarily characterised by tin roofs, which create challenges for indoor living during high temperatures. Participants reported that these permanent tin-roofed houses were established by the Government in 2009 following the destruction caused by flooding in 2007. A community member noted that the popularity of tin roofs is due to their cost-effectiveness and durability. Traditionally, these roofs were covered with clay, “khaprail tiles,” but their use has declined.

Affordability of Passive Cooling Solutions

Prevalence of frequent power outages undermines the effectiveness of cooling devices–fans and desert coolers leaving residents to endure heightened levels of heat and humidity during the hotter months. During nighttime, women within the community often resort to sleeping draped in wet stoles and sarees.

Heat-related Illnesses & Healthcare

The duration from April to May is recognised as the peak of the annual heat cycle, with May typically recording the highest temperatures. Healthcare workers shared about a rise in cases of blood pressure fluctuations, digestive issues, dehydration, dizziness, vomiting, diarrhoea, fainting, sunburns, skin allergies, eye redness, and headaches. Heat stress is a growing concern for pregnant women working in the field during high temperatures. It can lead to increased heart rates, nausea, and complications like premature delivery. Children may also suffer from rashes, fungal infections, and early puberty in girls. Individuals suffering from preexisting health conditions are particularly at-risk, as elevated temperatures can exacerbate their existing medical issues. An ASHA worker narrated an incident involving an elderly woman, aged over 60 years, who experienced fainting due to heat exhaustion while working in the field during the 2020-2021 period. There is also an increase in typhoid cases and concerns about water quality during this time.

Psychosocial wellbeing of women adversely effected

Exposure to heat can negatively affect mental health, leading to increased irritability, especially among female farmers and workers who face additional work-related burdens and stressors. They reported experiencing sleep deprivation, which profoundly impacts their overall well-being, particularly compared to their male counterparts. This is due to changes in their daily work schedules during the intense heat. Women typically begin their day between 4 AM and 5 AM, preparing meals for their families and managing other responsibilities before heading to the fields. After their fieldwork, they continue with caregiving and additional chores.

Surekha Shyam Kadsarpe experienced discomfort and low blood pressure at work on August 3, 2025, coinciding with high temperatures during the monsoon season. She was advised to take the day off by the Gram Rojgar Sevak and received saline treatment. It is important to note that health-related absenteeism can lead to wage losses for MGNREGS workers.

Wage rates typically drop in summer due to fewer working hours, while more labourers are available. Hence, women farmers often work two shifts in the fields– mornings from early until 11 AM, and evenings from 4 PM to 7 PM and participate in the MGNREGS to earn a viable daily wage. This situation significantly impacts subsistence, food security, and income levels, frequently resulting in increased debt due to inadequate crop yields. Consequently, agricultural labourers and marginal farmers are compelled to seek employment in the fields of others or in brick kilns, irrespective of extreme temperature conditions.

Collectively, eight MGNREGS women workers constructed five sheds on their fields by utilising their own funds and materials, as working under extreme heat conditions became intolerable. They carry their drinking water from home; however, during the hotter months, the supply frequently depletes, necessitating refills from the borewell located at the Gram Panchayat.

Healthcare options

Most heat-related health issues are managed as outpatient conditions, leading to out-of-pocket expenses for those with a Golden Health Card, also known as the Ayushman Card or PM-JAY card, which offers free secondary and tertiary healthcare in India. The participants reported that sub-centres are often closed by the time the workers return from agricultural work, they tend to seek private consultations with local BHMS practitioners or professionals at Dr. Panjabrao Deshmukh Memorial Medical College and district hospitals.

COMMUNITY VOICES

Anita Rao's 13-year-old daughter was hospitalised at Amravati Hospital after exhibiting symptoms of "*Mendu Jwar*" (Meningitis), worsened by heat exposure after visiting a relative (Maharashtra).

"My wife, who had anaemia, fell seriously ill after fieldwork during peak temperature months, experiencing stiffness in her fingers and head pain," - Manohar Bapurao Ingle, an elderly farmer, Darapur Village, Block Daryapur, Amravati.

An elderly farmer who had bypass surgery died from heat stroke after working, emphasizing the risks heatwaves pose to elderly with comorbidity (Yawali Village, Amravati Block).

