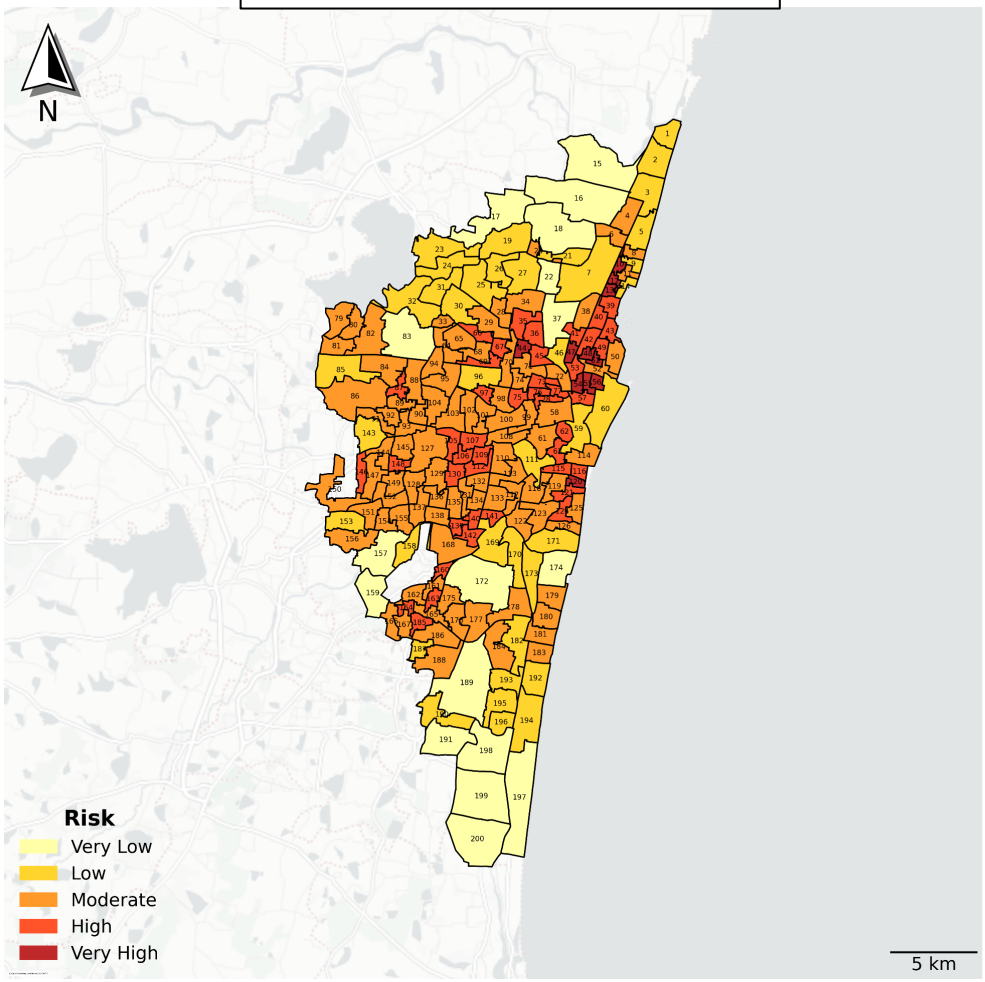
Chennai City
Heat Action Plan 2025

Heat Risk index map of Chennai city



Prepared by
Council on Energy, Environment and Water (CEEW)
and
Tamil Nadu Disaster Risk Reduction Agency (TNDRRA)

Preparation of City Heatwave action plan by CEEW

As per the G.O. (MS) No.9 dated 07.01.2025, the Council on Energy, Environment and Water (CEEW) was entrusted pro bono to develop the city Heat Action Plans for 11 cities of Tamil Nadu, namely - Chennai Metropolitan City which includes Greater Chennai Corporation, Tambaram and Avadi Corporations; Madurai, Thoothukudi, Tiruchirappalli, Coimbatore, Erode, Tiruppur, Vellore and Salem.

The CEEW is one of Asia's leading not-for-profit policy research institutions and among the world's top climate think tanks. It uses data, integrated analysis and strategic outreach to explain and therefore nudge the changes required in the use, reuse and misuse of resources. The Council addresses pressing global challenges through an integrated and internationally focused approach. It's 330+ team ensures independence of its high-quality research, develops partnerships with public and private institutions and engages with the wider public.

CEEW has a footprint in over 20 Indian states, working extensively with 15 state governments and grassroot NGOs. Some of these engagements include supporting power sector reforms, energy policy and driving low-carbon transitions in states including Tamil Nadu; promoting sustainable livelihoods, advancing industrial sustainability in states including Tamil Nadu, evaluating community-based natural farming and supporting groundwater management, e-auto adoption and examining crop residue burning.

About The Chennai City Heat Action Plan - A Dynamic Document:

The Heat Action Plan (HAP) 1.0 for Chennai City was developed using a comprehensive approach that integrates socio-economic data, historical climate datasets and future climate projections. Key climate data sources include the Indian Monsoon Data Assimilation and Analysis (IMDAA) and Regional Climate Models (RCMs) from the Ministry of Earth Sciences (MoES), covering the period from 1982 to 2050. This climatic data has been combined with satellite-derived indices and granular socio-economic information to map heat risk across Chennai city at ward level and outline preparedness, response and long-term heat risk mitigation strategies.

The HAP 1.0 plan has been formulated in accordance with the guidelines issued by the National Disaster Management Authority (NDMA), 2019 and follows the formats prescribed by the National Programme on Climate Change and Human Health (NPCCHH), MoHFW and the National Disaster Management Plan (NDMP),2019.

The Tamil Nadu Disaster Risk Reduction Agency (TNDRRA) has led the development of this plan in collaboration with Chennai City Corporation. The research and analysis of this plan was prepared by CEEW and the last Annexure: 'Heatwave Management Handbook' was prepared by TNDRRA/Government of Tamil Nadu based on the government orders, advisories and guidelines issued till date on the subject of heatwave. Given the increasing incidence of heatwaves, this plan has been formulated within a short timeframe using openly accessible and secondary data sourced from the respective cities. The plan is intended to be iterative in nature, with provisions for annual updates incorporating other relevant data and leveraging the latest tools and technologies. TNDRRA is thankful to CEEW for the preparation of HAP 1.0 and for the guidance by Dr. V. Thiruppugazh, I.A.S., (retd) for the entire initiative.

The formulae and source datasets used for the preparation of this HAP 1.0 can be accessed by scanning the QR code below. Academics, scientists, officials of all government organisations and other interested persons are welcome to collaborate with TNDRRA for corrections/modifications, as appropriate, to HAP 1.0. The contacts for the same is given the QR code

Scan the below QR Code to download HAP softcopy, raw datasets and formulae with TNDRRA Contacts.

NB: TNDRRA shall keep revising HAP 1.0 whenever base datasets change made available by the same stated above. TNDRRA is also dynamically reviewing the guidelines and handbook for heatwave management for the State of Tamil Nadu which is attached in the last annexure.
The latest versions of HAP and the handbook will be electronically available linked to the above QR code.

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1 Introduction

In January, 2025 India Meteorological Department announced 2024 to be the hottest year on record since 1901. With 2024 recorded as the hottest year globally and the 1.5°C global warming threshold approaching faster than anticipated, the impacts of climate change are becoming increasingly severe. These effects, evident through regional climate variability and extreme weather events, disproportionately affect vulnerable populations, particularly in developing and tropical countries like India (World Meteorological Organization, 2024).

One of the most immediate consequences of climate change is the intensification of heat extremes and the resulting heat stress. Globally, heatwaves have been linked to approximately 166,000 deaths between 1998 and 2017 (World Health Organization, 2018). In India, where nearly 80% of the population resides in climate-vulnerable districts, around 25,000 heat-related deaths were recorded between 1990 and 2015, despite challenges in directly attributing mortality to extreme heat events (CEEW, 2021; NDMA, 2020).

The summer of 2024 highlighted the growing risks of extreme heat in India. The country faced one of its longest heatwaves, exposing over one billion people across 23 heatwave-prone states (IMD, 2023). The intensity of recent years has been alarming: 2022 saw one of the most prolonged heatwaves, while 2023 had heatwaves declared in 10 states. By April 2024, the IMD had forecasted nearly 20 heatwave days—far above the usual 4–8 days—demonstrating the clear impacts of climate change, exacerbated by phenomena like El Niño (IMD, 2024). By the summer of 2024, India had recorded 536 heatwave days across meteorological subdivisions, the highest since 2010. June alone accounted for 181 heatwave days, surpassing the previous record of 177 days in 2010. In May, temperatures in over 37 cities across northern and central India exceeded 45°C, intensifying health risks and air pollution impacts, particularly in cities like Delhi.

Climate projections indicate that heatwaves in India will become more frequent, intense, longer-lasting and geographically widespread (Im, Pal and Eltahir, 2017). The health impacts of heat stress are projected to emerge as the most critical climate risk for India and South Asia (IPCC, 2019). Cities, which are warming at twice the rate of rural areas due to urbanization and the urban heat island effect, face compounding risks (Sethi and Vinoj, 2024). Coastal cities, in particular, will grapple with additional challenges from high humidity, which can increase the perceived temperature by 3–4°C (TMC and CEEW, 2024).

With decisive mitigation and adaptation measures the impact of heatwaves could be reduced. Addressing the escalating risks of heatwave requires mapping climate variability, tracking extreme heat events and designing robust, localized action plans.

This Heat Action Plan for Chennai City focuses on identifying trends in extreme heat, mapping heat risk hotspots and developing tailored strategies for mitigation, preparedness and response.

1.1 Understanding heat waves — global definitions and terminologies

Heatwaves lack a universally agreed-upon definition. The World Meteorological Organization (WMO) defines a heatwave as "*five or more consecutive days of prolonged heat, during which the daily maximum temperature exceeds the average maximum temperature by 5°C (9°F).*" However, definitions and criteria for assessing temperature extremes vary significantly across the world, tailored to local climatological and impact-specific conditions in each region (WMO 2011; Alexander et al. 2006; Vose et al. 2005).

For instance, the USA uses a complex "felt temperature" criterion that incorporates both humidity and temperature, while Denmark employs a simpler threshold, defining heat waves based on a daytime maximum temperature of 28°C. Similarly, countries like China and Brazil use a percentile-based approach to measure heat waves.

In India, the India Meteorological Department (IMD) employs a layered criterion to define heatwaves.

Figure 1: Criteria for mapping heatwaves in India

Criteria for mapping heatwaves in India	
Criteria 1: Heat wave is only considered if maximum temperature of a station reaches	40°C or more for **plains** 37°C or more for **coasts** 30°C or more for **hills**
Criteria 2: Once criteria 1 is satisfied, the departure from normal should be	Between **4.5 °C to 6.4 °C** for a heatwave day **More than 6.4 °C** for a severe heatwave day
Criteria 3: If criteria 1 and 2 are met in at least in **2 stations** in a Meteorological subdivision for at least **two consecutive days**, a heatwave/severe heatwave is declared on the second day	
However, if the maximum temperature is **≥ 45 °C and ≥47 °C,** a heatwave and severe heatwave is directly declared.	
Source: India Meteorological Department 2019	

Since 2024, the IMD has also begun issuing forecasts based on percentile exceedances, such as the 90th, 95th and 99th percentiles, corresponding to yellow, orange and red alerts, respectively. This approach helps capture district-level long-term normal and climatology, providing more regionally specific assessments of heatwave risks.

1.2 Climate change and escalating heat extremes in India

Between 1951 and 2016, India experienced a significant warming trend, with mean annual temperatures rising by 0.15°C per year (Krishnan et al. 2020). This increase in average temperatures has resulted in non-linear risks posed by extreme heat, contributing to nearly 25,000 deaths between 1992 and 2015, despite challenges in attributing mortality directly to heat (National Disaster Management Authority 2020).

Climatic projections indicate that heat extremes in India will intensify, becoming more frequent, lasting longer and affecting broader geographical areas (Im, Pal and Eltahir 2017). Both daytime and nighttime heat extremes are expected to increase two- to four-fold by 2050 under Representative Concentration Pathway (RCP) 4.5 and RCP 8.5, respectively (Krishnan et al. 2020). These impacts will be exacerbated by factors such as humidity and the urban heat island effect, leading to more heat-related deaths, challenging working conditions and a wider spread of vector-borne diseases (Vaghela and Mangal 2017; Bordoloi and Saharia 2021), particularly in coastal cities like Thane, Mumbai and Chennai, where the compounded effects will be most severe.

By 2050, as many as 23 cities in India are projected to experience average summertime maximum temperatures exceeding 35°C. This will have significant impacts on vulnerable populations, such as those living in slums and place additional stress on resource allocation in the context of rapid urbanization. The International Labour Organization (ILO) predicts a 5.8 per cent rise in working hours lost due to heat stress by 2030, equivalent to 34 million lost hours (ILO 2019). While cities are generally considered most at risk, recent heatwaves in India have also affected other critical sectors, including agriculture and livestock. For example, the prolonged 2022 heatwave led to wheat yield reductions of 15-25 per cent in states across the Indo-Gangetic plains. Milch animals also experienced a reduction in milk yield of up to 15 percent due to loss of appetite and elevated body temperature (Indian Council on Agriculture Research 2022). Moreover, the 2024 heatwave, one of the longest in India's history, resulted in over 44,000 suspected heat stroke cases, 350 plus heat stroke related mortalities, record-breaking power demand, declining reservoir water levels and widespread crop damage (National Centre for Disease Control 2024).

The increasing risks from extreme heat and heat stress will disproportionately affect multiple sectors and populations, threatening progress toward the Sustainable Development Goals (SDGs) and alignment with the Sendai Framework for Disaster Risk Reduction.

1.3 Trend of Heat Extremes in Tamil Nadu

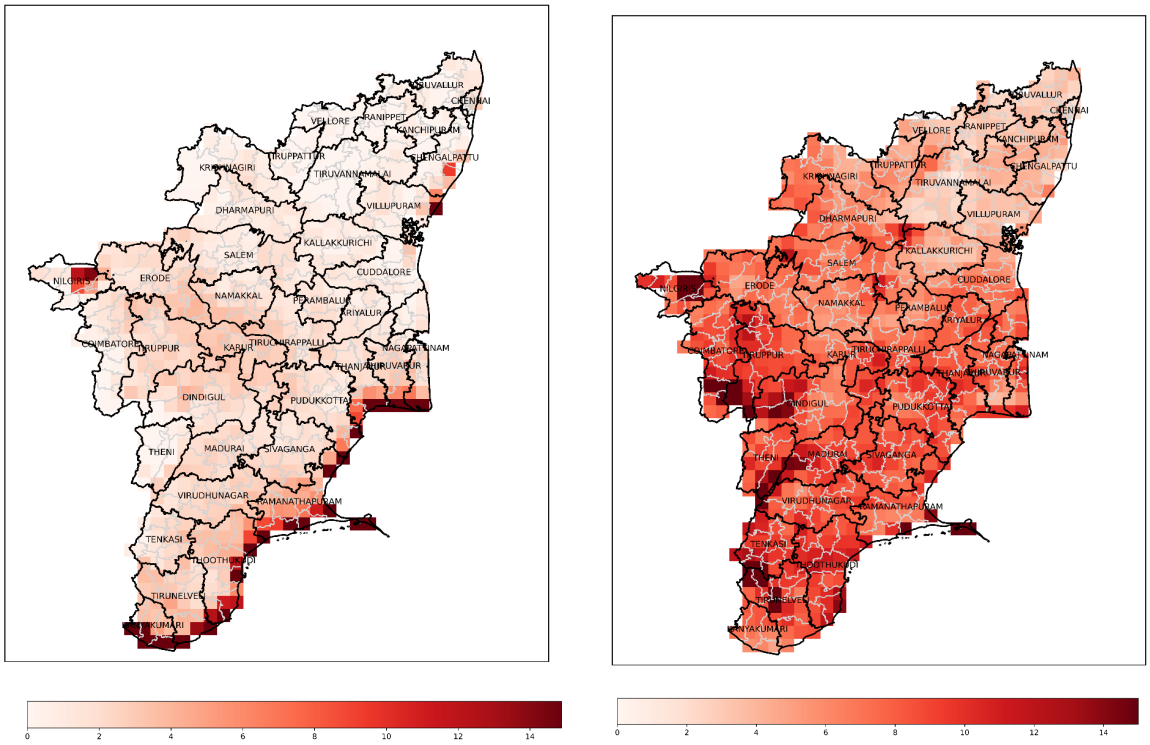
Tamil Nadu is the southernmost state in India with a tropical climate. The state experiences hot and humid weather throughout the year. The interior regions of the state are hotter than the coastal regions. April and May are the hottest months of the year with temperatures exceeding 40°C (Climate Change Information Portal n.d.). There is a substantial increase observed in the number of days exceeding the 40°C mark (Tamil Nadu Climate Change Mission Document 2024). Karur district witnessed a temperature of around 44°C in May 2024 (Chaitanya 2024). The state also noted an increased occurrence of heat stress days during the March to August along with a rising trend in heatwaves (MoES 2022).

Figure 2 represents the increase in the number of extreme hot days and warm nights in the last decade (2012-2022) compared to the climatic baseline (1982-2011). It is observed that the increase in extreme warm nights is greater than the increase in extreme hot days. The analysis is based on exceedance of 95th percentile threshold of Tmax and Tmin, respectively from IMDAA reanalysis data produced by IMD and NCMRF. Figure 3 shows that relative humidity has also increased by upto 6% in the state in the last decade (2012-2022) compared to the baseline (1982-2011) during summer (March to June).

Figure 2: The warm nights show a comparatively higher increase in frequency compared to increase in very hot days

a) Increase in frequency of very hot days in last decade (2012-2022) compared to climatic baseline (1982-2011). *

b) Increase in frequency of very warm nights in last decade (2012-2022) compared to climatic baseline (1982-2011). *



To determine whether a particular day qualifies as a hot day, the study applies a percentile-based threshold method using long-term temperature data. Specifically, the 95th percentile of daily maximum temperatures (Tmax) is calculated for each calendar day during the baseline period of 1982 to 2011. This is done using a 5-day moving window centered on each day (i.e., two days before and two days after), which captures natural short-term variability while ensuring statistical robustness.

For example, to set the threshold for 15 May, Tmax data from 13–17 May for all years from 1982 to 2011 are pooled together. The 95th percentile value from this dataset represents the temperature above which only 5% of the historical values fall. This value serves as the extreme heat threshold for that calendar day.

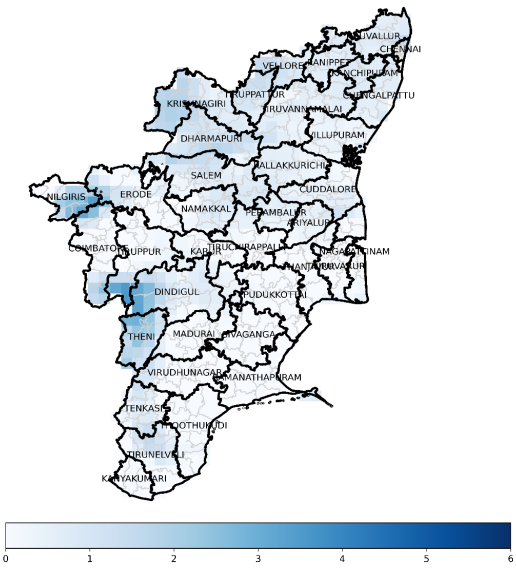
If the daily maximum temperature for a given location exceeds this 95th percentile threshold on any specific day between March and June, that day is classified as a hot day for that location.

Once the threshold was set for each day, the number of days in each year that exceeded these thresholds was counted. These annual counts provided the frequency of very hot days (based on Tmax) and very warm nights (based on Tmin) for each year. The average annual frequency was then calculated for the baseline period (1982–2011) and compared with the average for the recent decade (2012–2022). Data for 2023 and 2024 were excluded due to gaps in the IMDAA datasets. The reason for using a 30-year baseline is that it represents the standard duration recommended by the World Meteorological Organization (WMO) to define a climatic normal. This time span is long enough to capture natural variability while providing a stable reference period for detecting long-term trends. *

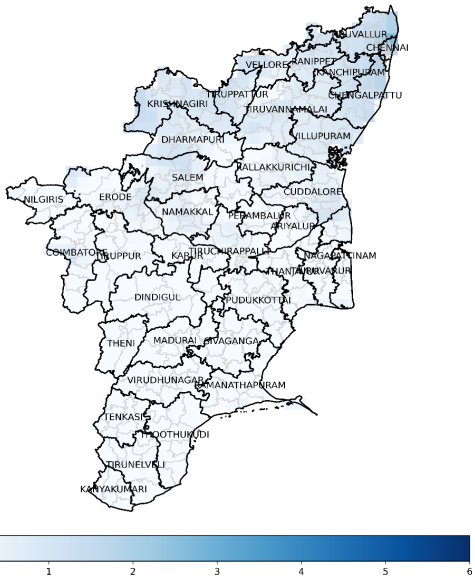
The difference between the recent and baseline averages was computed to assess the change in frequency. The results show a clear and consistent increase in both very hot days and very warm nights across all regions of Tamil Nadu. On average, the number of very hot days rose from about 6 to 8 per year, while very warm nights showed a more significant rise from 6 to about 13 per year. The increase in nighttime temperatures is especially concerning, as it may be driven by the urban heat island effect, where heat retained by buildings and roads during the day is slowly released at night, preventing the cooling that normally occurs. This prolonged exposure to heat, particularly at night, increases the risk of heat-related health issues, especially for vulnerable groups such as children, the elderly, pregnant women, and individuals with chronic health conditions.

Figure 3: Relative Humidity has increased up to 6 per cent in the decade 2012-2022 when compared to the climatic baseline 1981-2011*

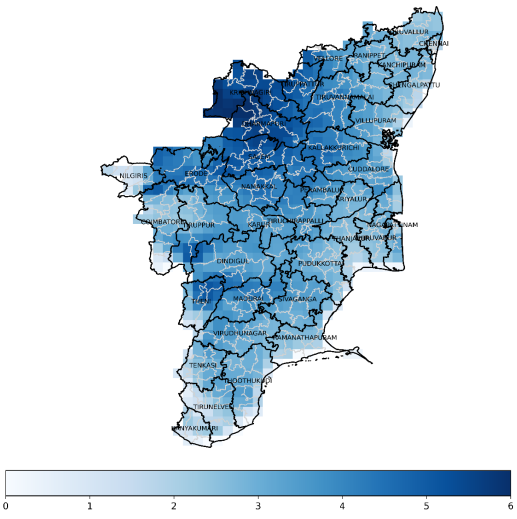
a) Changes in relative humidity (%) in March in the last decade (2012-2022) compared to climatic baseline (1982-2011)



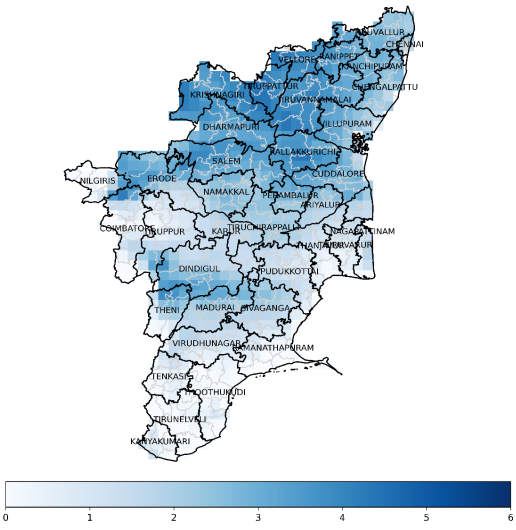
b) Changes in relative humidity (%) in April in the last decade (2012-2022) compared to climatic baseline (1982-2011)



c) Changes in relative humidity (%) in May in the last decade (2012-2022) compared to climatic baseline (1982-2011)



d) Changes in relative humidity (%) in June in the last decade (2012-2022) compared to climatic baseline (1982-2011)



This figure presents how average daily relative humidity has changed for each summer month—March, April, May, and June—over the 1982 to 2022 period. For every grid location, daily relative humidity values were averaged month-wise for each year. These monthly averages were then averaged again over the baseline period (1982–2011) to establish a climatological norm for each month.

Next, the same process was repeated for the recent decade (2012–2022), and the difference between the two periods was calculated to determine how relative humidity has shifted over time. This month-wise analysis helps reveal seasonal patterns, such as the natural increase in humidity levels from March to June, just before the onset of the monsoon. *

The results indicate that relative humidity has generally increased across Tamil Nadu, particularly during the hotter months of May and June. Higher humidity in already hot conditions exacerbates heat stress, as it interferes with the body's ability to cool itself through sweating. When sweat does not evaporate efficiently, body temperature rises, increasing the risk of heat exhaustion and heat stroke. Understanding changes in both temperature and humidity is therefore crucial for identifying areas most at risk during extreme heat events and for improving heat-health warning systems.

1.4 Heat Action Plans (HAPs) in India

Despite the increasing risk of more frequent and intense heat extremes, this particular hazard has proven preventable from escalating into a disaster. The key to this prevention lies in the effective implementation of Heat Action Plans (HAPs) across India. HAPs are policy documents developed by state, district and city governments that provide a comprehensive framework to prepare for, respond to, recover from and learn from extreme heat events.

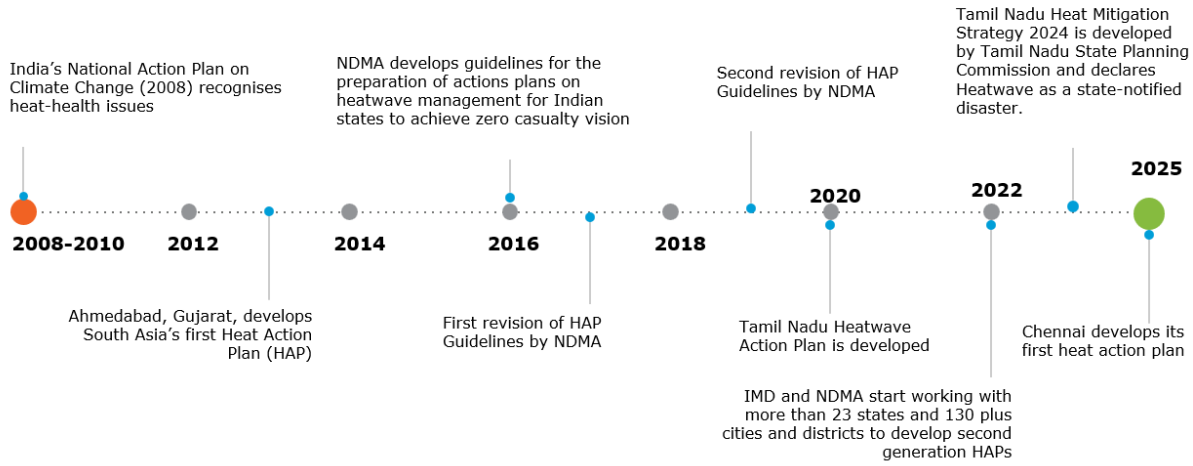
In 2016, the National Disaster Management Authority (NDMA) issued guidelines for developing HAPs, with a primary focus on enhancing the preparedness and response capacities of health systems and disaster management authorities. The overarching goal was to direct limited healthcare, financial, informational and infrastructural resources toward protecting those most vulnerable to extreme heat within a specific jurisdiction.

The guidelines were further revised in 2017 and in 2019, these guidelines were revised to incorporate short-, medium- and long-term strategies for heat risk reduction. The updated guidelines feature an eight-point checklist, highlighting the importance of effective coordination between agencies and stakeholders, mapping vulnerable and at-risk populations, establishing localized heat thresholds for early warning systems, creating a stakeholder responsibility matrix and outlining strategies for monitoring, evaluation and regular updates of the plans (NDMA 2019). The NDMA has also been conducting annual workshops with the nodal agencies, states, districts, municipalities, academia, civil society organizations and think tanks to enhance the preparedness before the heatwave season.

HAPs in India have demonstrated significant success in managing extreme heat, with studies showing a substantial reduction in heat-related mortalities

and helping administrations better respond to heatwaves. Notable examples include the cities of Ahmedabad in Gujarat State, Thane in Maharashtra State and Jodhpur in Rajasthan State, which have used scientific evidence-based assessments to identify heat thresholds and map heat risks down to the administrative ward level. Some studies indicate that Ahmedabad avoided an estimated 1,000 deaths annually (across all causes) in 2014–2015 compared to a baseline of 2007–2010, highlighting the tangible positive impact of HAP implementation (Hess et al., 2018).

Figure 4: Timelines of heat action plans in India and Chennai City



1.5 Nodal agencies

The Nodal Agencies for Heat Action Plans (HAPs), as outlined in the Ministry of Home Affairs' guidelines on combating extreme weather events—specifically heatwaves—are as follows:

1. National Disaster Management Authority (NDMA): At the national level, the NDMA issued the "National Guidelines for the Preparation of Action Plans – Prevention and Management of Heat Waves" in 2016. These guidelines serve as a framework for implementing, coordinating and evaluating activities related to extreme heatwaves in India. The NDMA revised these guidelines in 2017 and again in 2019 to enhance their effectiveness in managing heatwave risks.

2. India Meteorological Department (IMD): Working in close coordination with the NDMA, the IMD plays a critical role by focusing on early warnings and impact-based forecasts/alerts for heatwave events. These alerts help states implement timely and appropriate mitigation measures. As of 2024, IMD is also developing an India-specific Heat Hazard Index, which combines factors such as temperature, humidity, wind and the persistence of these variables to provide a more comprehensive heat risk assessment.

3. National Centre for Disease Control (NCDC): The NCDC monitors and compiles data on epidemic-prone diseases on a weekly basis, enhances the

capacity of medical personnel and provides certification for illness and casualties related to heatwaves. Recently, the NCDC released a template for the development of District Action Plans on Climate Change and Human Health (DAPCCHH) and formats for recording heat-related illnesses and mortalities.

4. State Governments: Several state governments have undertaken essential preparedness and mitigation measures to address heatwaves. In recent years, many states, districts and cities have developed and are actively implementing Heat Action Plans. These plans provide a comprehensive guide for state governments, district authorities and city administrations to implement measures aimed at preventing heat wave-related mortalities.

5. Municipalities: The implementation of HAPs is primarily led by municipal authorities, with support from district and state governments. Effective coordination is essential between various municipal departments and state and district nodal officers to ensure the timely dissemination of early warnings and the successful execution of HAPs. This coordination framework is outlined in the national guidelines and is crucial for minimizing the impacts of extreme heat.

2 Profile of Tamil Nadu state and Chennai City

2.1 Geographical and climatological profile of Tamil Nadu State and Chennai City

The State of Tamil Nadu, situated on the eastern side and forming the southernmost part of the Indian Peninsula, is the eleventh largest state in India, covering an area of 1,30,058 square kilometres. It has a coastline of about 1,076 km, accounting for nearly 15% of India's total coastal length and borders the Bay of Bengal to the east, the Indian Ocean to the south Andhra Pradesh to the north and Karnataka and Kerala to the west. Based on its physiographic characteristics, Tamil Nadu is divided into four major regions: the Coastal Plains, the Eastern Ghats, the Central Plateau and the Western Ghats. The flat, fertile eastern coastal plains are widest in the Kaveri River delta and become more arid further south. In contrast, the Western Ghats along the western border feature high mountain ranges such as the Nilgiri, Anaimalai and Palani hills, with Anai Mudi (Anai Peak) in the Anaimalai Hills being the highest at 2,695 metres above mean sea level. The Eastern Ghats and their outliers, including the Javadi, Kalrayan and Shevaroy hills, run through the central region with lower elevations. The diverse topography and coastal proximity of Tamil Nadu contribute to its tropical climate, characterized by minimal seasonal temperature variation throughout the year.

Chennai City is located on the Coromandel Coast in the northeastern part of Tamil Nadu and extends inland over an area of approximately 426 square kilometres. It positions itself on the southeastern coast of India. Chennai city lies on a flat coastal plain known as the Eastern Coastal Plains, with an average elevation of about 6.7 metres above sea level and a highest point reaching up to 60 metres. It is situated roughly 1,337 kilometres southeast of Mumbai and 345 kilometres east of Bangalore by road. The city is traversed by two major rivers—the Cooum River flowing through the central part and the Adyar River to the south which contribute to the city's hydrology and urban landscape.

Chennai experiences a tropical climate, influenced by its coastal location and low elevation, with warm temperatures prevailing throughout the year. According to the India Meteorological Department (IMD), the city recorded its hottest day of the year on March 6, when Nungambakkam and Meenambakkam stations reported maximum temperatures of 36.4°C and 37.7°C respectively which is, as recorded, well above their seasonal averages by 3.6°C and 4.3°C.

Administratively in Chennai District, the Chennai Metropolitan Area (CMA) includes 4 municipal corporations which are namely, the Greater Chennai Corporation, Avadi Corporation, Tambaram Corporation and Kancheepuram Corporation. The Greater Chennai Corporation, formerly known as the Madras Corporation, is the oldest municipal institution in India, established on September 29, 1688. Moreover, according to census 2011 the Greater Chennai Municipal Corporation has the total population of 6748026 persons.

2.2 Tamil Nadu Heat Mitigation Strategy 2024

The Heat Mitigation Strategy launched in 2024 focuses on tackling extreme heat events in Tamil Nadu through a structured approach under three key pillars: Health and Wellbeing, Ensuring Sustained Resources and Productivity and Cooling Solutions. Under the Health and Wellbeing component, the strategy emphasizes prioritizing access to cool, shaded spaces and clean drinking water, particularly for vulnerable populations such as school children, patients and the elderly. It also recommends training healthcare professionals and veterinarians in heat-related illness protocols and ensuring equitable access to healthcare resources. The strategy further calls for uninterrupted water and power supply to critical infrastructure such as hospitals, farms and remote areas, while promoting renewable energy solutions and rainwater harvesting. Additionally, it suggests using spatial mapping, AI and other technologies to improve disease surveillance, vaccine storage and integrate mitigation measures into existing welfare schemes.

The second component, Ensuring Sustained Resources and Productivity, aims to build resilience in agriculture and the economy through long-term planning. This includes developing detailed drought risk profiles at the state, district and local levels to enable targeted interventions. The strategy encourages crop diversification and improved market access for heat-tolerant crops. It also proposes financial incentives for adopting heat-resilient infrastructure and technologies, as well as strengthening cold chain logistics through public-private partnerships. Furthermore, tourism hubs are to be made heat-safe by implementing contingency plans that include shaded shelters, Oral Rehydration Solution (ORS) booths and public awareness drives.

The Cooling Solutions component advocates for environmentally sound and culturally relevant cooling techniques. It calls for scientific greening practices that align with local ecosystems, promoting the "plant with a plan" philosophy. Passive cooling solutions, such as cool roofs and green roofs, are encouraged to reduce indoor heat. The strategy also highlights the use of traditional construction materials like red oxide flooring and mud walls for their natural cooling properties. In addition, it mandates rainwater harvesting and wastewater management as tools to mitigate drought conditions. Finally, solar energy adoption is promoted to reduce dependence on water-intensive power generation, thereby enhancing both energy and water security in the face of rising temperatures.

3 Rationale, objectives and approach for Chennai City HAP development

3.1 Rationale for developing city level heat action plans

The National Disaster Management Act of 2005 mandates the preparation of disaster management plans at the national, state and district levels. While it does not explicitly require sub-divisional or city-level plans, it implies that the effectiveness of district-level plans relies on more localized analyses and adaptation strategies. Moreover, as per the Amendment to the DM Act 2024, cities will be required to form Urban Disaster Management Authorities (UDMAs), which will be implementing the city level plans and policies.

Additionally, the Constitution (Seventy-fourth) Amendment Act, 1992 (CAA), which came into effect on 1 June 1993, introduced Part IXA of the Constitution, granting constitutional status to Urban Local Bodies (ULBs). Article 243W of the CAA empowers state legislatures to enact laws that provide ULBs with the authority and responsibilities necessary to function as institutions of self-government. It also emphasizes the devolution of powers and responsibilities to these local bodies.

The XII Schedule of the Constitution outlines 18 key functions to be devolved to ULBs, including:

1. Urban planning, including town planning.
2. Regulation of land use and construction of buildings.
3. Planning for economic and social development.
4. Roads and bridges.
5. Water supply for domestic, industrial and commercial purposes.
6. Public health, sanitation, conservancy and solid waste management.
7. Fire services.
8. Urban forestry, environmental protection and ecological promotion.
9. Safeguarding the interests of weaker sections of society, including individuals with disabilities.
10. Slum improvement and upgradation.
11. Urban poverty alleviation.
12. Provision of urban amenities such as parks, gardens and playgrounds.
13. Promotion of cultural, educational and aesthetic aspects.
14. Burial and cremation grounds, including electric crematoriums.
15. Cattle pounds and prevention of cruelty to animals.
16. Vital statistics, including the registration of births and deaths.
17. Public amenities such as street lighting, parking lots, bus stops and public conveniences.
18. Regulation of slaughterhouses and tanneries.

By focusing on mitigation, preparedness and response measures to a disaster, ULBs can play a crucial role in addressing the rising frequency and intensity of extreme heatwaves, safeguarding their communities and fostering resilience.

3.2 Objectives of Chennai city HAP

The Chennai city Heat Action Plan 2025 has been developed based on a comprehensive heat mitigation strategy. The plan adopts a holistic framework that integrates many factors to formulate effective, localized heat action strategies.

The Chennai city HAP is uniquely designed to map heat risks at the administrative ward level, providing targeted mitigation, preparedness and response strategies tailored for specific stakeholders and departments.

The mission of the Chennai city HAP is to achieve:

- **Zero heat-related mortalities**
- **Reduced heat-induced illnesses and stress**
- **Minimized economic losses across key sectors**

Objectives

To achieve this mission, the Chennai city HAP focuses on the following objectives:

1. **Granular Mapping of extreme heat indices**
    - Map heat hazards under various climate change scenarios.
    - Establish localized heat-health thresholds for early warning systems.
    - Identify vulnerable populations for targeted interventions.

2. **Effective Preparedness and Response**
    - Design and implement preparedness and response strategies, focusing on health and disaster management.
    - Ensure zero heat-related fatalities through coordinated efforts.

3. **Reducing Heat-Health Risks**
    - Mitigate heat stress and heat-related illnesses through robust tracking and surveillance systems.
    - Deploy innovative cooling solutions to protect vulnerable populations.

4. **Minimizing Economic Losses**
    - Implement region-specific heat risk mitigation strategies to reduce long-term economic impacts across sectors.

5. **Capacity Building for Stakeholders**
    - Build the capacity of stakeholders to effectively prepare for and respond to heat events.
    - Periodically review and refine the Heat Action Plan to ensure its relevance and effectiveness.

The Chennai city HAP further aims to identify the integration of heat resilience solutions into long term urban planning for the city. It aims to protect lives, improve health outcomes and mitigate economic impacts by addressing the growing risks of extreme heat. With its localized and data-driven approach, the plan aims to set a replicable model for other cities, which grapple with the combined impacts of heat and humidity.

3.3 Approach for development of Heat Action Plan of Chennai city

To develop this Heat Action Plan, a multidisciplinary approach was adopted, integrating technical tools, scientific analysis, policy evaluation and stakeholder engagement. The plan builds upon the guidelines established by the NDMA in 2019 for Heat Action Plans and the National Disaster Management Plan 2019, providing a comprehensive framework for effective heat action. This framework focuses on three key components:

i) **When to take action**
ii) **Where to take action**
iii) **Who will take action and what actions will be taken**

Further details of this framework are provided in Figure 5. By following this structured approach, the plan ensures targeted, timely and coordinated responses to heat risks.

Figure 5: Framework for development of the Chennai city HAP

When to take action?	Where to take action?	Who will and how to take action?
Establishment of **city-specific heat thresholds** based on biometeorological indices	**Ward level heat risk index** based on IPCC AR5 risk assessment framework to map at risk wards	Line department wise **responsibility matrix** for actions to be taken for mitigation, preparedness and response
Recalibration of alert systems based on established thresholds to provide colour-coded impact-based early warnings	Combining climate, socio-economic and geospatial indicators to map **factors leading to high risk** in each ward	Development of **IEC strategies** for effective communication

Recent studies analysing existing HAPs in India have identified several design gaps in them. These gaps encompassed the absence of localised heat hazard and threshold mapping, insufficient vulnerability and heat risk assessments and a lack of identification of financing mechanisms (Pillai and Dalal 2023). Consequently, to establish the Chennai city HAP as a second-generation plan and as a template plan for other cities with similar climatic conditions to

replicate, the approach was tailored to address these gaps. This HAP will be further revised going further to make it more recent versions more and more comprehensive.

The approach to developing the Chennai city HAP underwent rigorous validation through extensive stakeholder consultation where various stakeholders actively participated. The consultations centred around presenting climatological analysis, the heat risk index with its indicators and the locally developed heat thresholds. Further details on these aspects, along with the stakeholder responsibility matrix, are elaborated in subsequent chapters of this heat action plan.

Furthermore, since the primary focus of the HAP is the long-term mitigation of risks from extreme heat, significant emphasis has been placed on urban greening solutions. A detailed financial breakdown and cost estimation for these solutions are also provided in the respective chapters.

4 Heat Hazard, Vulnerability and Risk assessment for Chennai City

Heat impacts are not uniform and vary significantly depending on exposure and vulnerability, even within the same city. While climate science agrees that climate change has increased the frequency, intensity and duration of extreme heat events, their risks are shaped by local population dynamics and socio-economic factors.

Many city-level Heat Action Plans (HAPs) in India have introduced response mechanisms, such as heat-health warning systems, to address heat as a hazard. These systems provide essential information about the health implications of extreme heat conditions, helping decision-makers determine 'when to take action.' However, these warnings are often issued at broad regional scales, lacking the detailed insights required to identify variations in vulnerabilities and risks within a city. Localized understanding, helps prioritize e actions based on data. A truly comprehensive HAP requires a clear understanding of sub-city-level at-risk populations, a critical component missing in nearly 95 per cent of Indian HAPs (Pillai and Dalal, 2023).

To bridge this gap, the Chennai city Heat Action Plan incorporates ward-level analysis of heat risks. This analysis is conducted following the Intergovernmental Panel on Climate Change's (IPCC) climate risk framework, which evaluates heat risks through a granular assessment of:

- observed heat extremes (1982–2022) and projected trends (2022–2050) using historical climate data and future projections. [12Km resolution]
- exposure mapping, including urban heat islands identified through satellite imagery. [30 M resolution]
- socio-economic vulnerability mapping, using official data collated by the Chennai city Corporation. [Ward level]

This localized approach enables decision-makers to not only identify 'when to take action' but also 'where to prioritise action'.

4.1 Mapping of heat and humidity hazards over Chennai city

In the context of rapid climate change, understanding local-level shifts in climatic variables is essential for effective action plan formulation. This section presents an analysis of climatological changes in Chennai city, focusing on heat extremes over observed (1982–2022) and projected (up to 2050) time periods. The analysis employs indices recommended by the World Health Organization (WHO), World Meteorological Organization (WMO) and India Meteorological Department (IMD). It is based on high-resolution climate data obtained from the Ministry of Earth Sciences (MoES) and climatological models developed by the Indian Institute of Tropical Meteorology (IITM).

To analyse observed and projected trends in both day-time and night-time heat extremes, this study uses a combination of data from:

- Indian Monsoon Data Assimilation and Analysis (IMDAA) [~12Km resolution]
- India Meteorological Department (IMD) gridded data [~100Km]
- CORDEX-SA regionally downscaled models (RegCM4) developed by the Indian Institute of Tropical Meteorology (IITM) [Downscaled from 44Km to 12 Km approx.]

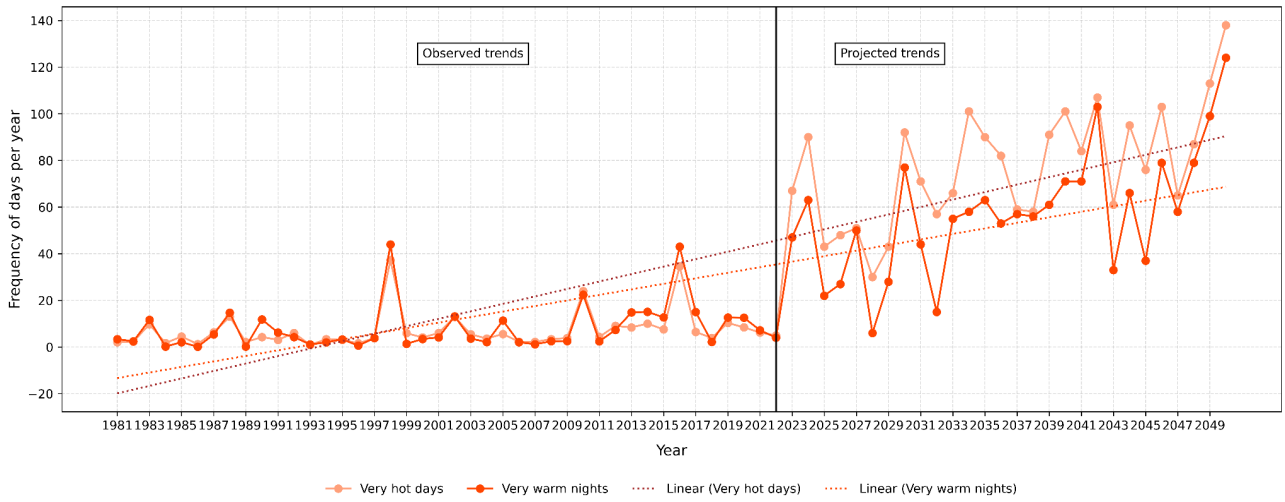
Details regarding the models, downscaling methodology, bias correction and data processing are available in Annexure of this report.

The analysis focuses on the frequency of extreme hot days and warm nights, projecting changes in Chennai city's heat extremes under the representative concentration pathway (RCP) 4.5 scenario. RCP 4.5 represents a mid-emission pathway aligned with India's and Tamil Nadu's net-zero targets.

The indices for extreme hot days and extreme warm nights are derived using the 95th percentile threshold of the baseline (1982–2011) for individual months from March to June. The number of days exceeding this threshold has been calculated for each year from 1981 up to 2050.

This granular analysis provides critical insights into how heat extremes in Chennai city are expected to evolve, enabling the formulation of targeted strategies to mitigate heat risks and build resilience at the local level.

Figure 6: The increase in frequency of extreme warm nights is projected to be of greater magnitude than extreme hot days up to 2050 over Chennai City



The trends indicate a steady increase in the frequency of extreme hot days from 2024 to 2050, compared to the period between 1982 and 2024. Notably, the frequency of warm nights is projected to rise to nearly 40-45 days annually during the summer (March to June). The heightened occurrence of warm nights is linked to the urban heat island effect, where building structures and other built-up areas like concrete roads trap the heat and impede the upward movement of ground heat during the day-time, resulting in warmer night-time temperatures (Parker 2010; Nichol 2005).

This surge in both extreme hot days and warm nights presents substantial challenges for Chennai city's population. Warmer nights hinder the cooling of human bodies from daytime temperatures, compounded by the augmented heat stress due to increased relative humidity. Addressing these challenges, the heat action plan outlines long-term strategies for heat risk mitigation in the subsequent sections.

To understand the aggravated heat impacts by humidity with temperature and establish the thresholds for felt temperature—a crucial factor in comprehending heat stress in regions experiencing both high heat and humidity—the heat index developed by Steadman in 1979, widely utilised by the National Oceanic and Atmospheric Administration (NOAA) has been used.

The human body typically regulates its temperature through the evaporation of sweat. Elevated relative humidity diminishes evaporation and the cooling effect, amplifying discomfort and the potential for heat stress. Individuals may perceive heat differently due to factors such as body shape, metabolism, hydration level, pregnancy, or other physical conditions. The heat index (HI) serves as an indicator that combines air temperature and relative humidity in shaded areas, presenting an equivalent temperature perceived by humans – essentially, how hot it would feel if the humidity were at a different value in the shade. For instance, when the temperature reads 32 °C with 70 per cent relative humidity, the heat index is 41 °C.

Figure 7: The heat index matrix

Heat Stress Index															
Temperature (°C)	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
27	26.4	26.6	26.9	27.1	27.4	27.7	28.1	28.5	28.9	29.3	29.7	30.2	30.7	31.3	31.8
28	27.1	27.4	27.7	28	28.4	28.9	29.4	30	30.7	31.4	32.1	32.9	33.7	34.7	35.6
29	27.9	28.2	28.6	29.1	29.7	30.3	31	31.8	32.7	33.7	34.7	35.9	37.1	38.4	39.7
30	28.8	29.2	29.7	30.3	31	31.9	32.8	33.9	35	36.3	37.7	39.1	40.7	42.4	44.2
31	29.7	30.3	30.9	31.7	32.6	33.7	34.8	36.2	37.6	39.2	40.9	42.7	44.7	46.8	49
32	30.8	31.5	32.3	33.2	34.4	35.6	37.1	38.7	40.4	42.3	44.4	46.6	49	51.5	54.2
33	32	32.8	33.8	34.9	36.3	37.8	39.5	41.4	43.5	45.7	48.1	50.8	53.5	56.5	59.7
34	33.3	34.3	35.4	36.8	38.4	40.2	42.2	44.4	46.8	49.4	52.2	55.2	58.4	61.9	65.5
35	34.7	35.8	37.2	38.8	40.7	42.7	45.1	47.6	50.3	53.3	56.5	60	63.7	67.6	71.7
36	36.2	37.5	39.1	41	43.1	45.5	48.1	51	54.2	57.5	61.2	65.1	69.2	73.6	78.2
37	37.8	39.3	41.2	43.4	45.8	48.5	51.4	54.7	58.2	62	66.1	70.4	75.1	80	85.1
38	39.4	41.3	43.4	45.9	48.6	51.6	55	58.6	62.5	66.7	71.3	76.1	81.2	86.6	92.4
39	41.2	43.3	45.8	48.5	51.6	55	58.7	62.7	67.1	71.8	76.8	82.1	87.7	93.7	99.9
40	43.1	45.5	48.3	51.3	54.8	58.5	62.6	67.1	71.9	77	82.5	88.3	94.5	101	107.9
41	45.1	47.8	50.9	54.3	58.1	62.3	66.8	71.7	77	82.6	88.6	94.9	101.6	108.7	116.1
42	47.2	50.3	53.7	57.5	61.7	66.2	71.2	76.5	82.3	88.4	94.9	101.8	109	116.7	124.8
43	49.4	52.8	56.6	60.8	65.4	70.4	75.8	81.6	87.8	94.5	101.5	108.9	116.8	125.1	133.7
44	51.7	55.5	59.6	64.2	69.3	74.7	80.6	86.9	93.6	100.8	108.4	116.4	124.9	133.7	143
45	54.1	58.3	62.8	67.9	73.3	79.2	85.6	92.4	99.7	107.4	115.6	124.2	133.2	142.7	152.7
46	56.6	61.2	66.2	71.6	77.6	84	90.9	98.2	106	114.3	123	132.2	141.9	152.1	162.7
47	59.2	64.2	69.6	75.6	82	88.9	96.3	104.2	112.6	121.4	130.8	140.6	150.9	161.7	173
48	62	67.4	73.3	79.7	86.6	94	102	110.4	119.4	128.8	138.8	149.3	160.2	171.7	183.7
49	64.8	70.6	77	83.9	91.4	99.4	107.9	116.9	126.4	136.5	147.1	158.2	169.9	182.1	194.8
50	67.7	74	80.9	88.4	96.4	104.9	114	123.6	133.7	144.4	155.7	167.5	179.8	192.7	206.2

Source: DoM, Sri Lanka

To compute the heat index, the biometeorological formula illustrated in Figure 8, comprising 9 constants and 3 variables was applied. The inputs for calculating the heat index variable included the relative humidity in percentage and the 2m dry air temperature in °F, grid covering Chenai city corporation (12Km resolution), derived from the IMDAA hourly reanalysis data over Chennai city from 1982 to 2022 for the months of March to June. The resulting heat index variable was then converted from °F to °C. The outputs of the heat index are referred to as 'felt temperature' or 'felt heat' for the sake of consistency and ease of interpretation.

Figure 8: Bio-meteorological formula used for developing heat index

$$\mathrm{HI} = c_1 + c_2 T + c_3 R + c_4 T R + c_5 T^2 + c_6 R^2 + c_7 T^2 R + c_8 T R^2 + c_9 T^2 R^2$$

where

HI = heat index (in degrees Fahrenheit)

T = ambient dry-bulb temperature (in degrees Fahrenheit)

R = relative humidity (percentage value between 0 and 100)

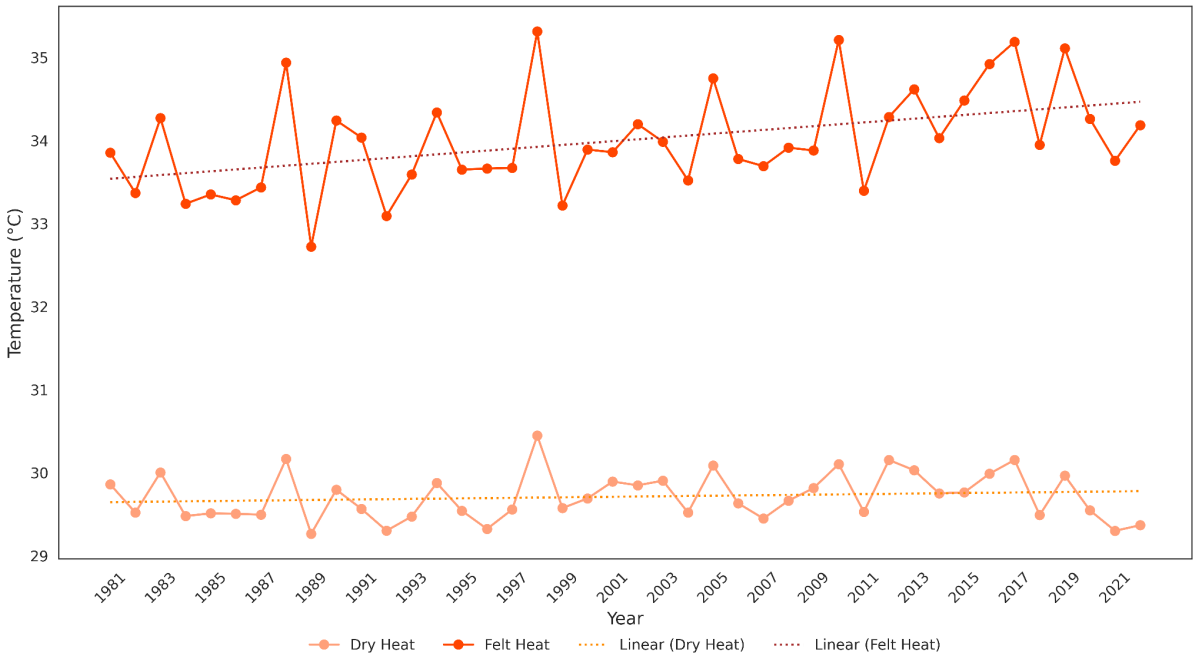
$$c_1 = -42.379, \quad c_2 = 2.049\,015\,23, \quad c_3 = 10.143\,331\,27,$$
$$c_4 = -0.224\,755\,41, \quad c_5 = -6.837\,83 \times 10^{-3}, \quad c_6 = -5.481\,717 \times 10^{-2},$$
$$c_7 = 1.228\,74 \times 10^{-3}, \quad c_8 = 8.5282 \times 10^{-4}, \quad c_9 = -1.99 \times 10^{-6}.$$

Source: Steadman 1979

Analysis of the heat index indicates that Chennai city reported a significant increase in both felt and dry maximum temperatures during the summer

months in the last forty years (1982-2022). However, the difference between the felt and dry temperatures was also found to be slightly increasing in the recent few years, with 2022 for example having the felt heat being higher by almost 5°C than dry heat due to the added impacts of humidity as can be seen in Figure 9.

Figure 9: Trends in average maximum summer dry heat and felt heat (HI) over Chennai city from 1981-2022



4.2 Mapping of surface land temperatures to quantify the urban heat island impacts

While air temperature provides critical insights into its effects on human health, land surface temperature (LST) is equally important in understanding city-level heat extremes, particularly its role in the formation of urban heat islands (UHI).

LST measures the Earth's surface temperature and is detected using remote sensing instruments. It provides key insights into the thermal properties of different land cover types. Urban Heat Islands (UHI) occur when urban areas are significantly warmer than surrounding rural regions due to human activities and changes to the natural environment. Urban areas, dominated by buildings, roads and other infrastructure often made of materials like cement, steel and bricks, absorb and retain large amounts of heat. The lack of green spaces exacerbates this effect, as solar radiation heats these surfaces, trapping warmth and raising temperatures, especially during the night.

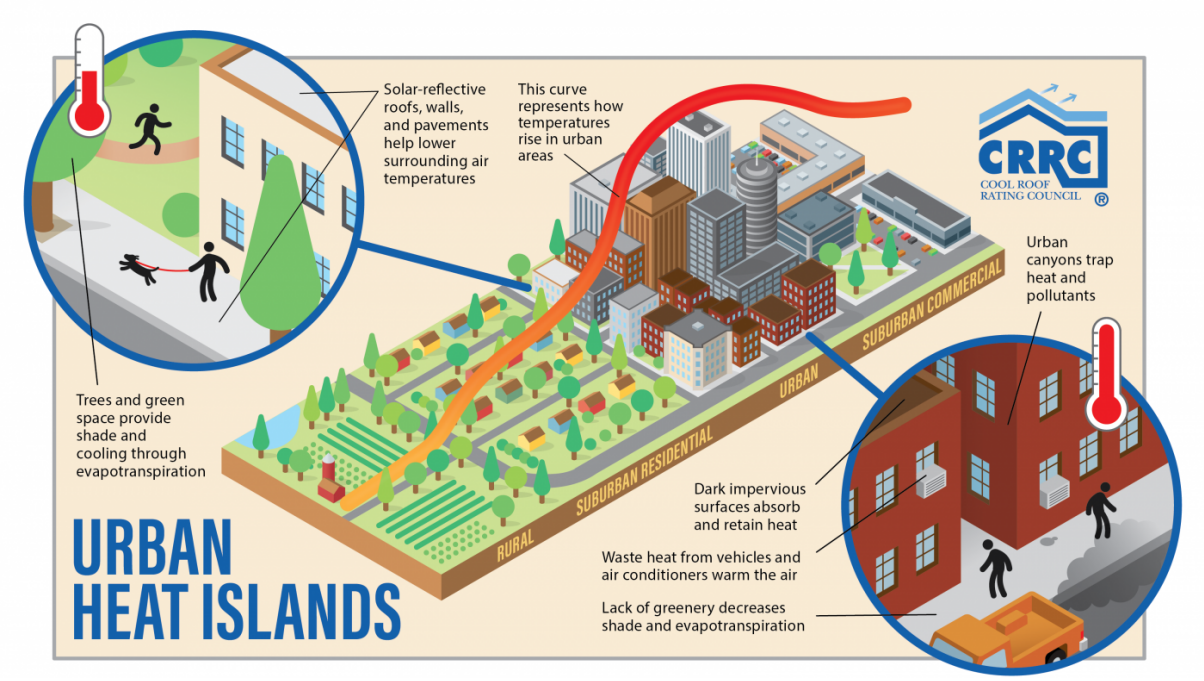
Elevated surface temperatures not only contribute to higher air temperatures but also exacerbate the impacts of extreme heat. UHIs amplify discomfort, increase heat-related illnesses and mortality and drive-up energy costs as

residents rely more heavily on-air conditioning. This also leads to higher air pollution due to increased energy consumption.

The adverse effects of urban heat are not evenly distributed and disproportionately affect marginalized communities, who often lack access to resources like cooling systems or green spaces, compounding their vulnerability (Hsu et al., 2021; Hoffman et al., 2020; Wilson, 2020).

Understanding and addressing LST and UHIs is essential for developing effective urban heat mitigation strategies, reducing health risks and promoting equitable urban resilience.

Figure 10: How urban heat islands develop and create heat risk

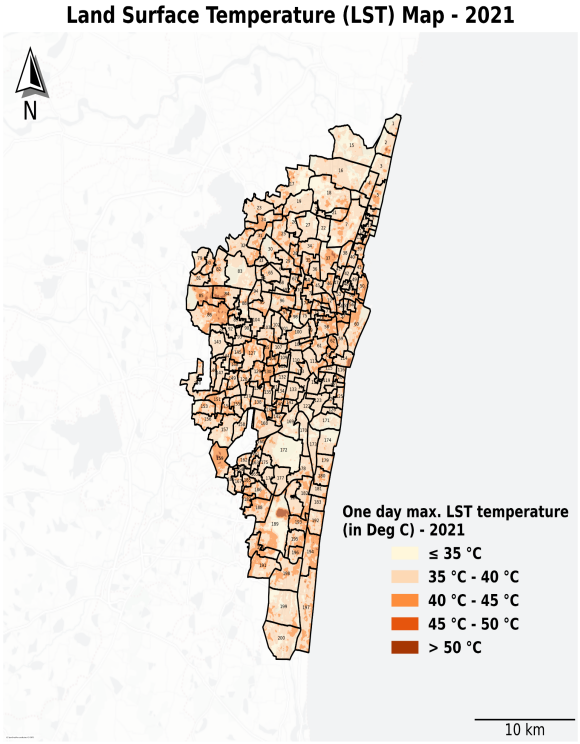


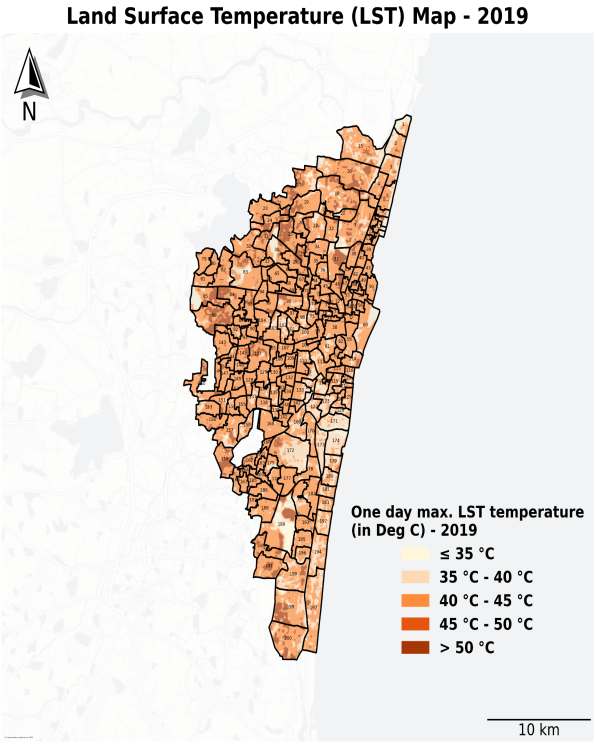
Source: Cool Roof Rating Council 2023

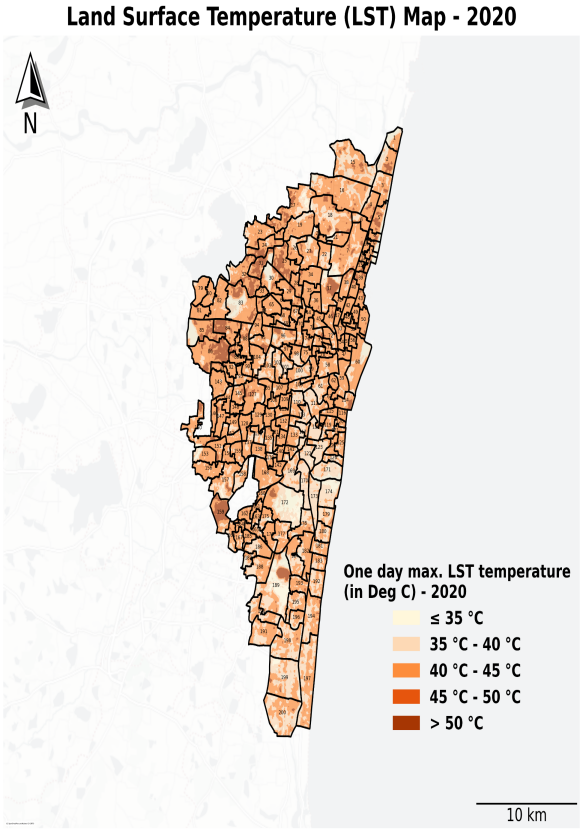
Land surface temperature data identifies cool and hot spots within the city. Cool spots, with lower temperatures, may indicate green spaces or bodies of water mitigating UHI effects, while hot spots signal more intense UHI, often linked to high-density development or insufficient green infrastructure. By understanding LST patterns, city planners can formulate targeted strategies, like green roofs or increased tree canopy cover, to mitigate UHI effects in specific areas.

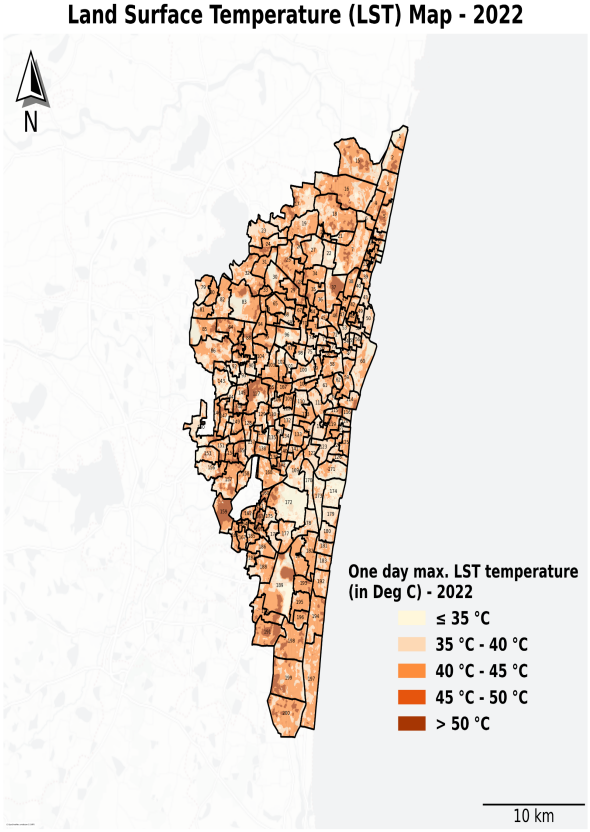
For Chennai city HAP, LST mapping over the last six years (2019-2024) used Landsat 8 satellite imagery at a 30-metre spatial resolution. This data aids in identifying UHI hotspots, guiding strategies like cooling shelters and greening interventions based on spatial and thermal information. Temporal variations in LST highlight areas consistently experiencing elevated temperatures, indicating potential UHI hotspots. The complete detailed methodology of the LST quantification can be found in the Annexure 1 of this plan.

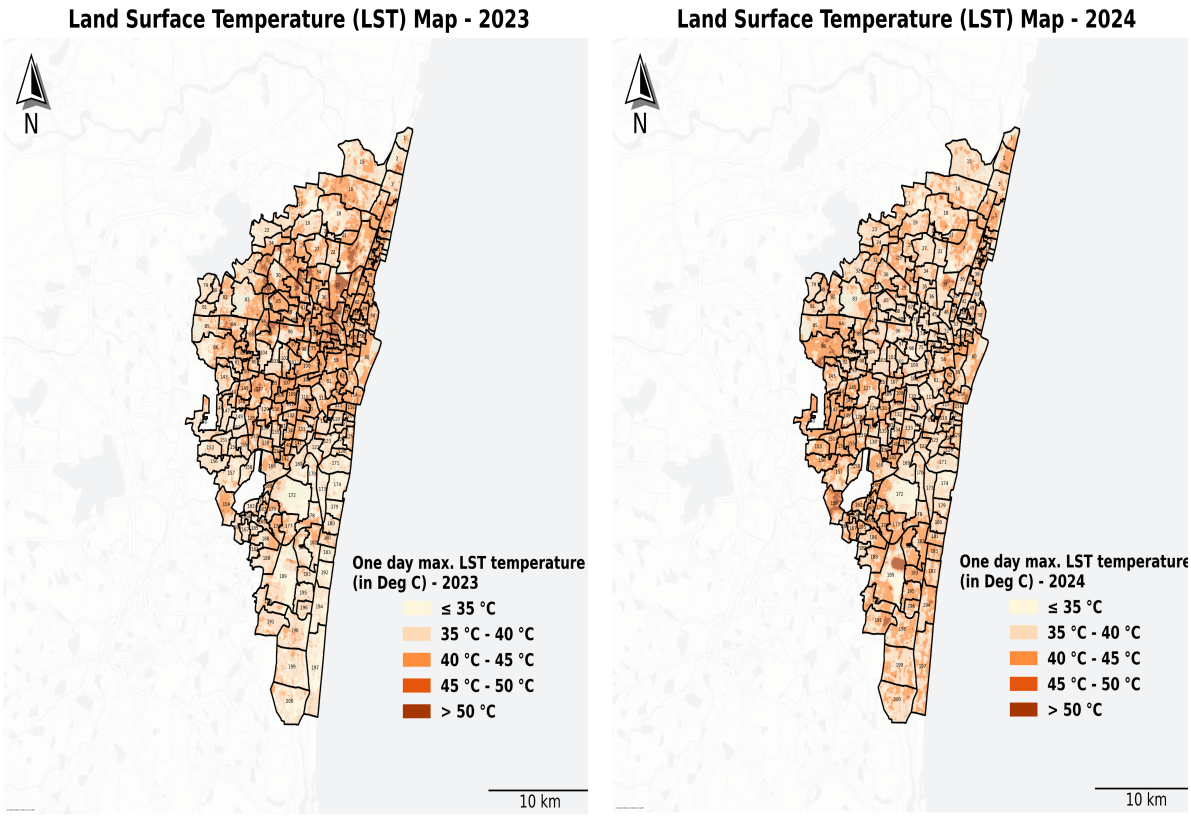
Figure 11: Highest day maximum land surface temperature (LST) from March to June (2019-2024).











4.3 Mapping of ward level heat risks over Chennai City

To strengthen the 'where to take action' aspect of Chennai City's Heat Action Plan (HAP), this study introduces a ward-level heat risk index. The index evaluates extreme heat exposure and vulnerability across Chennai city's wards, assigning risk scores to enable targeted interventions.

Heatwave risks arise from the interplay of socio-economic, physiological, climatological and behavioural factors. Changes in any of these variables can significantly alter the state of risk, either amplifying or mitigating it. This analysis systematically identifies the factors contributing to heat risk in each ward, paving the way for tailored adaptation and mitigation strategies.

The ward-level heat risk index was developed following the IPCC Fifth Assessment Report (AR5) framework, a globally recognized methodology for climate risk assessment, also endorsed by the Department of Science and Technology (DST) for national-level evaluations. This framework, supported by the Ministry of Environment, Forests and Climate Change (MoEFCC) in India, conceptualizes risk as the outcome of interactions between vulnerability, exposure and hazard.

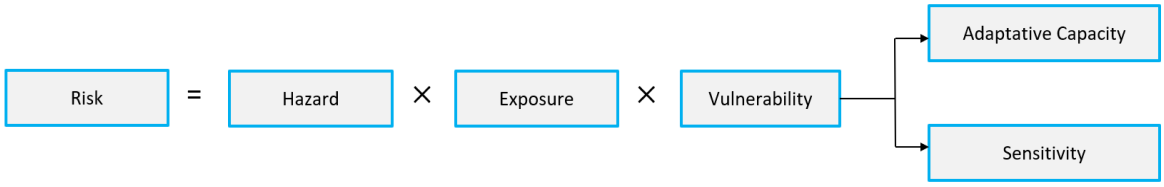
Risk here is defined as: *"Risk refers to the potential for adverse consequences for human or ecological systems, recognizing the diversity of values and objectives associated with such systems. In the context of climate change, risks emerge from potential impacts of climate change and human responses*

to it. Relevant adverse consequences include impacts on lives, livelihoods, health, infrastructure, ecosystems and species."

The risk assessment framework comprises three key components:

1. Hazards: Climatic events that pose threats, such as extreme heat.
2. Exposure: Populations, infrastructure, or systems at risk of being affected by hazards.
3. Vulnerability: A function of two sub-components:
    - Sensitivity: The degree to which a system or population is affected by climate variability or change.
    - Adaptive Capacity: The ability of systems, institutions and individuals to adjust to potential damage, seize opportunities, or respond to impacts.

Figure 12: Risk assessment equation



A robust risk assessment requires a systematic, multistep process guided by clear goals and objectives. These goals shape the type, scale, tier, indicators and methods of the assessment. Risk can be assessed through two primary approaches:

- Starting Point/ Contextual Approach: Views risk as a pre-existing condition within a system in anticipation of a hazard.
- The second is an endpoint/ Outcome Approach: Focuses on assessing risk before and after exposure to a hazard (DST, 2019; Kelly, 2000).

For this action plan, the starting point/ contextual approach was adopted to identify risks based on pre-existing conditions in Chennai city. This assessment, centred on current climate hazards, provides insights into existing vulnerabilities within natural and socio-economic systems. It identifies the factors contributing to these vulnerabilities, forming the basis for strategies to address weaknesses and enhance resilience.

The first step involved selecting indicators for each risk component—hazard, exposure and vulnerability. Indicators are variables that represent complex phenomena in measurable terms. They allow for the relative assessment of a system's risk profile and are valuable tools for planning, monitoring and evaluating development interventions over time (Crane et al., 2017).

In this analysis, indicators were chosen based on:

- Review of relevant literature to align with established risk determinants.
- Data availability at the sub-city level for granular insights.
- Stakeholder consultations to ensure relevance and applicability.

The selected indicators reflect the multidimensional nature of risk and provide a framework for targeted action. Detailed lists of these indicators, including their data sources and rationale, are provided in Tables 1 to 3.

This structured approach ensures a comprehensive understanding of heat risks in Chennai City, enabling the design of effective mitigation and adaptation strategies.

Table 1: Indicators selected for computing heat hazard at ward level

Indicator	**Description**	**Relation to heat risk**	**Data source**
Increase in frequency of very hot days	An increase in frequency of day-time, night-time extremes and felt temperatures will directly lead to higher risk. The indicators have been calculated as increase in the indicator in the last decade (2012-2022) compared to climatic baseline (1982-2011)	Direct	CEEW analysis based on IMDAA reanalysis data at 12 km resolution from 1982-2022
Increase in frequency of very warm nights		Direct	
Increase in heat index		Direct	
Decrease in rainy days	A decrease in number of rainy days will lead to compounding impacts on increasing heat extremes	Direct	
Land Surface temperatures (LST)	LST aids in pinpointing hotspots in specific areas prone to elevated heat conditions, primarily attributed to the urban heat island phenomenon.	Direct	CEEW analysis based on Landsat8 data at 30m resolution

Table 2: Indicators for exposure component

Indicator	Description	Relation to heat risk	Data source
Population density	Urban areas with high population density often face heightened vulnerability due to inadequate infrastructure, limited access to cooling resources and elevated socio-economic disparities, worsening the impact of extreme heat events on health.	Direct	Greater Chennai Corporation
Percentage of built-up area to total geographical area	Areas with high levels of impervious surfaces such as roads and buildings may experience higher temperatures due to the urban heat island effect and the trapping of heat.	Direct	CEEW analysis based on Land Use Land Cover Analysis from Sentinel 2A at 10 m resolution, 2022
Building density	High building density exacerbates heat exposure by intensifying the urban heat island effect, trapping and radiating heat, elevating temperatures.	Direct	CEEW analysis based on Google building footprint data, 2023

Table 3: Indicators for vulnerability

Indicator	Description	Relation to heat risk	Data source
Sex ratio	Women often face greater vulnerability to disasters, particularly in developing nations. Social and economic factors can magnify the impact of extreme heat on females, including gender-based inequalities in healthcare,	Direct	Greater Chennai Corporation

	education and economic opportunities.		
Number of slum households	Slum populations face higher exposure to extreme heat due to poor housing, overcrowding and lack of green spaces, intensifying the urban heat island effect, limited access to electricity, cooling appliances, clean water and healthcare increases their susceptibility to heat-related illnesses.	Direct	
Illiteracy rate	Individuals with lower literacy rates may be more vulnerable to extreme heat events due to reduced awareness of potential dangers and limited access to heat alerts.	Direct	
Green spaces	Normalised Difference Vegetation Index (NDVI) is a remote sensing index employed to evaluate the health of vegetation. Higher NDVI values represent dense and healthy vegetation, which can be used as an indicator to depict green spaces that bring the cooling effect	Inverse	CEEW analysis based on Landsat8 imagery, 2023
Proportion of young population to total population (below 5 years)	It is widely acknowledged by the World Health Organisation and NDMA guidelines that the young and old population is more vulnerable towards extreme heat due physiological factors and pre-existing health conditions. Limited adaptive capacity, behavioural considerations and the urban heat island effect further exacerbate this vulnerability.	Direct	Greater Chennai Corporation
Proportion of old population to total population (above 65 years)			
Proportion of population with chronic health conditions	Heat can lead to severe dehydration, acute cerebrovascular accidents and contribute to thrombogenesis (blood clots). Those with	Direct	Health department, Chennai city 2025

	chronic diseases on daily medications face an elevated risk of complications and death during heatwaves, along with older individuals and children (WHO 2018, WHO 2004)		
Proportion of population with disabilities (Both physical and mental)	Individuals with disabilities often face heightened risks during extreme heat events due to physical, social and economic barriers. These barriers can limit access to emergency services, exacerbate health risks and disrupt essential caregiving and support systems.	Direct	Greater Chennai Corporation
Access to water sources	Access to water sources is crucial in dealing with extreme heat. Water sources additionally reduce heat risk by moderating temperatures through evaporation and creating localised cooling.	Inverse	CEEW analysis based on Modified Normalised Difference Water Index (MNDWI), 2023 from Landsat8 satellite imagery
Number of Automatic Weather Stations (AWS) per sq. km	A higher number of Automatic Weather Stations (AWS) facilitates the recording of localised meteorological data, enabling timely alerts for extreme heat. Moreover, it contributes to the enhancement of long-term forecasting systems.	Inverse	Greater Chennai Corporation, 2025
Access to road networks	It ensures quick mobility to healthcare, cooling centres, and emergency services during extreme heat events. A well-connected road system allows faster response times and better access to essential	Inverse	Greater Chennai Corporation

	resources, reducing heat-related risks.		
Number of parks per square kilometre	It plays a crucial role in reducing heat stress by mitigating the urban heat island (UHI) effect. Green spaces provide shade, lower local temperatures through evapotranspiration, and improve air quality, benefiting public health.	Inverse	Greater Chennai Corporation
Number of health centres per thousand population	It is a key indicator of a city's ability to respond to climate-induced health risks, especially during heatwaves. A higher density of health facilities ensures quicker access to medical care for heat-related illnesses like dehydration, heat strokes, and cardiovascular issues.	Inverse	Greater Chennai Corporation
Schools with open spaces	This indicator can be utilized to mitigate the impacts of heat through urban greening efforts and aid in heat mitigation by building temporary shelters during heatwave seasons for the homeless	Inverse	Greater Chennai Corporation
Number of minor water bodies	Water bodies such as ponds, lakes, rivers, canals and reservoirs have the potential to influence urban climates by altering the surrounding temperature and humidity	Inverse	Greater Chennai Corporation

	through various heat transfer mechanisms		

The development of the heat risk index at the ward level was heavily influenced by data availability, ensuring that the indicators selected provided a robust and granular understanding of heat risk. The selection process was guided by a comprehensive review of national and global literature, as well as recent heat action plans from Indian cities such as Jodhpur (2023) and Ahmedabad (2019) (Qureshi and Rachid, 2022; Wu et al., 2022a; Liu et al., 2020; Adnan et al., 2022; Xiang et al., 2022; Sidiqui et al., 2022; Estoque et al., 2020; Zhang, McManus and Duncan, 2018; Abrar et al., 2022; Cai et al., 2019; Inostroza, Palme and De La Barrera, 2016; Conlon et al., 2020; Rathi et al., 2022; Leal Filho et al., 2018; Nanda et al., 2022; Johnson et al., 2012). Additionally, stakeholder consultations with key line departments involved in the heat action plan played a crucial role in shaping the final set of indicators.

The selected indicators reflect both direct and inverse relationships with heat risk. For example:

- Direct relationship: An increase in the proportion of the population with chronic health conditions indicates greater vulnerability, thereby increasing heat risk.
- Inverse relationship: Improved access to water resources reduces vulnerability, consequently lowering heat risk.

This dual perspective ensured a comprehensive representation of factors contributing to heat risk across wards.

The indicators were normalised to bring all the indicators to a common scale and to make them unit-free by the min-max normalisation technique in case of indicators related to exposure, vulnerability and hazard. Due to certain gaps where data was not available at ward level, the citywide data was disaggregated based on population apportionment method. Normalisation is based on the indicators' functional relationship with vulnerability. For positively related indicators, i.e., where risk increases with an increase in the value of the indicator, the following formula is used.

$$x^{P}_{ij} = \frac{Xij - \text{Min}_i\{Xij\}}{\text{Max}_i\{Xij\} - \text{Min}_i\{Xij\}}$$

For negatively related indicators, i.e., where vulnerability decreases with an increase in the value of the indicator, the following formula was used:

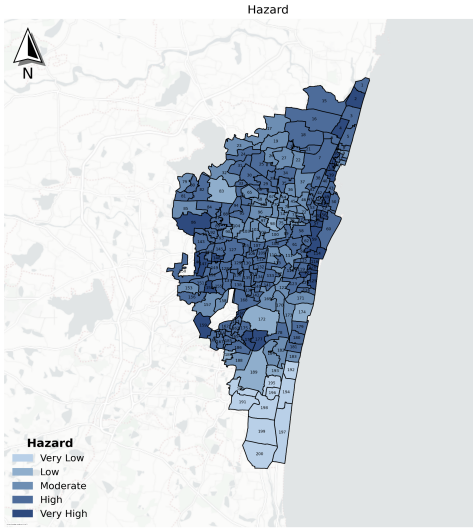
$$x^{N}_{ij} = \frac{Max_i\{Xij\} - Xij}{Max_i\{Xij\} - Min_i\{Xij\}}$$

Normalised values of an indicator will lie between 0 and 1. The value 1 will correspond to a ward with maximum risk and 0 will correspond to a ward with minimum vulnerability with respect to a particular indicator. Due to a lack of information on indicator weightages contributing to heat risk in the Indian context and the absence of these weightages in existing Indian HAPs and literature, an equal weightage approach has been used when calculating scores for each risk component.

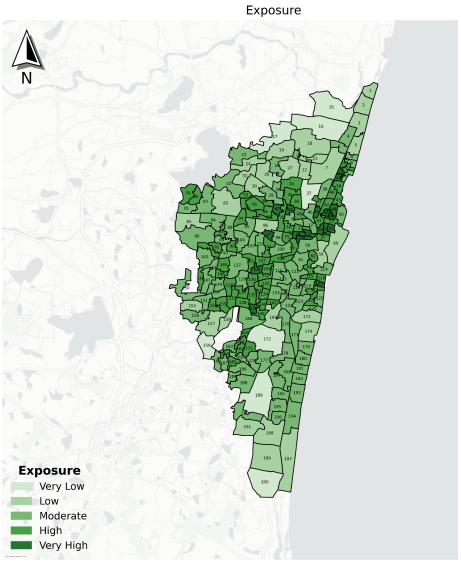
This meticulous approach to indicator selection and normalization ensures that the heat risk index accurately reflects the varying levels of risk across Chennai city's wards, supporting informed decision-making for targeted interventions. The risk map categorisation was done using equal interval classification method, where on a final scale of 0-1, those wards which received between 0-0.2 fell in very low risk category, those in 0.2-0.4 in low risk, 0.4-0.6 in moderate risk, 0.6-0.8 high risk, 0.8-1 is very high-risk category.

Figure 13: Findings from the heat risk index for Chennai City

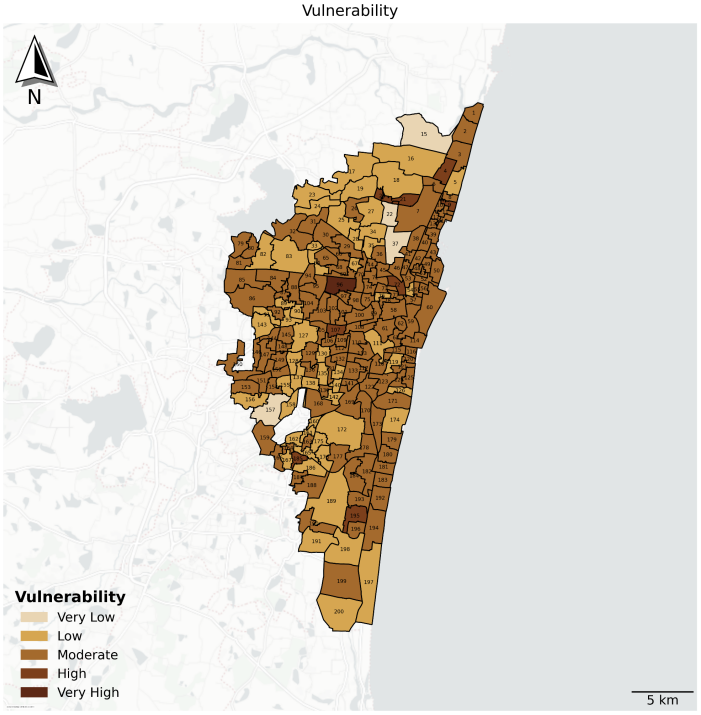
a) Hazard Index



b) Exposure Index



c) Vulnerability Index



d) Heat risk index

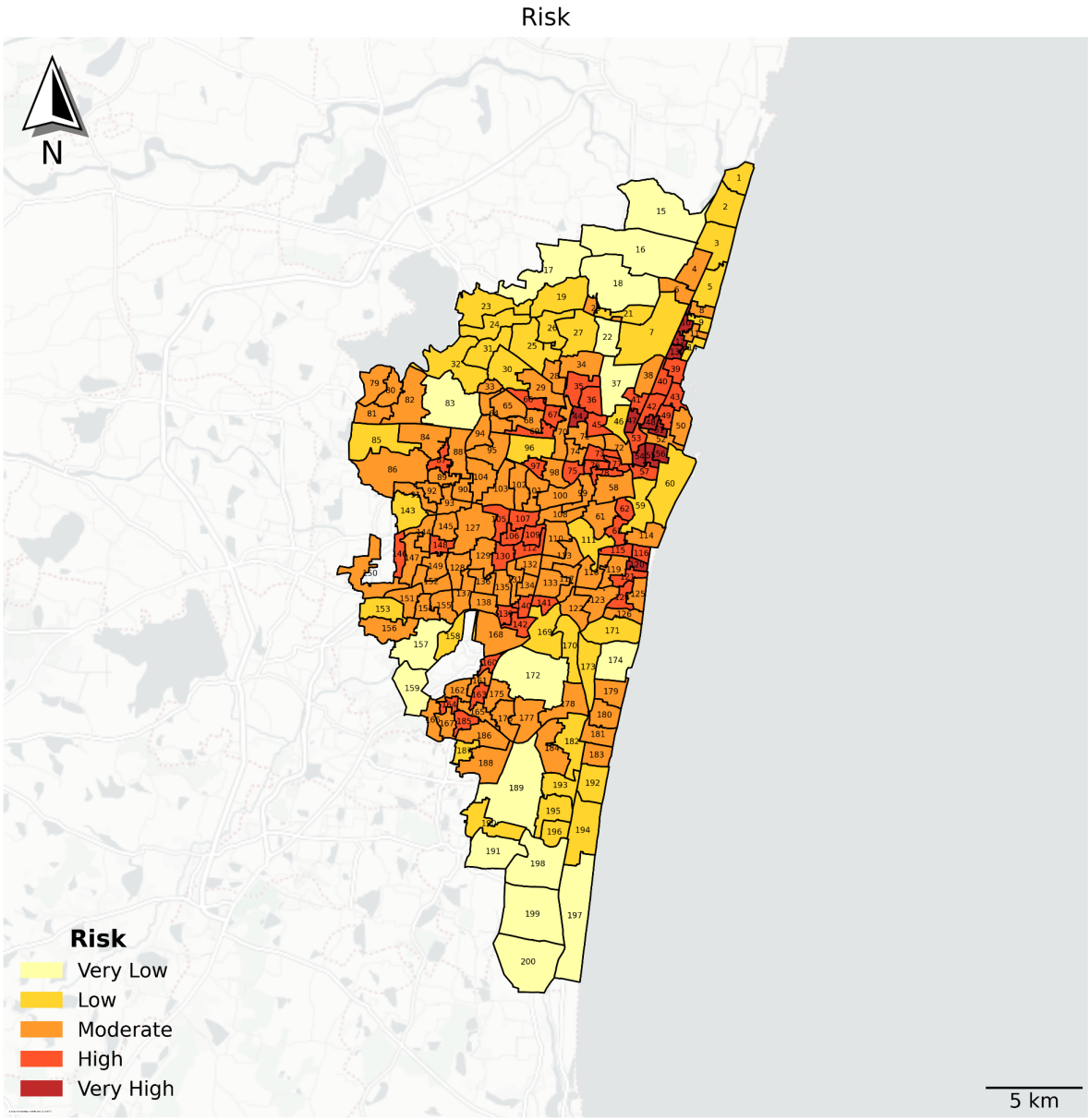


Table 4: Ward numbers falling in very high, high and moderate risk categories

Ward numbers falling in very high risk category	10, 12, 13, 44, 47, 48, 51, 54, 55, 56, 120

Ward numbers falling in high risk category	35, 36, 39, 40, 41, 42, 43, 45, 49, 53, 57, 62, 63, 66, 67, 69, 73, 75, 76, 77, 78, 87, 97, 105, 106, 107, 109, 112, 115, 116, 121, 124, 130, 139, 140, 141, 142, 146, 148, 160, 163, 164, 185
Ward numbers falling in moderate risk category	4, 6, 8, 11, 20, 28, 29, 33, 34, 38, 50, 52, 58, 61, 64, 65, 68, 70, 71, 72, 74, 79, 80, 81, 82, 84, 86, 88, 89, 90, 91, 92, 93, 94, 95, 98, 99, 100, 101, 102, 103, 104, 108, 110, 113, 114, 117, 118, 119, 122, 123, 125, 126, 127, 128, 129, 131, 132, 133, 134, 135, 136, 137, 138, 144, 145, 147, 149, 150, 151, 152, 154, 155, 156, 161, 162, 165, 166, 167, 168, 175, 176, 177, 178, 179, 180, 181, 183, 184, 186, 188

The classification of wards 10, 12, 13, 44, 47, 48, 51, 54, 55, 56, and 120 in very high-risk category is based on a relative heat risk assessment for Chennai City, and does not necessarily indicate that these wards are the hottest in terms of land surface temperature or air temperature at the state level. Rather, these wards exhibit a higher cumulative risk due to a combination of hazard, exposure, and vulnerability parameters. During periods of extreme heat events, these wards are more susceptible to impacts, in comparison to the other wards of the city.

Multiple factors contribute to this elevated risk profile: Ward 10, 12, 13, 44, 47, 48, 51, 54, 55, 56, and 120 show a high percentage of built-up area, which contributes to a higher urban heat island effect. Vulnerabilities are further compounded by limited access to water sources and public parks in several wards, factors that reduce adaptive capacity.

These findings underscore the importance of interpreting heat risk as a multi-dimensional construct. **It is not solely dependent on ambient temperature but influenced by the interplay of urban form, infrastructure, and social vulnerability.** Targeted interventions in these wards should therefore prioritize but not limited to improving green cover, implementing cooling solutions and expanding health services during extreme heat events, to build long-term resilience against heatwaves.

*The complete list of wards with the factors contributing to their heat risk is at Annexure 12.9.

5 Establishing local level heat thresholds for early warning systems for Chennai City

In addition to identifying 'where to take action' through the heat-risk index, it is equally important to determine 'when to take action.' Unlike sudden-impact hazards like floods or cyclones, heatwaves have gradual and cumulative effects on human health. Therefore, understanding the thresholds at which temperatures become hazardous and necessitate a response is critical. This section focuses on developing and implementing localized heat-health thresholds tailored to Chennai City, enabling precise early warnings and alerts for heatwaves.

5.1 Approach for establishing local heat-health Thresholds

Heat-health thresholds differ from general heatwave criteria by focusing on the specific impacts of extreme heat on the human body. In 2015, the World Meteorological Organization (WMO) and the World Health Organization (WHO) introduced guidelines for Heat Health Warning Systems (HHWS), emphasizing the importance of early warning systems in Heat Action Plans (HAPs). These guidelines outline two primary methods for establishing heat thresholds:

1. Analysis of extreme temperature variable and health impact

This method identifies the relationship between extreme temperature variables and health outcomes. It often uses health indicators such as:

- All-cause daily mortality (standardized to account for seasonal variability).
- Cause-specific daily mortality (e.g., non-accidental deaths or mortality in people aged 65 and older).
- Daily hospital admissions or emergency service calls (e.g., ambulance service data).

For meteorological variables, thresholds are determined using either:

- A single parameter, such as maximum temperature (T.Max).
- A composite parameter, like the Heat Index, considering geographical and historical data availability.

Widely referenced studies (e.g., Sheridan and Kalkstein, 2004; Pascal et al., 2006) have utilized these approaches. The Ahmedabad Heat Action Plan (2019), for example, used a dose-response relationship between daily maximum temperature and all-cause mortality to establish thresholds.

2. Biometeorological Indices

In cases where health data is unavailable, percentile-based thresholds (e.g., 90th or 95th percentile) derived from long-term temperature data can serve as warning triggers. This percentile approach, endorsed by WHO-WMO, has been applied globally to identify critical thresholds for heat events.

In India, a hybrid approach combining both methodologies has been employed. For instance, the Ahmedabad Heat Action Plan (HAP) established thresholds by developing a dose-response relationship between the daily maximum temperature during summer and the corresponding daily all-cause mortality. Expanding on this initiative, in 2019, the National Disaster Management Authority (NDMA) conducted a comprehensive study to establish these thresholds for 103 cities in India. This involved a time-series analysis of temperature and mortality for five cities, determining thresholds based on published research for two cities and establishing seasonal and monthly maximum temperature thresholds using the 75^{th}, 85^{th} and 95^{th} percentile values for 96 cities (Srivastava et al. 2019).

The local heat thresholds for Chennai city are developed by leveraging the latest fine-resolution IMDAA reanalysis data, available at a 12-km spatial grid. The approach goes beyond daytime extreme dry temperatures to incorporate felt temperatures, utilising the heat index - a composite of relative humidity and temperature outlined in the previous sections. Figure 14 provides a detailed methodology for the computation of heat thresholds for Chennai city. For this plan, the 90^{th}, 95^{th} and 99^{th} percentiles have been analysed to compute yellow, orange and red colour-coded alert thresholds, respectively, aligning with the IMD thresholds. It is important to note that the heat index used in this plan to develop thresholds is intended solely for estimating heat stress during the summer season. An India-specific heat index is currently under development by the India Meteorological Department (IMD) and is being provided on an experimental basis.

Figure 14: Schematic representation of approach for calculating percentile heat thresholds over Chennai city

Indian Monsoon Data Assimilation and Analysis (IMDAA) hourly reanalysis data for temperature and relative humidity (1982 – 2022) at 2 m above ground and 12 Km resolution grid
Preparation of hourly and daily time series datasheets of maximum temperatures and heat index over Chennai City
Calculating 90^{th}, 95^{th} and 99^{th} percentile thresholds of daily maximum felt and dry temperatures for March, April, May and June

A percentile is a way to rank temperatures by comparing them to historical data. For example, if the 95th percentile is 38°C in a region, it means that

95 per cent of the time, temperatures are below 38°C and anything above it is unusually hot for that area. This approach, recommended by organizations like WHO, WMO and IMD, considers local climate and how people in different areas are acclimatised to heat.