"Pregnant women face increased risks like elevated heart rates, dizziness, and nausea, often due to participating in agricultural work out of necessity, with instances of childbirth occurring in the fields" - Sunita Athawale, ASHA, Darapur block, Amravati.

Capacity Building of Health Workers

ASHA workers serve as the primary healthcare providers; however, they remain vulnerable to the risks associated with high heat exposure, as they cover extensive populations and follow up with individuals requiring targeted assistance. An ASHA supervisor also recounted her own experience of fainting from heat exhaustion while returning from a meeting in Amravati, which occurred between February and March, highlighting her discomfort during the journey on public transportation.

They play a vital role in advising the community on essential measures such as rehydration solutions, appropriate clothing, fluid intake, and the use of head coverings. However, they have not been exposed to a formal training on heatwaves including the identification of symptoms and the administration of first aid in serious instances. In critical situations, they refer individuals to the PHC or district hospital for additional support. This lack of focused support can lead to misclassification of heatwave-related fatalities.

Furthermore, there has yet to be a comprehensive awareness initiative addressing the impacts of heatwaves and the necessary precautions. While ASHA workers do receive guidance on fundamental measures to mitigate health risks and engage in discussions during monthly meetings, they lack familiarity with the State Heat Action Plan 2024 and the State Action Plan for Climate Change and Human Health (2022-2027). Addressing these gaps could enhance their capacity to support the community effectively during heatwave events.

Community-level Mitigation Measures

In response to the heatwaves experienced within the farming community, the following measures are commonplace among them:

- Consume lemonade (nimbu pani), sugar, buttermilk, and homemade oral rehydration solution made from water, sugar, and salt.
- Use of Dauna plant, scientifically known as Artemisia Nilagirica, is also utilized for its medicinal properties
- Carry an onion in one's pocket
- Wear cotton garments to improve comfort during elevated temperatures.
- Voluntarily adjust their work schedules in response to prevailing weather conditions

Health infrastructure

The PHC is equipped with specialised heatwave ward and a cooler to alleviate excessive temperatures. Furthermore, an Oral Rehydration Therapy (ORT) corner has been instituted, providing Oral Rehydration Solutions (ORS) and electrolytes to the community. Regular meetings are convened at the PHC which include the Medical Officer, PHC Supervisor, Auxiliary Nurse Midwife (ANM), and Community Health

Officer (CHO). These meetings serve as a critical platform for addressing challenges related to heat and other public health issues.

The health facilities are equipped with reliable water provision, including piped supply, borewells, and wells. But the local water supply has high salinity, which poses maintenance challenges for the Reverse Osmosis (RO) systems, often leading to operational issues. Likewise, persistent power outages, particularly during heatwaves, create challenges for these facilities and renders the equipment inoperative at the SHCs, which lacked adequate power backup solutions during the time of landscape assessment. To address this concern, the CHOs informed that the government is actively considering the implementation of solar panel installations at the SHCs.

The Village Health and Nutrition Orientation Committee (VHNSC), chaired by the Sarpanch could play a vital role in promoting heatwave preparedness. Despite budget constraints, VHNSCs can improve their annual planning and address critical issues more effectively by integrating heatwave response actions into its monthly activities and the Gram Panchayat Development Plan informed by local hazard risk mitigation planning and budgeting.

Heatwave effect on Anganwadi Services

Anganwadi centres (AWC) are essential in India's public health and child development system, offering healthcare, preschool education, and nutrition services for children from 0-6 years old, pregnant women, and new mothers. They provide immunizations, health check-ups, nutrition education, and supplementary nutrition. The AWCs are staffed by women community health workers known as Anganwadi workers (AWW).

The AWCs have tin roofs that create uncomfortable temperatures for children and staff, leading to issues like heat rashes. Focus group discussions with Anganwadi workers revealed that, despite having fans, water filters, televisions, and lighting, frequent power outages cause significant heat discomfort indoors and outdoors. Although on-grid solar panels were installed, they are currently non-operational due to damage from wildlife, such as monkeys. This situation has led to some parents being hesitant to enrol their children to AWCs. As a result, some Anganwadi workers have had to take prepared food to children's homes. When water is scarce, workers have to go to nearby villages to fetch it, increasing their difficulties during peak heat. Additionally, staff lack training on managing heatwaves, making it harder to address these issues. Their workload from scheme enrolment limits their ability to include heat management awareness in their schedules.

Availability and Access to Adequate and Potable Water

In Darapur village, residents skip bathing for several days due to limited water supply even in high temperatures. They receive water only four months a year during the monsoon season. In summer, water is available every three days for one to two hours, and every two days during other months. The main source of safe drinking water is the Purna River, but during dry spells, shortages can last up to four days, forcing residents to travel to Shingnapur for bore well access. The Gram Panchayat water dispenser, which used to sell water for one rupee per litre, is currently out of service.

Female agricultural workers face significant transportation challenges, requiring them to travel long distances to the fields while carrying heavy water containers. This situation arises from limited access to potable water in agricultural areas, caused by the high alkalinity of local water sources. During the hottest part of the day, the water supply often runs out, forcing workers to drink saline water, which can lead to health issues such as kidney stones and digestive problems.

Green spaces: Availability, Awareness and Access

During the monsoon season, which occurs from June to August, the prolonged heat can become increasingly difficult to endure, even when temperatures do not exceed 40 degrees Celsius. A notable concern expressed by women farmers possessing marginal to small landholdings is the practice of clearing

large trees from their limited plots to optimize cultivation. This approach is reportedly adopted to mitigate wildlife attacks and intrusions that can damage crops, but it results in a significant reduction of green cover. Farmers are confronted with an absence of shade where they might rest. Consequently, some take refuge beneath bullock carts. The practice is particularly prevalent among nomadic tribes, with the Pardhis often constructing makeshift shades and swings (jhulla) from sarees to protect their infants.

Community Risk Financing

The women are members of Self-Help Groups (SHG), locally known as Bachatgats, that function consistently according to the established norms throughout the state. Based on the accumulated group savings at ₹100 a month, they can secure small loans at an interest rate of 2 percent repayable within one year. This mechanism serves as a readily accessible financial reserve for the members. Additionally, they are enrolled in the Mukhyamantri - Majhi Ladki Bahin Yojana, through which they receive monthly assistance of Rs 1500, alongside social security pensions for persons with disabilities, senior citizens, and widows, e-Shram scheme, Agricultural Technology Management Agency (ATMA) Scheme, Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY), Atal Pension Yojana, and Pradhan Mantri Suraksha Bima Yojana, and POKHARA (Project on Climate Resilient Agriculture) initiative.

In addition to relying on local moneylenders, members also have access to a variety of financial institutions, including cooperatives, banks, and microfinance institutions (MFI) such as Sahyog, ESAF, and Shakti. These institutions offer loans at elevated interest rates, which typically range from 10 to 12 percent. Consequently, they are often not favoured by borrowers. The existing financing options have the potential to support resilience-building initiatives at the community level in response to heatwaves. Currently, these resources are primarily allocated for agricultural purposes and to address individual household exigencies and social needs.

Other at-risk groups identified by ASHA workers for heatwave risk management initiatives

Seasonal Migrant Agriculture Workers: Migrant agricultural workers employed during harvest season, labour long hours in the heat.

Brick-Kiln Workers: Due to their prevalence in Amravati, workers and their families continue to labour during the heatwave, making them more susceptible to heat exposure from brick kilns.

Dhangar: are particularly affected due to livestock-raising practices that require them to forage during high temperatures in fields.

De-notified and Nomadic Tribes: These tribes migrating from Rajasthan, Madhya Pradesh, and Melghat engage in labour-intensive activities and are further endangered by extreme poverty, forcing them to work longer hours and manage livestock.