Table 5: Heat thresholds based on dry temperature for summer season (March to June)

Yellow alert	Orange alert	Red alert
40°C	42°C	43°C

Figure 15: Heat thresholds based on felt heat – which includes temperature plus humidity for summer season (March to June)

		Temperature (°C)											
		31° C	32° C	33° C	34° C	36° C	37° C	38° C	39° C	40° C	41° C	42° C	43° C
Relative Humidity	40%	30°C	33°C	34°C	36°C	38°C	41°C	43°C	46°C	48°C	51°C	54°C	58°C
	45%	32°C	34°C	36°C	38°C	40°C	43°C	46°C	48°C	51°C	54°C	58°C	
	50%	33°C	35°C	37°C	39°C	42°C	45°C	47°C	51°C	55°C	58°C		
	55%	32°C	36°C	38°C	41°C	44°C	47°C	51°C	54°C	58°C			
	60%	35°C	38°C	41°C	43°C	47°C	51°C	54°C	58°C				
	65%	37°C	39°C	42°C	46°C	49°C	53°C	58°C					
	70%	38°C	41°C	44°C	48°C	52°C	57°C						
	75%	39°C	43°C	47°C	51°C	56°C							
	80%	41°C	45°C	49°C	54°C								
	85%	43°C	47°C	52°C	57°C								
	90%	46°C	50°C	55°C									
	95%	47°C	53°C										
	100 %	49°C	56°C										

Figure 15. presents city specific heat thresholds based on felt heat, which combines actual air temperature and relative humidity to estimate how hot it feels to the human body. This threshold has been derived using the heat

index based on IMDAA hourly data from 1982-2022. Felt heat goes beyond dry temperature readings and provides a more accurate measure of the stress heat imposes on human health, especially in coastal regions during the summer months from March to June. **For instance, in Chennai, a temperature of 33°C with 80% humidity can result in a felt heat of nearly 49°C.** In the table, the x-axis shows actual temperatures while the y-axis displays relative humidity levels. Each cell presents the corresponding felt heat value. As both temperature and humidity increase, the felt heat rises sharply, indicated by colour intensification. The early warnings of hot weather and heatwaves and the suggested actions for yellow, orange and red alert can be availed at city and ward level through the TN ALERT app. The QR code for downloading the app is attached below.

The higher thresholds for felt heat compared to dry temperature underscore the need to factor in humidity when designing heat warning systems for Chennai City. Doing so provides a more accurate picture of heat risks, enabling better protection for vulnerable communities.

Scan code to download the TN ALERT Mobile App

App store (iOS)

Play store (Android)

Upon downloading the application, the user can find Heat Wave Module in the main interface of the TN Alert app to get the 5-day forecast and advisory for Heat Wave and Heat Stress warnings for the user locations.

6 Heatwave Preparedness and Response Plan for Chennai City

This section outlines a stakeholder responsibility matrix for preparedness and response to address extreme heat events in Chennai city. Its purpose is to provide stakeholders and departments within the Chennai city Corporation and TNDRRA with clear actions and strategies. These measures are designed for implementation in the short term i.e. within a period of 18 months, particularly during the pre-summer months (January and February) and throughout the summer season (March to June).

Table 6: Heatwave preparedness and response plan

Sl. No.	Key strategy	Planned action	Responsible authority
Preparation and updation of plans and policies			
1	Preparation and implementation of annual heat action plan	Coordinate with relevant stakeholders and experts to develop and implement the Heat Action Plan effectively, ensuring a collaborative and comprehensive approach.	Heatwave Task Force Committee
2	Standard Operation Procedures (SOPs)	Develop a comprehensive Standard Operating Procedure (SOP) for heatwave response, clearly defining the roles and responsibilities of various departments within the Municipal Corporation (MC), along with specific timelines for implementation. Issue necessary orders and notices to ensure clarity and accountability, while coordinating effectively among all stakeholders for seamless execution.	Heatwave Task Force Committee
Early warning and alert mechanisms			
3	Early warning and Coordination	Establish coordination with weather forecasting and warning institutions prior to the summer season to ensure timely access to critical weather updates and forecasts for proactive planning and response.	ICCC
		Analyze weather updates received from the India Meteorological Department (IMD), district and state authorities and other research institutions and disseminate the information promptly to all ward members to ensure informed decision-making and proactive heatwave	ICCC

		management.	
		Modify and customize heatwave warnings and alerts at the local level, tailoring them to ward-specific thresholds and target groups to ensure effective communication and targeted response measures.	ICCC
4	Impact based early warning dissemination	Disseminate colour-coded, impact-based early warnings to all ward members, clearly communicating the severity of heatwave risks to enable timely preparedness and response. Prioritize targeted outreach to the most vulnerable populations identified in the Heat Action Plan (HAP), ensuring they receive actionable information to mitigate risks effectively. Collaborate with city-level institutions and experts to enhance local capacity for information dissemination	ICCC
Interagency coordination mechanisms for preparedness and response to extreme heat events			
5	Formation of a heatwave task force committee	Establish a dedicated Heatwave Management Cell at the Municipal Corporation level to oversee and coordinate heatwave preparedness and response efforts. Appoint a Heat Officer to lead the cell and ensure effective management. Develop a clearly defined, area-specific response plan tailored to local needs and vulnerabilities. Coordinate closely with district and state agencies to facilitate response and mitigation	Commissioner

		activities. Monitor the implementation of the Heat Action Plan on a daily basis during the heatwave season to ensure timely actions. Regularly organize meetings to assess ongoing conditions, ensure immediate response measures and recommend necessary actions.	
6	Appointment of a nodal officer	Appoint a Heat Officer as the nodal officer to oversee heatwave management, along with ward-level heatwave in-charge officers to ensure localized implementation. The Heat Officer should coordinate preparedness, response and mitigation measures with all relevant stakeholders, including municipal divisions, district and state agencies, non-governmental organizations (NGOs) and other key partners to ensure an integrated and efficient approach.	Commissioner
		The nodal officer, with permission of chairman of the heatwave task force committee, can implement regulatory and advisory orders related to heatwaves, ensuring compliance within the municipal area. These measures should include flexible timings for schools, markets and offices during heatwave alerts to minimize exposure to extreme heat and safeguard public health.	
7	Formation of expert groups	Establish city-level technical advisory groups or committees comprising	Additional

		experts, NGOs, academicians and other key stakeholders to provide guidance and support for the effective implementation of the Heat Action Plan (HAP). These groups will ensure evidence-based decision-making, foster collaboration and enhance the plan's overall impact.	Commissioner (Health)
		Form ward-level working groups or committees comprising representatives from local NGOs, Civil Society Organizations (CSOs) and Resident Welfare Associations (RWAs) to coordinate activities within their respective wards. These committees will facilitate the implementation of heatwave response measures, ensure effective communication and share vital information to enhance community resilience.	Additional Commissioner (Health)
8	Restrict public gatherings and limit permissions for large events during heatwave alerts to minimize exposure	Avoid granting permissions for public gatherings during heatwaves. If such gatherings are unavoidable, develop a comprehensive checklist to ensure the availability of essential facilities, such as drinking water, shaded areas and other necessary resources at the site. Additionally, discourage outdoor games, sports and activities during daytime hours and regulate the use of swimming pools to minimize heat exposure and ensure public safety.	City Police commissioner
9	Protecting the traffic and	Ensure the provision of adequate shade at traffic	City Police

	outdoor police workers	points for traffic police personnel, as they are highly exposed to heatwave conditions. Facilitate the distribution of cool jackets to traffic personnel to help mitigate heat stress and enhance their safety and comfort during duty hours.	Commissioner
10	Protection from exposure due to summer elections	Ensure polling booth-specific precautionary measures during election periods, including the provision of shaded areas, adequate drinking water and accessible medical facilities, to safeguard voters and election personnel from heatwave-related risks.	Commissioner, GCC/ Electoral registrar officer
11	Hospital and health centre preparedness	Develop a comprehensive city-wide hospital plan to address heatwave-related illnesses and treatment, ensuring preparedness across all healthcare facilities. The plan should include the following measures: 1. **Heat Related Illness Management:** Establish protocols for the diagnosis and treatment of heatwave-related illnesses in all healthcare centres. 2. **Mental Health Preparedness:** Develop and implement a specific mental health plan to address the psychological impacts of heatwaves. 3. **Procurement of Essential Supplies:** Ensure the timely procurement and stockpiling of life-saving medicines, IV fluids, oral rehydration salts (ORS) and other critical supplies across	City Health Officer

		all healthcare centres. 4. **First Aid Facilities:** Set up First Aid and Medical Aid stations at key high-risk areas identified in the Heat Action Plan (HAP) to provide immediate relief. 5. **Specialized Health Facilities:** Ensure that specific healthcare services are available for individuals with pulmonary illnesses, renal conditions, psychiatric issues and other heatwave-aggravated health conditions. 6. **Daily Reporting:** Implement a system for daily reporting of heatwave-related cases and activities from all relevant departments and units within health facilities. 7. **Data Collection and Analysis:** Collect ward-wise data on heatwave impacts based on formats provided in chapter 11.	
12	Water supply	Ensure the continuous supply of safe drinking water at all identified vulnerable points and worksites on a priority basis. This measure will help mitigate heatwave-related risks, particularly for individuals working outdoors or residing in high-risk areas.	CMWSSB
13	Livestock	Ensure the well-being of livestock during heatwaves by providing sufficient shade and access to water in vulnerable wards. Additionally, establish First Aid and Medical Aid facilities for livestock and ensure the procurement of adequate quantities of necessary	Animal Husbandry Department

		medicines to address heat-related health issues in animals.	
14	Outdoor workers	Coordinate with relevant authorities to reschedule working hours for workers and laborers across various sectors within municipal areas to minimize exposure to peak heatwave conditions. Ensure the provision of safe drinking water at worksites and promote the use of temperature control measures, such as fans and coolers, to enhance workplace safety and comfort during extreme heat.	Deputy Commissioner (Works), Deputy Commissioner(Revenue and Finance)
15	Tourism	Ensure that all tourist guides adhere to the issued heatwave advisories and guidelines. Provide comprehensive training to tourist guides to raise awareness about the effects of heatwaves and educate them on preventive measures to safeguard both themselves and tourists during extreme heat conditions.	Tamil Nadu Tourism Department
Capacity Building – Training, public awareness, community outreach			
16	Training and capacity building	Organize targeted training programs for various stakeholders, including health professionals, ANMs, municipal school teachers and representatives from NGOs/CSOs. These programs should focus on activities to be undertaken before, during and after the heatwave season, ensuring they are well-equipped to respond effectively and contribute to mitigation and	1) City Health Officer 2) Additional Commissioner(Health) 3)Zonal Assistant Commissioner

		preparedness efforts.	
		Organize training sessions for Civil Defense (CD) personnel, Resident Welfare Associations (RWAs), community members, volunteers, health workers and rapid response teams to build their capacity for effective heatwave preparedness and response. Additionally, conduct specialized training programs tailored to the needs of specific vulnerable groups, ensuring they are informed about heatwave risks and equipped with the knowledge to protect themselves during extreme heat conditions.	1.Additional Commissioner(Health) 2.Regional Deputy Commissioner 3.City Health Officer 4.Zonal Assistant Commissioner
17	Mock-drill exercises	Collaborate with local administration and staff to conduct joint emergency mock drills in areas prone to heatwave impacts. These drills should simulate heatwave emergencies to assess preparedness, identify gaps and strengthen coordination among stakeholders for effective response and mitigation measures.	Regional Deputy Commissioners
18	Inclusive heat response	Integrate gender-sensitive and equitable approaches into capacity-building programs to address heatwave-related illnesses, symptoms and protective measures, ensuring inclusivity and addressing the unique vulnerabilities of different population groups.	City Health Officer (CHO)
		Identify and engage youth groups and college student associations to actively support vulnerable	City Health Officer (CHO), PRO

		communities by disseminating heat-related information and raising awareness about preventive measures. Their involvement will strengthen outreach efforts and foster a community-driven approach to heatwave resilience.	
19	Public awareness campaigns	Raise public awareness about heatwave preparedness through targeted sensitization campaigns. Utilize print and electronic advertisements in local newspapers to educate the general public about heatwave risks and preventive measures. Highlight safety guidelines regarding the use of swimming pools during heatwaves to minimize heat-related risks. Additionally, disseminate forecasts and alerts via bulk mobile messages to ensure timely communication, including distribution to media outlets for wider outreach and broadcast.	City Health Officer (CHO),PRO, Health Education Officer
20	Information, Education and Communication (IEC) campaign	Develop and implement an Information, Education and Communication (IEC) campaign to raise awareness about heatwave preparedness and response. Target individuals, communities, Resident Welfare Associations (RWAs) and the general public through various modes such as posters, pamphlets and public advertisements. During red alert warnings, prominently display information about heat-	Health Education Officer

		related illnesses, symptoms and protective measures in high-visibility areas. Ensure Do's and Don'ts are displayed at public places, hospitals, parks, schools and RWA premises in local languages to maximize reach and comprehension. This approach will foster widespread awareness and empower communities to mitigate heatwave impacts effectively.	
		Broadcast short TV commercials (TVCs) in public places at regular intervals to raise awareness among the general public about the precautions necessary to safeguard against heatwaves. These ads should provide clear, actionable guidance on heatwave preparedness, including hydration, avoiding outdoor activities during peak hours and recognizing the symptoms of heat-related illnesses, ensuring maximum reach and impact.	Public Relations Officer
		Install electronic screens at busy traffic intersections and market areas to display real-time heatwave information. These screens should provide critical updates, including heatwave alerts, temperature forecasts, safety tips and hydration reminders, to ensure public awareness and prompt action in high-risk areas.	ICCC

While the primary responsibility for implementing this plan will rest with the **Chennai city Corporation**, successful execution will depend on close collaboration and support from the **Tamil Nadu Disaster Risk Reduction Agency.** The key areas of responsibility will include:

Table 7: Key strategies for heatwave preparedness and response – district and state

Key Action Points	District-Level Responsibilities	Responsible Authority (District)	State-Level Responsibilities	Responsible Authority (State)
Heat Action Plan (HAP) Development	Develop or update district-specific HAP aligned with state and NDMA guidelines, incorporating local vulnerabilities.	DDMA	Formulate or update State HAP integrating district-level plans for a unified heatwave response strategy.	(SDMA can also develop the district/city HAP's for the first time)
Early Warning Systems	Collaborate with IMD, RMCs and local institutions to establish robust systems and disseminate timely alerts to local authorities and vulnerable groups.	DEOC	Coordinate with IMD, RMCs and research institutions to disseminate short, medium and long-range forecasts to districts, municipalities and PRIs.	SDMA/SEOC
Healthcare Preparedness	Equip district hospitals and health centres with resources such as life-saving medicines, IV fluids, ORS and mental health support plans.	Chief Medical Officer under DDMA	Direct hospitals to establish heatwave response units, ensure procurement of medical supplies and address the needs of vulnerable groups.	Health and Family Welfare Department (H&FW)
Capacity Building and Public Awareness	Train ANMs, teachers and NGOs on heatwave response activities	Health & FW, school education and higher	Organize statewide public awareness	SDMA

	and conduct community outreach and IEC campaigns to build awareness.	education departments	campaigns and prepare IEC materials. Provide resources to districts for outreach to communities and vulnerable groups.	
Monitoring and Evaluation	Monitor HAP implementation daily during heatwave season through the Heatwave Management Cell using IT tools like GIS for data-driven decisions.	DDMA	Establish a state-level monitoring cell to review HAP execution weekly across districts, collecting and analysing data to scale up best practices.	SDMA/SEOC and
Policy Directives and Regulatory Orders	Ensure compliance with state directives for regulatory measures, such as adjusting public gatherings, school timings and industrial safety protocols.	District Collector and City Commissioner	Issue regulatory orders and advisories on public gatherings, working hours, school timings and industrial safety during heatwaves.	SDMA/SEOC

7 Long term heat risk mitigation plan for Chennai City

This section presents a stakeholder responsibility matrix for heat risk mitigation, focusing on both structural and non-structural measures. The Chennai city Corporation will take the lead in implementing these measures, with a particular focus on identifying synergies and necessary support from TNDRRA whenever required. These measures are aimed at long-term implementation and sustainability.

Table 8: Heat risk mitigation plan

Sl. No.	Key strategy	Planned action	Responsible authority
Understanding and mapping of heat risks and vulnerabilities			
1	Hazard, vulnerability and risk assessment	Conduct a comprehensive heatwave vulnerability and risk assessment to evaluate ward-level exposure, sensitivity and adaptive capacity, with a particular focus on slums, individual households and communities. Additionally, identify infrastructure at risk and assess occupational hazards affecting vulnerable groups such as outdoor workers. Utilize this information to map heatwave risk hotspot areas, which will serve as a basis for designing targeted and effective response and mitigation measures.	City Administration under TNSDMA guidance
		Develop a detailed mapping of physical and socio-economic vulnerabilities based on primary survey data, considering factors such as age, pregnancy, chronic illnesses, morbidities and the specific challenges faced by outdoor vendors, workers and indoor labourers. Incorporate housing types, occupational risks and other socio-economic parameters into the assessment. Leverage available resources and apply robust scientific methods to ensure the accuracy and reliability of the vulnerability analysis, which will form a critical foundation for targeted heatwave response and resilience strategies.	City Administration
		Develop a heatwave risk index through a comprehensive assessment that integrates exposure, sensitivity and adaptive capacity parameters. Use the findings to create a ward-wise atlas that identifies areas of varying risk levels. This atlas will serve as a critical tool for planning and implementing targeted mitigation and adaptation measures, ensuring that resources and interventions are prioritized for the most vulnerable communities.	City Administration under TNSDMA guidance
2	Estimation of local temperature threshold	Estimate ward-wise thresholds by analysing key variables such as temperature, humidity and health indicators like all-cause mortality. Collaborate with state and district research organizations to ensure a robust and data-	City Administration

		driven approach, enabling the identification of critical heatwave thresholds for effective risk mitigation and response planning.	
		Enhance the availability of weather observation networks across the city to achieve a density of at least one weather observation station for every 4 square kilometres, in alignment with World Meteorological Organization (WMO) guidelines. This expansion will improve the accuracy and granularity of weather data, enabling more precise monitoring, forecasting and early warning systems to support heatwave preparedness and response efforts.	City Administration/ TNSDMA
3	Mainstreaming and up-scaling	Facilitate the integration of developmental schemes into heatwave risk reduction activities across all relevant departments, ensuring alignment with heat resilience objectives. Engage local NGOs, CSOs and ward leaders to collaborate in implementing these measures, leveraging their community reach and expertise to create inclusive and sustainable solutions. This approach will ensure that developmental initiatives contribute directly to reducing vulnerabilities and enhancing adaptive capacities to heatwave impacts.	City Administration/All department
		Identify opportunities for the convergence of various programs and schemes implemented by different departments that align with heatwave risk reduction activities. Conduct a comprehensive review to identify overlapping objectives, resources and potential synergies. Issue clear instructions to relevant departments to facilitate coordination and integration, ensuring a unified and efficient approach to addressing heatwave vulnerabilities while maximizing the impact of existing resources and efforts.	City Administration/All department
Non-structural heat risk mitigation measures			
4	Community cooling systems	Coordinate the establishment and management of public cooling centres, as well as the development and maintenance of green spaces and parks, to provide residents with safe locations to cool off and prevent heat-related illnesses. Incorporate urban planning strategies to address future heatwave risks, ensuring that city designs are	City Administration

		resilient and adaptable to evolving climate scenarios. Implement measures such as sprinkling water on roads to mitigate surface temperatures and improve air quality, particularly during peak heatwave conditions. These efforts will create a more sustainable and heat-resilient urban environment.	
5	Restoration of natural buffers	Enforce laws and regulations aimed at increasing heat resistance and resilience across communities and infrastructure. Enhance urban green cover by implementing large-scale plantation drives and restoring natural water bodies such as ponds, fountains and lakes, while expanding the number of green parks to mitigate heat impacts. Promote the adoption of heat-resilient building codes to encourage the development of infrastructure designed to withstand extreme heat. Advocate for the use of heat-resistant building materials and urban planning strategies that reduce the urban heat island effect, fostering a cooler and more sustainable urban environment.	City Administration
6	Public health interventions	Implement targeted health advisories tailored to the needs of vulnerable populations in all wards and ensure these advisories are prominently displayed on ambulances to raise public awareness during the summer season. Organize regular health check-up camps focused on mental health, providing necessary treatments to address heatwave-induced psychological impacts. Conduct health check-up camps in slums and other vulnerable areas to reach at-risk populations effectively. Ensure the timely procurement of adequate quantities of life-saving medicines, IV fluids, ORS and other essential supplies in all health centres under the jurisdiction of the Municipal Corporations to address heat-related illnesses promptly and efficiently.	City Health Officer and H&FW Department
7	Water supply	Ensure the portability and quality of water to safeguard public health during the summer season. Guarantee the availability of drinking water supply across all wards, with a special focus on vulnerable areas. Establish clean drinking water facilities at common public locations such as bus stands, labor hubs, markets and parks to cater to the needs of	City Administration, Executive Engineer and Tamilnadu Water Supply and Drainage Board

		the community. Provide sufficient water supply at all cooling centres to support their functionality and effectiveness. Set up water kiosks at identified heat hotspot areas to ensure easy access to drinking water for at-risk populations. Conduct frequent repair and maintenance of mechanical and electrical components of water supply systems before the onset of the summer season to prevent service disruptions and ensure uninterrupted water availability.	
8	Road transport	Promote the use of public transport, electric vehicles and bicycles to reduce vehicle emissions and traffic congestion, contributing to a safer and more sustainable environment. Ensure roadside assistance during traffic congestion and implement effective diversions to facilitate smooth vehicular movement. Provide essential amenities such as shelters and shaded areas at bus stops, along with drinking water facilities, to enhance commuter comfort and safety during extreme heat. Prioritize roadside tree plantations and the creation of green dividers to mitigate the urban heat island effect and improve air quality, fostering a cooler and greener urban landscape.	City Administration
9	Railway transport	Collaborate with local railway station authorities to ensure timely repair and maintenance of mechanical and electrical systems, prioritizing their functionality during the heatwave season. Facilitate the provision of adequate sheds, shelters, temperature cooling equipment and a reliable water supply in public waiting areas to enhance passenger safety and comfort, reducing the risk of heat-related illnesses.	Divisional Railway Manager
10	Power and electricity	Coordinate with the electricity department to ensure uninterrupted power supply, especially in high-risk areas and wards and facilitate the prompt restoration of electricity during outages. Strengthen power infrastructure to enhance resilience against heatwave impacts. Encourage energy-saving practices and promote the use of renewable energy sources, such as solar energy, to meet cooling and electricity demands. Prioritize the integration of solar energy in cooling centres	TANGEDCO

		and other critical facilities to ensure sustainable and reliable power during extreme heat conditions.	
11	Education	Adjust the timings of municipal schools and institutions to align with prevailing heatwave conditions, prioritizing the safety and comfort of students. Ensure that all schools and institutions are equipped with functional cooling equipment and sufficient water facilities to mitigate heat stress. Restrict outdoor games and physical activities during the heatwave season to prevent heat-related illnesses among students. Integrate heatwave awareness and preparedness into school curricula to educate students about heat-related risks and preventive measures, fostering a culture of resilience from an early age.	Chief Education Officer and Zonal Assistant Commissioner
12	Labour	Conduct heat illness orientation programs for factory officers, staff and general practitioners, using IEC materials to raise awareness about the symptoms, risks and preventive measures for heat-related illnesses. Organize regular awareness campaigns, with heightened efforts during high-risk heatwave days, to ensure all workers are informed and prepared. Ensure that drinking water is readily available at work sites and promote the use of temperature control measures such as fans and coolers to maintain a safer working environment during extreme heat conditions.	MSME and Industries Departments & All departments implementing works (PWD, WRD, Highways etc)
13	Livestock	Ensure the provision of adequate sheds and shelters for livestock in high-risk wards to protect animals from extreme heat. Launch public awareness campaigns to educate farmers and communities on protective measures for livestock and poultry during prolonged heatwaves. Guarantee that all veterinary hospitals are stocked with sufficient medicines and fluids to address heat-related health issues in animals. Additionally, ensure that mobile veterinary hospitals are well-equipped and ready to be deployed to vulnerable areas at short notice, providing timely care to livestock and poultry in need.	Animal Husbandry Department
14	Parks and	Ensure that all parks provide open spaces	City

	gardens	with sitting and resting areas to offer the public a comfortable environment during heatwaves. Conduct promotional campaigns to encourage the adoption of green roofs and cool roof buildings, which help in reducing indoor temperatures, enhancing ventilation and promoting the development of green spaces. Advocate for the construction of green buildings that incorporate sustainable practices to mitigate heat effects. Work to increase green cover by engaging individuals, households, communities, RWAs and institutions in tree planting and landscaping efforts, fostering a cooler and more resilient environment.	Administration
15	Fire	Coordinate with the fire department to ensure readiness for potential fire emergencies during heatwaves. Ensure that an adequate supply of water and foam is available at critical locations to effectively combat fires. Maintain a list of designated points of contact for each ward and zone, ensuring that emergency responders can be swiftly reached in the event of a fire emergency. Communicate the locations of emergency facilities, including cooling shelters and shaded areas, to the public to provide safe refuge during heatwave conditions and fire emergencies.	District fire officer
16	Tourism	Ensure the availability of cooling-off sheds, drinking water and immediate first aid facilities at key tourist junctions to provide relief during heatwaves. Additionally, ensure that all tourist guides are well-trained and fully informed about the effects of heatwaves and the necessary prevention measures, so they can effectively assist tourists in managing heat-related risks.	District Tourism Officer (DTO)
Structural heat risk mitigation measures			
17	Heat resilient infrastructure	Establish public cooling centres and green spaces, including parks, where people can find refuge during heatwaves, reducing the risk of heat-related illnesses and fatalities. Promote adherence to building codes that mandate the use of heat-resilient infrastructure and building materials in all new construction projects to minimize the urban heat island effect. Ensure that these	City Administration

		constructions incorporate cool roofs, thermal insulation and other heat-resistant materials as part of the design to enhance energy efficiency and protect residents from extreme temperatures.	
18	Urban planning for climate change	Ensure that all building infrastructure incorporates heat-resistant materials, including cool roofs and thermal insulation, to reduce indoor temperatures and improve comfort during heatwaves. Encourage the greater use of permeable materials in civic infrastructure and residential construction, as these can help mitigate the urban heat island effect by promoting better water absorption and reducing heat retention. Additionally, implement strategies for managing transport and parked vehicles, ensuring that adequate shading and cooling measures are in place to prevent heat buildup and reduce the impact of heat on public spaces.	PWD
19	Social housing schemes	Increase urban greenery through the extensive plantation of trees in public spaces, streets and residential areas to provide shade, reduce heat retention and improve overall air quality. Ensure that social housing schemes incorporate incentives for using reflective materials on buildings to reduce heat absorption. Additionally, include the integration of ventilated cooling spaces into building bylaws, encouraging the design of homes that promote natural cooling, reduce energy consumption and enhance the resilience of communities to heatwaves.	PWD, TNHB, TNUHDB, RD Departments
20	Rooftop solar energy	Incentivize and promote dual climate change adaptation and mitigation activities by encouraging the installation of rooftop solar panels, which not only generate renewable energy but also contribute to cooling the interiors of buildings. This dual benefit helps reduce energy consumption, lower indoor temperatures and increase the overall sustainability of buildings, thereby enhancing resilience to heatwaves and reducing the urban heat island effect.	TANGEDCO
21	Renewable energy	Encourage the widespread use of renewable energy sources, such as solar and wind energy, to meet cooling and electricity needs, reducing dependency on conventional power	TANGEDCO, Environment & Forest Department

		sources and promoting sustainability. Promote the installation of solar-powered appliances, including fans and air conditioners, to help individuals and businesses stay cool and comfortable while minimizing energy consumption and supporting environmental goals.	
22	Solid waste management	Implement and closely monitor solid waste management at the source to reduce methane emissions and prevent the occurrence of fires, both of which exacerbate urban heat. Effective waste management strategies, including segregation and proper disposal, can significantly mitigate these risks. Additionally, enforce the state policy aimed at minimizing the impact of solid waste on human health and the environment, ensuring that practices such as recycling, composting and safe waste disposal are followed to reduce heat-related and environmental hazards.	City Administration

8 Financing the implementation of Chennai City HAP

Financing the Heat Action Plan (HAP) is a critical component of its implementation strategy through the convergence of existing government schemes and programs at the district/local level. Securing adequate financial resources is critical for the successful implementation of Heat Action Plans (HAPs) in Tamil Nadu. Effective climate finance strategies enable the state to strengthen heat resilience, protect vulnerable communities and sustain long-term adaptation efforts. By mobilizing funds through government budgets, international climate finance and public-private partnerships, Tamil Nadu can ensure the efficient execution of HAPs. A well-structured financing framework, combined with transparent allocation and monitoring, will be key to building climate resilience and mitigating the impacts of extreme heat in the state.

The potential:

The indicative potential of the financial resources is listed below, subject to eligibility and approval to be accorded at the appropriate level:

A. Government Funds:
   1) National Disaster Response Fund (NDRF)/State Disaster Response Fund (SDRF)
   2) National Disaster Mitigation Fund (NDMF)/State Disaster Mitigation Fund (SDMF)
   3) Grant in Aid recommendation by Central Finance Commission (CFC)
   4) Grant in Aid recommendation by Sixth State Finance Commission (SFC)
   5) Central Sector Programmes/Schemes (CSS)
   6) State Program and Schemes (SPS)
   7) Local resources – own taxes and duties
   8) Loans and Advances

B. Private Sector Funds
   1) Corporate Social Responsibilities (CSR) Fund
   2) Non-governmental organization (NGOs) projects/programs
   3) Public and private sector donation

The details regarding the available funds have been elaborated in the annexure to this chapter. This section is intended to provide an indicative overview of the potential sources of funding that can be leveraged for the implementation and mitigation measures outlined in the City Heat Action Plan (HAP). It must be noted that the final identification, prioritization and allocation of funds will be determined through further consultations and decisions made by the relevant Urban Local Body (ULB) authorities and state government departments, based on local needs, administrative processes and resource availability.

9 Inter-agency and departmental coordination mechanisms

To ensure inter-departmental and inter-agency coordination for successfully implementing the strategies outlined in the previous chapters, a heatwave task force committee has been established in the Chennai city under the chairmanship of the Commissioner, Chennai city Corporation.

Table 9: The heatwave task force committee

Designation	**Role**
Commissioner	Chairperson
Additional Commissioner (Health)	Member Secretary
Joint Commissioner (Education)	Member
Deputy Commissioner (Works)	Member
Chief Engineer (General)	Member
Chief Engineer (SWM)	Member
Chief Engineer (Parks)	Member
City Health Officer	As needed
S.E. (Storm Water Drain)	Member
S.E. Coordination	Member Secretary

Source: Proceedings of the Municipal Commissioner of Chennai (attached in annexure 12.8)

9.1 Early warnings and alert mechanisms

India Meteorological Department (IMD), Ministry of Earth Sciences, is the nodal agency for providing weather information, including forecast and current warnings for all weather-related hazards for optimum operation of weather-sensitive activities. It provides a warning against severe weather phenomena like tropical cyclones, squally winds, heavy rainfall/ snow, thunder-squall, hailstorms, dust storms, heat waves, warm nights, fog, cold waves, cold nights, ground frost, etc. It also provides real-time data and weather prediction of maximum temperature, heat wave warnings, extreme temperatures and heat alerts for vulnerable cities/ rural areas.

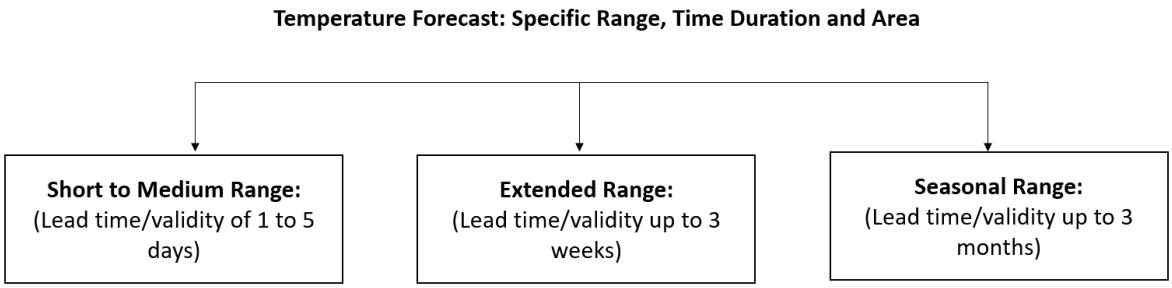
IMD issues forecasts and warnings for all weather-related hazards in short to medium range (valid for the next five days) every day as a part of its multi-hazard early warning system. These warnings, updated four times a day, are available on the link (http://www.imd.gov.in/pages/allIndiawxfcbulletin.php.)

A new system of exclusively heat-related warnings has been introduced with effect from 03 April, 2017. These warnings, valid for the next four days, are issued around 1600 hours IST daily and are provided to all concerned authorities (Departments of Health, Disaster Management, Indian Red Cross and Indian Medical Association, NDMA etc.) for taking suitable action at their end. A bulletin in extended range with an outlook for the next two weeks (for all hazards including heat waves) is issued every Thursday (http://www.imd.gov.in/pages/extended.php).

In addition to the above, Climate Forecast System based maps of daily maximum temperatures and their departures from normal for the next 21 days (issued every Thursday) are also available on the IMD website (http://nwp.imd.gov.in/cfs_all.php?param=tmax) and (http://nwp.imd.gov.in/cfs_all.php?param=tmaxa).

IMD has also issued seasonal temperature outlooks for the next three months, valid from March to May and the second one for April to June every year. These seasonal outlooks are issued as press releases on the IMD website and through electronic and print media. They are also provided to all concerned Chief Secretaries, Disaster Managers and the health sector through the India Medical Association (IMA).

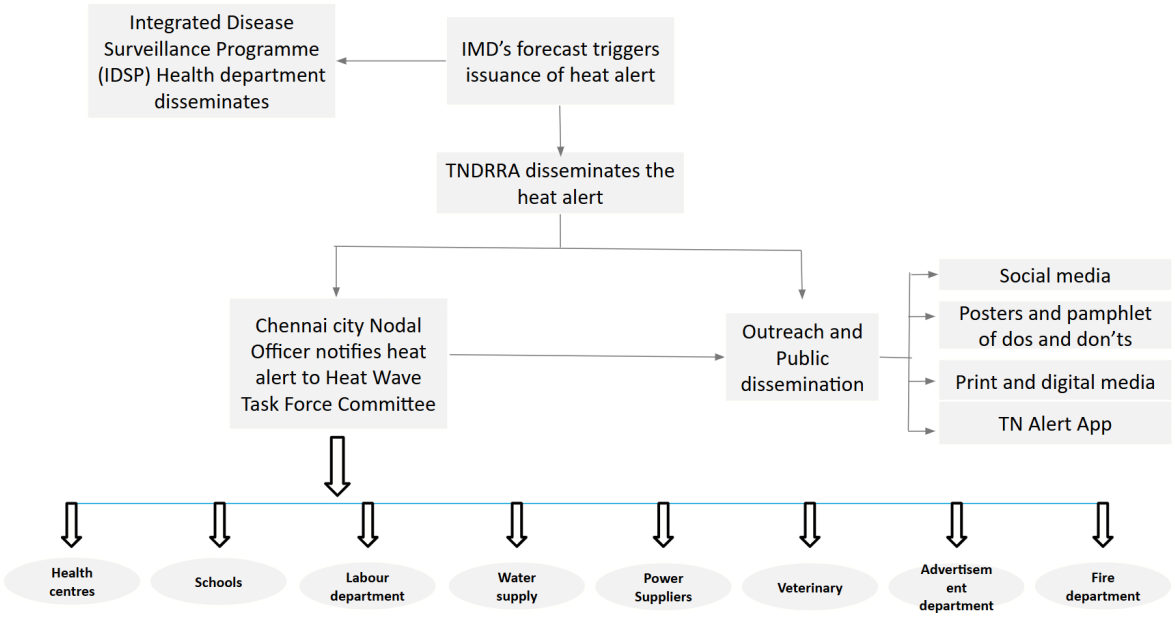
Figure 16: The operational system of weather forecasts and warnings



Source: IMD 2019

The District Disaster Management Authority (DDMA) will receive forecasts from the IMD Regional Meteorological Centre in Chennai and forward them to the nodal officer of the Chennai city Heatwave Taskforce Committee through the DDMA. Based on the heat thresholds established in this plan, the nodal officer will analyse meteorological variables such as temperature and relative humidity. Using this analysis, the nodal officer will issue colour-coded heat alerts to the Heatwave Taskforce Committee. These alerts will then be disseminated to relevant line departments and vulnerable populations. Figure 17, illustrates the communication flow for the dissemination of these alerts.

Figure 17: Communication flow for sending out heat alerts



The outreach materials in the form of Information, Education and Communication (IEC) presented in the next chapter will be utilised by the heatwave task force committee in collaboration with the AMC advertisement department and social media influencers to raise awareness among vulnerable populations. The focus will be on communicating

essential dos and don’ts, with priority actions emphasised in identified at-risk and vulnerable wards.

TN ALERT Mobile App

The TN-ALERT mobile application, launched by the Tamil Nadu State Disaster Management Authority (TNSDMA), serves as a centralized platform for real-time dissemination of disaster-related information. The app provides citizens with timely updates on disaster risks, early warnings, rainfall forecasts and safety advisories such as dos and don’ts. Notably, the application has been enhanced to include heatwave alerts, enabling users to receive heat advisories, precautionary measures and guidance on staying safe during extreme heat events. This initiative strengthens the state’s capacity for risk communication and supports proactive community response to both sudden and slow-onset climate hazards.

Scan code to download the TN ALERT Mobile App

App store (iOS)

Play store (Android)

Upon downloading the application, the user can find Heat Wave Module in the main interface of the TN Alert app to get the 5-day forecast and advisory for Heat Wave and Heat Stress warnings for the user locations.

10 Monitoring, evaluation and updating the Chennai city heat action plan

While this action plan integrates all the necessary components for an effective Heat Action Plan (HAP), the successful implementation of the plan is equally crucial. Continuous monitoring, evaluation and revision are vital to its success. Evaluation is essential to assess whether the activities are achieving their intended effects (effectiveness), determining if they are cost-efficient (efficiency), ensuring they are acceptable to the target population (social acceptability) and guaranteeing that evaluation occurs at all stages of planning, development, implementation and review (WHO, 2008).

To ensure the effective and timely implementation of the HAP, both the process and outcomes must be monitored at designated intervals. Monitoring short-term strategies through quantitative, performance-based indicators will enhance the preparedness of officials and stakeholders, as well as raise awareness and build the capacity of vulnerable groups. After the heatwave season, analysing the plan's outcomes and impacts will provide valuable insights into its effectiveness, highlight any remaining gaps and identify future needs for improving the plan's impact.

10.1 Monitoring and evaluation framework for the Chennai City HAP implementation

Key Performance Indicators (KPIs) aligned with each outlined strategy—both for preparedness and response (in the short term) and heat risk mitigation (in the long term)—will enable a quantitative evaluation of the plan’s performance. The KPIs associated with each strategic theme, as outlined in Chapters 6 and 7, have been presented as part of an actionable framework. The authority responsible for implementing each sub-theme will also be tasked with data collection, mapping and estimating the measurable KPIs against established minimum performance standards. This process will track progress and ensure alignment with the larger goal of effectively mitigating heat risks and improving resilience.

Table 10: Monitoring and evaluation framework for the Chennai city HAP implementation

Process Evaluation					
Sl.No	**KPI type**	**Description of Measurable KPI**	**Short Term**	**Long Term**	**Assessment Period**
1	Evaluation of Stakeholders' Understanding of Heat Risk	No. of expert consultations for understanding of heat risk			End of March
2		No. of questionnaire- based interviews with heat wave cell for understanding of SOP			
3		No. of stakeholders participating in training programmes			
4		No. of consultations with SDMA/DDMA before summer season			
5	Evaluation of Vulnerable Communities' Awareness of Heat Risk & Preparedness	No. of wards that received colour coded impact based early warning			
6		No. of focus group discussions conducted with identified vulnerable communities in each at risk ward			
7		No. of questionnaire-based surveys with heat vulnerable households			
8		No. of emergency mock drills conducted with vulnerable communities			
9		No. of IEC Materials distributed			
10	Evaluation of Preparedness against heat-wave related illnesses	No. of wards with appointed heat wave in-charge officer			Mid-April
11		No. of nodal officers for coordinating preparedness			
12		No. of wards with population identified at risk from heat related illnesses			
13		No. of workshops in			

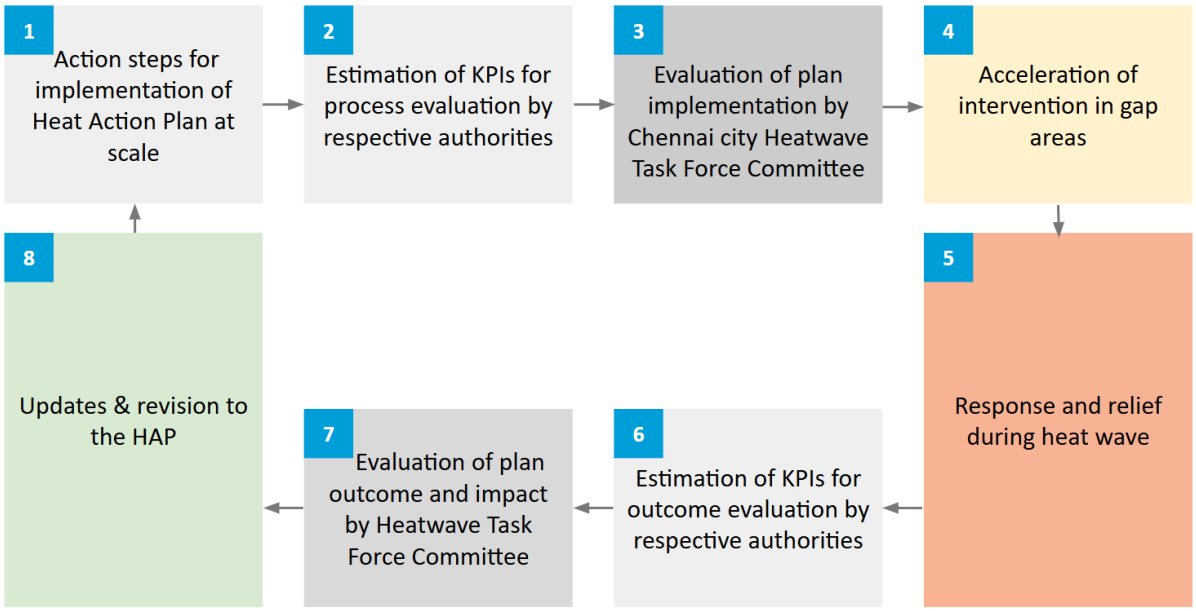
		hospitals to implement hospital preparedness plan			
14		No. of trainings conducted for health professionals			
15		No. of wards with data collection plan			
16		No. of water supply stations added in wards			
17	Evaluation of preparedness & response of relevant authorities	No. of ward level committees to coordinate preparedness and response actions			
18		No. of meeting organised to prepare for emergency response and relief			
Output Evaluation					
Sl.No	**KPI type**	**Description of Measurable KPI**	**Short Term**	**Long Term**	**Assessment Period**
1	Monitoring of heat-related socio-economic parameters	No. of reported heat related illnesses (ward-wise)			July
2		No. of heat induced mortality cases (ward-wise)			
3		No. of wards with reported water shortage			
4	Monitoring of Mitigation & Adaptation measures	Ward-wise change in green space per person			December
5		No. of wards with improved water access			
6		No. of wards with improved water quality			
7		Change in modal share of electric vehicles			
8		Change in share of renewable energy use			
9		No. of roads with green divider introduced			
10		Change in share of renewable energy use			
11		No. of rooftop solar panels installed (ward-wise)			
12		No. of promotional campaigns for innovative			

		cooling solutions			
13		No. of ward-wise cooling shelters installed			
14		No. of health check up camps organised in slum areas			
15	Monitoring of heat-related environmental parameters	Change in ward-wise land surface temperature			January

10.2 Revising the HAP

Given the evolving and projected heat extremes in Chennai city and recognizing this as the inaugural version of the Heat Action Plan (HAP) for the city, it is essential to revisit and revise the plan after the 2025 heatwave season. The revision process should be guided by the successes and challenges observed during the 2025 heatwave season. The heatwave management cycle, as illustrated in Figure 18, integrates monitoring, evaluation and plan updates into a continuous, year-round implementation framework. This cyclical approach ensures the plan remains adaptable and effective in addressing emerging heat-related challenges in Chennai city, fostering long-term resilience and preparedness.

Figure 18: Heatwave management cycle for Chennai city



In preparation for the next iteration of Chennai city's Heat Action Plan (HAP), several key considerations should guide its development:

Establishment of Heat-Health Thresholds: While the current plan establishes local-level thresholds using biometeorological indices, it is crucial to enhance this by correlating mortality and heat illness data (as outlined in Chapter 13) with observed felt and dry temperatures. The use of bio-statistical analysis techniques will allow for the establishment of more precise and accurate heat-health thresholds, improving the plan's ability to predict and mitigate heat-related impacts.

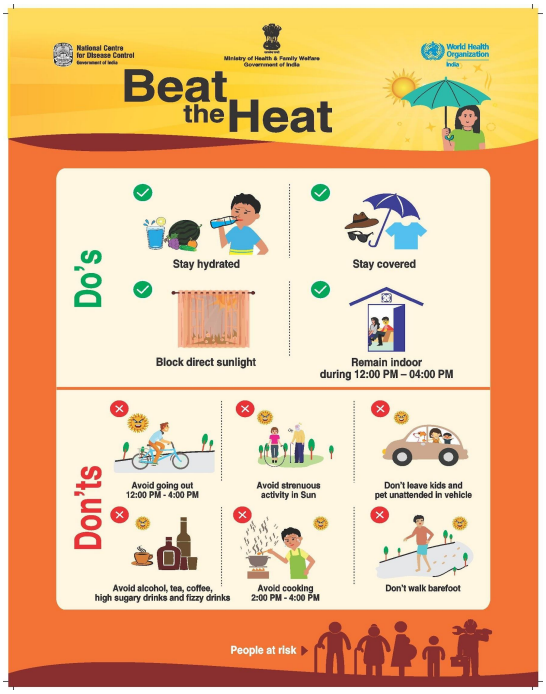
Incorporation of Wind Speeds and Meteorological Persistence: The current version of the plan relies on the heat index based on daytime and nighttime relative humidity and temperature variables. Moving forward, it would be beneficial to incorporate India-specific heat index data being developed by the India Meteorological Department (IMD). Integrating this data will provide a more comprehensive understanding of heat risks, accounting for variables such as wind speed and meteorological persistence, which play a significant role in heatwave intensity and duration.

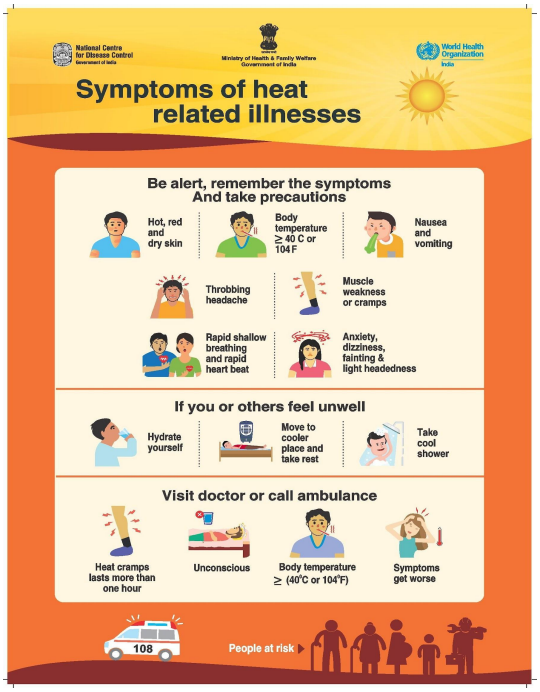
Development of Ward-Level Heat Risk Index: The current plan includes a heat risk index at the sub-city level using secondary data, but it is essential to refine this approach to the ward level through on-ground surveys. By collecting socio-economic data via field surveys, authorities can assess heat risk more accurately at the local level. This localized analysis will allow for better prioritization of mitigation and response measures, ensuring that resources are allocated to areas with the highest heat vulnerability.

These key considerations aim to enhance the accuracy, relevance and effectiveness of future heat action plans for Chennai city, enabling more informed decision-making and better preparedness in the face of rising heat risks.