Recommendations

FARMERS

Heatwave Impact	Heatwave Preparedness	Heatwaves Response	Heatwave Resilience Measures (Long-Term)
HEALTH			
• Dizziness, light-headedness, vomiting, diarrhoea, fainting, BP fluctuations, elevated diabetes, skin allergies, redness of the eyes, headaches, typhoid etc. • Mental Health affected-poor sleep - irritability and heat stress • Pregnant women at higher risk–premature deliveries • Increased financial strain from out-of-pocket medical costs. • Severe power shortages are hampering healthcare facilities during the heatwave.	• Implement HW awareness and family emergency kits • Self-adjusted work schedules and temperature forecast • Establish a secure ambulance service and mobile vans in every village for quick medical response. • Heat training and refreshers before HW season for frontline health workers to recognize and respond. • HW trainings for preventive actions for the SHGs under Rural Livelihood Missions • Public campaigns to raise and reinforce awareness about heatwaves, protect local and migrant workers, and educate brick kiln contractors and owners. • User-friendly IEC and training with gender considerations • Integration with VHNSC activities • Emergency family kits including first-aid supplies, homemade rehydration solutions, and an emergency helpline number. • Awareness about HW dos and don'ts, preparedness and risk mitigation for pregnant women through ANMs • Inclusion of heatwave risks and mitigation for pregnant women into ANM handbooks	• Enforcement of advisories and dialogue with contractors and employers • Wear protective gear against sun exposure • Wear breathable fabrics and cotton shirts in fields • Carry homemade fluids • Augment PDS supplies, home delivery of dry ration by ANWs • Penalty-free flexible work hours in MGNEGS • Implement sessions on HW in VHNSC and panchayat meetings through trained VHNSC members • HW resilient community health infrastructure / green nets and fibre sheets /roofing for AWCs • Heat reflective roofing for SHCs and AWCs • Enhance food provision for children under 5 and pregnant/lactating women during HW under ICDS. Mobilise trained members for first aid response in their areas and communicate with relevant authorities. • Implement solar panels and power backups with consistent water supply across all SHCs and AWCs	• Enable flexible working hours under MGNREGS design • Wage support when temperatures exceed 40 degrees under the SDMF • Develop special assistance package for heatwaves, with in-kind and financial assistance, integrated into the SDRF. • Create advisories for migrant workers informed by insights from challenges encountered during field implementation of advisories. • Enhance the design of SHCs and AWCs to improve heat resilience and environmental sustainability. • Integrate HW related illness with outpatient consultations and medications under relevant health schemes • Direct financial and parametric support to women's bank accounts for medical emergencies or unforeseen events. • Implement solar panels and power backups with consistent water supply at SHCs and AWCs focusing on high-priority HW hotspots.

	• Training SHG members with Aapda Mitra on local hazards like heatwaves as first responders. • Promote emergency funds in villages by encouraging effective financial planning and inclusion of SHGs • Conduct regular inspections of the solar grid to ensure functionality and protect against damage from wildlife.		
GREEN SPACES			
• Bus stops with tin roofs retain heat, needing water and shade for commuters. • The clearing of trees reduces shaded areas, contributing to heat in the field. • Agriculture workers rely on makeshift solutions for lack of shaded areas resulting in high exposure • Marginal holders' insufficient land; and only subsidies for fencing and shades. • The lack of community cooling centers increases heat exposure for farmers and workers.	• Improvise bus stops using cooling mats, sprinklers, reflective paints, shade nets, and trees, water points. • Enhance green cover by preserving old trees and planting fruit trees managed under MGNREGS by the panchayats. • Halt road construction during heatwaves period • Provision community centres with water coolers and first-aid under panchayat development plans	• Ensure HW-equipped bus stops with water points, toll-free emergency helplines • Implement mandatory work breaks from 12 to 3 PM at brick-kilns and agricultural workers, including seasonal migrant workers. • Designate shaded areas with water points under MGNREGS • Sprinkle water on roadside trees and roads by the City Corporations & PWDs to keep surroundings coolers • Promote sheds using a land pooling approach and offer upfront fencing assistance. • Implement community centers and similar spaces with accessibility and preparedness measures through the panchayats.	• Allocate funds from SDMF and CAMPA for green corridors • HW resilient bus stops under State Transport Depts/Municipalities • Allowing E-class land for plantations and cultivation by the landless workers • Directives to the concerned authorities for mandatory work breaks for brick-kiln and agricultural workers, including seasonal migrants, are set from 12 PM to 3 PM. • Train PRI representatives and paani mitras on HAP, weather monitoring, and preparedness activities. • Upfront support for group-farm sheds for marginal holder farmers • Block-level oversight of the communal preparedness measures before the heatwave season
WATER			
• Water shortages lead to reduced consumption; and risky irrigation in peak temperature	• Shaded covering for open water sources / collection points • Farmers training on alkaline soil and water management, using drip or sprinkler irrigation systems	• Place earthen water pots at public places–institutions, schools, panchayats, bus stops, etc. with consistent water refills • Carry water bottles wrapped in wet jute sleeves	• Provide sufficient, functional, and safe drinking water by setting up shaded water points in villages as part of state and national water initiatives. • Water treatment at source for household supply

	• Farmers Collective for capacity building on HW resilience	• Regular water supply through piped connections or free tankers during peak water scarcity months.	• Farm ponds, and percolation tanks to store rainwater • Soak Pit Construction for groundwater recharge.
HOUSING			
• GI roofs retain heat and make indoor living challenging throughout nighttime- humidity heat, more for women, infants, chronically ill.	• Train local masons and farmers on heat-resilient housing feature and design. • Capacity building of PRI elected representatives on Heat Risk Management, IMD App, use for forecast /HW plans-GPDP	• Place water-soaked jute mats across windows and utilise exhaust fans	• Use traditional and weather-appropriate materials for reflective roofing, such as khaprail tiles, green roofs, and green nets. • Incorporate multi-hazard and heat-resilient markers into state housing design and policy, including solar power. • Subsidise heat-resistant building materials from certified suppliers if needed.

5. RISK FINANCING SOLUTIONS: GOVERNMENT AND NON-GOVERNMENT INITIATIVES

Parallel to the ongoing Government efforts, the NGO, the private sector, and the banks have partnered to implement risk financing models aimed at supporting the most vulnerable occupational groups within the informal sector, including the self-employed. These models employ state sponsored insurance schemes and parametric solutions for informal sector workers including the gig workers.

The Karnataka State Gig Workers Insurance Scheme provides insurance benefits to gig workers in Karnataka with free registration via the Sevasindhu Portal. It covers work and personal incidents, offering ₹4 lakh for accidental death, ₹2 lakh for permanent disability, and up to ₹1 lakh for hospital expenses. The scheme applies to delivery personnel from platforms like Swiggy and Zomato and is available to those aged 18 to 60 with an E-Shram Registration Number. While some gig companies offer insurance, state coverage can enhance protection against challenges like heatwaves.[35]

Parametric insurance programs in India are being developed to provide financial protection against climate-related income losses for informal sector workers during heatwaves and reduced earnings for farmers due to heat stress and excessive rainfall. The data driven model uses real time temperature monitoring to trigger automatic payouts when the maximum temperature (or rainfall) crosses certain predefined thresholds, without the need for claims or assessment of actual loss or medical documentation. It provides easy funds for informal workers facing climate-related health risks, with no proof of loss or paperwork needed. They are gaining ground as disaster risk transfer options for the vulnerable population.

On August 2, 2024, the Nagaland State Disaster Management Authority launched the Disaster Risk Transfer Parametric Insurance Solution (DRTPS). This program aims to close the significant gap in insurance coverage, as about 90% of disaster-related losses are currently uninsured. DRTPS uses rainfall data from the IMD and 34 weather stations to assess flood risks in tehsils (revenue blocks). These areas are categorized into high, medium, and low-risk zones. The scheme offers a total payout of ₹1 crore. It provides 10% of the payout for every 80 mm of rainfall above 1,500 mm. If rainfall exceeds 2,200 mm, the program pays out the full amount. Nagaland is the first Indian state to fully insure against heavy rainfall. This program is supported by the InsuResilience Solution Fund and partners such as State Bank of India General Insurance and Munich Re (Sirur, 2025)

In March 2025, the Ministry of Home Affairs announced plans to provide parametric insurance to all citizens as part of its strategy to reduce disaster risk. The NDMA is working with different organizations to create insurance options for disaster risks. This includes a plan for insurance related to disaster deaths, linking relief efforts to crop insurance, creating an infrastructure risk pool, and improving access to international reinsurance.[36]