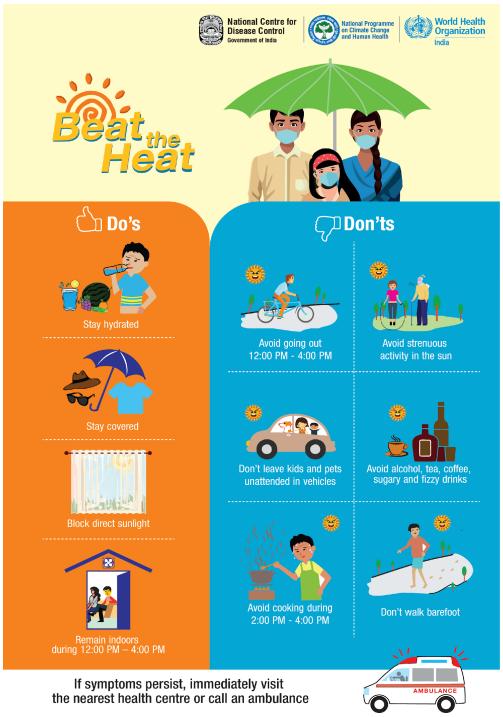
11 Information, Education and Communication (IEC)

Figure 19: IECs Issued by NPCCHH for Heat wave warning and management









Source: National Programme on Climate Change & Human Health (NPCCHH), NCDC

Figure 20: IECs Issued by NPCCHH for Heat wave warning and management













Source: Tamil Nadu Health Department

12 Annexures

12.1 Methodologies for climatological projections and calculating satellite-based indices

1. Methodology for undertaking climatological projections over Chennai city Corporation

To grasp future climatic patterns, the detailed downscaled projections from the Coordinated Regional Climate Downscaling Experiment (CORDEX) South Asia program, overseen by the Centre for Climate Change Research (CCCR) at the Indian Institute of Tropical Meteorology (IITM), Pune have been used in this plan. These projections stem from the CMIP5 (Coupled Model Intercomparison Projects, 5th generation) climate models, a collaborative platform showcased in the IPCC's fifth assessment report (AR5). Under CORDEX, regional models driven by CMIP5 data portray scenarios for Representative Concentration Pathways (RCPs) – specifically, RCP 4.5 (mid-range emissions) and RCP 8.5 (high-end emissions). These scenarios depict a time series of emissions, concentrations of greenhouse gases, aerosols and land-use changes. While temperature projections are considered with high or moderate confidence, rainfall projections bear lower confidence, prompting the use of robust statistical methods for model selection and bias correction. Despite such corrections, the inherent variability in the Indian climate and coarse model resolution introduces some level of uncertainty.

Figure A1: Workflow for evaluating and selecting suitable Regional Climate Models (RCMs) for Tamil Nadu.

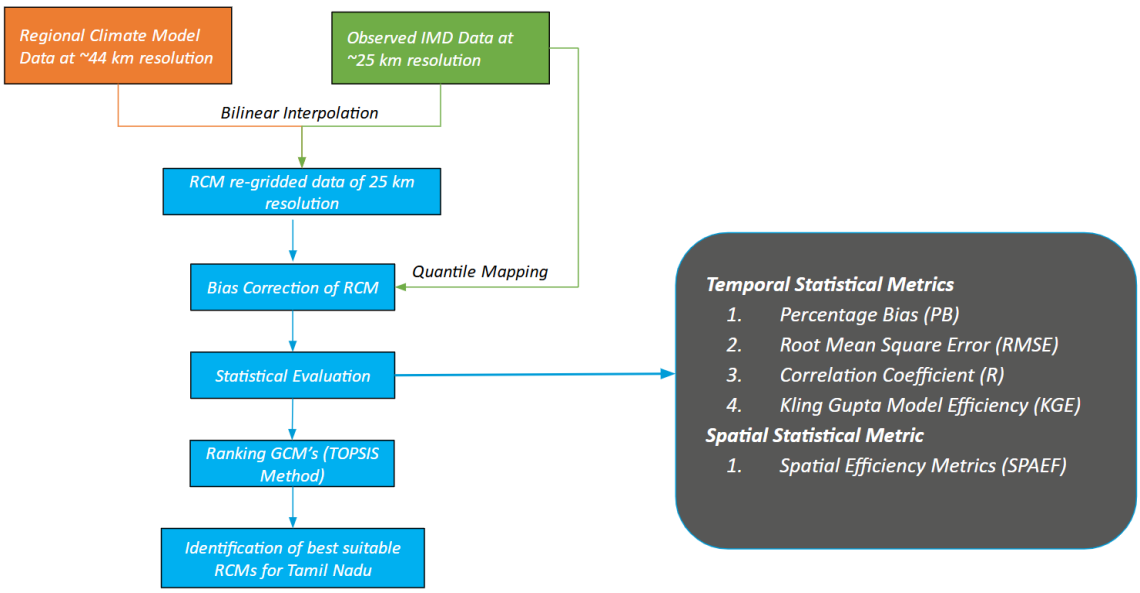


Table A1: List of models chosen for projection analysis

Driving CMIP5 GCM	Contributing CMIP5 Modelling Centre
CCCma-CanESM2	Canadian Centre for Climate Modelling and Analysis (CCCma), Canada
NOAA-GFDL-GFDL ESM2M	National Oceanic and Atmospheric Administration (NOAA), Geophysical Fluid Dynamics Laboratory (GFDL), USA
CNRM-CM5	Centre National de Recherches Me´te´orologiques (CNRM), France
MPI-ESM-MR	Max Planck Institute for Meteorology (MPI-M), Germany
IPSL-CM5A-LR	institut Pierre-Simon Laplace (IPSL), France
CSIRO-Mk3.6	Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

2. Detailed Methodology for calculating satellite based indices

Calculating satellite derived Indices: For mapping the urban heat islands and various other landscape indicators, a combination of satellite based data obtained from the Landsat-8 and Sentinel 2 has been used. Landsat-8 data is particularly useful for calculating various indices, such as the Normalised Difference Vegetation Index (NDVI), Modified Normalised Difference Water Index (MNDWI), etc. These indices utilise the spectral information captured by Landsat-8 to derive meaningful insights about land cover, vegetation health and water bodies.

Normalised Difference Vegetation Index (NDVI): The NDVI is a widely used vegetation index calculated from remotely sensed data, in this case- Landsat-8 data. It quantifies the presence and health of vegetation by measuring the difference between near-infrared (NIR) and red (RED) bands of the electromagnetic spectrum (Sha Huang 2020). The formula for NDVI is:

$$NDVI = \frac{NIR - Red}{NIR + Red}$$

NDVI values range from -1 to 1, where higher values indicate healthier vegetation and lower values indicate sparse or stressed vegetation. It provides insights into vegetation density, distribution and health over large spatial scales.

Modified Normalised Difference Water Index (MNDWI): The MNDWI is designed to detect the presence of water bodies in remotely sensed imagery. It is particularly effective at distinguishing between water and non-water features, such as built-up areas or vegetation. MNDWI

calculated using the green (Green) and shortwave infrared (SWIR) bands of the electromagnetic spectrum (Liwei Chang 2022). The formula for MNDWI is:

$$MNDWI = \frac{Green - SWIR}{Green + SWIR}$$

MNDWI values typically range from -1 to 1, where higher values indicate the presence of water and lower values correspond to non-water features.

Normalised Difference Built-up Index (NDBI): The NDBI is used to detect built-up or urban areas in remotely sensed imagery. It helps differentiate between impervious surfaces, such as buildings and roads and natural features, such as vegetation or soil. NDBI is calculated using the near-infrared (NIR) and shortwave infrared (SWIR) bands of the electromagnetic spectrum (Mohammad Subzar Malik 2019). The formula for NDBI is:

$$NDBI = \frac{SWIR - NIR}{SWIR + NIR}$$

NDBI values typically range from -1 to 1, where higher values indicate the presence of built-up areas and lower values correspond to non-built-up areas.

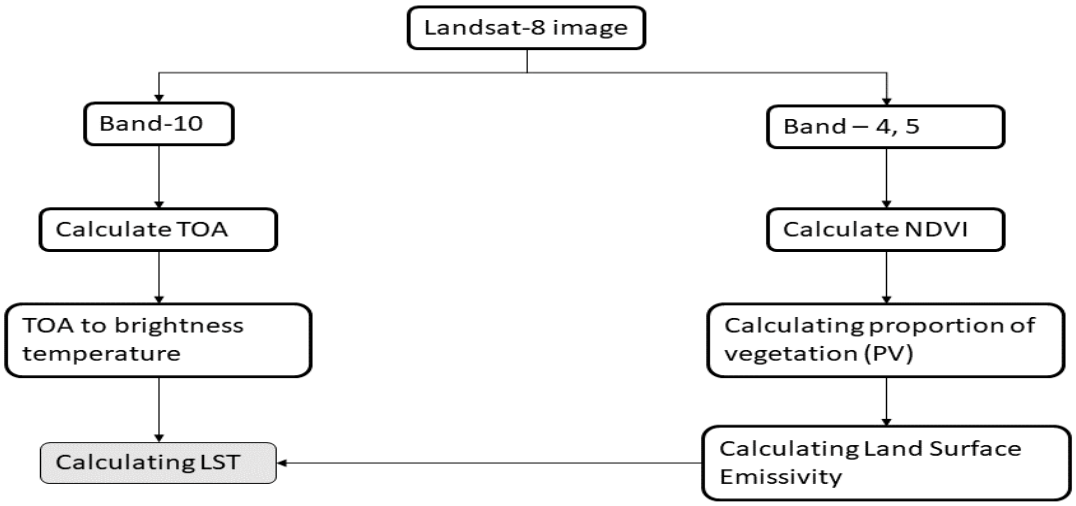
Land Use/Land Cover: The land use/ land cover data was taken as the direct product of Sentinel 2A derived indices from the ESRI's Living Atlas as a raster data of the year 2022 (most recent available data at the time of analysis). This data underwent initial categorization into various classes, subsequently refined into six distinct categories tailored for our specific analysis. These categories include: Water, Vegetation, Crop, Build, Swampy region and Bare.

Building Density: Utilising Google's Open Building dataset, an assessment of building density was conducted through the creation of 500-m square grids. These grids were generated using the fishnet tool within ArcGIS Pro, ensuring a systematic and comprehensive coverage of the study area. Following this, a spatial join operation was executed, integrating the building data with the generated grids. As a result, each grid acquired a count of total buildings within its boundaries, facilitating the calculation of building density across the analysed region. This methodological approach ensures a detailed understanding of the spatial distribution and concentration of buildings within the study area.

Land Surface Temperature (LST): Land Surface Temperature (LST) refers to the temperature of the Earth's surface as measured from a satellite or other remote sensing platform. It is a crucial parameter which

provides insights into surface energy fluxes, urban heat island effects and land-atmosphere interactions. Landsat-8 is equipped with the Thermal Infrared Sensor (TIRS), which enables the estimation of land surface temperature (Ridho 2023), (Anandababu D 2018),.

Figure A2: Methodology for computing Land Surface Temperatures from Landsat-8



12.2 Detailed Methodology for Ward-Level Heat Risk Assessment

To evaluate climate related risks in an organized manner across cities, a composite ward-level risk index has been constructed on the basis of the IPCC AR5 framework. The approach adopts a systematic, multi-step methodology that seeks to capture the intricate interactions between hazard, exposure and vulnerability at a higher spatial resolution.

The four fundamental thematic areas guide the analysis:

1. **Hazards trends:** Trend analysis of climatic hazards such as extreme precipitation, temperature variability at the ward level, using IMDAA-based and Landsat-derived land surface temperatures. This approach allowed them to capture both air and land surface temperature trends and hotspots. Local secondary factors in terms of variability of humidity, as well as precipitation deficits, are also discussed in order to perceive local dynamics of hazards.

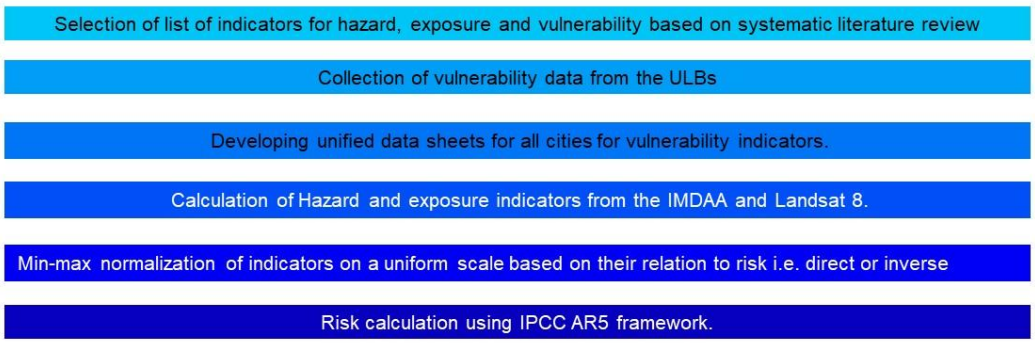
2. **Population exposure and vulnerability:** Analysis of the population groups most exposed to climate hazards and assessment of social, economic and infrastructural factors leading to increased vulnerability within wards.

3. **Existing risk levels:** Measurement of current levels of climate risk among wards by combining hazard, exposure and vulnerability indicators into an overall composite risk index.

4**. Drivers of risk and possible solutions**: Identification of the most important drivers of heightened risk at the ward level and potential strategies and interventions to improve climate resilience.

This approach offers a comprehensive understanding of heat risk distribution across the wards and informs targeted strategies for enhancing resilience.

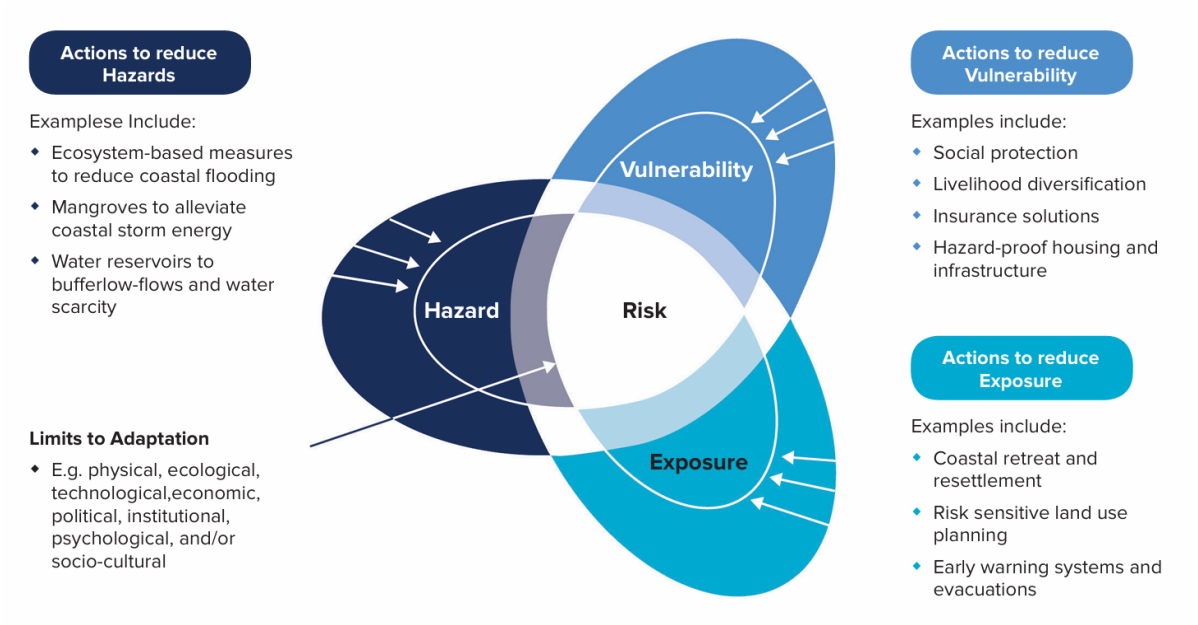
Figure A3: Detailed schematic of approach and methodology



The risk assessment framework

The development of the heat risk index in this assessment adhered to the standardised methodology outlined in the IPCC Fifth Assessment Report (AR5) of 2014, which is also endorsed by the Indian Department of Science and Technology (DST) for national-level assessments. This approach, acknowledged by the Ministry of Environment, Forests and Climate Change (MoEFCC) in India, highlights the 'risk' concept as the outcome of interactions between vulnerability, exposure and hazard. The framework defines 'risk' as "the potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems. In the context of climate change, risks can arise from potential impacts of climate change as well as human responses to climate change. Relevant adverse consequences include those on lives, livelihoods, health and wellbeing, economic, social and cultural assets and investments, infrastructure, services (including ecosystem services), ecosystems and species" (IPCC 2014).

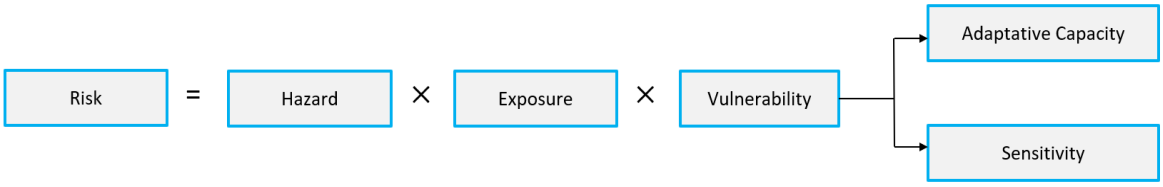
Figure A4: Risk assessment framework



Source: IPCC 2014

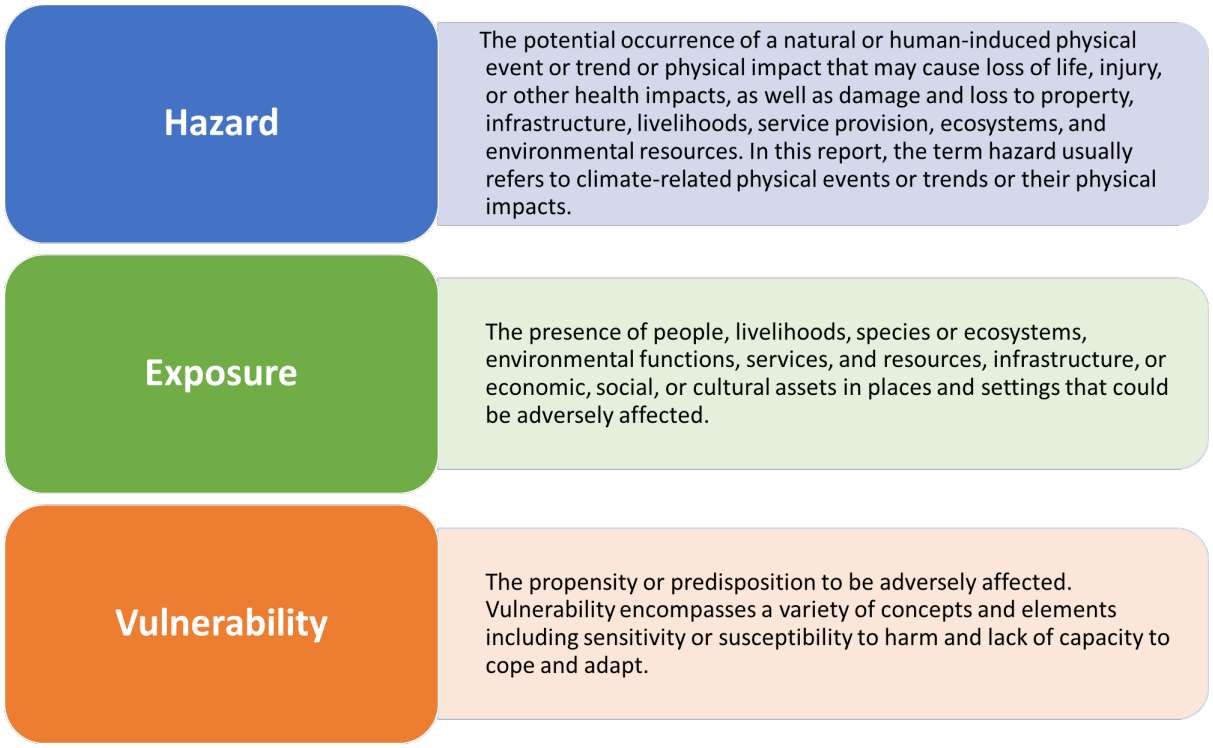
In its AR5, the IPCC emphasises that the severity of impacts resulting from weather and climate events, whether extreme or non-extreme, is closely tied to the level of vulnerability and exposure to these events. Consequently, comprehending the nature of vulnerability and the extent of exposure becomes imperative to mitigate and adapt to the challenges presented by climate change. The risk is calculated by the equation presented in Figure A5.

Figure A5: Equation for Risk Calculation



The framework comprises three components that define the risk to the systems (in this analysis, the Wards). The sub-indices are Hazards, Exposure and Vulnerability, which consist of adaptive capacity and sensitivity, as defined in Figure A6.

Figure A6: Definitions of sub-indices of hazard, exposure and vulnerability



The vulnerability component of the AR5 framework further encompasses two sub-indices, which are as follows:

- Sensitivity refers to the degree to which a system or species is negatively or positively affected by climate variability or change.
- Adaptive capacity refers to the ability of systems, institutions, humans and other organisms to adjust to potential damage, seize opportunities, or respond to consequences arising from climatic or anthropogenic causes.

12.3 Case study-based details of potential solutions for Chennai city's city-level heat action plans (HAPs)

This chapter provides details of the proposed solutions in the previous chapter based on selected case studies of their implementation across multiple countries. The following solutions have been proposed, catering to multiple thematic areas: EWS, infrastructure, public health resilience and urban greening.

Table A2: Contents of the proposed solutions

Name of the solution	Theme and scale of the solution		
	Infrastructure	Public health	Sustainable urban planning
Green Roof	■		
Cool Roof	■		
Green Facade	■		
Cooling Shelter	■	■	■
Shade Structure on Footpaths			■
Urban Greenery			■
Cool Pavements	■		■
Development of Urban Acupuncture	■		■
Thatch / Palm leaves roofing.	■		
Hollow Concrete / Terracotta Tiles	■		
Heat Wave Wards		■	

1. **Name of Solution - Green Roofing Systems**

Location - Open Roofs with direct exposure

A green roof is a layer of vegetation planted over a waterproofing system installed on top of a building. It helps mitigate urban heat by cooling the environment, reducing building temperatures and improving overall thermal comfort.

Types of Green Roof System

Green roofs come in three main types: **extensive, intensive and semi-intensive**, each varying in design, vegetation, maintenance and structural requirements.

Intensive Green Roof

Intensive green roofs are **heavier and more complex** due to their deeper soil layer, often exceeding **6 inches**. This allows them to support a variety of plant species, including shrubs, perennials and even small trees, creating a park-like setting. Due to their weight, these roofs require regular irrigation, maintenance and structural reinforcement. They significantly contribute to urban cooling by absorbing and retaining heat, preventing temperature spikes in buildings and improving air quality through excellent plant coverage.

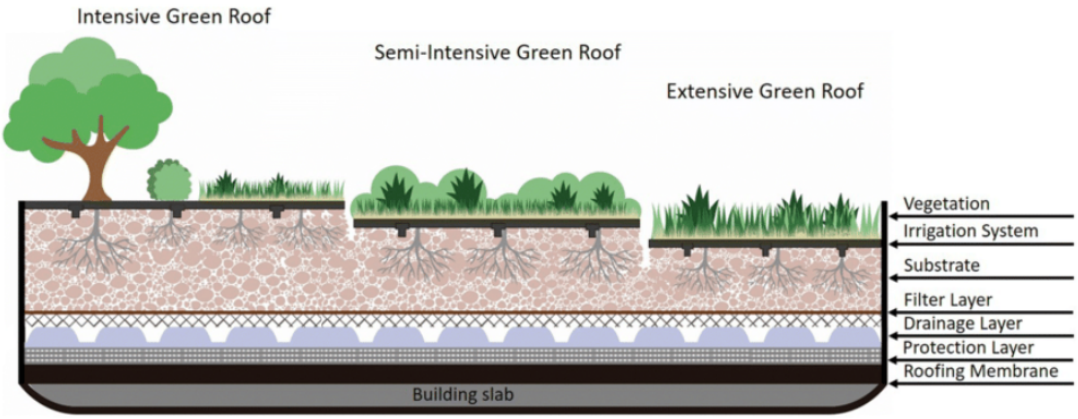
Semi-Intensive Green Roof

Semi-intensive green roofs combine elements of both extensive and intensive systems. They can support a mix of grasses, ground covers and small shrubs with a moderate soil depth. They require **intermediate levels of maintenance and irrigation** compared to intensive green roofs. These roofs are commonly used in commercial and institutional buildings where a balance between ecological benefits and functional aesthetics is needed.

Extensive Green Roof

Extensive green roofs are the lightest and most low-maintenance type. They have a shallow soil depth, typically between **2 to 6 inches** and support hardy, drought-resistant plants such as sedums, grasses and mosses. These roofs are designed primarily for environmental benefits rather than aesthetic or recreational purposes. Because they require minimal irrigation and upkeep, they are ideal for retrofitting buildings with limited structural capacity.

Figure A7: Cross Section of Green Roof



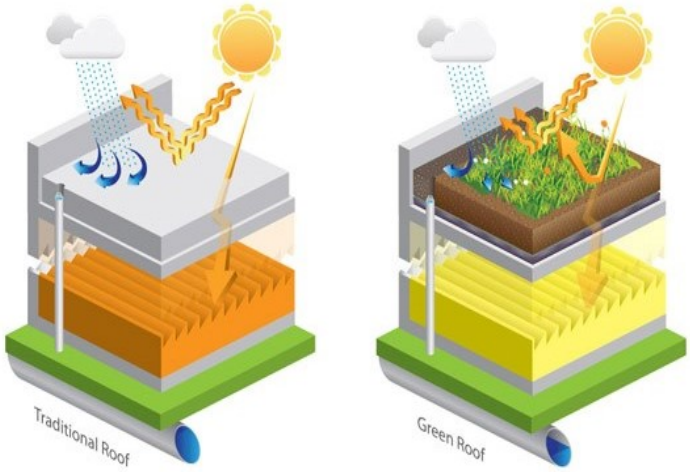
Source: Calheiros, Cristina, Stefanakis, Alexandros. 2021. Green Roofs Towards Circular and Resilient Cities. Circular Economy and Sustainability. 1. 10.1007/s43615-021-00033-0.

How green roofs help in reducing heat

Green roofs play a vital role in **reducing urban heat** through various natural cooling mechanisms:

1. **Evapotranspiration & Cooling:** Plants absorb and release water as vapor, naturally lowering surrounding air temperatures.
2. **Thermal Insulation:** The soil and vegetation act as a barrier, reducing heat transfer into buildings, leading to **lower indoor temperatures in summer** and **heat retention in winter**.
3. **Reduction of Urban Heat Island (UHI) Effect:** Several studies demonstrate that green roof temperatures can be 16–22°C (60.8–71.6°F) lower than that of conventional roofs. When transforming 80–90% of the roofs in a city to green roofs, they may reduce the average ambient temperature between 0.3°C and 3°C (32.5°F and 37.4° F) (Santamoursi 2014). Research conducted in Lagos, Nigeria, showed that a green facade reduces internal air temperatures by an average of 2.3°C (36.14°F) (Akinwolemiswa et al. 2018) and reduces the temperature of the facade itself between 2°C and 10°C (35.6°F and 50°F) compared to the natural stone (Eisenberg and Polcher 2020).
4. **Heat Absorption & Delayed Heat Release:** Green roofs absorb solar radiation and release it slowly, preventing temperature spikes during the day and stabilizing nighttime temperatures.

Figure A8: Heat Dissipation in Green Roof in contrast with Conventional Roof



Source: Heidarinejad, Ghassem and Arash Esmaili.2016. "Assessment of Green Roof Energy Savings compared to Conventional Roof.", Environmental Science, Engineering.199603023

Figure A9: Thermal Map of Roofs with green roof and conventional roof



On a typical day, the Chicago City Hall green roof measures almost 80°F (40°C) cooler than the neighboring conventional roof.

Source: Heidarinejad and Esmaili 2015

Potential Location of Implementation of Green Roof Systems



2. Name of Solution - Cool Roof Systems
Location - Open Roofs with direct exposure

A **cool roof system** is a heat-mitigating solution designed to reduce urban temperatures by reflecting more sunlight and absorbing less heat compared to conventional roofs. It plays a crucial role in **mitigating the urban heat island (UHI) effect**, lowering indoor temperatures and improving energy efficiency. Ahmedabad, a city in India known for its extreme summer heat, has successfully implemented **cool roof strategies** to combat rising temperatures and enhance thermal comfort for its residents.

How Cool Roof Systems Work

Cool roofs utilize **high-albedo (reflective) materials** or **coatings** that reduce heat absorption and improve energy efficiency. These roofs can be categorized into:

1. **Reflective Coatings & Paints** – These are applied to existing roofs with high solar reflectance, reducing surface temperatures.
2. **Cool Roofing Sheets & Membranes** – Prefabricated sheets with reflective properties that minimize heat absorption.
3. **High-Albedo Tiles & Roofing Materials** – Light-coloured, heat-reflective tiles that help keep rooftops cooler.

Conventional roofs can reach temperatures of 150°F or more on a sunny summer afternoon. Under the same conditions a reflective roof could stay more than 50°F (28 °C) cooler**.**

Implementation of Cool Roofs in Ahmedabad

Ahmedabad, one of India's hottest cities, experiences summer temperatures exceeding **45°C (113°F)**. The city adopted **cool roof solutions** to address extreme heat conditions under its **Heat Action Plan (HAP)**. The initiative focused on:

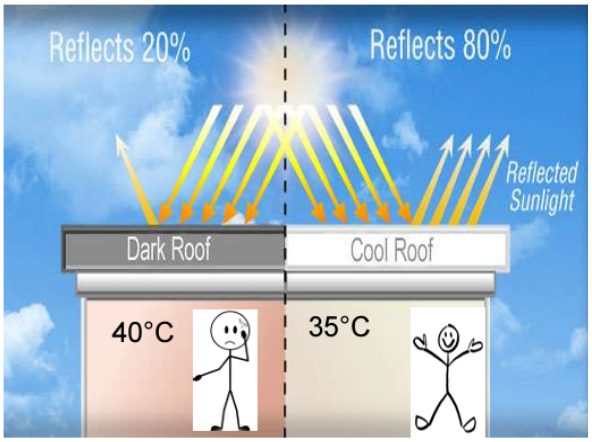
1. **Pilot Cool Roof Program (2017)**
    - Ahmedabad Municipal Corporation (AMC) launched a **pilot project** covering **3,000 low-income houses** with white reflective coatings, reducing indoor temperatures by **2–5°C** (NRDC 2017)
    - The project focused on **slum areas, informal settlements and public buildings**, where people were most vulnerable to extreme heat.
2. **Scaling Up in 2019**
    - The **cool roof program expanded** to include more households, commercial buildings and public infrastructure based on successful pilot results.

    - The initiative encouraged **private developers** and homeowners to adopt cool roofing materials.
3. **Integration into Urban Planning (2020–Present)**
    - AMC made cool roofs part of **building by-laws and urban heat resilience strategies**.
    - Government and private agencies partnered to **subsidize** cool roofing solutions for low-income communities.
    - Roof cooling materials such as **white lime coatings, solar-reflective paints and cool tiles** were promoted citywide.

Benefits of Cool Roof Implementation in Ahmedabad

1. **Reduction in Indoor Temperatures**
    - Cool roofs **lower indoor temperatures by 2–5°C**, improving thermal comfort, especially for vulnerable populations (NRDC 2017)
2. **Energy Savings & Reduced Cooling Costs**
    - A cool roof can reduce the amount of energy needed for air conditioning by up to 15 per cent on a single-story building, leading to substantial savings on energy bills (EESI 2012).
3. **Mitigation of the Urban Heat Island (UHI) Effect**
    - Large-scale implementation of cool roofs helps **reduce citywide temperatures**, making Ahmedabad more **resilient to heat waves**.
4. **Improved Public Health & Heat Resilience**
    - Reduced indoor heat exposure minimises **heat-related illnesses and deaths**, particularly for low-income communities and elderly populations.
5. **Scalability & Affordability**
    - The Cool Roof program is **cost-effective**, requires minimal investment and can be **easily implemented on new and existing buildings**.

Figure A10: Difference between Dark Roof and Cool Roofs

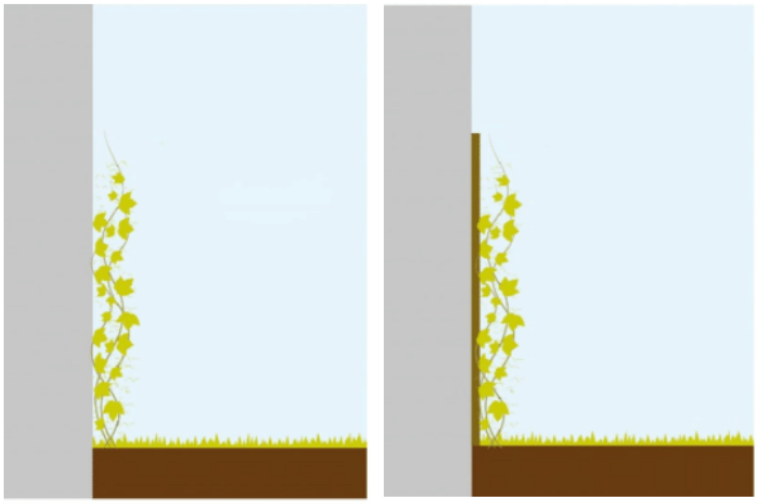


Source: S. Himmelstein. 2017. "California Study: Cool Roof Technology impacts Air Quality

3. Name of Solution - Ground-Based Green Facade and Facade Bound Greening
Location - Building Facade, Periphery of Building

Ground Based - Ground-based green facades are green walls with climbing plants rooted in ground planters. With adhesive pads as part of their anatomy, the climbing or self-clinging plants can grow directly on the wall or in a unique frame connected to the wall. The plants extract water and nutrients from the soil at ground level, grow very tall and adjust to climate fluctuations and lighting conditions. Many flowering and evergreen species can add aesthetic experience to exterior walls, calm and freshen the air

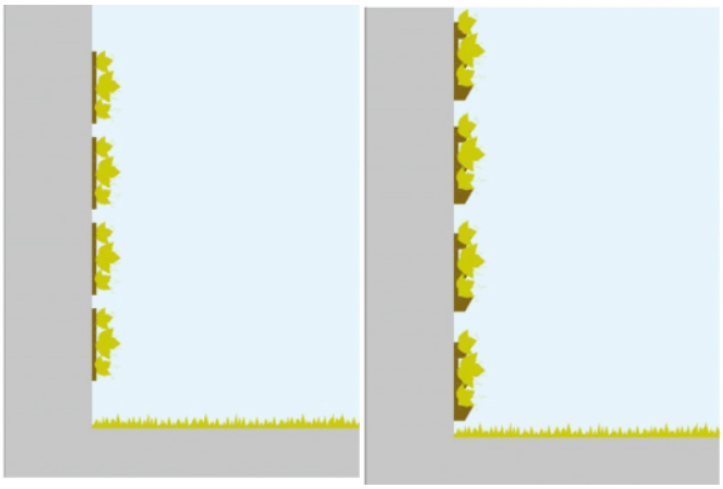
Figure A11: Ground-based green facades, either self-climbing or with support structure



Source: Closing Water Cycles in the Built Environment through Nature-Based Solutions: The Contribution of Vertical Greening Systems and Green Roofs Water, 2021.

Facade Bound Greening - Facade-bounded greening is a type of green wall using irrigation technology and unique substrates to reduce the weight of green facades. They are more expensive than ground-based greening and require higher use of resources in construction and maintenance. Facade-bounded greening allows for a combination of 10–15 plant species, most often mosses and perennials and grows fast and uniform. The thin layer of soil inhibits their suitability in cold, temperate regions.

Figure A12: Wall-based green facades, either with panels attached to the wall or as stand-alone systems



Source: Closing Water Cycles in the Built Environment through Nature-Based Solutions: The Contribution of Vertical Greening Systems and Green Roofs. Water. 2021.

Heat Regulation

- The vegetation layer of the green facade absorbs solar radiation through photosynthesis, protects the heat transmission into the building and provides shade if trees are planted. It reduces building temperature and cools the surrounding air.
- Research conducted in Lagos, Nigeria, showed that a green facade reduces internal air temperatures by an average of 2.3°C (36.14°F) and reduces the temperature of the facade itself between 2°C and 10°C (35.6°F and 50°F) compared to the natural stone (World Bank 2021)

Potential Location of Implementation of Green Facade Treatment



4. Name of Solution - Cooling Shelter
Location - Places of high footfall and pedestrian-intensive location

Cooling shelters in cities serve as **climate-resilient spaces** designed to provide relief from extreme heat, particularly during heatwaves. These shelters are strategically located in **high-footfall areas such as bus stops, markets, parks and transport hubs**, offering shaded and ventilated spaces for public use.

They incorporate **passive cooling techniques**, including **green roofs, bamboo or perforated structures, solar-reflective materials and evaporative cooling systems**. Some shelters also integrate **water dispensers, misting systems and vegetation** to enhance cooling further.

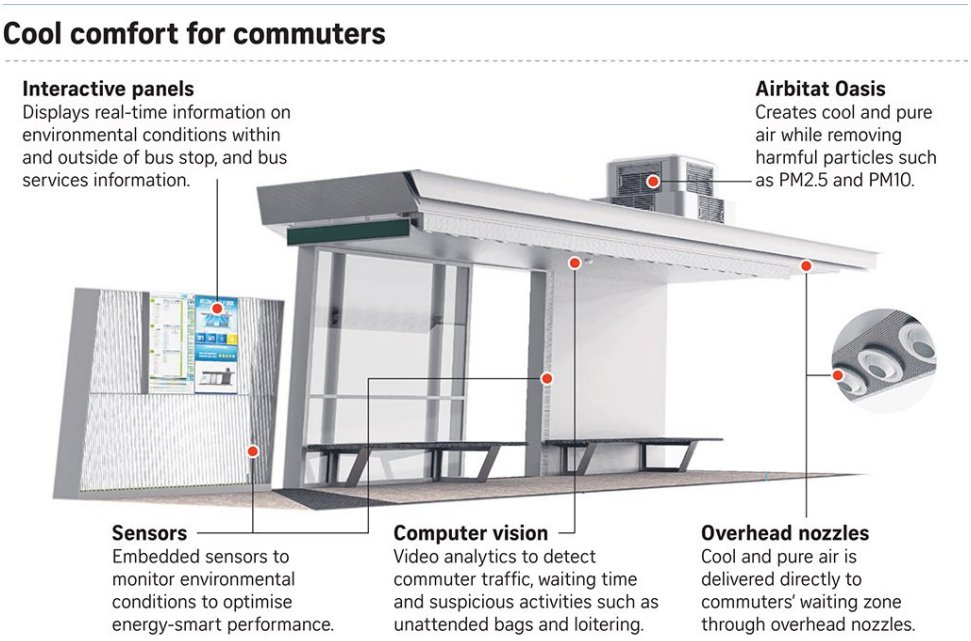
Cooling shelters help protect vulnerable populations, improve urban thermal comfort and contribute to a city's **heat action plan by reducing** heat exposure and offering a comfortable resting place.

Figure A13: Cooling Shelter



Source: Freepik

Figure A14: Components of Cooling Shelter



Source: Ilyas Sholihyn. 2018. "Singapore trials 'smart' bus stop that tracks commuter detects shady activities and blows cool air".

With more than 900 plus multi-purpose cyclone shelters, already established in the state, it provides a good opportunity to also leverage the existing infrastructure for a combination of passive cooling (green roofs, cool roofs) and active cooling solutions (misting, AC, fans).

Example of Jodhpur Cooling Shelter (NRDC 2024) and Ahmedabad Cool Bus-Stop

Figure A15: Jodhpur Cooling Shelter





Source: NRDC 2024

Figure A16: Ahmedabad Cool Bus Stop



Source: Ahmedabad Cool Bus Stop, AMC, AMTS, MHT

5. Name of Solution - Shading Structures on Footpaths
Location - Pedestrian Pathways

Shading infrastructure is crucial in **enhancing pedestrian comfort, reducing heat exposure and improving walkability** in urban areas. Shading is an effective method of improving microclimate conditions in cities and shading structures such as canopies and covered walkways can improve pedestrians' thermal comfort in open urban spaces (Hsing-Yu Ou et.al 2023). By integrating shading solutions, cities can create **cooler, more comfortable and safer pedestrian environments** while mitigating the **urban heat island (UHI) effect**.

Fabric Canopies & Tensile Structures (Latifa Sultana et.al 2019)

- Lightweight, **fabric-based shading systems** (e.g., tensile fabric canopies) offer **flexibility and easy installation**.
- Reflective or light-coloured fabrics help **reduce heat absorption**.
- Ideal for **temporary events, public plazas, or narrow streets where trees cannot be planted**.

Bamboo & Wooden Shade Structures (Renwu Wu et al. 2023)

- **Sustainable materials** like bamboo and wood create **eco-friendly and visually appealing shading elements**.
- These can be used as **arched walkways, pergolas, or modular canopy designs**.
- Suitable for **urban promenades, cultural districts and heritage sites**.

Benefits of Shading Infrastructure in Urban Areas

- **Enhances Pedestrian Comfort & Walkability:** Encourages people

to **walk and use public spaces**, reducing car dependency.

- **Mitigates Urban Heat Island (UHI) Effect:** Reduces heat absorption from roads, buildings and sidewalks.
- **Improves Public Health:** Lowers risks of **heat exhaustion, dehydration and heat-related illnesses**.
- **Supports Sustainable Urban Design:** Integrating greenery and shading promotes **climate-adaptive city planning**.

Figure A17: Pedestrian Shelter



Source: Adele, Peters. 2021. "What US Cities can learn from Abu Dhabi about surviving record heat"

6. Name of Solution - Urban Greenery
Location - Locations in cities with exposed pavements, exposed roads and locations with less green covers

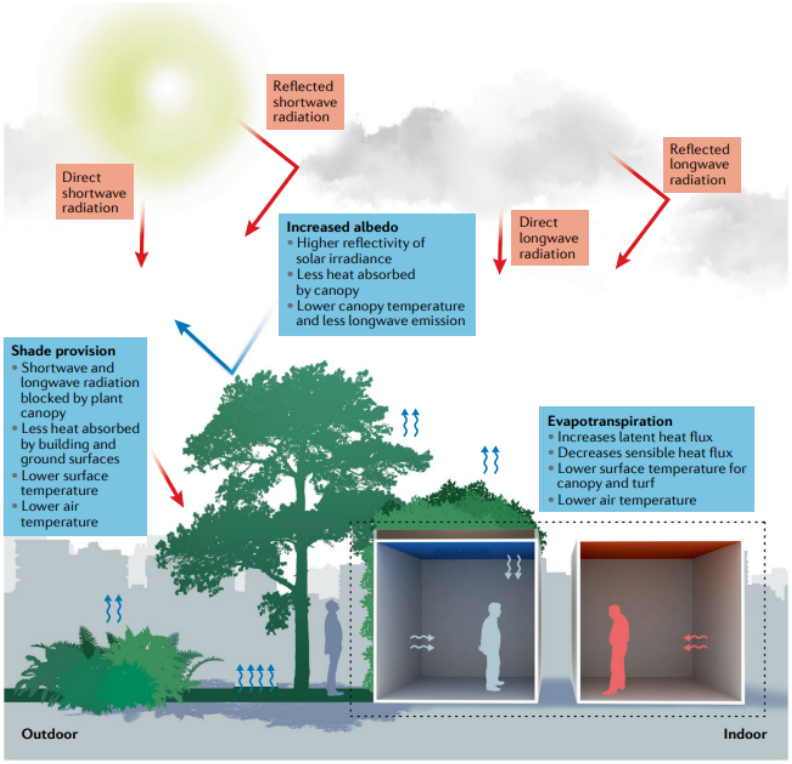
Urban greenery modifies shade provision, evapotranspiration and albedo. Combining these three mechanisms reduces sensible heat gain, lowering heat gain and surface temperatures. Red boxes indicate warming mechanisms and blue boxes indicate cooling mechanisms.
How Urban Greenery Reduces Heat (Nyuk Hien Wong et al. 2021)

1. **Shade Provision**
    - Trees and vegetation block direct solar radiation, reducing the heat absorbed by buildings, roads and ground surfaces.
    - This leads to lower surface temperatures and cooler surrounding air, creating shaded microclimates that enhance pedestrian comfort.
2. **Increased Albedo Effect**
    - Green canopies reflect more sunlight than dark urban surfaces, reducing heat absorption.
    - Lower canopy temperatures result in less longwave radiation

emission, which helps cool the environment.

3. **Evapotranspiration Cooling**
    - Plants absorb water through their roots and release moisture through evapotranspiration, increasing humidity and reducing surrounding air temperature.
    - This process also lowers surface temperatures of green spaces, rooftops and walls, preventing excessive heating of urban structures.

Figure A18: Factors contributing to UHI in cities



Source: Nyuk Hien Wong, Chun, Liang Tan, Dionysia, Denia Kolokotsa and Hideki Takebayash. N.d. "Greenery as a mitigation and adaptation strategy to urban heat".

Case Studies - Singapore Green Plan (2030)

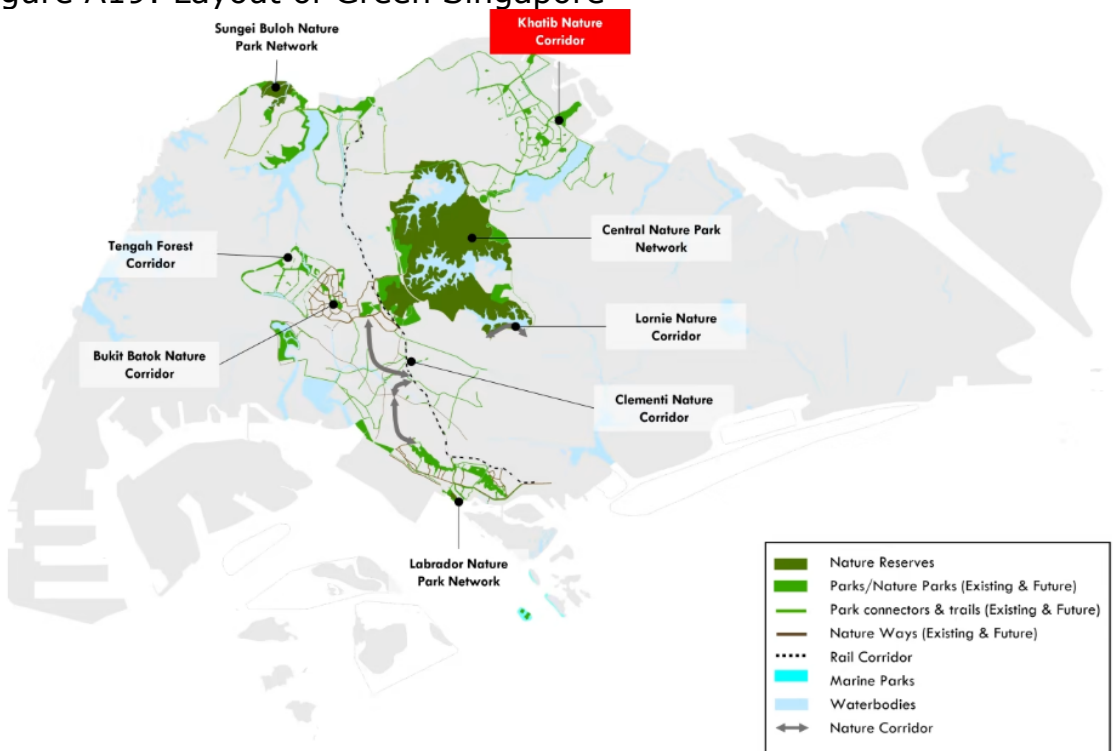
The **City in Nature program**, launched in 2020, was a key initiative under **Singapore's Green Plan 2030.** It aimed to transform the country into a green, livable and sustainable home for its citizens by 2030 (Green Plan Singapore 2023).

By 2030, Singapore intends to introduce **200 hectares of skyscraper greenery and plant over 170,000 more trees in industrial areas**, bringing nature into the city's dense urban fabric.

To improve accessibility to green spaces, Singapore committed to strengthening connections between green spaces by constructing **300 kilometres of Nature Ways and 500 kilometres of park connectors**. This would ensure that every household was within a 10-minute walk of a

park.