80 percent of India's labour force works in the informal sector, with women comprising 90-92 percent of this group. Many of these women use their homes as workplaces and storage, relying on their environment for both social security and economic activity. Climate-related hazards like heatwaves impact housing and infrastructure, directly affecting their livelihoods and limiting their ability to work during extreme heat events.[37]

In 2023, a program was piloted in 22 districts, including Ahmedabad, covering 50,000 SEWA members who paid an annual premium of $3.50. The remaining premium cost of approximately $4.73 was funded by Climate Resilience for All. The members received $8.78 if the temperature exceeded 43.6°C for two

35 https://ksuwssb.karnataka.gov.in/92/karnataka-state-gig-workers-insurance-scheme/en#:~:text=All%20eligible%20gig%20workers%20will,need%20not%20to%20pay%20any
36 https://india.mongabay.com/2025/06/first-payout-under-extreme-weather-insurance-triggers-relief-and-intrigue/
37 https://beta.celsiuspro.com/news-archive/index-based-heatwaves-parametric-insurance-extreme-heat-events-insurance-india-mahilahousingtrust-mht-naturaldisasterfund-ndf?

consecutive days and $14.63 if it exceeded 44.1°C for the same duration. Each qualifying heatwave triggers one payout, regardless of work status or direct losses. In 2024, the program distributed approximately $350,859 to SEWA members, with most payments processed within six to eight weeks after the threshold is met.[38]

In 2024, Mahila Housing Trust (MHT) launched a seasonal climate risk insurance policy for two women-led credit cooperatives in Gujarat's industrial cities—Ahmedabad, Baroda, and Surat. The initiative aimed to cover 26,000 women members from March to June, using a two-tier payout model based on temperature thresholds. In Ahmedabad, payouts occur if temperatures exceed 43.7°C or 44.1°C for two consecutive days, with benefits of ₹750 and ₹1,250, capped at ₹2,000 per season. Vadodara had a threshold of 43.6°C, and Surat, 37.8°C. Developed with Global Parametrics and Go Digit Insurance, premium subsidies from Howden India supported this pilot project (Shekhar, 2025).

The Jan Sahas Foundation launched a heat insurance program to assist vulnerable migrant workers during extreme heat. Payouts activate when temperatures reach 42°C to 43.7°C for five consecutive days, with additional support for heat exposure lasting over ten days. Each insured worker can receive up to ₹3,000 for essentials and a hospital cash benefit of up to ₹5,000 for hospitalisation due to illness or injury, independent of temperature thresholds. This initiative is implemented in six cities: Delhi, Noida, Ghaziabad, Gurgaon, Faridabad, and Lucknow. The parametric insurance scheme was developed by Go Digit General Insurance, K.M. Dastur Reinsurance Brokers, and Jan Sahas Foundation, with the entire premium funded by Jan Sahas Foundation, making it free for labourers (Dubey, 2025).

While these solutions have not yet achieved nationwide reach, successful pilot initiatives conducted in partnership with the Government and private sector indicate the future of risk transfer by providing financial support to economically disadvantaged groups whose livelihoods are adversely affected by rising temperatures.

Conclusion

The assessment has revealed critical insights regarding the vulnerabilities and challenges faced by specific demographics during heatwaves. It highlights the disproportionate impacts on vulnerable groups, including construction workers, gig workers, residents of informal settlement, and smallholder and marginal farmers, with particular attention to the differentiated effects on women within these populations. In alignment with the requirements of Heat Action Plans, the findings and recommendations presented herein can facilitate localized heatwave risk management, enhancing awareness among these groups about heat-related risks, effects, and available adaptation and risk reduction strategies.

Simultaneously, the assessment findings will guide authorities, particularly the National, State, and District Disaster Management Authorities, to implement targeted short-term and long-term actions for effective heatwave response and risk management. The assessment highlights key areas that need further policy focus and decentralized funding for participatory, gender-responsive, and inclusive grassroots initiatives, thereby contributing to resilient public services and infrastructure and communities against heatwave impacts.

38 https://www.npr.org/sections/goats-and-soda/2025/07/16/g-s1-76948/hot-temperatures-insurance-gig-workers-india

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