Figure A19: Layout of Green Singapore



Source: Singapore Green Plan, 2023

Singapore Therapeutic Garden

- These gardens are designed based on scientific research to **encourage interaction with nature**, **enhancing the overall well-being** of visitors and residents (Green Plan Singapore 2023).
- These gardens are carefully planned spaces that provide a **calm and natural environment to promote relaxation, reduce stress and improve mental and emotional health**. They aim to offer a restorative experience for individuals of all ages.

Figure A20: Therapeutic Garden



Source: Singapore Green Plan, 2023

7. Name of Solution - Cool Pavements
Location - Pedestrian Pathways and locations with high footfalls

Cool Pavements and Their Implementation in Urban Areas

Cool pavements are specially designed surfaces that reduce heat absorption and **lower urban temperatures** than conventional asphalt and concrete pavements. These pavements are essential in mitigating the **urban heat island (UHI) effect**, as traditional dark-coloured roads and sidewalks absorb and retain heat, increasing surface and air temperatures.

Cool pavements use materials and technologies that **reflect more sunlight, absorb less heat and enhance cooling**. They are categorized into:

1. **High-Albedo Pavements** – These pavements have **light-coloured or reflective surfaces** that reduce heat absorption and increase solar reflectance (albedo), keeping temperatures lower.
2. **Permeable Pavements—**Made of materials like porous asphalt, permeable concrete, or interlocking pavers, permeable pavers allow water to seep through, reducing surface temperatures through evaporative cooling.
3. **Evaporative Pavements** contain water-retaining materials that **absorb and release moisture through evaporation**, cooling the pavement surface.

Benefits of Cool Pavements and Evaporative Pavements Work

Cool Pavements

1. **High reflectivity (Albedo Effect):** They reflect more sunlight rather than absorbing it as heat (Taha H et al. 2002).
2. **Lower surface temperatures:** Studies show they can be **10-20°C cooler** than traditional asphalt (Sophia Kappou et al. 2022).
3. **Durability & Sustainability:** Many superb pavement materials are designed to be **longer-lasting** and reduce energy costs.

Evaporative Pavements

1. **Moisture retention:** These pavements contain hydrophilic materials that **store water and gradually release it** through evaporation.
2. **Heat dissipation:** The evaporative cooling effect lowers surface temperatures, making surrounding areas more comfortable.
3. **Permeability:** They allow rainwater infiltration, reducing runoff and improving groundwater recharge.

Actionable Implementation of Cool Pavements in Urban Areas

1. **Public Spaces & Sidewalks** – Applying cool pavement coatings to pedestrian pathways and public squares reduces surface heat and improves walkability.
2. **Roadways & Parking Lots** – Using high-reflectivity materials in parking areas prevents excessive heat accumulation.
3. **Playgrounds & Sports Courts** – Implementing cool pavement surfaces in schools and parks enhances thermal comfort for children and athletes.
4. **Bus Stops & Transit Hubs** – Applying permeable and evaporative pavements in transportation areas lowers heat stress for commuters.
5. **Residential & Commercial Driveways** – Using permeable concrete or reflective coatings in driveways improves local cooling and stormwater management.

Figure A21: Types of cool pavements and their uses

Pavement type	Solar Reflectance (SR)	Uses	Pavement surface life
Clear Resin Binders	Depends on aggregate	New construction & maintenance for streets, sidewalks, parking lots, etc.	20 years
Coatings (e.g., cementitious coating, elastomeric coating)	New: 35–55%	Coatings for preventive maintenance for streets, driveways, parking lots, etc.	1 to 5
Light-Colored Aggregates (e.g., chip seal)	Depends on aggregate	Overlay for preventive maintenance for highways, streets, parking lots	2 to 5 years
Light-Colored Cement (e.g., slag, white cement)	New: 70–80%	New construction & maintenance for highways, streets, sidewalks, parking lots, etc.	40 years
Porous Asphalt Cement (AC), Pervious Portland Cement Concrete (PCC), & Reinforced Grass Pavements	Depends on pavement type	New construction, to aid with stormwater management	varies
Portland Cement Concrete (PCC)	New (gray cement): 35–50% Aged (gray cement): 20–35%	New construction & maintenance for highways, streets, sidewalks, parking lots, etc.	40 years

Source: Global Cool Cities Alliance 2012

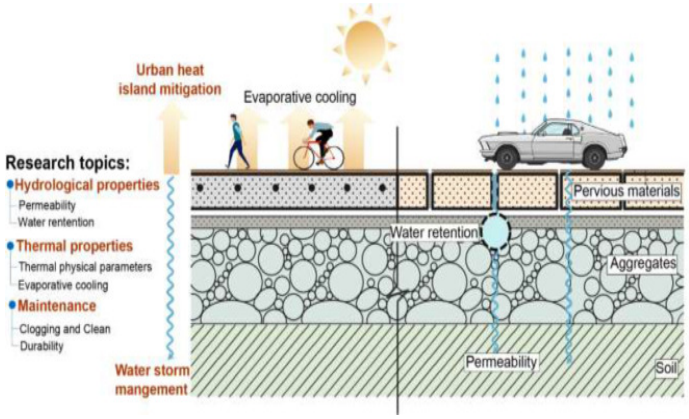
Cool pavements are **cost-effective, environmentally friendly and improve urban resilience** against extreme heat. Their integration with **green infrastructure**, such as **tree-lined streets and shaded pedestrian pathways**, further enhances city cooling benefits.

Figure A22: Dark Pavements v/s Cool Pavements



Source: Lui, Hui, John, Harvey, Arash, Saboori, Ali, A Butt. 2017. "Development and Application of LCA Tool for Cool Pavement". University of California

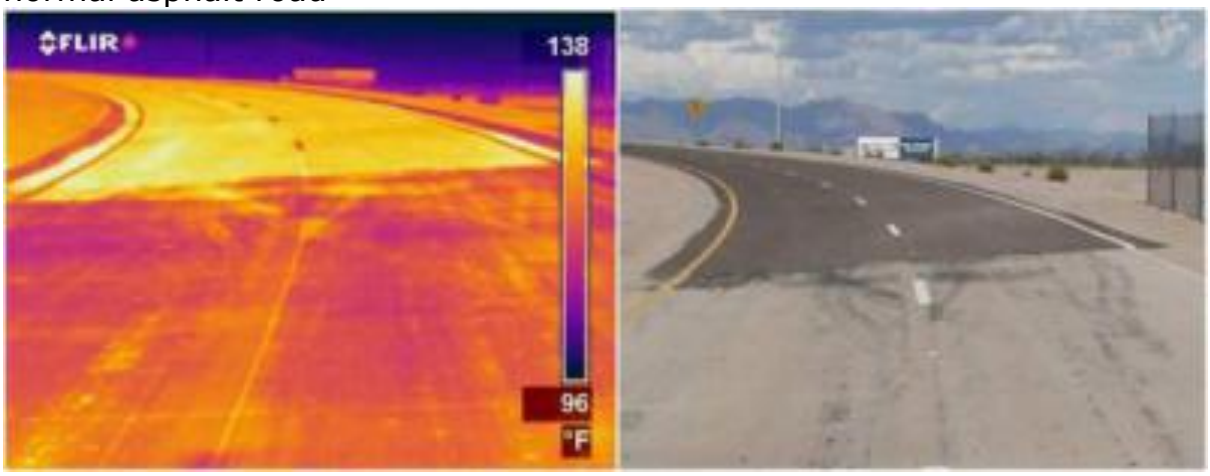
Figure A23: Evaporative Cooling



Source: Performance synergism of previous pavement on stormwater management and urban heat island mitigation: A review of its benefits, key parameters and co-benefits approach. Water Research. 2022

The UHI effect is due to the materials used in the construction of urban areas, which absorb and store more heat during the daytime than rural areas, later releasing it and boosting afternoon and night-time temperatures.
Reflective pavements (RP) r**educe the amount of light** and, therefore, heat absorbed by pavements. Reflective materials can be used to coat existing pavements or to construct entirely new ones.

Figure A24: Thermal Infrared Vision of cool pavements compared to a normal asphalt road



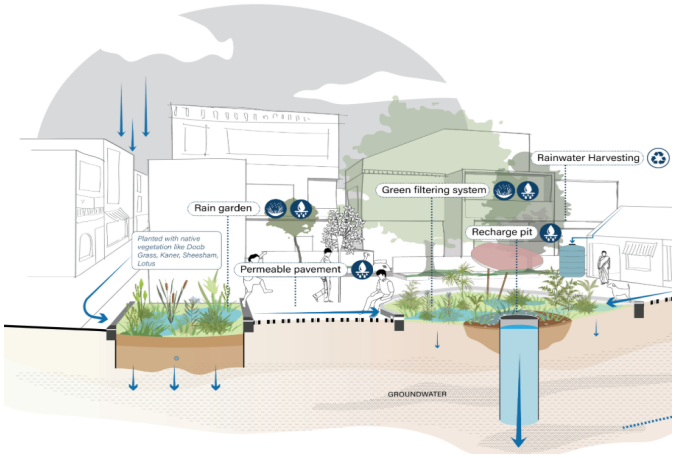
Source: Heat Island Group

Thermal infrared (left) and visible (right) images of a road with light and dark segments. The infrared image shows that the light segment (bottom) is about 17°C (30°F) cooler than the dark segment (top). (Image courtesy of Larry Scofield, APCA)

8. Name of Solution - Development of Urban Acupuncture
Location - Urban Voids, Pocket Parks, Kitchen Gardens in Hospitals

Areas with high public activity levels can be used to incorporate the Disaster Risk Reduction (DRR) concept. These public spaces can also leverage the **small niches, corner greens/buffers and neighbourhood parks to be holistically developed into blue-green acupunctures of varying scales**. Multiple acupuncture can also be designed in conjunction. For example, recharge wells can be part of a stormwater park that can help improve the overall livability of the area. If the groundwater level is shallow, water collected into these wells can be treated using native plants. In cases where it's deep, the water can retain and recharge naturally.

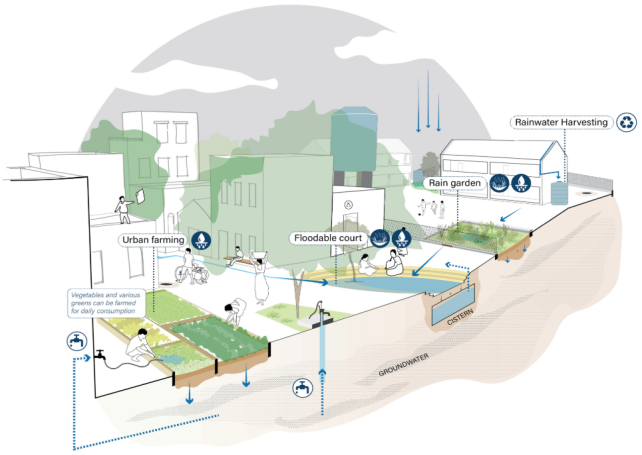
Figure A25: Development of Urban Blue-Green Acupuncture



Source: *WRI India. 2021, "Creating a flood resilient Indian "Sheher" through Water Sensitive Urban Design"*

In cities, the marginalised neighbourhoods are adversely affected by flooding and are further crippled with challenges such as inadequate access to WASH and the right to healthy spaces. These urban settlements are highly dense, organic and lack open spaces; the blue-green acupunctures will have multi-functional and circular values. Small pockets of open spaces (community kitchen gardens, wetlands) will be carved up, which can be synergistically designed to provide clean water, livelihood and public green spaces. Efficient rainwater harvesting and recharge wells can ensure access to safe, clean water for the community.

Figure A26: Leveraging small open spaces to act as temporary ground for water



Source - WRI India. 2021, "Creating a flood resilient Indian "Sheher" through Water Sensitive Urban Design"

9. Name of Solution - Thatch / Palm Leaves for roofing
Location - Rural and Peri-Urban Areas

Bamboo, Thatch and palm leaves are locally available across India and can be installed as a secondary roof screen, reducing the heating effect.

Traditional materials like bamboo, thatch and palm leaves offer excellent heat mitigation and solar reflectance benefits, making them ideal for sustainable architecture.

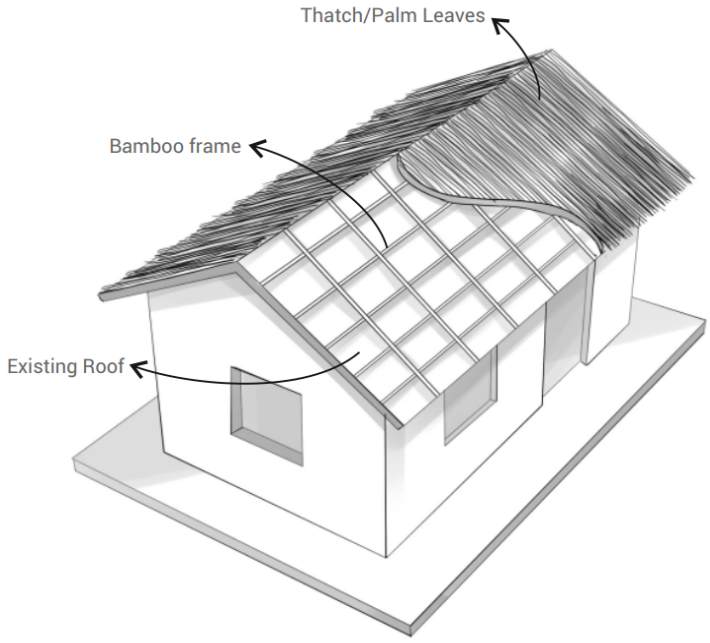
With natural light tones, thatch and palm leaves reflect some solar radiation while providing effective insulation due to the trapped air within their fibers, keeping interiors cooler.

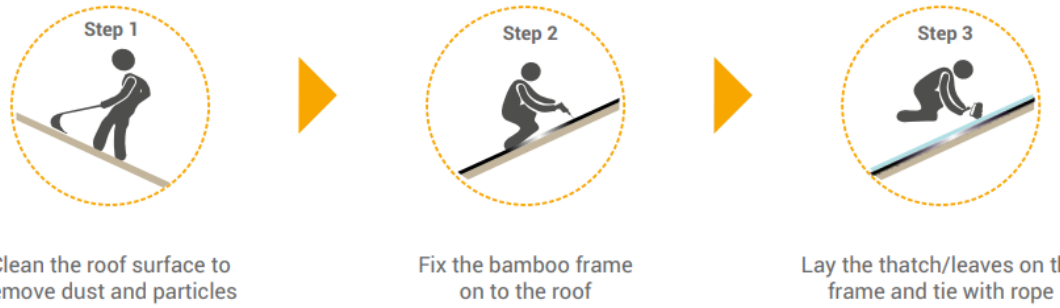
When used in slatted or woven forms, bamboo creates a semi-permeable barrier that allows light and air to pass through, reducing heat buildup.



Method for Installation

Figure A27: Deployment of Thatch / Palm leaver over roofs



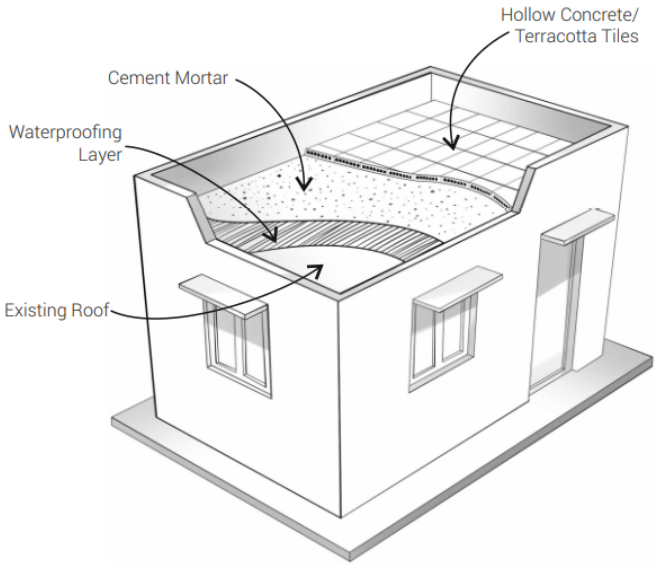


Source: *NDMA 2021 "House Owners' Guide to Alternate Roof Cooling Solutions," New Delhi*

10. Name of Solution - Hollow Terracotta/ Concrete Tiles
Location - Exposed Rooftops

- Hollow concrete/terracotta tiles have high thermal and sound insulation properties, limiting heat flow. The air inside the cavities provides the insulation to heat.
- Hollow concrete tiles contribute to heat mitigation by enhancing thermal insulation and reducing heat absorption. Their **hollow cores trap air as a natural insulator, slowing heat transfer and cooling surfaces**.
- Unlike solid concrete, which retains heat and radiates it back into the surroundings, hollow tiles minimize thermal mass, reducing the urban heat island effect.
- Additionally, their design allows for **better airflow, further aiding in cooling by dissipating trapped heat**.
- Hollow concrete tiles can significantly lower surface temperatures, creating a more comfortable microclimate, especially in hot and humid regions when used in pavements, roofs, or facades.
- Their ability to accommodate **water-permeable designs also supports cooling through evaporative effects**, enhancing their role in sustainable urban development.

Figure A28: Deployment of Hollow Concrete / Terracotta Tiles on existing roofs



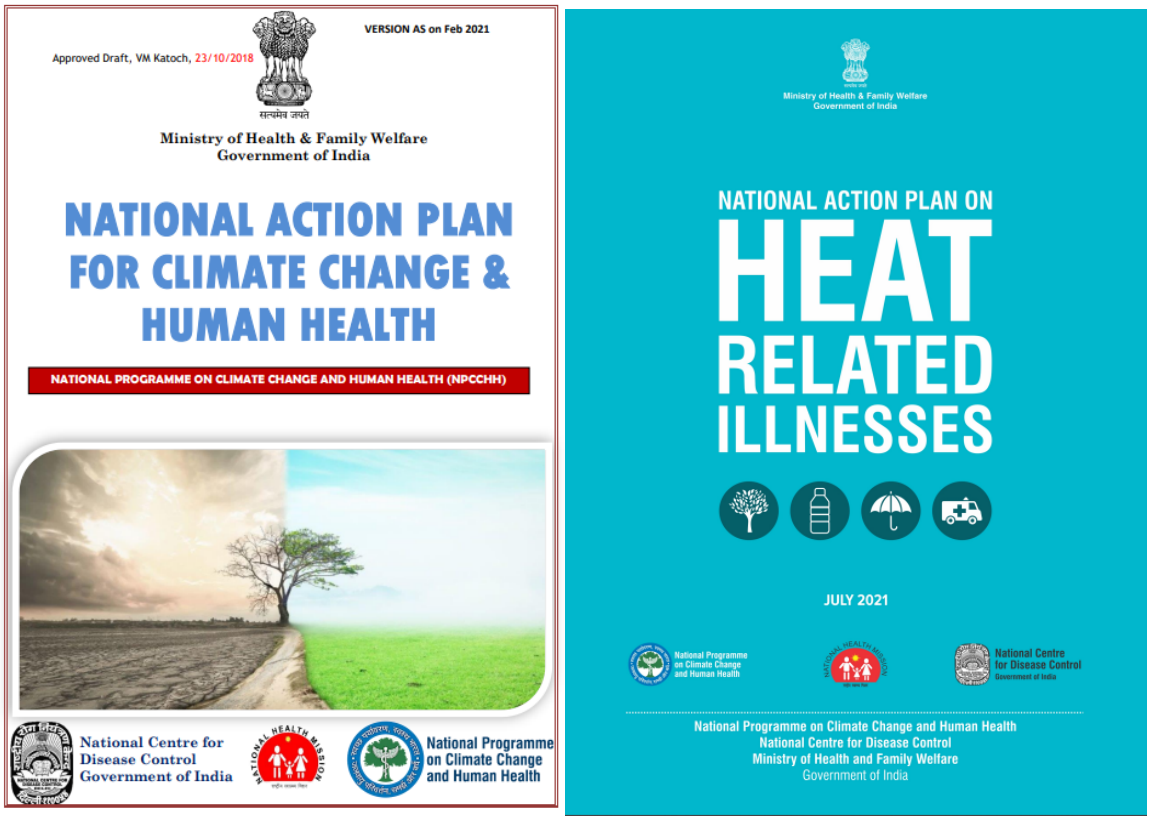
Source: *NDMA. 2021 "House Owners' Guide to Alternate Roof Cooling Solutions," New Delhi*

12.4 Health sector preparedness and response plans

Health sector has to play one of the most crucial roles in advancing heat resilience. Effective health sector preparedness, timely response and long-term planning for risk reduction are crucial for minimizing the adverse impacts of extreme heat, particularly on vulnerable populations. This includes understanding the clinical manifestations of heat-related illnesses (HRIs), establishing protocols for their timely management and ensuring that health facilities are equipped with dedicated heatwave wards and robust response mechanisms. Integrating Heat Health Early Warning Systems is also a key component, allowing for timely alerts and coordinated interventions when extreme heat conditions are anticipated.

As part of a comprehensive Heat Action Plan (HAP), these measures form the foundation for a resilient public health response—one that can anticipate, manage and mitigate the health impacts of extreme heat through both preventive and reactive strategies. This chapter, based on the guiding documents provided by India's National Programme on Climate Change and Human Health, NCDC, MoHFW, outlines measures for health sector resilience.

Figure A29: Guiding documents provided by India's National Programme on Climate Change and Human Health, NCDC, MoHFW



Source: NPCCHH, NCDC, MoHFW

1. Understanding and managing heat-related illnesses

One of the most direct outcomes of extreme heat is Heat-related illnesses (HRI), which have now emerged as a significant public health concern, notably contributing to fatalities associated with extreme heat events (Savioli et al., 2022). In India alone, reports presented in the Lok Sabha in 2024 revealed that there were more than 67,637 suspected cases of heatstroke between March and July due to severe heat waves in the same year (Vasudha Mukherjee, 2024). A global systematic review indicates that for every degree rise in temperature from the baseline, there is an associated increase of 18 per cent in morbidity and a staggering 35 per cent in mortality related to heat illnesses (Faurie et al., 2022).

1.1 Pathophysiology

Human beings maintain a core body temperature of 37°C through four primary heat dissipation mechanisms :

- Conduction: transfer of heat through direct contact with a cooler object or air.
- Convection: heat transfer through direct contact with cooler air.
- Evaporation: loss of heat through sweat or water on the skin.
- Radiation: Heat is transferred from the skin tissue to the surrounding air.

It's important to note that, except for evaporation, the effectiveness of the other three pathways diminishes at temperatures above 35°C. Additionally, when relative humidity exceeds 75 per cent, evaporation becomes inefficient too (NPCCHH, 2024). As the thermoregulatory system becomes overwhelmed due to the inability to dissipate body heat, individuals may experience a range of heat-related illnesses (HRI). These can range from non-fatal conditions such as heat cramps, exhaustion, rashes and edema to the more severe and potentially fatal heat stroke. If non-threatening conditions are not addressed on time, they can progress into heat stroke

Table A3: The range of heat-related illnesses

Heat-Related Illnesses	Description	Treatment
Severe illness		
Heat stroke	A multisystem, life-threatening illness characterised by elevation of the core body temperature (>40°C) and CNS dysfunction	Move the patient to a cool environment; manage airway, breathing and circulation; administer rapid cooling with cold-water or ice water immersion or other means; administer intravenous rehydration; and evacuate to the emergency department after on-site cooling is performed. ICU admission is warranted for the management of end-organ sequelae.
Moderate illness		
Heat exhaustion	Profound fatigue, weakness, nausea, headache or dizziness or a combination of these symptoms resulting from a decrease in body water content or blood volume due to water or salt depletion from heat exposure; mild elevation (<40°C) in body temperature may be present, but not altered mental status	Remove the patient from the hot environment; treat with rest in supine position, evaporative cooling and intravenous or oral rehydration; monitor mental status. A delayed response to treatment warrants further evaluation
Mild illness		
Heat syncope	Brief loss of consciousness due to vasodilation and pooling of blood in the limbs as a result of physiological compensation to heat exposure	Remove the patient from the hot environment; treat with rest in supine position, passive cooling and intravenous or oral rehydration. Prolonged recovery or a medical history or physical examination arousing concern for a cardiac cause, if the patient has cardiac risk factors, should prompt further evaluation
Heat edema	Swelling of limbs caused by peripheral	Remove the patient from the hot environment and elevate the legs.

	vasodilation and interstitial pooling resulting from physiological compensation in response to heat exposure	Diuretic agents are not indicated
Heat cramps	Painful muscle spasms in the abdomen, arms, or legs during or after activity in the heat, which often occur when excessive amounts of salt are lost during sweating from physical exertion	Remove patient from the hot environment, treat with rest, oral electrolytes and fluid repletion
Heat rash	An inflammatory disorder of the epidermis that results from blockage of sweat glands; may be followed by superimposed bacterial soft-tissue infection	Remove patient's clothing; treat with evaporative cooling and glucocorticoid and antibacterial cream as needed, but avoid topical emollients; monitor for cellulitis. Advise the patient to avoid hot environments and to wear loose clothing.

Source: Sorensen et al., 2022

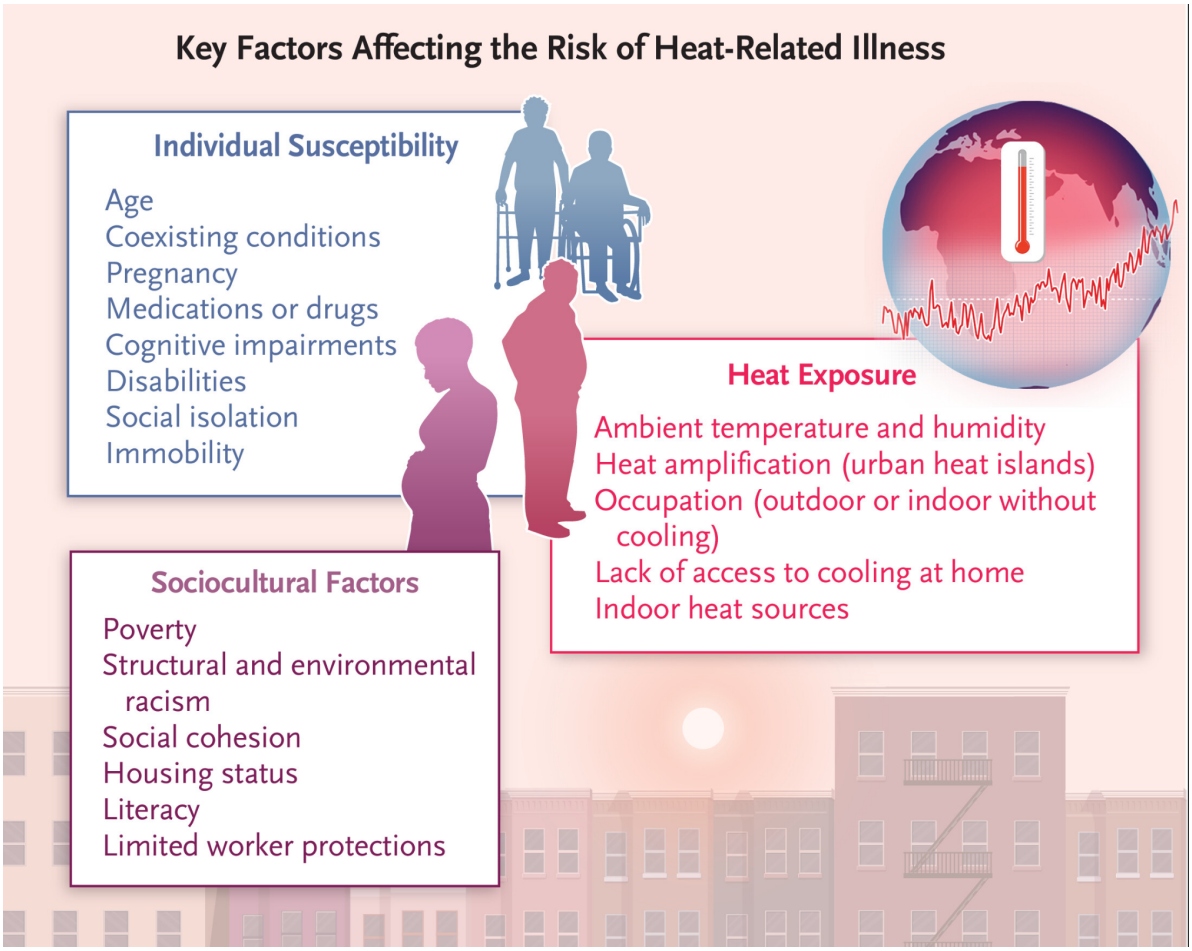
1.2 Risk factors for HRI

Increasing frequency and intensity of extreme heat events predispose certain groups to HRI. This risk is an amalgamation of 3 factors (Sorensen et al., 2022):-

- Heat exposure: a combination of ambient temperature, humidity and bodily metabolic heat generated
- Individual vulnerability: age, sex, gestational status and preexisting illnesses
- Socio-cultural factors: income status, healthcare access, working and living conditions

The risk factors have been quantified in chapter four of this heat action plan, where a ward-level heat risk map has been developed.

Figure A30: Risk Factors of Heat-Related Illness



Source: [Sorensen et al., 2022]

1.3 Heat stroke

On the spectrum of HRI, Heat strokes are considered a catastrophic emergency requiring immediate medical assistance. It is characterised by an increased core body temperature of 40°C and above associated with neurological dysfunction such as convulsions, delirium and, in severe cases, coma. There are two types of heat strokes:

- Classical Heat Stroke (CHS): Occurs periodically in vulnerable groups at increased risk to HRI in extreme heat and humid environments
- Exertional Heat Stroke (EHS): Individuals engaged in high physical activity levels in extreme heat and humid conditions are predominantly at risk. Occupations such as athletes, outdoor manual workers and military personnel are particularly vulnerable to these environmental stresses.

The primary distinction between EHS and CHS is the inability to dissipate excess internal heat stored from increased skeletal muscle activity. However, the clinical manifestations of both conditions remain the same, irrespective of the cause.

Table A4: Features of EHS and CHS

Feature	**Exertional Heat Stroke**	**Classic Heat Stroke**
Occurence	Sporadic (any time of year)	Epidemic (heat waves)
Exposure	. Athletic event . Working in high heat stress conditions	A. High environmental heat with/ without high humidity
Acute risk factors	● Dehydration ● Concurrent Illness ● Obesity ● Wearing too much clothing ● Poor cardiovascular fitness	● Lack of adequate ventilation/ cooling ● Confined places ● Physical exertion not a prerequisite
Heat equilibrium	Overwhelmed: heat gain> heat loss ● Heat gain from environment with/ without an increase in internal heat production	Impaired: reduced heat loss capacity ● Internal heat loss mechanism impaired ● Restricted/ inadequate ventilation
Heat injury development	Quick rise in core body temperature (over minutes/hours)	Slow rise in core body temperature (over hours or days)
Sweating	Usually present (wet skin)	May be absent (dry skin)
CNS dysfunction	Common	Common
Pathophysiological changes	● Metabolic acidosis ● Hypoglycaemia ● Rhabdomyolysis: Frequent ● Liver dysfunction: Severe ● Renal failure: Common ● DIC: Severe ● Hypocalcaemia, Hyperkalemia	● Respiratory alkalosis ● Liver dysfunction: mild ● DIC: Mild ● Volume and electrolyte abnormality is common
Risk factors		
Physiological	● Healthy, active adult	● Elderly ● Children ● Pregnancy ● Obesity ● Chronic illness ● Poor physical or psychological health
Medication/ drug use	Amphetamines and amphetamine like agents,	Antihypertensives, laxatives, anticholinergic drugs,

	MDMA, cocaine, PCP and LSD, synthetic stimulants of the cathinone class, alcohol	salicylates, thyroid agonists, benztropine, trifluoperazine, butyrophenones, tricyclic antidepressants, SSRIs
Socio-economic (individual/ institutional)	Occupation/ physical exertion linked: work time, duration, adequate time to rest, lack of cooling and hydration facilities	• Social isolation • Living on higher floors • Unventilated and non-air conditioned living space • Inability to care for oneself

Source: NPCCHH, 2024

1.4 Clinical manifestation

The signs and symptoms of heat stroke are:

- Warm skin with or without sweating
- Hypotension
- Tachycardia
- Tachypnea
- Anhidrosis is the last presentation

The liver and brain are particularly vulnerable to the effects of hyperthermia and the prognosis is influenced by both the severity and duration of the hyperthermic episode. However, if cooling measures are implemented promptly and completed within 30 minutes of the onset of symptoms, the chances of death can be reduced to zero. This emphasises the critical importance of rapid intervention in preventing severe health outcomes in hyperthermic patients (Savioli et al., 2022).

1.5 Severe Heat-related Illness Management

Heat-related illnesses are largely preventable, but if not promptly identified and managed, they can lead to severe health complications and, in critical cases, even death. The clinical manifestations of heat stroke can closely resemble those of various other conditions, including sepsis, metabolic disorders, cerebrovascular events, neuropathic emergencies and potential toxicological exposures. Therefore, it is always essential to record the core body temperature and rule out other causes of hyperthermia. Simultaneously, prompt initiation of heat stroke treatment is critical to avoid adverse health outcomes. A comprehensive set of routine investigations should be conducted for patients suspected of heat stroke. These include:

- Complete blood count (CBC)
- Arterial blood gas (ABG) analysis
- Liver function tests (LFTs)

- Kidney function tests (KFTs)
- Blood glucose levels
- Electrolyte panel
- Toxicological screening
- Urinalysis
- Additionally, a chest X-ray should be performed if the patient exhibits respiratory symptoms. This thorough assessment helps guide appropriate treatment and management of heat stroke.

The foundation for effectively treating HRI lies in quickly recognising heat as a causative factor, implementing rapid cooling techniques and relocating the patient to a cooler environment. Rapid cooling is the most effective treatment for suspected HRI cases, reducing the risk of mortality from more than 50 per cent to as low as 5 per cent (U.S. Customs and Border Protection). The technique adopted should be completed within 30 minutes of the onset of symptoms, ultimately maintaining a core body temperature between 38 to 39°C.

2. Rapid cooling

Heat-related illnesses, particularly heatstroke, require immediate cooling to prevent severe organ damage or fatal outcomes. Rapid cooling treatments help lower the body temperature as quickly as possible to prevent complications like brain swelling, kidney failure and cardiovascular stress.

2.1 Managing principles when considering Rapid Cooling in heat stroke suspected cases

- Assess competency of airway, breathing, circulation, disability and exposure before treatment initiation and monitor them throughout the procedure, particularly in CHS patients.
- A temperature gradient must be created between the skin and the surroundings, leveraging the body's thermoregulatory mechanisms.
- Cooling rates between 0.784 to 0.154 Deg C/min are efficient in preventing further organ dysfunction complications.
- The primary aim of managing heat stroke patients in emergencies is to *"Cool first, Transport second "* (NPCCHH, 2024)
- Depending on the scene of the collapse, appropriate cooling techniques should be undertaken to complete cooling within 30 minutes of clinical presentation.
- It is not required to differentiate a case between EHS and CHS, as the treatment line remains the same.
- Cooling is not advised when the body temperature is normal or low.
- Avoid prescribing antipyretics such as Paracetamol, Aspirin, Ibuprofen, etc.

- The use of Dantrolene, a skeletal muscle relaxant, is also not recommended in EHS.

2.2 Challenges

- Shivering may be triggered by rapid cooling even after persistent hyperthermia and is more commonly seen in the elderly and children. In such cases, wet bedsheets, water spray and fans are used to cool the patient down. If shivering persists, seek pharmacological support.
- Monitoring of vital signs is crucial through electrodes, especially for severely ill patients presenting with CHS, as they are at an increased risk of cardiovascular decompensation. In cases of rapid cooling methods such as cold water immersion, it is not possible.

2.3 Appropriate rapid cooling techniques for heat strokes

2.3.1 For Exertional Heat Stroke

i. Ice/ Cold water immersion

The use of cold water immersion is widely recognized as the gold standard for cooling patients with exertional heat stress (EHS) who are otherwise physically healthy. Due to its high thermal conductivity, cold water facilitates efficient and rapid cooling compared to alternative methods.

Resources required: Tub/ Portable pool/ Tarp, cold water, ice buckets with ice, rectal thermometer, lubricating gel, 3-4 towels, tarp for shade, if outdoors, 3 to 4 trained personnel for stirring the water, recording vitals, managing patient vitals and monitoring rectal temperature.

Mechanism: In this technique, a vessel filled with ice slurry or cold water is maintained at a temperature between 2 to 10°C. The patient should be exposed as much as possible to the cool medium and immersed up to the torso with hands outside the vessel. A cold cloth should also be placed on the head for additional cooling. The patient should be securely positioned with a cloth under the axilla and stabilised by personnel to prevent any risk of drowning. The immersion should last between 15 to 20 minutes, with the water being vigorously stirred to enhance heat transfer. This process should continue until shivering occurs or the patient reaches a target temperature of 38°C to 39°C. Following successful cooling, the patient should be transported to the nearest emergency department for further monitoring and evaluation. Continue cooling in the best possible way if temperatures are not met during transportation.

Cooling time: 15 minutes

Challenges: Effective pre-planning is essential for managing heat stroke incidents in the field, necessitating the allocation of appropriate resources, both material and personnel. This requires thorough preparation and coordination to ensure a timely and effective response.

Figure A31: Cold Water Immersion in the field



Source: NPCCHH, 2024

ii. Tarpaulin-Assisted Cooling with Oscillation (TACO)

This method is designed for use in resource-limited settings.

Resources required: Instead of a traditional tub or pool for cold water immersion, a tarpaulin is utilized.

Mechanism: First, the tarpaulin is filled with ice and the patient lies on their back in the centre of the tarp. The corners of the tarp are then lifted, allowing cold water to be added until the patient's chest is fully submerged. To enhance the cooling effect, the tarp is gently moved back and forth to mix the ice and water, facilitating effective cooling.

Challenges: It requires dedicated staff just for lifting patients. For obese patients, more people may be needed.

Cooling time: 10 to 15 minutes

Figure A32: TACO in the field



Source: NPCCHH, 2024

iii. Cold water dousing with ice massage

Also known as Water Ice Therapy.

Resources required: Utilises the same resources as cold water immersion; additionally, a porous stretcher is used.

Mechanism: The patient is placed on the porous stretcher inside the tub/ portable pool and multiple personnel drench the patient entirely except the head in the ice-cold water from the tub. Simultaneously massage muscles of the chest, abdomen, thighs and legs with icepacks.

Cooling time: 12 to 24 minutes

2.3.2 For Classical Heat Stroke

i. Body bag immersion

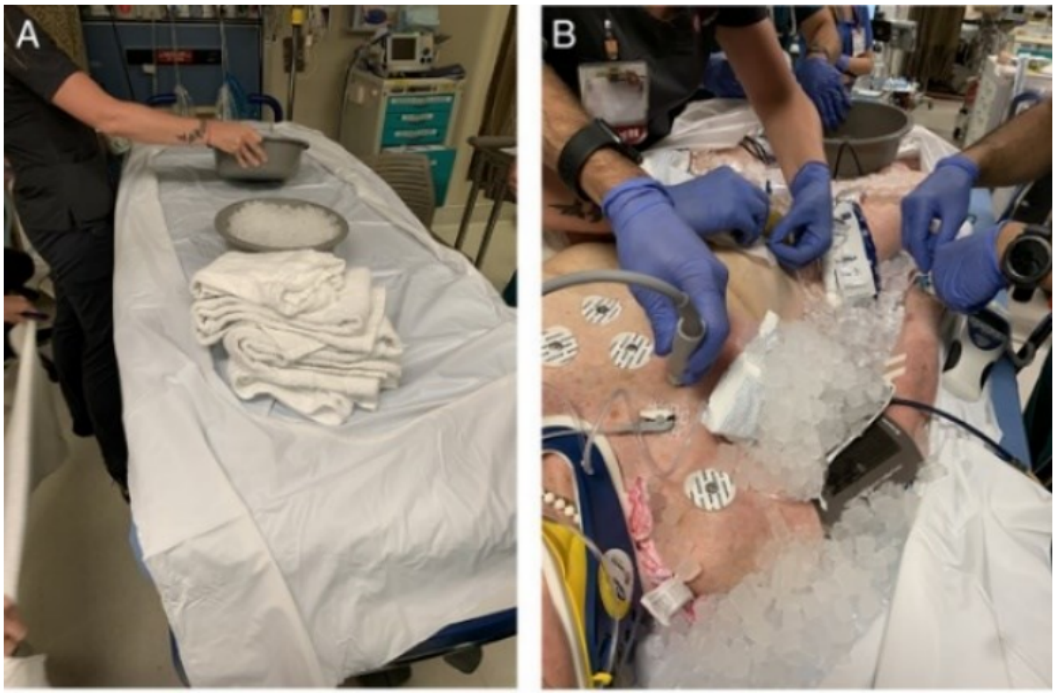
The technique has similar cooling rates as that of cold water immersion but allows for continuous monitoring of the patient as the chest is exposed. Hence, it is the ideal treatment mode in CHS patients. This technique can be used in the field, in an ambulance, or the emergency room of a hospital.

Resources required: Utilizes same resources as cold water immersion, except for a tub, a waterproof, leakproof body bag is used and other medical equipment such as monitor, chest and limb leads.

Mechanism: Place the patient into the body bag filled with ice and cold water, baring the chest. Attach the monitor to assess ABCDE. Once the initial assessment is completed, close the body bag until the rectal temperature reaches 38 to 39°C.

Cooling time: 15 mins

Figure A33: Cold water immersion using a body bag in the emergency department



Source: NPCCHH, 2024

ii. Water spray and Directed Fan

This technique effectively utilizes the body's evaporative and convective thermoregulatory pathways, making it particularly beneficial in cases of CHS, especially for children and older adults.

Resources required: Spray bottle, fan

Mechanism: Once the initial assessment is complete, carefully expose the patient and lightly spray them with cold water while turning on the fan to enhance the cooling effect. If the patient begins to shiver, switch to using room temperature water to ensure their comfort.

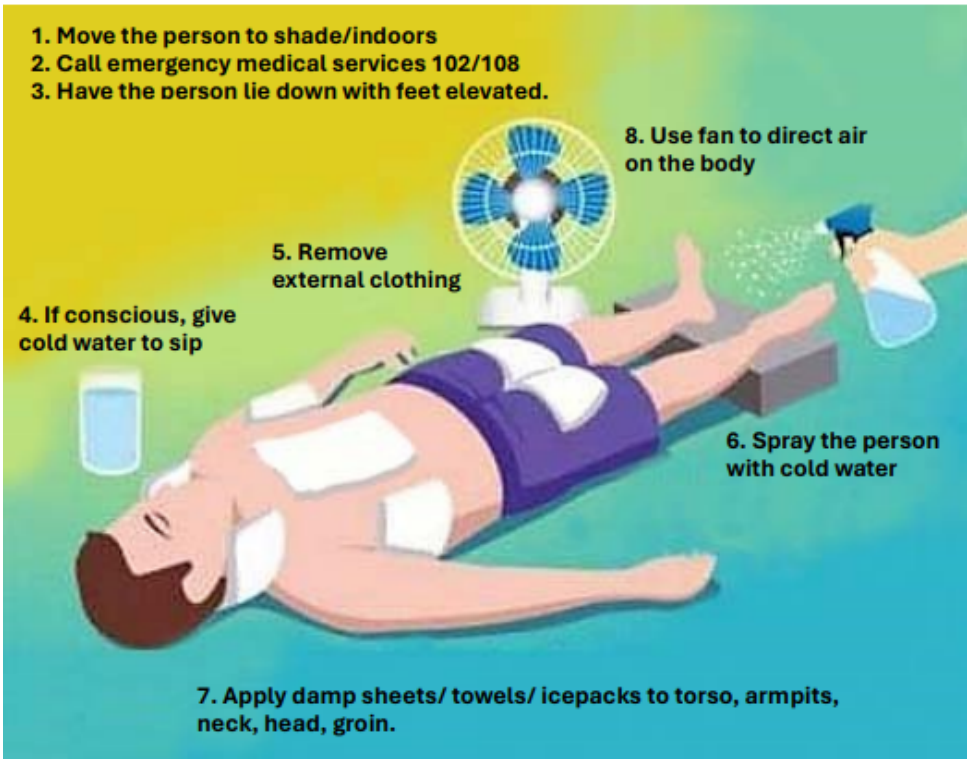
Challenges: It requires access to ample amounts of water and takes longer to cool down when utilizing water at room temperature.

iii. Water-soaked bedsheets and Directed Fan

Soak bed sheets in cool water and apply them over the patient's exposed skin while positioning a fan to blow air at a high speed. This method is particularly effective for children and elderly patients, as it helps to lower body temperature quickly and safely.

iv. Ice pack/ Crushed Ice, Water spray and directed fan

Figure A34: Multiple methods implemented at a time for rapid cooling



Source: [NPCCHH, 2024]

3. Hospital initiatives towards heat wave preparedness

Heatwave Ward: Specialised Hospital Care for Heat-Related Illnesses (Anumeha Yadav, 2024)

A heatwave ward is a dedicated hospital space designated for the treatment of patients suffering from mild and severe heat-related illnesses. These wards are especially crucial in regions experiencing extreme heat conditions due to climate change and rising global temperatures, leading to an increased frequency of hot days and nights.

Owing to the sudden rise in heat-related mortality in 2024, hospitals like Safdarjung, AIIMS (All India Institute of Medical Sciences) and RML (Dr. Ram Manohar Lohia Hospital) in Delhi have established specialised heatwave units to provide dedicated care for patients affected by extreme heat. These wards feature well-ventilated, air-conditioned rooms equipped with life-saving drugs, expert HRI-skilled medical staff, ORS, IV fluids, ice and cold water, along with advanced cooling technologies to stabilize patients and prevent life-threatening complications. (Ankita Upadhyay, 2024)

Benefits of Heatwave Wards

- ❖ Prevents Fatal Heatstroke Cases: Rapid cooling interventions reduce mortality rates drastically, using evidence-based rapid cooling techniques to lower core body temperature.
- ❖ Reduces Heatwave-Related Hospital Admissions: Early intervention prevents complications and shortens hospital stays.
- ❖ Enhances Climate Resilience in Healthcare: These wards facilitate hospital preparedness for the rise in climate change-associated heat waves.
- ❖ Protects Vulnerable Populations: This is critical for elderly patients, outdoor workers, pregnant women and those with chronic illnesses.

Figure A35: Inflated pools and Ceramic Tubs for Heat Wards



Source: Upadhyay, Ankita. 2024. "Battling 107°F fever with ice and water: Inside RML Hospital's heat stroke unit".

4. Hospital Preparedness Measures for Managing Heat-related Illness

The hospital preparedness plan developed under the NPCCHH serves as a foundational guide for states to design, implement, coordinate and assess heatwave response measures within health facilities.

It outlines planned activities across three seasonal phases: pre-heat season, heat season and post-heat season. These activities are categorized into three main areas: infrastructure and logistics, capacity building and information and education and communication (IEC)/awareness. The plan is tailored for three tiers of healthcare institutions: Primary Health Centres (PHCs), Community Health Centres (CHCs) and District Hospitals (DHs)//medical colleges (MCs).

Table A5: Hospital Preparedness Chart- Pre-heat, during and post-heat Season

PHC	CHC	DH/MC
A. Pre-heat Season		
INFRASTRUCTURE AND LOGISTICS		
1. Check inventories for basic equipment and medicines required. 2. Ensure adequate arrangement of staff 3. Explore the creation of ice pack dispensaries to increase access to vulnerable communities 4. Adopt long-term measures such as cool roofs and improving the green coverage of health facility 5. Identify a Rapid Response Team (RRT) to respond to any exigency call outside the hospitals 6. Try to establish outreach clinics at various locations easily accessible to the vulnerable population		
CAPACITY BUILDING		
1. Prepare a detailed action plan to tackle HRI (updated annually). 2. Organize fresher/refresher targeted training course–maintaining hospital records, improve expedience of recording of cause of death, heat illness examination procedures 3. Community involvement of trained staff to create awareness.		
• Map susceptible villages (identify areas/populations that are vulnerable)	• Map susceptible PHCs (identify areas/populations that are vulnerable)	• Map susceptible blocks (identify areas/ populations that are vulnerable)
IEC/AWARENESS		
1. Prepare targeted IEChoardings, banners, posters, leaflets, factsheets, information cards, media, mic announcements, rallies, song/drama activities and street plays. 2. Plan for dissemination as per assessment of vulnerable area/ communities. 3. Conduct sensitisation meetings. 4. Prepare handouts for health staff about heat illness 5. Ensure the availability of funds for the above activities		
B. Heat Season		
INFRASTRUCTURE AND LOGISTICS		

1. Ensure adequate medical supplies are available 2. Identify surge capacities and mark the beds dedicated to treating heatstroke victims and enhance emergency department preparedness to handle more patients		
• Increase ANM/ MPHW outreach in at-risk villages during a heat alert, if feasible.	• Increase ANM/MPHW outreach in at-risk PHC during a heat alert, if feasible. • Ensure dedicated bed availability • Ensure ambulance availability	• Increase MPHW outreach in at-risk blocks during a heat alert, if feasible. • Ensure dedicated bed availability • Ensure ambulance availability • Dedicated heat corners • Increase staffing at DH/MCs to attend to the influx of patients during a heat alert, if feasible. • Organize DNO-CC/ SNO-CC visits to CHCs to confirm proper preparation has been made for HRI and conduct case audits during the heat season.
CAPACITY BUILDING		
1. Ensure reporting of HRI cases daily 2. Adopt HRI treatment and prevention protocols 3. Expedite recording of cause of death due to HRI		
• Referral of patients to the higher facility only after ensuring adequate stabilization and basic definitive care (cooling and hydration)	• Prepare weekly reports of health impact for nodal officer • Conduct case review during heat season	• Prepare weekly reports of health impact for nodal officer • Conduct case review during heat season
IEC/AWARENESS		
1. Ensure IEC dissemination 2. Target the vulnerable area/communities followed by other areas. 3. Plan activities as per the Heatwave alert issued by IMD		

C. Post-heat Season
A. INFRASTRUCTURE AND LOGISTICS
• Review to assess/identify gaps, if any, e.g., ► Any shortage of equipment, medicine, staff. ► Any long-term measures adopted and maintained • Enlist/document the lessons learnt for the next season
CAPACITY BUILDING
• Review to assess/identify gaps, if any, e.g., ► Any flaw/fault in reporting channel/format/ efficiency ► Number of deaths reviewed • Enlist/document the lessons learnt for the next season
IEC/AWARENESS
• Review to assess/identify gaps, if any, e.g., ► IEC messages ► Dissemination area/community ► Efficient use of resources • Enlist/document the lessons learnt for the next season

Source: National action plan on heat-related illnesses (HRIs) by NPCCHH, 2024

4.1. Basic equipment and medicines required as a part of Hospital preparedness for heat season

Primary Health Centre (PHC), Community Health Centre (CHC), District Hospital (DH) and Medical Colleges should ensure the following requirements before the start of heat season:

- Dedicated bed for HRI patients in cooler area of hospital
- Thermometer, ORS packets, ice packs, BP apparatus
- Silver sulphadiazine cream, Calamine lotion, Chlorhexidine in a light cream or lotion base
- Cold IV normal saline (0.9%), dextrose 50% in water solution (D50W)
- Glucometer and testing strips
- ECG equipment: ECG machine, Gel, electrodes, ECG paper
- Cooling equipment: AC, cooler, fan as per requirement
- Water cooler
- Medicines: Lorazepam, diazepam
- Ambulance with ice packs and cold water.

The director/In-charge of Hospitals CHCS and PHCS in all States/Districts should ensure that the following measures are in place:

- A detailed action plan to tackle heat-related illnesses well in advance of hotter months.
- Operational framework - preparing specific health adaptation plan, development of guidelines and response plan for climate sensitive diseases (CSD).
- Need to update heat health action plan and issue advisories for hospital preparedness, surveillance and weekly monitoring, including capacity building.
- Promoting strategic media coverage of climate and health linkages at the State level in regional languages to increase support for climate mitigation and adaptation responses.
- Long-term measures such as adopting cool roofs, improving green/forest coverage and analysing health impacts in urban planning.
- Standard Operating procedures should be established to tackle all levels of heat-related illnesses. Capacity-building measures for doctors, nurses and other staff should also be undertaken.
- Cases with suspected heat stroke should be rapidly assessed using standard Treatment Protocols.
- Identify surge capacities and mark the beds dedicated to treat heat stroke victims and enhance emergency department preparedness to handle more patients.
- Identify RRTs (Rapid Response Teams) to respond to any emergency call outside the hospitals.
- Ensure adequate arrangements of Staff, Beds, IV fluids, ORS, essential medicines and equipment to cater to the management of volume depletion and electrolyte imbalance.
- May try to establish outreach clinics at various locations easily accessible to the vulnerable population to reduce the number of cases affected. Health Centres must undertake awareness campaigns for neighbourhood communities using different means of information dissemination.
- Primary health centres must refer the patients to the higher facility only after ensuring adequate stabilization and basic definitive care (cooling and hydration).
- Hospitals must ensure proper networking with nearby facilities and medical centres to share the patient load that exceeds their surge capacities.

All cases of heat-related illnesses (suspected or confirmed) should be reported to the IDSP (Integrated Disease Surveillance Programme) unit of the district.

5. Heat Health Early Warning Systems (EWS)

Heat Health Early Warning Systems (EWS) utilize climate and weather forecasts, along with predefined heat stress thresholds, to issue public advisories and activate health interventions aimed at minimizing heat-related health risks before, during and after extreme heat events. These systems are essential decision-support tools, typically developed and maintained through collaboration between public health experts and meteorological agencies. As a core element of broader Heat Action Plans (HAPs), Heat Health EWS plays a vital role in informing health and social service protocols, ensuring timely and appropriate preparedness, prevention and response measures during heatwaves.

Local heat thresholds for early warning systems can be developed using the following methods:

A. Biostatistical methods: The thresholds for temperature are prepared by IMD in India and can be coupled with impact indicators of health. These two can be used in combination to send out alerts and can be used to plan for preparedness as well.

   To establish a correlation between temperature and health impact (outcome) variable, which may include-

   - All cause daily mortality count data
   - Cause-specific daily mortality count data
   - Hospital daily admissions count data
   - Emergency ambulance (108) services daily call count data

B. Meteorological (Bio-meteorological) method: The 2015 WMO WHO Heatwaves and Health: Guidance on Warning-System Development suggests that "In situations where there is basic meteorological information but no health data, a percentile-based threshold (90th, 95th) could be contemplated as a warning trigger value."

   Establishing of percentile thresholds based on thermal and bio-meteorological variables-

   - Tmax, Tmin and Tmean
   - Humidex
   - Wet bulb globe temperature
   - Universal thermal climate index
   - Heat index

   NDMA recommends using the 75th, 85th and 95th percentile for Indian context

Extreme heat goes beyond just high daytime temperatures—it also involves factors like humidity and how well people are acclimatised. For early warning systems to be effective, they must account for these variables.

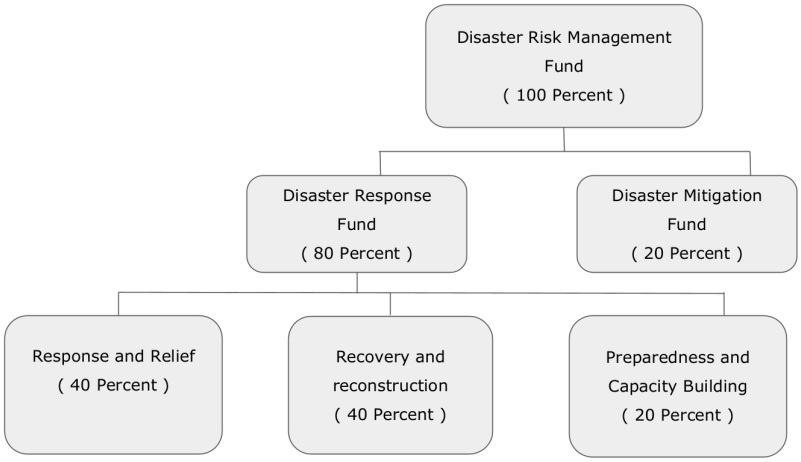
This means combining weather forecasts with historical health and climate data to better anticipate the actual health impacts. Without this integrated approach, the true danger of extreme heat events can be missed. For example, many heat-related illnesses are triggered by persistently high nighttime temperatures, even when daytime highs don't seem extreme.

12.5 Potential Financial Resources for Implementation of the HAP

12.5.1 Government Funds

National Disaster Risk Management Fund (NDRMF) and State Disaster Risk Management Funds (SDRMF)

The 15th Finance Commission has recommended the creation of funds for disaster mitigation along with disaster response, which will now together be called the National Disaster Risk Management Fund (NDRMF) and State Disaster Risk Management Funds (SDRMF).



National Disaster Response Fund (NDRF)/State Disaster Response Fund (SDRF):

The coverage of the funds recommended by the 15th Finance Commission goes beyond the disaster response funds that already exist at the national (NDRF) and state (SDRF) levels. The State Disaster Response Fund (SDRF), constituted under Section 48 (1) (a) of the Disaster Management Act, 2005, is the primary fund available to state governments for responses to notified disasters. The Central Government contributes 75% of SDRF allocation for general category States/UTs and 90% for special category States/UTs. The annual Central contribution is released in two equal installments per the Finance Commission's recommendation. SDRF shall be used only to meet the expenditure for providing immediate relief to the victims.

- **Disaster (s) covered under SDRF:** Cyclone, drought, earthquake, fire, flood, tsunami, hailstorm, landslide, avalanche, cloudburst, pest attack, frost and cold waves.

- Local Disaster including Heat wave as notify: A State Government may use up to 10 percent of the funds available under the SDRF for providing immediate relief to the victims of natural disasters that they consider to be 'disasters' within the local context in the State and which are not included in the notified list of disasters of the Ministry

of Home Affairs subject to the condition that the State Government has listed the State specific natural disasters and notified clear and transparent norms and guidelines for such disasters with the approval of the State Authority, i.e., the State Executive Authority (SEC).

National Disaster Mitigation Fund (NDMF)/ State Disaster Mitigation Fund (SDMF)

On the recommendations of the 15th Finance Commission, the Government of India has set-up the National Disaster Mitigation Fund (NDMF) and Tamil Nadu, has set up State Disaster Mitigation Funds (SDMFs) for the purpose of mitigation measures.

These funds are exclusively for mitigation projects in respect of notified disasters covered under SDRF/ NDRF guidelines and the state-specific local disasters notified by the State Governments. The Central Government has allocated funds under NDMF and SDMF for the period 2021-22 to 2025-26. The State Governments can undertake mitigation activities for various disasters, as per the guidelines issued by the Ministry of Home Affairs for SDMF and NDMF on 14.01.2022 and 28.02.2022, respectively and revised on 25th September 2024.

Grant in Aid recommendation by Central Finance Commission for Tamil Nadu

To cater to the growing urbanisation needs, specific recommendations for urban local bodies for the period 2021-26. Inter se distribution among States is with a weightage of 90 per cent on population and 10 per cent on area. The Commission has recommended grants in two parts - a Basic grant and a Performance grant for duly constituted Gram Panchayats (Rural Local Bodies) and Municipalities (Urban Local Bodies). The ratio of basic to performance grants is 90:10 for Gram Panchayats and 80:20 for Municipalities. The Commission has recommended grants to local bodies (Rural and Urban), sector-specific grants, state-specific grants and Disaster management grants to Tamil Nadu.

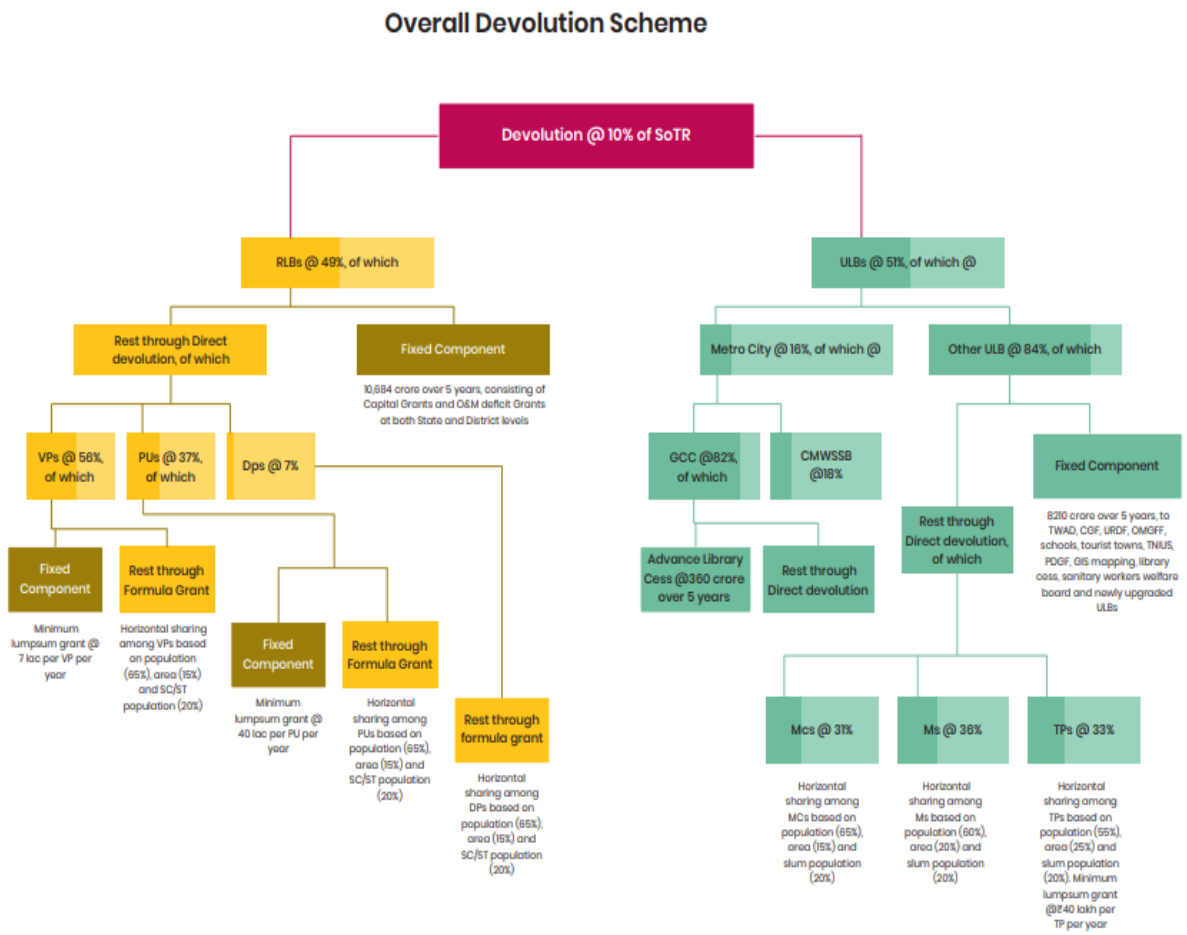
Grants recommended for Tamil Nadu include: (i) Revenue deficit grant, (ii) Grants for local bodies, (iii) Grants for disaster management, (iv) State-specific grants and (v) Certain Sector-specific grants.

Six State Finance Commission (SFC) Tamil Nadu

The Sixth State Finance Commission Report was submitted in March 2022, along with recommendations and the Explanatory Memorandum. The advantage of considering the latest Central Finance Commission to adjust for the impact in its report. The Tamil Nadu Government has accepted the recommendations of the Sixth State Finance Commission and the Implementation period is from April 2022 to March 2027.

While 10% share of States Own Tax Revenue to Local Bodies is retained, the sharing Ratio between Rural and Urban Local Bodies is to be 49:51 and the devolution to have Fixed and Variable components. 14 Fixed Special Grants for Rural Local Bodies and 12 Fixed Special Grants for Non-Metro Urban Local Bodies. Sharing of devolution based on population, area, SC/ST population, or slum population in the Different Weightage for area and population for horizontal distribution among sub-categories of Local Bodies. Fund Sharing ratio of 7:37:56 to District Panchayats, Block Panchayats and Village Panchayats. The ULB describes a separate category for a sharing ratio of 16:84 between Greater Chennai Corporation and the remaining ULBs (Non-Metro ULBs). Also, describe the sharing ratio of 31:36:33 among Municipal Corporations, Municipalities and Town Panchayats. Cantonment Boards to get fixed amounts for devolution as Municipalities.

Figure A36: The overall devolution scheme of the Sixth State Finance Commission (SFC)



Source: Sixth state finance commission (SFC) report

Major Central and State Sectors Schemes

The funds are available for the different programs and schemes in Tamil Nadu, it varies from the specific scheme, the objectives of the program and the district's development priorities. The funds are allocated to local bodies (ULBs/RLBs) //districts by the state and central governments and disbursed based on the needs and priorities of each district. Tamil Nadu, being a large state with both rural and urban districts, receives funding from the central government, state government and various schemes targeting specific sectors like infrastructure, rural development, health, education and climate resilience.

The financial convergence of different schemes for heat wave mitigation in Tamil Nadu involves integrating funds and resources from both central and state schemes to create a coordinated approach for addressing the impacts of heatwaves. The financial convergence with different government schemes/programs running at the district / local level is a critical aspect of ensuring that adequate resources are allocated for heat wave resilience.

This will create a holistic, multi-dimensional response system that maximizes resources and ensures that vulnerable populations are better prepared for heat waves. While several schemes exist to address different aspects of climate resilience and community welfare, the specific issue of heat waves is often addressed in isolation.

The converging efforts at district level authority through coordination by District Nodal officers is to ensure easily available resources for implementation of Heat Action Plan.

Table A6: Overview of key indicative funding sources of programs and schemes available at the district level in Tamil Nadu

SN	Program/Schemes	Purpose	Support to heat wave resilience activities
1	**National Health Mission (NHM)**	To improve healthcare services, with a special focus on rural and underserved areas.	The funds can be used for healthcare interventions related to heatwaves, such as setting up health camps, providing treatment for heat-related illnesses and launching awareness programs in vulnerable districts. State and central healthcare funds ensure that there are adequate medical facilities and treatment options available during heatwave emergencies.
2	**Swachh Bharat Mission (SBM)**	To promote sanitation and cleanliness.	Funds are used for sanitation facilities, water supply systems and public awareness campaigns that are crucial during heatwave conditions.
3	**Smart Cities Mission**	To promote sustainable urban development and smart city initiatives.	Funds can be used for heatwave mitigation in urban areas, such as creating smart cooling systems, Cool roof installations, Solar-powered cooling systems, Water fountains and public cooling areas, improving water

			distribution and increasing green cover.
4	**National Urban Cooling Programme (NUCP)**	Aims to reduce urban heat islands through solutions such as cool roofs.	The program helps to reduce urban heat islands through solutions such as cool roofs, district cooling systems and better building designs. Tamil Nadu has been supported under this program to help create cooler urban environments. The funding supports urban infrastructure improvements that directly mitigate heatwaves, especially in urban areas.
5	**Pradhan Mantri Awas Yojana (PMAY)**	To provide affordable housing for the urban and rural poor.	Funds are used for constructing affordable housing units with provisions like cool roofs and efficient ventilation, which can indirectly help mitigate heatwave effects in urban and rural areas.
6	**Tamil Nadu Health Systems Project (TNHSP)**	Aimed at improving the health services infrastructure.	Aimed at improving the health services infrastructure, focusing on maternal and child health, public health facilities and expanding healthcare access to rural areas
7	**Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (AB-PMJAY)**	Aimed at providing healthcare coverage to vulnerable populations.	To provide health Insurance for the vulnerable people.
8	**Chief Minister's Comprehensive Health Insurance**	To provide free healthcare services.	Provides free healthcare services, covering hospitalization, surgery, diagnostic and emergency services for eligible families in Tamil Nadu.

	Scheme (CMCHIS)		
9	**National Rural Infrastructure Development Scheme**	To provide better infrastructure in rural areas.	Central and state collaboration to enhance rural infrastructure, including roads, electrification and water supply systems.
10	**Mission Manglam (Urban) Scheme**	To help the urban poor.	The Scheme helps the poor urban Self-help Groups and "Sakhi Mandals" by linking them with the banks for easy and speedy financial assistance.
11	**Ujjwala Yojana**	To provide cooking facilities and improvement of health.	A central government scheme aimed at providing free LPG connections to poor families to reduce dependence on traditional cooking fuels and improve health.
12	**Tamil Nadu Solar Energy Policy**	To promote solar energy adaptation.	The state has developed an aggressive policy to promote solar energy, with incentives for both large-scale and rooftop solar installations.
13	**National Electric Mobility Mission Plan (NEMMP)**:		A central government initiative to promote electric vehicles, focusing on cleaner transport solutions.
14	**Tamil Nadu State Transport Development Project**		A state initiative to modernize and expand the state's public transport system.
15	**Atal Mission for Rejuvenation and Urban**	To provide basic infrastructure in urban areas, such as water supply, sewage	Funds are used for heat mitigation measures in urban areas, including the creation of

	Transformation (AMRUT)	and green spaces.	green spaces, water fountains and other cooling infrastructure.
16	**Tamil Nadu Urban Livelihood Mission (TNULM)**	To promote sustainable livelihoods through community-based interventions.	A mission to empower women in the community, including capacity building and training, self-employment programs and support to urban street vendors.
17	**Tamil Nadu Integrated Urban Development Mission (IUDM)**	To improve urban infrastructure in smaller towns and cities.	Funds can be used for heatwave mitigation efforts in urban areas, such as creating cool roofs, establishing shade-giving public spaces and improving water infrastructure.
18	**Tamil Nadu Sustainable Urban Development Project (TNSUDP)**	To support urban services in cities and towns.	These are World Bank-funded projects used for building infrastructure that addresses heat wave mitigation such as providing water supply systems, public health infrastructure and enhancing health and water services districts.
19	**Tamil Nadu Urban Development Fund**	To improve urban /rural infrastructure in cities and towns.	This fund supports urban infrastructure projects that contribute to disaster resilience and overall development. Funding can be used for heatwave mitigation by improving water supply, public cooling centres and public green spaces.
20	**Mahatma Gandhi National Rural Employment Guarantee**	Employ rural households through the creation of public assets such as water	The funds can be used for creating community infrastructure that mitigates heatwaves, such as water harvesting systems, shade-providing trees and other heat-resilient projects.

	Act (MGNREGA)	bodies, plantations, greeneries, etc.	
21	**Rashtriya Krishi Vikas Yojana (RKVY)**	To promote agricultural development in states and districts by providing grants for agricultural infrastructure and growth.	The funds can be used for agricultural climate-resilience projects, such as promoting drought/heat-resistant crops, enhancing water efficiency in agriculture and other heat-related interventions in districts. Also, provide shelter and water to reduce livestock heat stress and deaths.
22	**Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)**	To improve irrigation infrastructure and water use efficiency in agriculture.	Funds can be used in rural districts to develop irrigation infrastructure, water conservation systems and agriculture heat resilience measures.
23	**Pradhan Mantri Kaushal Vikas Yojana (PMKVY)**	To improve employability through skill development training and certification.	Provide capacity building, training and certification through skill development to increase employability and source of income.
24	**Tamil Nadu Skill Development Mission**	To improve employability through skill development training and certification.	This state-run initiative focuses on providing skill development training to youth in various sectors to enhance their employability.
25	**State Water Conservation Schemes**	To tackle water scarcity in rural area	Tamil Nadu has implemented several projects focusing on rainwater harvesting, groundwater recharge and river management to tackle water scarcity in rural areas.

26	**National Rural Livelihood Mission (NRLM)**	To promote sustainable livelihoods through community-based interventions.	NRLM funds can be used for training programs, creating local heat-resilience projects and building community infrastructure to address heatwave challenges.
27	**State Action Plan on Climate Change (SAPCC)**	To address the impacts of climate change, including heatwaves.	Funds are directed to districts for long-term climate adaptation measures, such as afforestation, water conservation and the creation of green spaces to reduce heat.
28	**Forest Fire Prevention and Management Scheme**	To prevent fire incidents and public infrastructure.	Prepare firefighting equipment to allow for rapid responses to forest fires.

12.5.2 Corporate Social Responsibilities (CSR) Fund

The "Corporate Social Responsibility (CSR)" assesses and takes responsibility for the company's effects on the environment and impact on social welfare. The Corporate Social Responsibility Rules under Section 135 of the Companies Act, 2013, The Company Board of Directors shall ensure that in each financial year, the Company spends at least 2% of the average Net Profit made during the three immediate preceding financial years. Many private companies in Tamil Nadu engage in CSR activities, providing funds for cooling infrastructure, tree plantation drives and other heatwave mitigation efforts in vulnerable areas. The following activities may be undertaken under CSR.

a) Eradicating hunger, poverty & malnutrition, promoting preventive health care & sanitation & making available safe drinking water;
b) Promoting education, including special education & employment enhancing vocation skills especially among children, women, elderly & the differently unable & livelihood enhancement projects;
c) Promoting gender equality, empowering women, setting up homes & hostels for women & orphans, setting up old age homes, day care centres & such other facilities for senior citizens & measures for reducing inequalities faced by socially & economically backward groups;

d) Reducing child mortality and improving maternal health by providing good hospital facilities and low-cost medicines;
e) Providing hospital and dispensary facilities with more focus on clean and good sanitation to combat human immunodeficiency virus, acquired immune deficiency syndrome, malaria and other diseases;
f) Ensuring environmental sustainability, ecological balance, protection of flora & fauna, animal welfare, agroforestry, conservation of natural resources & maintaining the quality of soil, air & water;
g) Employment enhancing vocational skills
h) Protection of national heritage, art & culture including restoration of buildings & sites of historical importance & works of art; setting up public libraries; promotion & development of traditional arts & handicrafts;
i) Measures for the benefit of armed forces veterans, war widows & their dependents;
j) Training to promote rural sports, nationally recognized sports, sports & Olympic sports;
k) Contribution to the Prime Minister's National Relief Fund or any other fund set up by the Central Government for socio-economic development & relief & welfare of the Scheduled Castes, the Scheduled Tribes, other backward classes, minorities & women;
l) Contributions or funds provided to technology incubators located within academic institutions, which are approved by the Central Government;
m) Rural development projects, etc
n) Slum area development.

The Above list is illustrative, not exhaustive. All activities under the CSR umbrella should be environment-friendly and socially acceptable to the local people and Society. Contribution towards C.M. relief fund shall be a part of CSR activities above 2% of Net profit other than the activities mentioned above.

12.5.3 NGOs and Civil Society Organizations

NGOs work alongside the government in distributing cooling kits, providing emergency medical care and spreading awareness. Funding from these organizations can be used to augment government efforts during heatwave periods.

Conclusion

The financial convergence for heatwave mitigation in Tamil Nadu is a combination of resources from both central and state government schemes, as well as inputs from the private sector and NGOs. These financial resources are directed toward improving infrastructure, providing health and disaster relief and enhancing public awareness to reduce the impacts of heatwaves. Coordination and Collaboration between different levels of

government and other sectors ensure a holistic approach to heatwave management.

12.6 Documentation of the heat related mortality and morbidity data

To mitigate the risks associated with the projected heat extremes in Chennai City, resilient health systems must serve as the primary responder to heat-related mortalities and illnesses. For this, the availability of detailed and granular health data related to heatwave-induced mortalities and illnesses is crucial. High-quality heat-tagged data will not only strengthen heat-health early warning systems but will also enhance localized heat risk assessments in future revisions of this action plan.

This chapter outlines the formats and guidelines for recording and documenting this data, based on national-level formats provided by the National Program on Climate Change and Human Health (NPCCHH), Ministry of Health and Family Welfare (MoHFW) and the National Disaster Management Authority (NDMA). In 2015, MoHFW issued the "Guidelines on Prevention and Management of Heat-Related Illnesses." Building on this, the "National Action Plan on Heat-Related Illness, July 2021" was developed. This plan includes chapters addressing pediatric age groups, hospital preparedness plans, updated surveillance formats, standard operating procedures and guidelines for investigating suspected heat-related illness (HRI) deaths. Since 2015, the Integrated Disease Surveillance Programme (IDSP), under MoHFW, has collected and compiled data on HRI and related deaths annually from 17 heat-vulnerable states (now 23 as of 2019). These states include Andhra Pradesh, Bihar, Chhattisgarh, Delhi, Gujarat, Haryana, Jharkhand, Karnataka, Maharashtra, Madhya Pradesh, Odisha, Punjab, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh, Kerala, Goa, Uttarakhand, Jammu & Kashmir, West Bengal, Arunachal Pradesh and Himachal Pradesh. The surveillance formats were revised in 2021 to capture cases of heat stroke, deaths due to suspected/confirmed heatstroke, deaths due to cardiovascular diseases (CVD) and all-cause deaths.

These guidelines and formats were developed by an internal MoHFW committee at the National Centre for Disease Control (NCDC) and an expert group consisting of specialists from the departments of medicine and pediatrics in central government hospitals, NDMA, National Institute of Disaster Management (NIDM), India Meteorological Department (IMD), World Health Organization (WHO), Emergency Medical Relief (EMR), IDSP, Indian Institute of Public Health Gandhinagar and the Public Health Foundation of India (PHFI).

This section integrates these formats into the Chennai City Heat Action Plan to ensure effective data collection on heat-related illnesses and mortalities. These formats will also be incorporated into the Chennai District Action Plan on Climate Change and Human Health (DAPCCHH), ensuring cohesive data collection at various administrative levels. The detailed formats and the report on the 'National Action Plan on Heat-Related

Illnesses' can be accessed here: https://ncdc.gov.in/WriteReadData/linkimages/NationActionplanonHeatRelatedIllnesses.pdf.

1. Guidelines for Investigation of Suspected Heat Related Illness Death

Unique ID:

Respondent's Name: Relationship of respondent with deceased:

Residential address of respondent:

Section A: Deceased's identifier details

A.1. Name of deceased:	A.2. Age (in completed years & months):	Y	Y	M	M
A.3. Sex: Male / Female/Transgender:	A.4. Father's/Mother's/Spouse's name:				
A.5. Residential Address of deceased					
A.5.1 State:	A.5.2. District:				
A.5.3. Block/Taluka:	A.5.4. Ward/village:				
A.6. Does the deceased have the following socio-economic card	i. BPL ii. Antayodya iii. Annapurna iv. Other or equivalent (mention)..... v. None				
A.7. What was the last occupation of the deceased:					

Section B: Death detail

No.	Questions	Coding categories	If no, Skip to
B.1	Was the deceased found unconscious or dead?	Yes.....1 No.....2 I don't Know.....3	B.3
B.2	Place where deceased was found unconscious or dead?	Athome.....1 At workplace.....2 At social gathering...3 On-road.....4 Other (specify).....	
B.3	Location where deceased was found unconscious or dead		

	B.3.1 State:			B.3.2. District:		
	B.3.3. Block/Taluka:			B.3.4. Ward/village:		
B.4	Name of hospital and address where deceased was brought dead or died:					
B.5	Date and time of the death: (from medical record)	DD	MM	YYYY	HH	MM

Section C: Clinical history in past 24 hr before death (from medical record followed by respondent)

C.1. Symptoms at the time of onset of illness:					
C.1.1. Was the skin hot and dry? (a. From Medical Record b. From Respondent c. both)	Yes……1 No……2 I don't Know…..3				
C.1.2 Was the deceased in altered mental sensorium? (a. From Medical Record b. From Respondent c. both)	Yes……1 No……2 I don't Know…..3				
C.1.3. What was the core body temperature? (from medical record only):					
C.1.4. What was the deceased's vitals? (from medical record only): a. Pulse rate: b. Respiratory rate: c. Blood pressure:					
C.2. Date and time of onset of the first symptom of heat illness:	DD	MM	YYYY	HH	MM
C.3. Place of onset of first symptom:	At home……1 At workplace……2 At social gathering…..3 On-road……4 School/college…….5 Other (specify)……				
C.4. Location of onset of symptoms					
C.4.1 State:	C.4.2. District:				
C.4.3. Block/Taluka:	C.4.4. Ward/village:				
C.5. Did the deceased have an alcoholic beverage within a day of onset of illness?	Yes……1 No……2 I don't Know…..3				

Section D: Outdoor activities just before the onset of illness

No.	Questions	Coding categories	If no, Skip to
D.1	Just before the onset of illness, was the deceased present outdoors?	Yes……1 No……2 I don't Know…..3	E.1
D.2	Was the deceased engaged in outdoor occupational activities?	Yes……1 No……2 I don't Know…..3	D.3

D.3	Was the deceased working under direct sunlight?	Yes……...……1 No……...…..2 I don't Know…...…..3	
D.4	Was the deceased working in peak hours of the day, i.e. 11 AM to 4 PM?	Yes……...……1 No……...…..2 I don't Know…...…..3	
D.5	Was the deceased working near heat sources.e., hot furnace, stove, gas fire, wood fire, steam, hot engines/ machines?	Yes……...……1 No……...…..2 I don't Know…...…..3	D.7
D.6	If yes to D.5, the type of heat source was:	Fire (hot furnace, stove, gas fire, hot engines)……..1 Steam ……2	
D.7	Was the deceased doing any physical exertional activity?	Yes……...……1 No……...…..2 I don't Know…...…..3	D.8
D.8	Was the deceased sitting in a vehicle?	Yes……...……1 No……...…..2 I don't Know…...…..3	D.12
D.9	If yes to D.8, was the vehicle parked in a shaded area?	Yes……...……1 No……...…..2 I don't Know…...…..3	
D.10	If yes to D.8, what was the approx. duration of sitting in vehicle?	0-1 hr……...…..1 >1 hr ……...……2	
D.11	If yes to D.8, was the air-conditioner working in vehicle?	Yes……...……1 No……...…..2 I don't Know…...…..3	
D.12	Remarks on outdoor activity, if any:		

Section E. Indoor conditions just before the onset of illness.

E.1	Was the deceased INDOORS?	Yes……1 No……2 I don't Know……..3	F1
E.2.	If yes to E.1, were the following items, i.e., ceiling fan, desert cooler, air conditioner present?	Yes……1 No……2 I don't Know……..3	
E.3	If yes to E.2, describe the item, its working condition and whether it was switched on or not? Description:		
E.4	Type of house/Room where decease was found	Pucca house (house-made with high-quality materials throughout, including the floor, roof and exterior walls)……1 Katcha house (House made from mud, thatch, or other low-quality materials)……2	

E.5	Windows in rooms	Yes……1 No……2 I don't Know……3	
E.6	If there were windows in the room, were they open at the time of onset of symptoms	Yes……1 No……2 I don't Know……3	

Section F: Medical conditions recorded at first medical contact (as per medical record)

No.	Questions	Coding categories	If no, Skip to
F.1	Was the deceased suffering from any chronic medical condition?	Yes……1 No……2 I don't Know……3	
F.2	Was the deceased suffering from any acute medical conditions before the onset of the current illness?	Yes……1 No……2 I don't Know……3	F.4
F.3	If yes to F.2, list the illness and duration of suffering-		
F.4	Was the deceased taking any medications before the onset of current illness?	Yes……1 No……2 I don't Know……3	Section -G
F.5	If yes to F.4, list the medication and duration since taking-		

Section G: Weather data from the India Meteorological Department

No.	Questions and Filters	Coding categories/Response	If no, Skip to
G.1	What was the maximum temperature (Tmax) of the day in the area at/ around the onset of illness/death (if onset unknown)?		
G.2	What was the maximum temperature (Tmax) for each day of the past 3 days from the date of patient death?:	a. One day back: b. Two days back: c. Three days back:	
G.3	Was there a heatwave affecting the area/region on the date of onset of illness?	Yes……1 No……2 I don't Know……3	
G.4	Was there a heatwave in the previous 3 days in the area where the onset of illness occurred?	Yes……1 No……2 I don't Know……3	

G.5	What was the relative humidity of the area at/around the onset of illness(or at time of death if onset unknown)?:		
G.6	What was the relative humidity for each day of the past 3 days from the patient's date of death?:	a. One day back: b. Two days back: c. Three days back:	

Form filled by:

Name: …….. Signature:

Designation:…… Date:

2. Surveillance of Heat -Related Illnesses (Formats with Standard Operating Procedures)

FORMAT 1 (A): HEALTH FACILITY FORMAT

Daily line List of Suspected Heatstroke CASES# at Health Facility

(From Medicine, Paediatrics and Casualty/Emergency department)

(To be kept at health facility for record)

Name of health facility:_____ Block:_____ District:_____	Date of reporting: _._/_._/_._
Type of health facility (Circle the applicable):1. PHC 2. CHC 3. Taluka/Rural Hospital/Block Hospital 4. Sub-district 5. District Hospital/Civil Hospital 6. Medical College & Hospital 7. Private hospitals with emergency facility 8. Other……	
(A). Total no. of patients in department (Casualty/Emergency of Medicine + Paediatrics):	

Daily line List of Suspected Heatstroke CASES# at Health Facility

S. No	Hospital Regist-ration No.	Name	Age*	Sex (M/F)	Address		Outcome within date of reporting (tick the box)				Re-marks
					Block	District	Admitted	Died	Referred	Reco-vered	
Total											

**Age in completed years*

Name of person filling the form:

Designation:

Signature:

Name of Facility In-Charge:

Signature of Facility In-Charge:

Date:

#Suspected Heatstroke: Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature ≥ 40 °C/≥104 °F,** without signs of stroke, history of infection, or signs of medication overdose **OR** Altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals, i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose. *(definition is applicable during heatwave season, i.e., March to July)*

Standard Operating Procedures: Format 1(A)

1. **Format 1 (A)** is a daily line list format of **suspected heatstroke cases** to be filled at health facility.
2. It will be kept at health facility for record purpose.
3. It will be **used to compile line list Format 1(B) and daily reporting Format 2.**
4. **Suspected heatstroke (Case definition):**Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature ≥ 40 °C/≥104 °F,** without signs of stroke, history of infection, or signs of medication overdose **OR** Altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose. *(definition is applicable during Heatwave season i.e., March to July)*
5. **Institute and department who will compile suspected heatstroke cases:**
   a. All public hospitals with casualty/emergency.
   b. All private hospitals with casualty/emergency.
   c. Reporting Departments will be casualty/emergency of medicine and paediatrics.
6. **Data collection period**: In standard it will be from **01st March to 31st July, every year**. Further direction will be communicated at the start of the year if required.
7. **Case identification**:
   a. **Person who will diagnose**: A qualified medical doctor will diagnose HRI case as per case definition.

b. **Where will the data be recorded**: A qualified medical practitioner will write the provisional diagnosis in the casualty/emergency register as suspected heatstroke.

c. **Data collecting person:** Pharmacist, multipurpose health worker-male (MPHW-M), staff nurse -either of the employee will collect the data of suspected heatstroke cases that were diagnosed on previous day from emergency/casualty of medicine and paediatrics departments every day.

8. **Day of diagnosis and recording:** The date of diagnosis will be considered as day zero. Cases diagnosed on day Zero should be recorded on the following day, i.e., day One in FORMAT 1 (A). Example: Cases diagnosed on Sunday (Day Zero) will be recorded on Monday (Day One).
9. **Data compilation:** A hard copy of each completed and signed **Format 1(A)** should be stored in a file **daily** in a proper order. A soft copy of the line list should be maintained as a single excel sheet which should be updated **weekly** to include all Heatstroke cases. It should be ready to be submitted to DSU or SSU as per request.
10. **Reporting after a holiday:** A report which should have been prepared on holiday (e.g. Sunday or gazetted holiday) must be compiled and filed on the next working day. For example, cases diagnosed on Saturday (Day Zero) must be recorded on **Format 1 (A)** on Monday (Day Two) along with a separate daily **Format 1 (A)** report of cases diagnosed on Sunday (Day One).
11. **Nil reporting is mandatory in the prescribed format.** No columns will be left blank; in case of nil reporting, **"0"** should be written.

FORMAT 1 (B): HEALTH FACILITY FORMAT

Daily line List of Suspected Heatstroke DEATHS# and Confirmed CVD DEATHS*

(From Medicine, Paediatrics and Casualty/Emergency department)

(To be kept at health facility for record)

Name of health facility:_____ Block:_____ District:_____							Date of reporting: _-_/_-_/_-_	
Type of health facility (Circle the applicable): 1. PHC 2. CHC 3. Taluka/Rural Hospital/Block Hospital 4. Sub-district 5. District Hospital/Civil Hospital 6. Medical College & Hospital 7. Private hospitals with emergency facility 8. Other……								
(A). Total no. of all-cause deaths in health facility (Casualty/emergency of Medicine and Paediatrics):								
Daily line List of Suspected Heatstroke DEATHS and Confirmed CVD DEATHS								
S.No	**Registration number**	**Name**	**Age**	**Sex (M/F)**	**Address**		**Deaths (tick the box)**	
					Block	**District**	**Suspected Heatstroke death##**	**Confirmed CVD death**
Total								

Name of person filling the form:

Designation:

Signature:

Name of Facility In-Charge:

Signature of Facility In-Charge:

Date:

[#]**Suspected Heatstroke:** Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature ≥ 40 °C/≥104 °F,** without signs of stroke, history of infection, or signs of medication overdose **OR** Altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals, i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose. *(definition is applicable during Heatwave season, i.e., March to July)*

[##]**Suspected Heatstroke Death**: This is a death on account of suspected heatstroke patient.

[*]**Cardiovascular death** includes death resulting from an acute myocardial infarction (MI) or sudden cardiac arrest or heart failure (HF) or cardiovascular (CV) procedures or CV haemorrhage or death due to other CV causes.

Standard Operating Procedures: Format 1 (B)

1. **Format 1 (B)**is a daily line list of **suspected heatstroke deaths** and **confirmed cardiovascular disease (CVD) deaths**.
2. The total number of all-cause deaths in a health facility (casualty/emergency of medicine and paediatrics) should also be recorded.
3. **Institute and department who will report suspected heatstroke cases:**
   a. All public hospitals with OPDs & casualty/emergency.
   b. All private hospitals are having casualty/emergency.
   c. Reporting departments will be casualty/emergency of medicine and paediatrics.
4. **Date of death and recording:** Date of death will be considered as day zero. Cases that died on day Zero should be recorded on the following day, i.e., day One in FORMAT 1 (B). Example: Cases diagnosed on Sunday (Day Zero) will be recorded on Monday (Day One).
5. **Data compilation:** A hard copy of each completed and signed **Format 1 (B)** should be stored in a file **daily** in a proper order. A soft copy of the line list should be maintained as a single excel sheet which should be updated **weekly** to include all suspected heatstroke deaths and confirmed CVD deaths. It should be ready to be submitted to the district or state nodal unit as per request.
6. **Nil reporting is mandatory in the prescribed format.** No columns will be left blank; in case of nil reporting, **"0"** should be written.

FORMAT 2: HEALTH FACILITY FORMAT FOR SENDING TO DISTRICT

Daily numbers of Suspected Heatstroke CASES[#] and All cause DEATHS[*]

(Compilation of Format 1, A & B)

(To be sent to District Nodal Unit daily)

Name of health facility: _____ _____ Block:_____ District:_____	Date of reporting: _._/_._/_._
Type of health facility (Circle the applicable): 1. PHC 2. CHC 3. Taluka/Rural Hospital/Block Hospital 4. Sub-district 5. District Hospital/Civil Hospital 6. Medical College & Hospital 7. Private hospitals with emergency facility 8. Other.....	
Department (Circle the applicable): 1. Emergency Medicine 2. Emergency Paediatrics 3. Casualty	

Date	Total patients in the department	New Suspected Heatstroke Cases (A)	Total Suspected Heatstroke cases since 1st March 2020 (B)	All-cause deaths**			
				Suspected Heatstroke deaths## (a)	Confirmed CVD deaths (b)	Others including unknown (c)	Total deaths (a+b +c)
01-03-20							
02-03-20							

Form filled by (Name):

Designation:

Signature:

Name of Facility In-Charge:

Signature of Facility In-Charge:

Date:

[**]**All-cause death:** All of the deaths in casualty/emergency medicine plus paediatrics, regardless of cause.

[#]**Suspected Heatstroke:** Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature ≥ 40 °C/≥104 °F,** without signs of stroke, history of infection, or signs of medication overdose **OR** Altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals, i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose. *(definition is applicable during Heatwave season i.e., March to July)*

[##]**Suspected Heatstroke Death**: This is a death on account of suspected heatstroke patient.

[*]**Cardiovascular death** includes death resulting from an acute myocardial infarction (MI) or sudden cardiac arrest or heart failure (HF) or cardiovascular (CV) procedures or CV haemorrhage or death due to other CV causes.

Standard Operating Procedures: Format 2

(Health facility format for sending to DISTRICT)

1. **Format 2** will be compiled from data of **Format 1 (A)** and **Format 1 (B)** by the nodal person at the health facility daily.
2. **Institute and department who will report HRI:**
   b. All public hospitals with casualty/emergency.
   c. All private hospitals are having casualty/emergency.
   d. Reporting Departments will be medicine, paediatrics and casualty/emergency.
3. **Time of reporting to district nodal unit: Format 2 compiled from Format 1 (A) should be reported to District nodal unit on the following day (day one) by 12.00 hr (i.e. noon).**
4. **Reporting person:** A nodal person identified for the health facility will prepare the report.
5. **Data compilation:** A soft copy in the form of an excel sheet shall be e-mailed **daily** to the district nodal unit through a proper channel. In places where the internet facility is not available, the report can be communicated by any possible means. A hard copy of each **Format 2** should be kept in a designated file daily at the institutions/health facility.
6. **Data collection period**: In standard, it will be from **01st March to 31st July every year**. Further direction will be communicated during the start of the year if required.
7. **Nil reporting is mandatory in the prescribed format.** No columns will be left blank; in case of nil reporting, **"0"** should be written.
8. **If not submitted on time:** Late report must be submitted within 48 hrs.

FORMAT 3 (A): DISTRICT FORMAT FOR DAILY COMPILATION

Daily numbers of Suspected Heatstroke CASES# and All cause DEATHS*

(Compiled from Format 2)

(To be kept at District for record)

Cases and deaths due to HRI- *District name* 2020					Date of reporting: _._/_._/_._				
S. No.	Name & type of Health Facility	Total patients of the day (Emergency Medicine + Emergency Paediatrics + Casualty)	New Suspected Heatstroke cases (A)	Total Suspected Heatstroke cases since 1st March, 2020 (B)	All-cause deaths**				Re-marks
					Suspected Heatstroke deaths## (a)	Con-firmed CVD deaths (b)	Others including unknown (c)	Total deaths (a+b +c)	
	PHC1								
	PHC2								
	CHC								
	CH/DH								
	PVT1								
	PVT2								
	PVT3								
Total for District 1									

Total number of New Confirmed Heatstroke Deaths* in the District on _._/_._/_._:**
Total number of Confirmed Heatstroke Deaths in the District since 1st March 2020:
[confirmed by death committee (heat death committee/three men committee)]

Name of person filling the form: Name of nodal officer:

Designation: Signature of nodal officer:

Signature: Date:

All-cause death: All of the deaths in casualty/emergency medicine plus paediatrics, regardless of cause.

Suspected Heatstroke: Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature ≥ 40 °C/≥104 °F,** without signs of stroke, history of infection, or signs of medication overdose **OR** Altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals, i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose. *(definition is applicable during heatwave season, i.e., March to July)*

Suspected Heatstroke Death: This is a death on account of a suspected heatstroke patient.

*__Cardiovascular death__ includes death resulting from an acute myocardial infarction (MI) or sudden cardiac arrest or heart failure (HF) or cardiovascular (CV) procedures or CV haemorrhage or death due to other CV causes.

***__Confirmed Heatstroke Death__: A suspected heatstroke death confirmed by the death committee (heat death investigation committee/three-person committee) at the district level.

Standard Operating Procedures: Format 3 (A)

(District format for compilation from health facility)

1. **Format 3**(A) will be compiled by a nodal officer **daily** at District nodal unit.
2. **Format 3 (A)**will be compiled from **Format 2** from all health facility.
3. **Format 3 (A) adaptation:** Modify relevant fields (in grey italic fonts) in given Format 3 (A) to add the name of your district, to list **all** the government facilities and private reporting units in a proper order- from the primary health centre (PHC), Community Health Centre (CHC), District Hospital (DH), Civil Hospital (CH) to Private. This will be the **standard Format 3**(A) for your district for daily data compilation during the whole reporting period of a year.
4. **Total patient of the day:** Against each health facility, write the total patient of the day from emergency medicine, emergency paediatrics and casualty.
5. **Data compilation**: District nodal unit should receive Format 2 from health facilities by **12.00 hr (i.e. 12.00 noon) daily.** Format 3 (A) should be compiled daily from all submitted Format 2 reports. A date-wise soft copy of each daily Format 3 (A) report should be maintained digitally in a designated folder. A hard copy of the same should be printed and filed daily at the district level.
6. **Data collection period**: In standard, it will be from **01st March to 31st July every year**. Further direction will be communicated during the start of the year if required.
7. No reporting by health facility:

a. If a health facility report (**Format 2**) is not received on time, write "delayed" in the row for that facility.

b. If the facility reports to the district after the deadline of 12:00 noon, **Format 3 (A)** should be updated to reflect the change. Format 3 (A) for the given reporting period can be updated till 48 hrs and should show the updated date of reporting, if applicable.

c. If the health facility does not submit **Format 2 at all or** submits it after 48 hrs of reporting deadline, Format 3 of that reporting period should be updated; "delayed" should be changed to "not available".

8. **Reporting after a holiday: Format 3 (A)** which should have been prepared on holiday (e.g. Sunday) must be compiled and prepared on the next working day. For example, facility reports (Format 2) submitted to the district on Saturday must be compiled on **Format 3**(A) on Monday, along with a separate **Format 3**(A) for facility reports submitted to the district on Sunday.
9. **Nil reporting is mandatory in the prescribed format.** No columns will be left blank; in case of nil reporting, **"0"** should be written.
10. **Confirmed heatstroke death:** a suspected heatstroke death is to be reported as and when the death is confirmed by the death investigation committee (heat death committee/three men committee) at the district level.

FORMAT 3 (B): DISTRICT FORMAT FOR SENDING TO STATE

Daily numbers of Suspected Heatstroke CASES[#] and All-cause DEATHS[*]

(Compiled from Format 3 A**)**

(To be sent to State Nodal Unit daily while keeping a copy for record)

Cases and deaths due to heatstroke- *District name* 20_ _								Date of reporting: _ _/_ _/_ _	
Date	**Total patients of the day (Emergency Medicine + Emergency Paediatrics + Casualty)**	**New Suspected Heatstroke Cases (A)**	**Total Suspected Heatstroke cases since 1st March, 20_ _ (B)**	**All-cause deaths****				**New Confirmed Heat-stroke Deaths*****	**Total Confirmed Heat Deaths since 1st March 20_ _**
				Suspected Heatstroke deaths## (a)	**Confirmed CVD deaths (b)**	**Others including unknown (c)**	**Total deaths (a+b +c)**		
01-03-2020									
02-03-2020									

Name of person filling the form: Name of nodal officer:

Designation: Signature of nodal officer:

Signature: Date:

[**]**All-cause death:** All of the deaths in casualty/emergency medicine plus paediatrics, regardless of cause.

[#]**Suspected Heatstroke:** Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature ≥ 40 °C/≥104 °F,** without signs of stroke, history of infection, or signs of medication overdose **OR** Altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose. *(definition is applicable during heatwave season, i.e., March to July)*

All-cause death: All of the deaths in casualty/emergency medicine plus paediatrics, regardless of cause.

#Suspected Heatstroke: Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature ≥ 40 °C/≥104 °F,** without signs of stroke, history of infection, or signs of medication overdose **OR** Altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose. *(definition is applicable during heatwave season, i.e., March to July)*

##Suspected Heatstroke Death: This is a death on account of suspected heatstroke patient.

***Cardiovascular death** includes death resulting from an acute myocardial infarction (MI) or sudden cardiac arrest or heart failure (HF) or cardiovascular (CV) procedures or CV hemorrhage or death due to other CV causes.

****Confirmed Heatstroke Death**: A suspected heatstroke death confirmed by the death investigation committee (heat death committee/three men committee) at the district level.

Standard Operating Procedures: Format 3 (B)

(District format for sending to State)

1. **Format 3** (B) will be compiled by a nodal officer **daily** at District nodal unit.
2. **Format 3 (B)** will be compiled from the end row of **Format 3 (A)**.
3. **Time of reporting to state nodal unit:** Format 3 (B) compiled from Format 3 (A) should be reported to the state nodal unit on the following day (**day one) by 04.00 PM.**
4. **Reporting after a holiday: Format 3 (B)** which should have been prepared on holiday (e.g. Sunday) must be compiled and prepared on the next working day. For example, facility reports (Format 2) submitted to the district on Saturday must be compiled on **Format 3**(B) on Monday, along with a separate **Format 3**(B) for facility reports submitted to the district on Sunday.
5. **Nil reporting is mandatory in the prescribed format.** No columns shall be left blank; in case of nil reporting, **"0"** should be written.
6. **Confirmed heatstroke death:** a suspected heatstroke death is to be reported as and when the death is confirmed by the death committee (heat death committee/three-man committee) at the district level.

FORMAT 4 (A): STATE FORMAT FOR DAILY COMPILATION (district wise)

Daily numbers of Suspected Heatstroke CASES[#] and all-cause DEATHS[*]

(To be sent to Central Nodal Unit daily while keeping a copy for record)

Cases and deaths due to Heatstroke- *State name* 2020									Date of reporting: _-_/_-_/_-_	
S. No.	**Name of District**	**Total patients of the day (Medicine + Paediatrics + Casualty/ Emergency)**	**New cases of Heat-stroke (A)**	**Cumulative total of Heatstroke cases since 1st March 2020 (B)**	**All-cause deaths****				**New Con-firmed Heat-stroke Deaths*****	**Total Confirmed Heatstroke Deaths since 1st March 2020**
					Suspected Heatstroke deaths## (a)	**Con-firmed CVD deaths* (b)**	**Others including unknown (c)**	**Total deaths (a+b +c)**		
1	*District 1*									
2	*District 2*									
3	*District 3*									
	Total									

Name of person filling the form: Name of nodal officer:

Designation: Signature of nodal officer:

Signature: Date:

[**]**All-cause death:** All of the deaths in casualty/emergency medicine plus paediatrics, regardless of cause.

[#]**Suspected Heatstroke:** Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature ≥ 40 °C/≥104 °F,** without signs of stroke, history of infection, or signs of medication overdose **OR** Altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals, i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose. *(definition is applicable during heatwave season, i.e., March to July)*

[##]**Suspected Heatstroke Death**: This is a death on account of a suspected heatstroke.

[*]**Cardiovascular death** includes death resulting from an acute myocardial infarction (MI) or sudden cardiac arrest or heart failure (HF) or cardiovascular (CV) procedures or CV haemorrhage or death due to other CV causes.

[***]**Confirmed Heatstroke Death**: A suspected heatstroke death confirmed by the death investigation committee (heat death committee/three-person committee) at the district level.

Standard Operating Procedures: Format 4 (A)

(State format for sending to centre)

1. **Format 4**will be compiled from data reported by all districts by nodal officer at the state nodal unit daily.
2. **Districts** will report health facility-wise aggregate number of cases due to suspected heatstroke. Also, the aggregate number of all-cause deaths with segregation of suspected heatstroke deaths confirmed CVD deaths and others.
3. **Time of reporting:**
   a. Health facility to district nodal unit: **Cases diagnosed on day zero** (from 00.01 hr to 24.00 hr of a day) at health facilities to be reported to district nodal unit on day 1 (i.e. next day) at 12:00 noon **in Format 2**. The daily compiled report from the district nodal unit **(Format 3)** should be submitted to Integrated Disease Surveillance Programme (IDSP) at the district Surveillance unit (DSU) through the proper channel by **01:00 PM** on day 1 (i.e. next day).
   b. District to State: by **04:00 PM** the **day 1.**
   c. State to centre: by **05:00 PM** the **day 1.**
4. **Data compilation:** A soft copy of **Format 4** in the form of an excel sheet shall be e-mailed **daily** to the Central unit through the proper channel. A date-wise soft copy of each daily **Format 4** report should be maintained digitally in a designated folder. A hard copy of **Format 4** should be kept daily in a designated file at the state level.
5. **Data collection period**: In standard, it will be from **01st March to 31st July every year**. Further direction will be communicated during the start of the year if required.

6. No report by a district:
   a. If a **Format 3** from a district is not received on time, write "**delayed**" in the row for that district.
   b. If the district reports to the state State after the deadline of 4.00 PM, **Format 4** should be updated to reflect the change. **Format 4** for the given reporting period can be updated till 48 hrs and should show an updated date of reporting, if applicable.
   c. If a district does not submit **Format 3 at all or** submit it after 48 hrs of reporting deadline, **Format 4** of that reporting period should be updated, i.e., "delayed" should be changed to "**not available**" for that district.
7. **Changing a filed report:** A submitted **Format 4** can be changed only if an update is generated by a health facility and communicated to the District within 48 hrs of reporting deadline. Updated **Format 4**for that reporting period should be submitted again to the Central unit with a new date of reporting if applicable.
8. **Reporting after a holiday:** A **Format 4,** which should have been prepared on holiday (e.g. Sunday), must be compiled and submitted on the next working day. For example, Format 4 for Saturday must be compiled on Monday along with a separate **Format 4** for Sunday.
9. **Nil reporting is mandatory in the prescribed format.** No columns shall be left blank; in case of nil reporting, **"0"** should be written.
10. **If not submitted on time:** Late report must be filed within 48 hrs with the correct date of reporting.
11. **Analysis:** Analysis of the data should be done every week according to the guidelines provided here.

FORMAT 4 (B): STATE FORMAT FOR DAILY COMPILATION (day wise)

Daily numbers of Suspected Heatstroke CASES[#] and all-cause DEATHS[*]

(To be kept at State for record)

Cases and deaths due to Heatstroke- State name 2020								Date of reporting: _._/_._/_._	
Date	**Total patients of the day (Medicine + Paediatrics + Casualty/ Emergency)**	**New cases of Heat-stroke (A)**	**Cumulative total of Heatstroke cases since 1st March, 2020 (B)**	**All-cause deaths****				**New Confirmed Heatstroke Deaths*****	**Total Confirmed Heatstroke Deaths since 1st March 2020**
				Suspected Heatstroke deaths## (a)	**Confirmed CVD deaths* (b)**	**Others including unknown (c)**	**Total deaths (a+b+c)**		
01-03-20									
02-03-20									
Total									

Name of person filling the form: Name of nodal officer:

Designation: Signature of nodal officer:

Signature: Date:

[**]**All-cause death:** All of the deaths in casualty/emergency medicine plus paediatrics, regardless of cause.

[#]**Suspected Heatstroke:** Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature ≥ 40 °C/≥104 °F,** without signs of stroke, history of infection, or signs of medication overdose **OR** Altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals, i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose. *(definition is applicable during heatwave season, i.e., March to July)*

[##]**Suspected Heatstroke Death**: This is a death on account of a suspected heatstroke.

[*]**Cardiovascular death** includes death resulting from an acute myocardial infarction (MI) or sudden cardiac arrest or heart failure (HF) or cardiovascular (CV) procedures or CV haemorrhage or death due to other CV causes.

[***]**Confirmed Heatstroke Death**: A suspected heatstroke death confirmed by the death investigation committee (heat death committee/three-man committee) at the district level.

12.7 Government order Letter from TNDRRA to develop city level HAPs for Tamil Nadu

ABSTRACT

Disaster Management - Heat Wave Management - Preparation of Heat Wave Action Plan 2025 for State and Cities – Entrusting the preparation of Heat Wave Action Plan 2025 to the Council on Energy, Environment and Water (CEEW) - Orders issued.

REVENUE AND DISASTER MANAGEMENT DEPARTMENT
DISASTER MANAGEMENT WING, D.M.III (1) SECTION

G.O.(Ms) No.09 **Dated:07.01.2025**
குரோதி வருடம், மார்கழி 23,
திருவள்ளுவர் ஆண்டு, 2055

Read:

1. G.O.(Ms) No.419, Revenue & DM [DM.3(1)] Department, dated 15.10.2024.
2. Letter of intent received from the Council on Energy, Environment and Water, New Delhi dated 09.10.2024 for developing Heat Action plans for the State, Cities and Districts of Tamil Nadu.
3. From the Additional Chief Secretary/ Commissioner of Revenue Administration & State Relief Commissioner letter No.P&CB/1916/2024, dated 10.12.2024.

******

ORDER:

In the Government order first read above, the Government have issued orders (notified in the Government Gazette No.336, dated 15.10.2024) for declaring the Heat Wave as a "State Specific Disaster" to ensure adequate preparedness measures for its management and provide relief to the people affected due to heat wave conditions.

2. In the letter third read above, the Additional Chief Secretary/ Commissioner of Revenue Administration & State Relief Commissioner has stated as follows:-

(i) Heat wave is emerging as a major threatening phenomenon that affects the day-to-day life of elderly people, children and those who have prior illness and other medical conditions and who are engaged in the work in open environments. During April - May 2024, many parts of Tamil Nadu have consistently recorded temperature above 40° C as detailed below:-

Sl. No.	Districts	Recorded Temperature Range	No.of Days
1	Chennai	40.1° C – 41.9°C	6
2	Coimbatore	40°C	1
3	Cuddalore	40.1°C – 40.2°C	2
4	Dharmapuri	40°C – 41.5°C	20
5	Erode	40°C – 43.6°C	31
6	Karur	40°C - 44°C	26

7	Madurai	40°C – 42.2°C	16
8	Nagapattinam	40.3°C	1
9	Namakkal	40°C – 41°C	10
10	Salem	40.1°C – 42.3°C	19
11	Thanjavur	40°C - 41°C	7
12	Tirupattur	40°C - 42°C	21
13	Tiruchirapalli	40.1°C – 42.7°C	18
14	Vellore	40°C – 43.7°C	23
15	Tiruvallur	40°C – 42.5°C	19
16	Tirunelveli	40°C – 41.5°C	4

(ii) The State Planning Commission has published a Study titled "**Tamil Nadu Heat Mitigation Strategy - Beating the Heat".** As per the Study nearly 74% of Tamil Nadu's population currently exposed to air temperature above 35°C. There is an urgent need to build heat resilience in the State as climate change-driven heat is only expected to intensify.

(iii) As per the Guidelines and advisories of National Disaster Management Authority, the States have to prepare Heat Wave Action Plans for the State, Districts and major Cities. The State has been preparing Heat Wave Action Plans from 2020, 2021, 2022, 2023 and 2024, following the Guidelines issued by the National Disaster management Authority in 2016, 2019 and the suggestions that emerged from the National Heat Wave Workshops.

(iv) A Comprehensive State level Heat Action Plan and independent City Level Heat Action Plan for Heat Wave Prone cities will meet the following broad requirement:-

a) The Temperature thresholds for Cities, and Districts have to be derived and prescribed for Cities adjacent to Coastal areas, densely populated heat islands, industrial areas, locations with rocky hillocks, hill stations etc.,
b) To give focussed attention for Preparedness, Response, and Relief by Multi Sectoral departments, Urban, Rural Local Bodies and Capacity Building of department officials medical professional, para medical staff etc., detailed State, District and City Plans are needed.
c) A system of monitoring the morbidities and mortalities due to heat impact has to be put in place.
d) A set of procedures for assessing the loss and damages to human and animal life needs to be prescribed for uniform adoption and
e) A well designed Awareness Campaign has to be launched by the Public Health Department in collaboration with the Urban & Rural Local Bodies for the benefit of the different stakeholders of the community, has to be launched.

(v) The Council on Energy, Environment and Water (CEEW) a not-for-profit policy research institution have expressed an interest in developing a State level heat action plan (HAP) for the State of Tamil Nadu, as well as city/ district level heat action plans for 10 most heat wave-prone cities or districts in the State with a vision to achieve zero mortality from heat stress and reduce heat-related illnesses in the State, CEEW proposes to develop granular city /

district level Heat Action Plans for the State. Additionally, they intend to conduct capacity-building initiatives for the health and disaster management authorities of the State to be better prepared before, during and after the heat waves.

3. The Additional Chief Secretary / Commissioner of Revenue Administration & State Relief Commissioner has therefore recommended to accept the proposal for preparation of Heat Wave Action Plan 2025 for the State and to entrust the preparation of the State Heat Wave Action Plan 2025 to Council on Energy, Environment and Water (CEEW) and to permit the CEEW to prepare the Heat Wave Action Plan 2025 for the following Nine (9) Cities:-

1. Chennai Metropolitan City encompassing Greater Chennai Corporation, Tambaram and Avadi Corporations
2. Madurai
3. Thoothukudi
4. Tiruchirappalli
5. Coimbatore
6. Erode
7. Tiruppur
8. Vellore and
9. Salem

4. The Additional Chief Secretary / Commissioner of Revenue Administration & State Relief Commissioner has also requested to permit him to issue a letter of engagement to the Council on Energy, Environment and Water (CEEW) for taking up the preparation of State Heat Wave Action Plan 2025 and Heat Wave Action Plan 2025 for the cities stated above subject to the conditions that there will be no financial implications to Government of Tamil Nadu and the data shared to CEEW by the cities/ districts shall be used only for the purpose of developing the heat action plans and also requested to place the above proposal before the State Executive Committee.

5. The Government after careful examination, have decided to accept the proposal of the Additional Chief Secretary / Commissioner of Revenue Administration & State Relief Commissioner and based on the approval of the State Executive Committee, accord approval for preparation of Heat Wave Action Plan 2025 for the State. The Government permit the Additional Chief Secretary / Commissioner of Revenue Administration & State Relief Commissioner to entrust the preparation of the State Heat Wave Action Plan to Council on Energy, Environment and Water (CEEW) to prepare the State Heat Wave Action Plan 2025 for the following Nine (9) Cities:-

1. Chennai Metropolitan City encompassing Greater Chennai Corporation, Tambaram and Avadi Corporations.
2. Madurai
3. Thoothukudi
4. Tiruchirappalli
5. Coimbatore
6. Erode
7. Tiruppur
8. Vellore and
9. Salem

6. The Government also accord permission to the Additional Chief Secretary / Commissioner of Revenue Administration & State Relief Commissioner to issue a Letter of engagement to the Council on Energy, Environment and Water (CEEW) for taking up the preparation of State Heat Wave Action Plan 2025 and Heat Wave Action Plan 2025 for the cities stated in para 5 above subject to the conditions that there will be no financial implications to Government of Tamil Nadu and the data shared to CEEW by the cities/ districts shall be used only for the purpose of developing the heat action plans.

7. This Order issues with the concurrence of Finance Department vide E.file No.18979/DM.3(1)/2024, dated 07.01.2025.

(BY ORDER OF THE GOVERNOR)

P AMUDHA
ADDITIONAL CHIEF SECRETARY TO GOVERNMENT

To

The Additional Chief Secretary /
Commissioner of Revenue Administration &
State Relief Commissioner, Chepauk, Chennai-600 005.
The Director, Disaster Management,
Tamil Nadu Disaster Risk Reduction Agency,
Chepauk, Chennai-600 005.

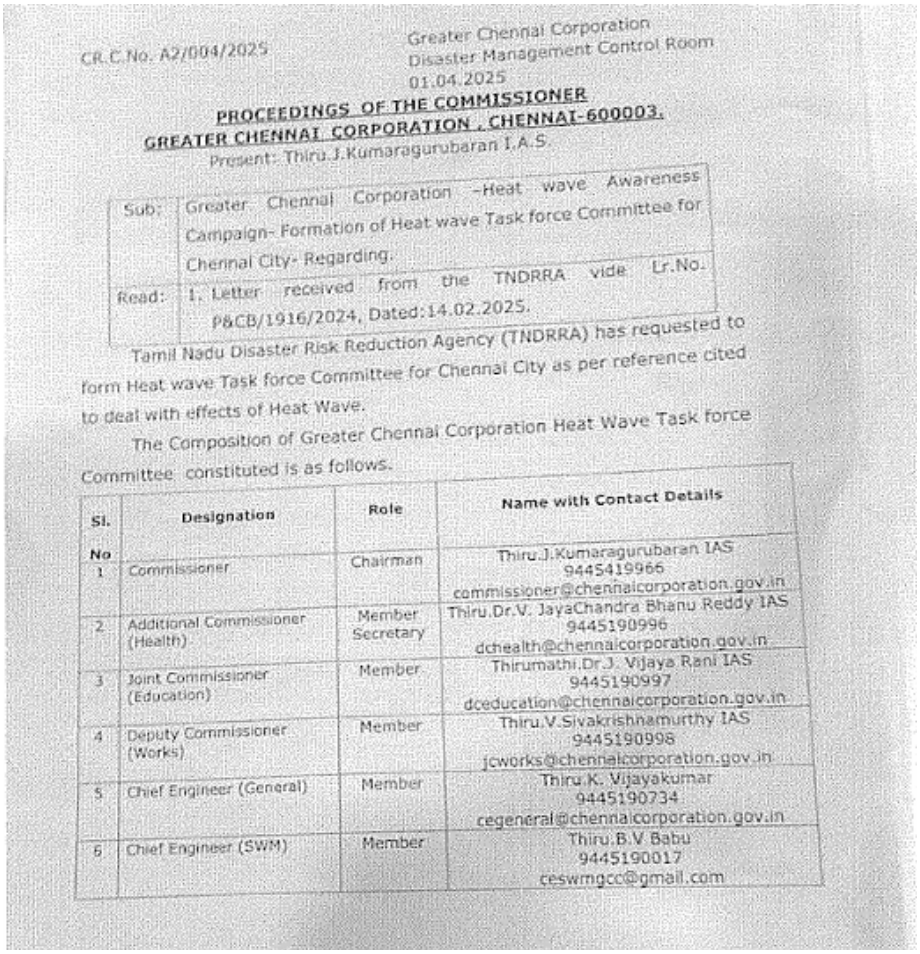
Copy to

The Additional Chief Secretary to Government,
Home, Prohibition and Excise Department, Chennai-600 009.
The Additional Chief Secretary to Government,
Water Resources Department, Chennai-600 009.
The Additional Chief Secretary to Government,
Health and Family Welfare Department, Chennai-600 009.
The Additional Chief Secretary to Government,
Public Works Department, Chennai-600 009.
The Principal Secretary to Government,
Finance Department, Chennai-600 009.
The Secretary to Government,
Highways and Minor Ports Department, Chennai-600 009.
The Senior Private Secretary to Chief Secretary to Government,
Secretariat, Chennai-600 009
The Principal Private Secretary to Additional Chief Secretary to Government,
Revenue and Disaster Management Department, Chennai-600 009.
The Finance (Revenue) Department, Chennai - 600 009.
The Revenue and Disaster Management (O.P.III) Department,
Chennai-600 009.
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// FORWARDED / BY ORDER //

7.01.2025
SECTION OFFICER

12.8 Heatwave task force formed by Municipal Commissioner



CR.C.No. A2/004/2025

Greater Chennai Corporation
Disaster Management Control Room
01.04.2025

PROCEEDINGS OF THE COMMISSIONER
GREATER CHENNAI CORPORATION , CHENNAI-600003.

Present: Thiru.J.Kumaragurubaran I.A.S.

Sub:	Greater Chennai Corporation –Heat wave Awareness Campaign- Formation of Heat wave Task force Committee for Chennai City- Regarding.
Read:	1. Letter received from the TNDRRA vide Lr.No. P&CB/1916/2024, Dated:14.02.2025.

Tamil Nadu Disaster Risk Reduction Agency (TNDRRA) has requested to form Heat wave Task force Committee for Chennai City as per reference cited to deal with effects of Heat Wave.

The Composition of Greater Chennai Corporation Heat Wave Task force Committee constituted is as follows.

Sl. No	Designation	Role	Name with Contact Details
1	Commissioner	Chairman	Thiru.J.Kumaragurubaran IAS 9445419966 commissioner@chennaicorporation.gov.in
2	Additional Commissioner (Health)	Member Secretary	Thiru.Dr.V. JayaChandra Bhanu Reddy IAS 9445190996 dchealth@chennaicorporation.gov.in
3	Joint Commissioner (Education)	Member	Thirumathi.Dr.J. Vijaya Rani IAS 9445190997 dceducation@chennaicorporation.gov.in
4	Deputy Commissioner (Works)	Member	Thiru.V.Sivakrishnamurthy IAS 9445190998 jcworks@chennaicorporation.gov.in
5	Chief Engineer (General)	Member	Thiru.K. Vijayakumar 9445190734 cegeneral@chennaicorporation.gov.in
6	Chief Engineer (SWM)	Member	Thiru.B.V Babu 9445190017 ceswmgcc@gmail.com

Sl. No	Designation	Role	Name with Contact Details
7	Chief Engineer (Parks)	Member	Thiru.D.Anbalagan 9499956219 ceparks@chennaicorporation.gov.in
8	City Health Officer	Member	Thiru.Dr.M. Jagadeesan 9445190744 ho@chennaicorporation.gov.in
9	S.E. (Storm Water Drain)	Member	Thiru.S.Baskaran 9445190732 seswd@chennaicorporation.gov.in
10	S.E.Co-ordination	Member	Thiru.B.Shankaravelu 9445190801 sebridges@chennaicorporation.gov.in

Sd/- J.Kumaragurubaran,
Commissioner.

To
The Members Concerned.

Copy to:
O/o. the Hon'ble Mayor/Respectful Deputy Mayor
O/o. the Commissioner , Greater Chennai Corporation
O/o. the Additional Commissioner (Health)
O/o. the Joint Commissioner (Education)
O/o. the Deputy Commissioner (Works), Greater Chennai Corporation
O/o. All Chief Engineers
O/o. the City Health Officer
O/o. the Superintending Engineer (Storm Water Drain)
O/o. the Superintending Engineer (Bridges)
O/o. the TNDRRA
File and Spare.

// Forwarded /By Order//

Chief Engineer (General)

12.9 Factors contributing to heat risk for each of the wards

Description on list of parameters used in assessment with description

1. **Land Surface Temperatures (LST)**
   What it means: The actual temperature of the ground or surfaces like roads, rooftops, and open land.
   Why is it important: This helps cities map out heat hotspots—places like concrete-heavy neighbourhoods or industrial zones that get much hotter. With this, cities can plant trees, install cool roofs, or create shade structures in the most affected areas.
   Apart from weather and climate data, understanding how cities are built and how people live in them is critical for tackling extreme heat. These urban indicators help explain why some areas get hotter than others and which populations are most at risk. These indicators help cities design targeted heat reduction strategies, improve urban planning, and protect people living in high-risk environments through effective Heat Action Plans (HAPs).

2. **Percentage of built-up area to total geographical area**

What it means: The proportion of land covered by buildings, roads, and other concrete structures versus open or green spaces.
Why is it important: Built-up areas absorb and retain more heat, creating urban heat islands. Less open space means less cooling from trees and vegetation. This helps cities:

- Identify areas that need more green cover or cool roofs.
- Avoid further construction in already heat-stressed zones.
- Strategically place urban cooling infrastructure, like parks or fountains.

3. **Population density**

What it means: How many people live in a given area (e.g., people per square kilometre).
Why is it important: High population density means more people are exposed to heat in a small area. This can strain public services like water, electricity, and healthcare during heat waves. Cities can use this to:

- Prioritize cooling centres and heat alerts where more people live.
- Plan outreach campaigns in crowded neighbourhoods.
- Improve access to shade, water, and ventilation in densely populated zones.

4. Building Density

What it means: How closely packed buildings are in an area (e.g., buildings per hectare or floor area ratio).

Why is it important: Tightly packed buildings block airflow and trap heat, making neighbourhoods hotter and more humid, especially at night. High building density can also limit escape routes during emergencies. Cities use this to:

- Promote heat-resilient building designs with better ventilation.
- Improve urban airflow through the proper spacing and orientation of buildings.
- Plan retrofitting measures (like cool roofs or insulation) for densely built areas.

To protect people from extreme heat, it's not enough to just track temperatures — cities also need to understand who is most vulnerable, where they live, and what resources are available. These indicators help identify at-risk communities and guide targeted, life-saving heat action strategies.

5. Sex Ratio

What it means: The number of females per 1,000 males in a population.

Why is it important: Women are biologically more sensitive to heat due to lower sweat rates and higher body fat, which reduces heat dissipation. This makes them more vulnerable during extreme heat events, especially in resource-poor settings. In some areas, women and girls may have less access to cooling, healthcare, or water during heat waves. Tracking this helps cities:

- Ensure gender-sensitive heat response plans.
- Target awareness campaigns and services to reach underserved women.
- Ensure adequate health service in the area so that women get access to the services.

6. Proportion of people with differently abled (both mental and physical)

What it means: The percentage of people living with physical or mental disabilities in a given area.

Why is it important: People with differently abled often face mobility challenges, communication barriers, or reliance on caregivers, which can delay or prevent them from accessing heat relief measures. Those with mental disabilities may also struggle to recognize or respond to heat stress.

This indicator helps cities to:

- Ensure inclusive heat alerts (e.g., visual, audio, easy-to-read formats).
- Provide accessible cooling centres and transport.
- Coordinate with care networks and disability organizations for outreach and support.

7. Number of slum households

What it means: Households living in informal settlements with poor infrastructure.

Why is it important: Slum dwellers often face high exposure to heat due to tin roofs that trap heat, crowded conditions, poor ventilation, and limited access to water/electricity. This data helps cities:

- Prioritize cooling interventions like water stations and shaded areas.
- Offer free or subsidized health services during heat waves.
- Roll out early warnings via local networks.

8. Illiteracy Rate

What it means: The percentage of people who cannot read or write.

Why is it important: People who are illiterate may not understand heat warnings, public notices, or healthcare instructions. Cities can:

- Use visuals and community radio for outreach.
- Deploy local volunteers or community leaders to communicate safety tips

Disclaimer: Due to the unavailability of the latest data on this indicator, Census 2011 data was used as an indicative proxy. But the Government of Tamil Nadu has taken special focused efforts to minimise the percentage of illiteracy and it has reached a negligible level.

9. Green spaces

What it means: Areas with trees, parks, or vegetation.

Why is it important: Green spaces cool the city naturally, reduce heat stress, and offer safe zones during hot days. This indicator helps cities:

- Identify neighbourhoods lacking greenery.
- Plan for urban afforestation and shade development.
- Promote community parks and green roofs.

10. Proportion of young population (below 5 years)

What it means: Percentage of very young children in the population, particularly children under 5 years of age

Why is it important: Young children are extremely vulnerable to heat, dehydration, and heatstroke. Cities can:

- Equip Anganwadis and schools with cooling facilities.
- Train caregivers and parents on heat safety.
- Provide ORS, water, and shaded play areas.

11. Proportion of older population (above 65 years)

What it means: Percentage of elderly people in the population, particularly above 65 years of age

Why is it important: Elderly individuals are more prone to heat-related illnesses due to existing health issues and limited mobility. Cities should:

- Provide home visits or health check-ins during heat waves.(Makkalai Thedi Maruthuvam)
- Ensure easy access to community cooling centres and emergency transport.
- Prioritize the elderly in public communication and aid distribution.

12. Proportion of population with chronic health conditions

What it means: People living with conditions like heart disease, diabetes, asthma, etc.

Why is it important: Chronic illnesses can worsen in extreme heat, and medications may increase heat sensitivity. This helps cities:

- Strengthen healthcare system readiness.
- Create patient registries for outreach during heat events.
- Offer targeted care and counselling.

13. Health centres per thousand population

What it means: How many functioning clinics, primary health centres, or hospitals serve every 1,000 residents

Why is it important: Heatwaves sharply increase cases of dehydration, heat stroke, and flare-ups of chronic illnesses. A low health-centre-to-population ratio means longer travel times, crowded facilities, and delayed treatment—factors that can turn manageable heat stress into life-threatening

emergencies. Mapping this indicator pinpoints underserved neighbourhoods, guiding where to:

- Upgrade existing centres with cooling equipment and extra staff.
- Deploy mobile clinics or temporary heat-relief posts.
- Prioritize new facility construction or public–private partnerships. By aligning healthcare capacity with population needs, cities can cut response times and save lives during escalating heat episodes.

14. Number of parks per square kilometre

What it means: The density of public parks or green spaces within a given area of the city.

Why is it important: A higher number of parks per square kilometre means better local access to cooling areas. Areas with fewer parks per km² are more likely to suffer from intense localized heat, especially in densely populated or highly built-up zones. This indicator helps cities:

- Map heat-vulnerable areas lacking green coverage.
- Strategically increase urban greenery in underserved zones.
- Integrate parks into HAPs as designated cooling shelters and public outreach locations.
  By tracking park density, cities can promote equitable access to natural cooling and reduce overall urban temperatures.

15. Access to water sources

What it means: Whether people have a regular, clean water supply nearby.

Why is it important: Access to water is critical for staying cool, hydrated, and healthy during heat waves. This indicator helps cities:

- Install public water points in heat-prone areas.
- Plan for emergency water distribution.
- Ensure schools, hospitals, and slums have water access.

Wards 1 to 6

Metrics	1	2	3	4	5	6
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 7 to 12

Metrics	7	8	9	10	11	12
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 13 to 18

Metrics	13	14	15	16	17	18
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 19 to 24

Metrics	19	20	21	22	23	24
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 25 to 30

Metrics	25	26	27	28	29	30
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 31 to 36

Metrics	31	32	33	34	35	36
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 37 to 42

Metrics	37	38	39	40	41	42
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 43 to 48

Metrics	43	44	45	46	47	48
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 49 to 54

Metrics	49	50	51	52	53	54
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 55 to 60

Metrics	55	56	57	58	59	60
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 61 to 66

Metrics	61	62	63	64	65	66
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 67 to 72

Metrics	67	68	69	70	71	72
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 73 to 78

Metrics	73	74	75	76	77	78
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 79 to 84

Metrics	79	80	81	82	83	84
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 85 to 90

Metrics	85	86	87	88	89	90
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 91 to 96

Metrics	91	92	93	94	95	96
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 97 to 102

Metrics	97	98	99	100	101	102
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 103 to 108

Metrics	103	104	105	106	107	108
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 109 to 114

Metrics	109	110	111	112	113	114
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 115 to 120

Metrics	115	116	117	118	119	120
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 121 to 126

Metrics	121	122	123	124	125	126
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 127 to 132

Metrics	127	128	129	130	131	132
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 133 to 138

Metrics	133	134	135	136	137	138
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 139 to 144

Metrics	139	140	141	142	143	144
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 145 to 150

Metrics	145	146	147	148	149	150
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 151 to 156

Metrics	151	152	153	154	155	156
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 157 to 162

Metrics	157	158	159	160	161	162
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 163 to 168

Metrics	163	164	165	166	167	168
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 169 to 174

Metrics	169	170	171	172	173	174
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 175 to 180

Metrics	175	176	177	178	179	180

Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 181 to 186

Metrics	181	182	183	184	185	186
Mean LST						
Building density						

Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 187 to 192

Metrics	187	188	189	190	191	192
Mean LST						
Building density						
Builtup percentage						
Population density						

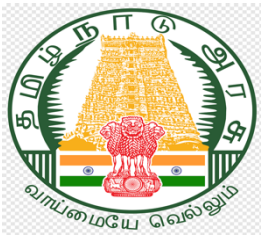
Sex ratio						
Proportion of people with disabilities to total population (mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 193 to 198

Metrics	193	194	195	196	197	198
Mean LST						
Building density						
Builtup percentage						
Population density						
Sex ratio						
Proportion of people with disabilities to total population(mental and physical disabilities)						
Proportion of Slum Population						
Illiteracy rate						
Health centres per square kilometres						
Number of parks per square kilometres						
NDVI						
Proportion of Young Population						
Proportion of Old population						
Proportion of population with chronic health						
Water%age						
Access to road network						

Wards 199 to 200

Metrics	199	200
Mean LST		
Building density		
Builtup percentage		
Population density		
Sex ratio		
Proportion of people with disabilities to total population (mental and physical disabilities)		
Proportion of Slum Population		
Illiteracy rate		
Health centres per square kilometres		
Number of parks per square kilometres		
NDVI		
Proportion of Young Population		
Proportion of Old population		
Proportion of population with chronic health		
Water%age		
Access to road network		



Handbook on Heat Wave Management – 2025

Tamil Nadu Disaster Risk Reduction Agency
Commissionerate of Revenue Administration
Chepauk, Chennai – 600 005.

12.10. Heatwave management handbook

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1. Understanding Heat Wave and its impact

The Global Context of the Heat Wave Impact

The global climate crisis continues to escalate, with 2024 officially recorded as the warmest year globally since records began in 1850. According to the National Oceanic and Atmospheric Administration (NOAA), USA and corroborated by the World Meteorological Organization (WMO), the global average temperature in 2024 was 1.29°C above the 20th-century average of 13.9°C. This surpasses the previous record set in 2023 (+1.18°C) and reflects a consistent upward trajectory over the past decade, during which all ten of the warmest years have occurred (2014–2024). The primary drivers include elevated greenhouse gas concentrations and the intensifying El Niño phenomenon. In fact, WMO reports that 2024 was the first-year global average temperature exceeded 1.5°C above pre-industrial levels for a 12-month period, marking a critical threshold in climate science projections.

This warming trend is not just a number—it signals more intense and frequent heatwaves, sea-level rise, extreme rainfall events, glacial retreat, and ecosystem collapses. The Intergovernmental Panel on Climate Change (IPCC) projects that heatwaves will increase in intensity, frequency, and duration throughout the 21st century, affecting every populated region. These changes can undermine livelihoods through disruptions in agriculture, water security and public health, especially in developing nations.

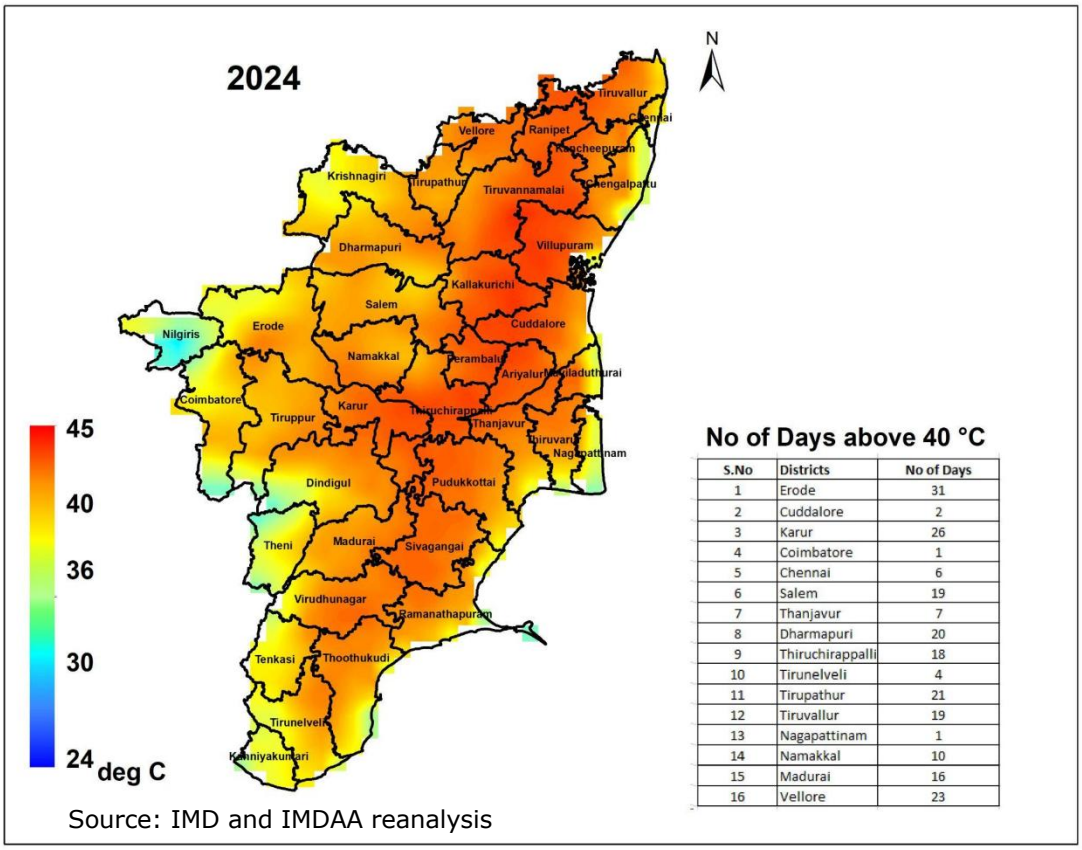
National Context

India has been significantly impacted by this global trend. As per the India Meteorological Department (IMD), 2024 was the warmest year on record in India since 1901, with the annual mean surface air temperature registering 25.75°C, or +0.65°C above the 1981–2010 average. This matches the anomaly observed in 2023, which was the second-warmest year on record.

Extreme weather-related casualties also rose. According to IMD and media reports, more than 3,200 people died due to extreme weather events in 2024, of which 459 fatalities were heat related. This represents a sharp increase from 2,376 deaths in 2023, when lightning and thunderstorms accounted for over 50% of fatalities. During the May–June 2024 heatwave, over 25,000 suspected heatstroke cases were recorded, leading to mass hospitalizations across multiple states. Power systems were also strained with north India experiencing a record-breaking peak power demand of 89 GW.

India's vulnerability to heatwaves is aggravated by its large population, urban heat islands, aging infrastructure, and limited access to cooling mechanisms in rural areas. The IMD has also noted increasing minimum night-time temperatures which diminish relief from daytime heat and exacerbate health risks.

Figure 1 Maximum temperature in Tamil Nadu during 2024.



No of Days above 40 °C

S.No	Districts	No of Days
1	Erode	31
2	Cuddalore	2
3	Karur	26
4	Coimbatore	1
5	Chennai	6
6	Salem	19
7	Thanjavur	7
8	Dharmapuri	20
9	Thiruchirappalli	18
10	Tirunelveli	4
11	Tirupathur	21
12	Tiruvallur	19
13	Nagapattinam	1
14	Namakkal	10
15	Madurai	16
16	Vellore	23

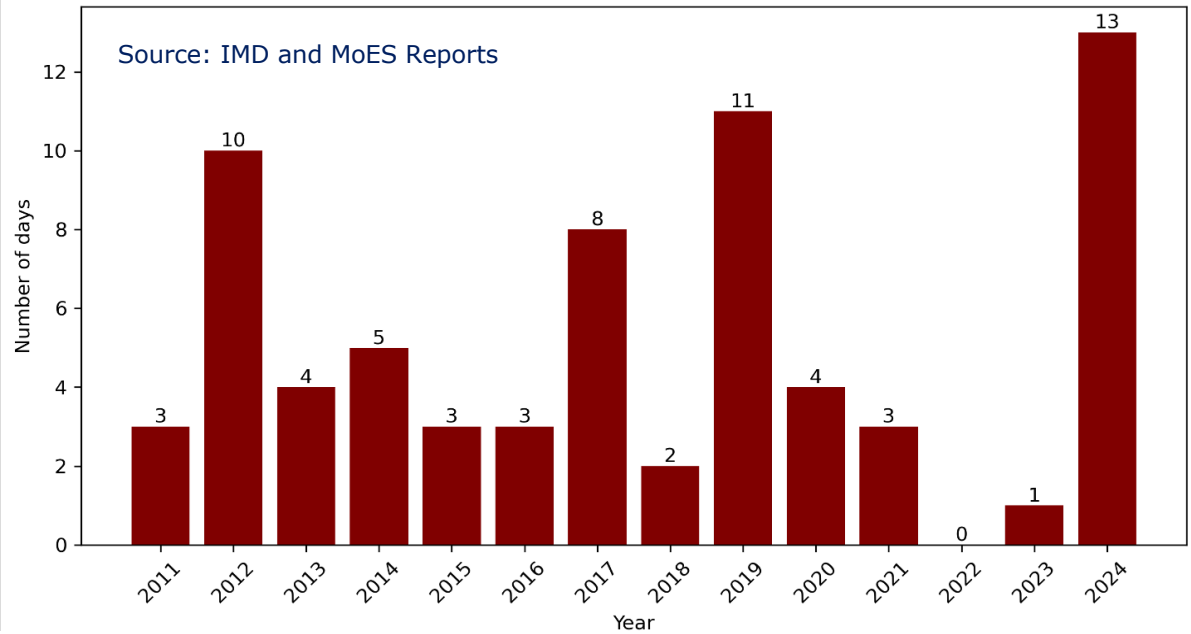
Source: IMD and IMDAA reanalysis

Tamil Nadu Context

Tamil Nadu has been witnessing a marked increase in extreme heat indicators. A 2023 study by IMD reports that the Heat Index in Tamil Nadu is rising at +0.56°C per decade in the summer and +0.32°C per decade during the monsoon. This index combines air temperature and humidity to reflect human-perceived heat and indicates growing discomfort, especially in the coastal and interior districts during April to June. As per the State-wise statement of Climate Report-2023 published by IMD, based on long-term climate data, maximum temperatures in Tamil Nadu have increased by +0.84°C per century and minimum temperatures by +0.51°C per century. Beating The Heat - Tamil Nadu Heat Mitigation Strategy 2024 reports, the average maximum temperature during March–June has risen by +1.5°C since 1981, equating to +0.2°C per decade. The Figure 1 shows the spatial distribution of extreme heat days in Tamil Nadu during 2024, showing the number of days, each district experienced maximum

temperatures exceeding 40°C. Erode, Vellore, and Tirupathur districts recorded the highest number of such days with over 23 days of extreme heat, highlighting regional heatwave hotspots. The figure 2 shows the average number of heatwave days in Tamil Nadu from 2011 to 2024. A sharp increase is observed in 2024, following a period of low heatwave occurrences from 2020 to 2023. The Beating the Heat - Tamil Nadu Heat Mitigation Strategy 2024 report utilized IMD's heatwave criteria-based analyses between 2011 and 2019 found that over 40% of the state experienced at least fifteen heatwave days annually. In 2023, Tamil Nadu recorded thirteen heat-related deaths, the highest since 2019. Fifty-six percent of Tamil Nadu's population now lives in areas where minimum temperatures exceed historical baselines, especially during the night. This has led to warmer nights, increased sleep disorders, and heightened cardiovascular risks. Cities like Vellore, Erode, and Madurai have witnessed significant nighttime warming, with minimums rising by 0.35°C between 2011 and 2019. The Universal Thermal Climate Index (UTCI) data from 1981 to 2022 indicates that Tamil Nadu experiences Strong Heat Stress (temperature ≥32°C) for over 81% of the year, particularly from March to May. During April and May, the state faces Very Strong to Extreme Heat Stress (≥38°C) for up to 9 hours per day. Interior regions are impacted earlier (March-April), while coastal areas suffer more in May-June.

Figure 2. The average number of heatwave days (2011 - 2024) in Tamil Nadu



2. Bio meteorological index - Heat Index

There will be no harm to the human body if the environmental temperature remains at 37° C. Whenever the environmental temperature increases above 37° C, the human body starts gaining heat from the atmosphere. If humidity is high, a person can suffer from heat stress

disorders even with the temperature at 37°C or thirty-eight°C. To calculate the effect of humidity we can use Heat Index Values. The Heat Index is a measure of how hot it really feels when relative humidity is considered with the actual air temperature. As an example, if the air temperature is 34°C and the relative humidity is 75%, the heat index--how hot it feels--is 49°C. The same effects reached at just 31°C when the relative humidity is 100%. The Temperature vs. Humidity chart and the temperature felt are presented below.

Heat Stress Index

Heat Stress Index															
Temperature (°C)	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
27	26.4	26.6	26.9	27.1	27.4	27.7	28.1	28.5	28.9	29.3	29.7	30.2	30.7	31.3	31.8
28	27.1	27.4	27.7	28	28.4	28.9	29.4	30	30.7	31.4	32.1	32.9	33.7	34.7	35.6
29	27.9	28.2	28.6	29.1	29.7	30.3	31	31.8	32.7	33.7	34.7	35.9	37.1	38.4	39.7
30	28.8	29.2	29.7	30.3	31	31.9	32.8	33.9	35	36.3	37.7	39.1	40.7	42.4	44.2
31	29.7	30.3	30.9	31.7	32.6	33.7	34.8	36.2	37.6	39.2	40.9	42.7	44.7	46.8	49
32	30.8	31.5	32.3	33.2	34.4	35.6	37.1	38.7	40.4	42.3	44.4	46.6	49	51.5	54.2
33	32	32.8	33.8	34.9	36.3	37.8	39.5	41.4	43.5	45.7	48.1	50.8	53.5	56.5	59.7
34	33.3	34.3	35.4	36.8	38.4	40.2	42.2	44.4	46.8	49.4	52.2	55.2	58.4	61.9	65.5
35	34.7	35.8	37.2	38.8	40.7	42.7	45.1	47.6	50.3	53.3	56.5	60	63.7	67.6	71.7
36	36.2	37.5	39.1	41	43.1	45.5	48.1	51	54.2	57.5	61.2	65.1	69.2	73.6	78.2
37	37.8	39.3	41.2	43.4	45.8	48.5	51.4	54.7	58.2	62	66.1	70.4	75.1	80	85.1
38	39.4	41.3	43.4	45.9	48.6	51.6	55	58.6	62.5	66.7	71.3	76.1	81.2	86.6	92.4
39	41.2	43.3	45.8	48.5	51.6	55	58.7	62.7	67.1	71.8	76.8	82.1	87.7	93.7	99.9
40	43.1	45.5	48.3	51.3	54.8	58.5	62.6	67.1	71.9	77	82.5	88.3	94.5	101	107.9
41	45.1	47.8	50.9	54.3	58.1	62.3	66.8	71.7	77	82.6	88.6	94.9	101.6	108.7	116.1
42	47.2	50.3	53.7	57.5	61.7	66.2	71.2	76.5	82.3	88.4	94.9	101.8	109	116.7	124.8
43	49.4	52.8	56.6	60.8	65.4	70.4	75.8	81.6	87.8	94.5	101.5	108.9	116.8	125.1	133.7
44	51.7	55.5	59.6	64.2	69.3	74.7	80.6	86.9	93.6	100.8	108.4	116.4	124.9	133.7	143
45	54.1	58.3	62.8	67.9	73.3	79.2	85.6	92.4	99.7	107.4	115.6	124.2	133.2	142.7	152.7
46	56.6	61.2	66.2	71.6	77.6	84	90.9	98.2	106	114.3	123	132.2	141.9	152.1	162.7
47	59.2	64.2	69.6	75.6	82	88.9	96.3	104.2	112.6	121.4	130.8	140.6	150.9	161.7	173
48	62	67.4	73.3	79.7	86.6	94	102	110.4	119.4	128.8	138.8	149.3	160.2	171.7	183.7
49	64.8	70.6	77	83.9	91.4	99.4	107.9	116.9	126.4	136.5	147.1	158.2	169.9	182.1	194.8
50	67.7	74	80.9	88.4	96.4	104.9	114	123.6	133.7	144.4	155.7	167.5	179.8	192.7	206.2

3. IMD Criteria for declaration of heatwave

In general terms, if maximum temperature of a station reaches at least 40°C or more for Plains and at least 30°C or more for Hilly regions, heat wave conditions could prevail.

The following criteria are used to declare heat wave based on Departure from Normal (average of minimum 30 years)

Plains Regions

Heatwave:

Max Temp ≥ 40°C AND Departure between 4.5°C and 6.4°C

OR Max Temp ≥ 45°C

Severe Heatwave:

Max Temp ≥ 40°C AND Departure ≥ 6.5°C

OR Max Temp ≥ 47°C

Coastal Regions

Heatwave:

Max Temp ≥ 37°C AND Departure between 4.5°C and 6.4°C

Severe Heatwave:

Max Temp ≥ 37°C AND Departure ≥ 6.5°C

Hilly Regions

Heatwave:

Max Temp ≥ 30°C AND Departure between 4.5°C and 6.4°C

Severe Heatwave:

Max Temp ≥ 30°C AND Departure ≥ 6.5°C

The above criteria must be met at least two stations in a Meteorological sub-division for at least two consecutive days and on the second day, heatwave will be declared.

Colour Code Signals for Heat Alert and suggested Actions				
Colour Code	**Alert**	**Warning**	**Impact**	**Suggested Actions**
Green Alert (No action)	Normal Day	Maximum temperatures are near normal	Comfortable temperature. No cautionary action required.	Normal activity.
Yellow Alert (Be update d)	Heat Alert	Heat wave conditions at isolated pockets persist for 2 days	Moderate temperature. Heat is tolerable for the public but moderate health concern for vulnerable people e.g., infants, elderly, people with chronic diseases.	(a) Avoid heat exposure. (b) Wear lightweight, light-coloured, loose, cotton clothes, (c) Cover your head.
Orange Alert (Be prepare d)	Sever e Heat Alert for the day	(i) Severe heat wave conditions persist for 2 days (ii) Though no severe, heat waves persist for 4 days or more.	High temperature. Increased likelihood of heat illness symptoms in people who are either exposed to sun for a prolonged period or doing heavy work. High health concern for vulnerable people e.g., infants, the elderly, people with chronic diseases.	(a)Avoid heat exposure – keep cool. Avoid dehydration (b) Wear lightweight, light-coloured, loose, cotton clothes (c) Cover your head (d) Drink sufficient water- even if not thirsty (e) Use ORS, homemade drinks like lassi, Rice water, lemon water, buttermilk, etc. to keep yourself hydrated (f) Avoid alcohol, tea, coffee and carbonated soft drinks, which dehydrates the body (g) Take bath in cold water frequently. **In case of Sunstroke:** Lay the person in a cool place, under a shade. Wipe her/him with a wet cloth/wash the body frequently. Pour normal temperature water on the head. The main thing is to bring down the body

				temperature. Consult a doctor immediately.
Red Alert (Act)	Extreme Heat Alert for the day	(i) Severe heat waves persist for more than 2 days. (ii) Total number of heat/severe heat wave days exceeding 6 days.	Extremely high likelihood of developing heat illness and heat stroke in all ages.	Along with suggested action for Orange Alert, Extreme care is needed for vulnerable people.

4. Initiatives of Government of Tamil Nadu

The State Planning Commission conducted a study in collaboration with the Stakeholder institutions and departments and two reports "Beating the Heat" -Tamil Nadu Heat Mitigation Strategy and Urban Heat Island Hotspot Analysis and Mitigation Strategies for Tamil Nadu.

Declaration of State-Specific Disaster: The Government of Tamil Nadu declared Heat Wave as a 'State-Specific Disaster' to strengthen the response and relief mechanisms during extreme heat conditions. This recognition enables the state to extend timely assistance and implement focused mitigation efforts. As part of the relief provisions, an ex-gratia payment of ₹4.00 lakh is offered to the families of individuals who succumb to heat-related causes, including personnel engaged in relief operations or preparedness activities, upon certification by the appropriate authority.

To further institutionalize preparedness, the State has developed Heat Action Plans for 11 Municipal Corporations namely Greater Chennai Corporation, Tambaram, Avadi, Madurai, Thoothukudi, Tiruchirapalli, Coimbatore, Erode, Tiruppur, Vellore and Salem, which outline preventive, adaptive and response strategies to manage extreme heat events at the urban level. Heat Wave Action Plans for the remaining 14 Urban Municipal Corporations and all thirty-seven districts and the State will be put in place.

Capacity Building / Training Programme: Heatwave Training Programmes have been provided to medical professionals, paramedical staff and community health staff, health care professionals at local level up to Ambulance Staff to recognize and respond to heat- related illnesses, particularly during extreme heat events, so that they can effectively

prevent and manage heat-related medical issues to reduce mortality and morbidity.

Establishment of medical aid facilities, widespread availability of Oral Rehydration Salts (ORS) and setting up water kiosks at public locations for easy access to safe drinking water. Local bodies are also directed to ensure continuous water supply and create awareness among vulnerable populations such as outdoor workers, the elderly, and children. These proactive steps reflect the state's commitment to reducing heat-related morbidity and mortality through coordinated disaster risk reduction strategies.

Strengthening GO-NGO Coordination: The government collaborates with Civil Society Organizations to improve green coverage, building temporary shelters, drinking water supply at places where people gather in large numbers, generate critical awareness among the public for adopting preventive measures.

Public Awareness and community outreach: The government has established an Early Warning System to alert residents to predictions of high and extreme temperatures through the Inter-Departmental coordination. Who will do what, when and how is made clear to all stakeholders, especially with respect to health department.

Disseminating public awareness messages on how to protect against the extreme heat- wave through print, electronic and social media and Information, Education and Communication (IEC) materials such as pamphlets, posters and advertisements and Television Commercials (TVCs) on Do’s and Don’ts and treatment measures for heat related illnesses, are part of the effects in IEC.

5. Early Warning Systems for Dissemination of Heat Wave

Once heat wave was declared as a state-specific disaster, the Government of Tamil Nadu empowered the Tamil Nadu Disaster Risk Reduction Agency (TNDRRA) under the Commissionerate of Revenue Administration to build and operate a state-of-the-art early warning system. At its core is **TNSMART**, a web-based decision-support platform that integrates multiple hazard modules—including Heat Wave—to provide district- and state-level authorities with inputs for real-time monitoring, analytics, and response planning. Complementing this, the **TN-Alert** mobile application delivers instant advisories and warnings straight to citizens’ phones, ensuring that last-mile communication reaches high-risk and vulnerable groups.

Key Components of the Heat Wave Early Warning Module

Multi-Model Heat Wave Forecast (5-Day Outlook)

- Forecasts draw on three independent weather models—IMD-GFS, SAC-WRF, and ECMWF—mapped spatially to District, Taluk, and Firka boundaries.
- A rolling five-day outlook flags each area as **Normal**, **Heat Wave**, or **Severe Heat Wave**, helping authorities pre-position resources and issue timely alerts.

Heat Stress Forecast (3-Hourly Resolution)

- Based on temperature and humidity inputs from the same three models, this component calculates a physiological stress index every three hours for five days ahead.
- It classifies conditions such as **Normal**, **Caution**, **Severe Caution**, or **Danger**, translating complex meteorological data into actionable health-risk categories.

Target-Group Advisory System

- For each risk level—whether Heat Wave or Heat Stress—the module generates tailored advisories for children, the elderly, pregnant women, outdoor laborers (construction and agriculture), street vendors, the homeless, tourists, and pilgrims.
- General "Dos and Don'ts" messages reinforce best practices for hydration, cooling, and activity scheduling.

Real-Time Public Alerts via TN-Alert

- Citizens receive push notifications that specify their location's current heat-wave status and stress category, along with succinct, behavior-focused guidance.
- By leveraging georeferenced forecasts, TN-Alert ensures those in the most at-risk areas are the first to know when conditions will deteriorate.

Together, these elements form an end-to-end early warning system: from sophisticated, multi-model forecasting through locally detailed heat-stress mapping to audience-specific advisories and direct citizen communications. This integrated approach equips both decision-makers and the public to act swiftly whether by opening cooling centres, adjusting

work schedules, or heeding personal safety measures thereby reducing the health, economic, and social toll of extreme heat in Tamil Nadu.

Figure 3. TN-Alert app Heat wave EWS module interface

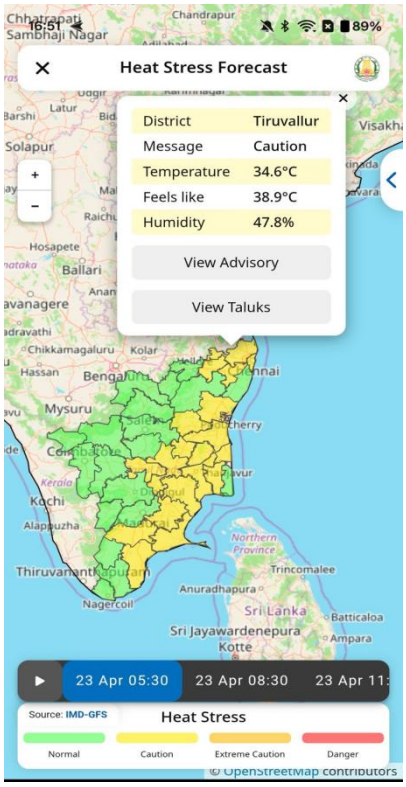
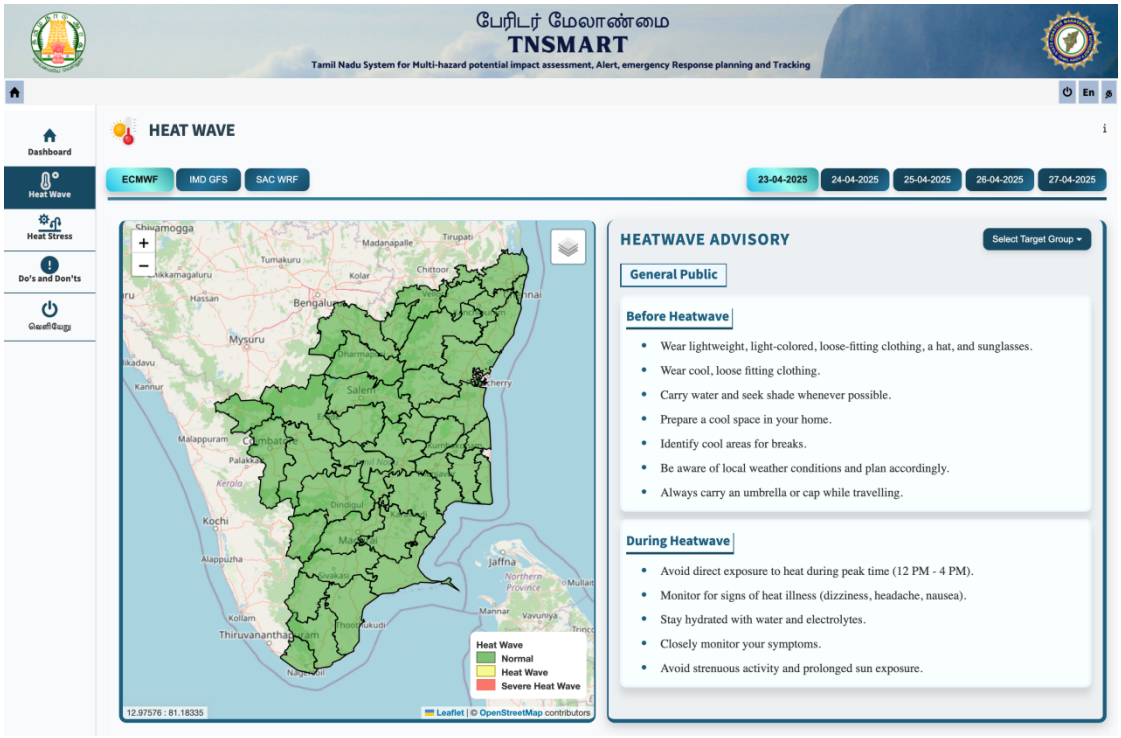


Figure 4. TN-SMART web-site Heat wave EWS module interface



Standard Operating Procedure for Investigation of Suspected Heat Related Illness Death

6. Extract of important Government Orders on Heat Wave

G.O MS No 419 Revenue and Disaster Management Department Disaster Management Wing DM (III) (1) Section dated 15-10-2024

Government notified the "Heat Wave" as a State Specific Disaster for the purpose of providing relief to the victims of the heat wave and for incurring under State Disaster Response Fund within the limit of 10% of the annual allocation of respective window. The procedures currently followed for identification of the beneficiaries for gratuitous relief to the families of diseased persons due to heat wave subject to the certification regarding cause of death from the appropriate authority.

The Government order permits provision for medical care including supply of ORS Packets and provision of drinking water in kiosks.

The Heat Wave will be notified, only after the Indian Meteorological Department declares an area or part of the area as Heat Wave affected based on the criteria followed by IMD.

G.O MS No 211 Revenue and Disaster Management Department Disaster Management Wing DM (III) (1) Section dated 30-04-2025

The Government have constituted Heat Death Certification Committee at the district level to ensure Standard Operating Procedure (SOP) for the heat related death to provide relief assistance of exgratia payment of Rs. 4.00 Lakh per diseased person under SDRF to the families of the deceased, including involved in relief operations or preparedness activities

S.No	Designation	Other than Chennai District	Chennai District
1	Chairman	District Collector	Commissioner GCC
2	Member Secretary	District Revenue Officer (DRO)	City Health Officer (GCC)
3	Member	1.District Health Officer 2.Joint Director of Health Services (JDHS) 3.A Nominated Physician and a Paediatrician from the Government Medical College Hospital (DME) or in Districts without a Government Medical College Hospital, nominated from the district Head Quarters Hospital (DMS)	1.Deans of Medical colleges. 2.City Medical Officer, GCC 3.A physician and a Paediatrician nominated from Rajiv Gandhi Govt. General Hospital (RGGGH)
The above committee shall be responsible for verifying and certifying deaths within 3 days of occurrence attributed to extreme heat conditions			

to facilitate the timely disbursal of ex-gratia payments to the affected families.

i. Instructions issues to city and district health officer

R.No.2874443/EPI/S3/2025 Office of the Director of Public Health and Preventive Medicine, Chennai 06.
Dated: 03.05.2025

Sub: Public Health and Preventive Medicine – Epidemics – Heat Wave Preparedness 2025 – Instructions to City & District Health Officers - Regarding.

Ref: 1. D.O.R.No.90/NCDC/CEOH&CCH/2020-21/Heat wave advisory/ Dt.24.01.2025 of Additional Director and Head of CEOH & CCH office of NCDC, MoHFW, GOI, New Delhi.
2. R.C.No.10264/P14/SHS/2019/dt.10.02.2025 O/o of The Mission Director, SHS, NHM, Chennai-06.

****

With the rising temperatures during Summer 2025, it is essential that all health facilities across the state remain fully prepared to manage heat-related illness, particularly during periods of extreme heat or heatwaves. In light of the advisory issued by the National Human Rights Commission (NHRC) regarding the ongoing heatwave conditions in Northern, Central, and Western regions of the country, it is imperative to remain vigilant to prevent heat-related morbidity and mortality.

Accordingly, the existing advisory on heatwave preparedness is hereby reiterated and must be implemented with strict compliance by all District Health Officers, City Health Officers, and Municipal Health Officers.

The World Meteorological Organization has outlined specific criteria for heat wave conditions based on temperature deviations and actual maximum temperatures.

World Meteorological Organization (WMO) defines heat wave as

1. Based on deviation from normal temperature: Heat wave is deviation from normal temperature by 4.5°C to 6.4°C and severeheat wave is deviation from normal temperature by > 6.4°C.
2. Based on actual maximum temperature: Heat wave is when actual maximum temperature is ≥ 45°C and severe heat wave is when actual maximum temperature is ≥ 47°C.

To declare a heat wave, the above criteria should be met for at least two stations in Meteorological sub-division for at least two consecutive days. Heat wave will be declared on the second day.

In this regard, it is requested to ensure the following activities in the District to avoid adverse health impact due to extreme Heat/Heat Wave.

1. **Conduct District Task Force Meeting on Climate Change and Human Health** Develop Heat Action Plan including the "Standard Operating Procedures" which will be in place during heat wave season.
2. **Sensitization and capacity building** of health staff as well as other line Department staffs on heat illness, i.e. HRI symptoms, management and reporting (Annexure enclosed).
3. **Issue Health Advisories and Plan IEC activities** from time to time to make the public aware about the precautions taken to safeguard against heat

wave **(Annexure enclosed - Public Health Advisory on Extreme Heat/Heat wave).**

4. **Health facility preparedness for prevention and management of HRI**
   - Procurement and supply of adequate quantities of ORS packs, essential medicines, IV fluids, ice-packs and equipment to support management of volume depletion and electrolyte imbalance etc.
   - Ensure availability of sufficient drinking water at all health facilities.
   - Ensure sufficient availability of cooling appliances and their functioning.
   - Equipping ambulance with Ice packs/gel packs and cold water for early management of HRI cases.
   - To allot 2 beds at the level of PHC, 5 beds at CHC and10 beds above the level of CHC exclusively for managing HRI.
   - The District Health Officers are hereby instructed to give necessary instructions to the District Epidemiologist to co-ordinate with District 108 co-coordinator in this regard and to ensure daily replacement of Ice packs/gel packs from nearby Primary Health Centres and to ensure that the same is returned back at the end of summer season.
   - Cases with suspected heat stroke should be rapidly assessed using standard treatment protocols.
5. **Health facility resiliency to extreme heat**
   - Coordinate with Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO) Tamil Nadu for uninterrupted electricity supply to hospitals for constant functioning of cooling appliances.
   - Adopt measures to reduce indoor heat and energy conservation in the health facilities like cool roof/green roof, window shading, rainwater harvesting, solarisation etc., and to provide shade outside the health facilities in heat-hotspot regions.
6. **Surveillance on Heat Related illnesses (HRI)**
   - It is instructed that the all the Heat Related Illnesses are reported in the IHIP-IDSP portal, monitored through the District Epidemiologists without fail.
   - It is requested to inform the Joint Directors of Medical services of your District to instruct the Chief Medical Officers to report Heat – Related Illness and line list in the IHIP-NPCCHH portal on daily basis without fail.
   - It is requested to inform the Deans of the Medical colleges in your District to instruct the Nodal officers to report Heat – Related Illness and line list in the IHIP-NPCCHH portal on daily basis without fail.
   - Heat Stroke/ Heat related deaths should be investigated as per Guidelines for Investigation of Suspected Heat-Related Illness Death and labelled as per the criteria issued by NPCCHH and the same to be reported in the IDSP-IHIP portal (enclosed).
   - Periodical data Analysis is essential for necessary timely intervention
   - **Dissemination of early warning**: India Meteorological Department (IMD) issues exclusively heat related warnings daily at around 1600 hours IST with forecast for next four days during heat wave season. District Nodal Officer shall identify the heat vulnerable population/ hotspots based on surveillance data and send advisories as per the colour coded recommendations in NDMA guidelines.
7. **HRI-Focused Mass Gathering/Sporting Event Preparedness**

To ensure the safety of attendees during summer events, proactive measures should be taken to prevent and manage Heat-Related Illnesses (HRI)

a. **Event Planning Considerations**

- Environmental Heat: Monitor heatwave forecasts, avoid scheduling events during peak heat hours (12 PM–3 PM), and consult IMD warnings.
- Event Infrastructure: Conduct venue assessments with medical teams for setting up medical camps, cooling areas, and water stations.
- Water Provision: Ensure 20L of water per person per day, with at least 4L for drinking. Provide a minimum of 2L of free drinking water per person or 500ml/hour, with one water outlet per 500 attendees.
- Shade & Cooling Shelters: Establish shaded areas, ventilated cooling zones, and misting stations.
- Health Promotion & Communication: Use social media, posters, and announcements to educate attendees on hydration, protective measures, and HRI symptoms.

b. **During the Event**

- Maintain adequate air circulation and prevent overcrowding.
- Monitor vulnerable populations using checkpoints and volunteers.
- Deploy medical teams with ice boxes, ORS, and cold water.
- Continuously broadcast safety messages about hydration and heat protection.
- Provide clear event maps showing medical posts and exit routes.
- Report heatstroke cases under NPCCHH surveillance.
- Maintain effective coordination between healthcare teams and event organizers.

8. **Drugs and Vaccine storage and Immunization sessions**

- To ensure adequate ventilation / Cross ventilation in the Cold Chain Room (ILR/DF), Pharmacy and the drugs storeroom in all the Primary Health Centres / Urban Primary Health Centres in the District.
- To ensure adequate space between the walls and the drugs shelf to prevent damage of the vaccines due to the conventional heat from the walls.
- To instruct all the VHNs, SHNs, CHNs and DMCHOs to start the immunization sessions much earlier than usual timings and complete the same before 11 am on all Immunization days in order to ensure not only the potency of vaccines but also the safe environment for the field staffs during the upcoming summer.

Further, the District Health Officers/CHOs and MHOs are hereby instructed to ensure that **ORS corner is made available in all health facilities** (HWC, PHC, CHC, HSC, UPHC, Urban Health and Wellness Centre & UCHC) for the Public in order to avoid dehydration resulting in morbidity and mortality due to Heat related illness throughout the summer.

Encl:

1. Annexure-I - Heat Related Illnesses
2. Annexure-II - Public Health Advisory on Extreme Heat/Heat wave
3. Guidelines for Investigation of Suspected Heat-Related Illness Death
4. Criteria to label Heat stroke/ Heat-related deaths in Clinical setting
5. IEC materials on Heat wave

Dr.T.S.Selvavinayagam
Director of Public Health and
Preventive Medicine, Chennai-06.

To

1. All the District Health Officers / All City Health Officers / All Municipality Health Officers.
2. The City Health Officer, Greater Chennai Corporation, Chennai-03.

Copy to:

1. The Director of Medical Education & Research, Chennai-10.
2. The Director of Medical and Rural Health Services, Chennai-06.
3. All the Programme Officers of the Directorate.

Copy Submitted to:

1. The Mission Director, National Health Mission, Chennai-06.
2. The Commissioner, State Disaster Management Authority, Chennai-05.
3. The Secretary / Commissioner of Greater Chennai Corporation, Chennai-03.
4. The Principal Secretary to the Government, Health and Family Welfare Department, Chennai-09.
5. The Additional Chief Secretary / Commissioner of Revenue Administration and Disaster Management, Chennai-05.

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for Director of Public Health and
Preventive Medicine, Chennai 06.

ii. Guidelines instructions of suspected Heat Illness Death

Guidelines for Investigation of Suspected Heat-Related Illness Death

(To be filled by an epidemiologist/medical officer)

Unique ID:		
Respondent's Name:	Relationship of respondent with deceased:	
Residential address of respondent:		
Section A: Deceased's identifier details		
A.1. Name of deceased:	A.2. Age (in completed years & months):	Y Y M M
A.3. Sex: Male / Female/Transgender:	A.4. Father's/Mother's/Spouse's name:	
A.5. Residential Address of deceased		
A.5.1 State:	A.5.2. District	
A.5.3. Block/Taluka:	A.5.4. Ward /Village	
A.6. Does the deceased have the following socio-economic card	i. BPL, ii. Antayodya, iii. Annapurna, iv. Other or Equivalent (mention)……, v. None	
A.7. What was the last occupation of the deceased?		

Section B: Death detail						
No.	**Questions**	**Coding categories**			If **no, Skip to**	
B.1	Was the deceased found unconscious or dead?	Yes……..**1**			B.3	
		No ……..2				
		I don't Know……...3				
B.2	Place where deceased was found unconscious or dead?	At home……..**1**				
		At workplace……2				
		At social gathering ……3				
		On-road ……...4				
		Other (specify) …….				
B.3	Location where deceased was found unconscious or dead					
	B.3.1 State:	B.3.2. District				
	B.3.3. Block/Taluka:	B.3.4. Ward/Village				
B.4	Name of hospital and address where deceased was brought dead or died:					
B.5	Date and time of the death: (from medical record)	DD	MM	YYYY	HH	MM

Section C: Clinical history in past 24 hr before death (from medical record followed by respondent)	
C.1. Symptoms at the time of onset of illness:	
C.1.1. Was the skin hot and dry? (a. From Medical Record b. From Respondent c. both)	Yes……...1 No……..…2 I don't Know…… …3
C.1.2. Was the deceased in altered mental sensorium? (a. From Medical Record b. From Respondent c. both)	Yes……...1 No……..…2 I don't Know…… ……3
C.1.3. What was the core body temperature? (from medical record only):_____	

C.1.4. What was the deceased's vitals? (from medical record only): a. Pulse rate:_____ b. Respiratory rate: _____ c. Blood pressure:_____					
C.2 Date and time of onset of the first symptom of heat illness:	DD	MM	YYYY	HH	MM
C.3 Place of onset of the first symptom of heat illness:	At home ……..1 At workplace ……..2 At social gathering…….3 On-road …… ..4 School/college…….5 Other (specify)…….				
C.4 Location of onset of symptoms					
C.4.1 State:	C.4.2. District:				
C.4.3. Block/Taluka:	C.4.4. Ward/village:				
C.5. Did the deceased have an alcoholic beverage within a day of onset of illness?	Yes……...1 No……..2 I don't Know……..3				

Section D: Outdoor activities just before the onset of illness			
No.	**Questions**	**Coding categories**	**If no, Skip to**
D.1	Just before the onset of illness, was the deceased present outdoors?	Yes……...1 No……..2 I don't Know……..3	E.1
D.2	Was the deceased engaged in outdoor occupational activities?	Yes……...1 No……..2 I don't Know……..3	D.3
D.3	Was the deceased working under direct sunlight?	Yes……...1 No……..2 I don't Know……..3	
D.4	Was the deceased working in peak hours of the day, i.e. 11 AM to 4 PM	Yes……...1 No……..2 I don't Know……..3	
D.5	Was the deceased working near heat sources.e., hot furnace, stove, gas fire, wood fire, steam, hot engines/machines	Yes……...1 No……..2 I don't Know……..3	D.7
D.6	If yes to D.5, the type of heat source was:	Fire (hot furnace, stove, gas fire, hot engine)……1 Steam……2	
D.7	Was the deceased doing any physical exertional activity?	Yes……...1 No……..2 I don't Know……..3	D.8
D.8	Was the deceased sitting in a vehicle?	Yes……...1 No……..2 I don't Know……..3	D.12
D.9	If yes to D.8, was the vehicle parked in a shaded area?	Yes……...1 No……..2 I don't Know……..3	
D.10	If yes to D.8, what was the approx. duration of sitting in vehicle?	0-1 hr……1 >1 hr……..2	

D.11	If yes to D.8, was the air-conditioner working in vehicle?	Yes……...1 No……..…….2 I don't Know……..3	
D.12	Remarks on outdoor activity, if any:	Yes……...1 No……..…….2 I don't Know……..3	

Section E. Indoor conditions just before the onset of illness.			
No.	**Questions**	**Coding categories**	**If no, Skip to**
E.1	Was the deceased INDOORS?	Yes……..……...1 No……..……..2 I don't Know……..……..3	F1
E.2	If yes to E.1, were the following items, i.e., ceiling fan, desert cooler, air conditioner present?	Yes……..……...1 No……..……..2 I don't Know……..……..3	
E.3	If yes to E.2, describe the item, its working condition and whether it was switched on or not? Description:		
E.4	Type of house/Room where decease was found	Pucca house (house-made with high-quality materials throughout, including the floor, roof and exterior walls)…….1 Katcha house (House made from mud, thatch, or other low-quality materials)……..2	
E.5	Windows in rooms	Yes……..……...1 No……..……..2 I don't Know……..……..3	
E.6	If there were windows in the room, were they open at the time of onset of symptoms	Yes……..……...1 No……..……..2 I don't Know……..……..3	

Section F: Medical conditions recorded at first medical contact (as per medical record)			
No.	**Questions**	**Coding categories**	**If no, Skip to**
F.1	Was the deceased suffering from anychronic medical condition?	Yes……..……...1 No……..……..2 I don't Know……..……..3	
F.2	Was the deceased suffering from any acute medical conditions before the onset of the current illness?	Yes……..……...1 No……..……..2 I don't Know……..……..3	F.4
F.3	If yes to F.2, list the illness and duration of suffering		
F.4	Was the deceased taking any medications before the onset of current illness?	Yes……..……...1 No……..……..2 I don't Know……..……..3	Section - G

F.5	If yes to F.4, list the medication and duration since taking-

Section G: Weather data from the India Meteorological Department		
No.	**Questions**	**Coding categories**
G.1	What was the maximum temperature (Tmax) of the day in the area at/ around the onset of illness/death (if onset unknown)?	
G.2	What was the maximum temperature (Tmax) for each day of the past 3 days from the date of patient death?:	a. One day back: b. Two days back: c. Three days back:
G.3	Was there a heatwave affecting the area/region on the date of onset of illness?	Yes……..……1 No……..……..……2 I don't Know……..……..……..3
G.4	Was there a heatwave in the previous 3 days in the area where the onset of illness occurred?	Yes……..……...1 No……..……..2 I don't Know……..……..……3
G.5	What was the relative humidity of the area at/around the onset of illness (or at time of death if onset unknown)?:	
G.6	What was the relative humidity for each day of the past 3 days from the patient's date of death?:	a. One day back: b. Two days back: c. Three days back:

Form filled by:

Name: ……..…….. Signature:

Designation:……..……

iii.Guidelines to fill Health Related Illness Death

Guidelines to fill HRI death investigation form

1. Any of the following should fill the HRI and death investigation form:
    a. Medical officer of Primary Health Centre or Community Health Centre.
    b. Doctor on duty in health facility/hospital where the suspected case of HRI died.
    c. Epidemiologist doing HRI death investigation.
2. Data sources to fill the form are as follows:
    a. Deceased's photo ID record: aadhar card/pan card/voter ID/ration card/driving licence, etc.
    b. Respondent's photo ID record: aadhar card/pan card/voter ID/ration card/driving licence, etc.
    c. Past medical records.
    d. Hospital medical record
    e. Interview with the relatives/caretakers/neighbour/person brought or saw the ill or suspected deceased.
    f. Weather record from Indian Meteorological Department (IMD) website or IMD office.
3. Unique ID:
    a. The unique ID will be as local government directory available at https://lgdirectory.gov.in/
4. Section A: deceased's details
    a. Section A.1 to A.6.: The name, age, sex, father's/spouse's name, residential address should be as per valid government ID. The information taken from government ID or relative or some other source should be mentioned in the remarks box.
    b. Section A.7: Current occupation: Within a week of death.
        Note: The activities/occupational activities just before death/onset of symptoms will be mentioned in section D.
5. Section B: Death detail
    a. Section B.2.: Place the deceased found: The purpose of getting information on the place where the decedent was found dead is to know the circumstances in which the death of person occur and to correlate it with the weather condition of that area (the weather condition will be recorded in section H).
    b. The name of the hospital where the deceased was brought dead or declared dead is for record purpose.
6. Section C: Clinical history in the past 24 hr before death (from medical record and relatives)
    a. The answers for this section should be extracted from medical records. If the information is not available from medical records, then it should be sought from respondents/relatives.
    b. Symptoms at the time of onset of illness: for diagnosis purpose
    c. Date and time of onset: for correlating with climate variables of that day and time.
    d. Place of onset of symptoms: for correlating with climate variables of that place.
    e. Did the deceased have an alcoholic beverage within a day of onset of illness?: for contributing factors
7. Section D: Outdoor activities just before the onset of illness:
    a. Section D. requires the details of whether the decedent was outdoor/indoor before/during the onset of symptoms.
8. Section E: Indoor conditions just before the onset of illness
9. Section F: Other non-Heat-Related questions, i.e., chronic, acute and medication history.
    a. Medical record: Any public or private facility or pharmacy note
10. Section H: Weather data from the India Meteorological Department
11. At the bottom of the form, give the details of the person filling the form with his/her name, designation, signature and date of signing. The form should be filled as by the person mentioned in the first point.

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iv.Criteria to Label Heatstroke/Heat-Related Deaths in Clinical setting.

National Programme on Climate Change and Human Health

Criteria to Label Heatstroke/Heat-Related Deaths in Clinical Setting

- *For application of any of following criteria, **environmental criteria** (described below) must be met.*
- *Please report accordingly in Nat. Heat-Related Illness & Death surveillance at https://ihip.mohfw.gov.in/npcchh using **p-form user** credentials.*

Criteria *(for each category, all criteria should be met)*	**Identify as**
1. **Antemortem core body temperature ≥105°F (≥40.5°C)** ◯ 2. + H/O Mental status change ◯ 3. + No alternate definite diagnosis ◯ 4. + Environmental criteria met (see below) ◯ ***OR*** H/O Heat stress ◯ *(Worked in poorly ventilated space/Vigorous physical activity)*	**Confirmed Heatstroke Death** (label as **Suspected Heatstroke Death** till all category criteria are confirmed)
1. **Antemortem core body temperature <105°F (<40.5°C)** ◯ 2. + H/O attempted body cooling prior to arrival ◯ 3. + H/O Mental status change ◯ 4. + No alternate definite diagnosis ◯ 5. + Environmental criteria met ◯ ***OR*** H/O Heat stress ◯ *(Worked in poorly ventilated space/Vigorous physical activity)*	
1. Death of **suspected heatstroke case** ◯	**Suspected Heatstroke Death** until an alternate diagnosis is confirmed
1. **Antemortem core body temperature not assessed** ◯ 2. + H/O Mental status change ◯ 3. + Environmental criteria met ◯ 4. + No alternate definite diagnosis ◯	
1. **Clinical assessment not possible/Patient brought dead** ◯ 2. + H/O Pre-existing disease known to be exacerbated by heat stress ◯ *(Chronic CVD, respiratory, renal disease, DM, obesity, physical/mental disability, or use of antihistamines, antipsychotics, beta blockers, CCBs, SSRIs, Diuretics)* 3. + Environmental criteria met ◯	
1. **Patient brought dead** ◯ 2. + Environmental criteria met ◯ 3. + From ***any*** of below vulnerable groups ◯ Elderly ◯ Infant/children ◯ Farmers ◯ Homeless ◯ Outdoor laborers ◯ Vendors ◯ rickshaw pullers ◯ Chronically sick ◯ Watchman, driver ◯ Delivery persons	

Environmental criteria

Active Heatwave or Severe Heatwave alert existed at the location of symptom onset ◯
If **NO active heatwave alert**, check for maximum daytime temperature

Maximum daytime temperature	Plain region	Coastal region	Hilly region
	>40°C ◯	>37°C ◯	>30°C ◯

Check IMD Warnings and temperatures at https://mausam.imd.gov.in/

- *District wise warning at map: https://mausam.imd.gov.in/responsive/districtWiseHeatwaveWarning.php*
- *Latest alerts issued: https://cap-sources.s3.amazonaws.com/in-imd-en/rss.xml*
- *Mausum app (IMD) or SACHET app (NDMA)*

Guidelines issued for the departments for the Heat Wave Management 2025

7. Guidelines for the Heat Wave Management 2025 - Roles of Departments

Objectives

The objective of this handbook is to mobilize communities to help protect themselves, their neighbours, friends, and relatives against preventable health problems during spells of extremely hot weather.

Severe and extended heatwaves will cause disruption to general, social, and economic services. Government departments have a critical role to play in communicating the alerts issued by IMD and preparing and responding to heatwaves at a local level, working closely with health and other related departments with a holistic and sustainable approach.

Roles of Departments:

1) Health & Family Welfare Department

- The Director of Public Health has issued instructions to JD, Health and DDHS for active surveillance on Heat Related Illness [HRI], Capacity building of health workers and preparedness of Health institutions, including all private Hospitals, to manage heat wave related morbidities.
- Advisories shall be issued to Public on heat wave, about Do's and Do's, on print, electronic and social media.
- Hospitals and public health facilities must maintain adequate stock of ORS in Public Health Centres and Hospitals.
- Exclusive ward/ cool ward must be set up with adequate beds for handling heat related illness.
- The VHN and UHN are to be trained for handling HRI and adequate stock of ORS can be stored at local bodies for use in case of requirements.
- Reports on Heat Related Illness (HRI) must be collected from all Government and Private Hospitals and updated in the IHIP portal daily and the report should be furnished to the District Collector/Chairperson of the DDMA and to the Commissionerate of Revenue Administration.
- Fire Safety Audit has to be conducted in all Hospitals by the Fire & Rescue Services to prevent any fire incidents in Hospitals.

2) Industries & Commerce Department.

- The areas where the working conditions are extremely hot, like steel rolling mills, furnace, etc., two batches of workers may be engaged, and each batch may work only for 1 hour or 2 hours on a rotational basis after having rest in the room provided for that purpose.
- Industr Associations shall be addressed regarding heat wave mitigation measures.

3) Labour Welfare Department

- The Labour department has to ensure that heat wave preparedness and management is available at Shops, Commercial establishments, Motor Transport, Catering establishments, Plantations, etc.,
- Ensure proper and clean toilet and bathroom facilities at premises for both the employees and the Public.
- Enforce working conditions like accommodation, proper seating, rest in rotation and legal working hours, as per relevant rules.
- As per the Labour Act, inspections have to be conducted periodically by the Enforcement officials to ensure the safety of labourers from the heat wave.
- Ensuring that the sanitary workers engaged in Solid Waste Management, Salt Pan Workers are provided with adequate rest during the day when the temperatures rise and are provided with drinking water, ORS Solutions, and places with shade at workplaces.

4) Urban/Rural Local Bodies, CMWSSB and TWAD

Greater Chennai Corporation / Corporations / Municipalities / Town Panchayats.

- The local bodies and department officials concerned shall ensure the availability of adequate drinking water facilities, shelters for rest, emergency medical facilities at public places viz., bus stands, markets, shandies, hospitals, government offices, tourist spots and places of worship.
- The department shall establish water kiosks (Thaneer Pandals) and temporary shelters at places where public gather.

- Ensuring adequate drinking water supply through Sintex tanks at places where the public gather.
- Availability of electrolytes, ORS and drinking water facilities in all Public Health Institutions such as UPHC and UCHCs may be ensured.
- Ensure all SOPs as per General Preparedness at Workplaces (GPWP) in the para-C, are followed at project sites. Construction workers engaged in highways, building, CMRL and railway work sites, shall be ensured of proper working hours, rest, and medical attention. None of them shall be engaged in strenuous works at peak heat hours without adequate protection.
- Ensuring that sanitation workers and other field workers follow appropriate safety measures.
- Strictly instruct the contractors to follow the heat wave management guidelines.
- Ensure that the solid waste dump yards do not catch fire and arrange for in-situ water facility at the solid waste dump yards to manage fires if fires occur.
- Prioritise water supply works and carrying out all repairs and maintenance immediately, to ensure adequate water supply to the public.
- Creating awareness through Public Address System, LED screen at public places like office, traffic signals, bus stands, parks, and markets.
- Distribution of IEC materials on Do's and Dont's
- The capacity building of medical officers and Paramedics shall be ensured.
- All the health facilities shall have beds for managing emergencies and referral regarding HRI.
- Shelters for urban homeless to be used as resting places, whenever needed by the people.
- Provide water supply to the stray animals and birds at public places and parks.

5) Rural Development and Panchayat Raj Department

- The local bodies and department officials concerned shall ensure the availability of adequate drinking water facilities, shelters for rest, emergency medical facilities at public places viz., bus stands, markets, shandies, hospitals, government offices, tourist spots and places of worship.
- Adequate Water supply to the Households should be ensured by the Village Panchayats.
- The Daily Water supply through Functional Household Tap Connections (FHTCs) should be maintained with proper chlorination.
- In cases of shortage in supply, alternate arrangements through Tankers to be ensured.
- All Water supply should be potable, and the quality of water should be assessed with Field Testing Kits regularly.
- In case of source depletion, source augmentation and necessary flushing of bore well should be taken up immediately by the Village Panchayats.
- Habitation wise domestic water supply has to be monitored on a daily basis by the Head of the Department
- District Collectors shall conduct meetings with TWAD Board officials and Rural Development officials to identify areas of concern in the district.
- Village Panchayats have to give suitable advisories to ensure animals are kept in the shade and provided adequate water in the cattle troughs wherever available.
- Panchayat secretaries have to be well informed of the heat wave conditions' Co-ordination with the health department should be ensured at panchayat level.
- MGNREGS works may commence early and end early as per the local climatic conditions. All SOPs as per the General Preparedness at Workplaces has to be ensured.

- ❖ All SOPs as per GPWP, in the para-C, are to be followed in all work sites. It must be ensured that the contractors strictly adhere to instructions in this regard.
- ❖ Electrolytes, Water, and shade should be ensured to the floating population through "Thaneer Pandhals", as required.
- ❖ Hotels and restaurants located in the rural areas may be advised to keep the ORS handy to help those who are in need.

6) Animal Husbandry, Dairying and Fisheries Department

- ❖ Animal health camps and an awareness programme on heat-related illness to cattle shall be conducted.
- ❖ Gestating animals, Lactating cattle and young ones are highly vulnerable to heatwave. Rehabilitation of affected animals and identification of safe location for their treatment must be done.
- ❖ Safe and adequate drinking Water to the cattle and other domestic animals at the veterinary hospital premises must be arranged.
- ❖ Adequate stock of Feed and Fodder shall be maintained.
- ❖ Adequate stock of health mixture for Milking Animals shall be maintained.
- ❖ Rope in the support of Local Bodies in supplying water to the cattle and animals.
- ❖ Advisories to be issued to the public not to leave the Pet Animals in a car (or) open space under direct sun.

7) CMRL, Public Works Department, Water Resources Department and Highways Department, Transport Department.
General Preparedness at Workplaces [GPWP]

- ❖ IEC materials on the symptoms, risk, preventive measures, Dos and Don'ts on Heat Related Illness and heat waves to be displayed in the usual places of the industry and to be distributed to the employees.

- Safe and adequate drinking water to be provided at multiple points in workplaces.
- Electrolytes, Lime juice, butter milk, ORS etc., may be made available to the workers / employees on extremely hot days to stay hydrated.
- Ample ventilation facilities shall be provided in workplaces.
- Cooling systems like an air cooler, fans may also be provided, as appropriate.
- Proper shade and rest stations shall be provided for the workers.
- Rescheduling the working hours to avoid peak heat period between 12.00 noon to 3.00 PM is desirable.
- Alternative transport like Buses/ vans may be arranged for employees commuting by 2-wheelers or they may be advised to travel by public transport.
- Outdoor work activities like maintenance, loading/unloading of goods during peak sunny hours, extremely hot conditions shall be avoided or done with appropriate protection.
- Intermittent breaks should be provided for those doing strenuous work.
- Health stations with paramedic/nurse shall be made available and Electrolyte supplements and other emergency medicines shall be kept in adequate quantities.
- Regular health checks should be conducted for the workers.
- Treatment and rest holidays shall be provided for those found unable to work in excessive heating conditions.
- If anyone is affected by Heat stroke, the person shall be taken immediately to the nearest Health centre for proper medical aid as heat strokes could be fatal.
- Arrangements shall be made for the tie-up with the local hospital for emergency care and ambulance facilities etc.,
- Appropriate arrangements shall be made so that the workers start their work early in the morning and finish it before the temperature increases, wherever possible.

- ❖ Further, all GPWP SOPs, as mentioned in para-C, shall be followed and contractors to be instructed to ensure heat wave preparedness at all work sites.

8) Forest Department

- ❖ Fire Lines should be maintained and created to prevent the spread of Forest Fires.
- ❖ Intensive patrolling to be done to avoid unauthorized entry of Trekkers.
- ❖ Water trough shall be arranged for Animals at appropriate places.
- ❖ The Standard Operating Procedure for Forest Fire Prevention, Control and Mitigation for the State and District Level Forest Fire Control plans issued in G.O.Ms.No. 11, Environment Climate Change and Forest (FR.14) Department, Dated: 11.01.2025 shall be followed.

9) School Education Department

- ❖ Organize an orientation programme at schools on Prevention and Management of Heat waves.
- ❖ Train the students through simple activities like Role Play and Demonstration using the videos.
- ❖ Consider rescheduling of school Working hours and summer holidays, if required.

10) TANGEDCO

- ➢ TANGEDCO has to prioritize maintaining power to critical facilities such as hospitals and Primary Health Centres, (PHC)/Urban Health Centres. (UHC)

11) Department of Information and Public Relations (DIPR)

- ❖ The news item about hot weather and the safety tips to be followed issued by the Tamil Nadu State Disaster Management Authority may be published /telecast through the Public Relations Department in all newspapers, televisions, and social media to create awareness among the public.
- ❖ Pamphlets and posters can be uploaded on social media.

- Awareness video if prepared by the Tamil Nadu State Disaster Management Authority regarding the heat wave may be screened in all theatres in Tamil Nadu and on the publicity vehicles of the district public relations office.
- Awareness videos about heat wave, if made available, may be uploaded on You Tube channel of Department of Information and Public Relations and Tamil Nadu Films Division.

The District Collectors/Chairpersons of DDMA are advised to ensure that Awareness Campaigns are organised jointly by the departments and local bodies so that the common public are well informed of the Dos' and Donts.' The services of NGOs, CSOs and voluntary Organisations, Print, Visual Media Social Media AIR, FM Radios may be effectively utilised to reach the public.

8.Heatwave Advisory from Public Health and Preventive Medicine, GoTN

The Directorate of Public Health and Preventive Medicine in Tamil Nadu has issued a heatwave advisory, recommending measures to prevent heat-related illnesses due to rising temperatures. The advisory encourages staying hydrated, avoiding strenuous activities during the hottest hours of the day, and seeking medical attention for symptoms like dizziness or headaches.

For the General Population

Stay Hydrated:

- Drink plenty of water, even if you are not thirsty.
- Carry drinking water while traveling.
- Use Oral Rehydration Solution (ORS) and consume homemade drinks like lemon water, buttermilk/lassi, and fruit juices with a pinch of salt.
- Eat seasonal fruits and vegetables rich in water content, such as watermelon, muskmelon, oranges, grapes, pineapple, cucumber, and lettuce.

Stay Protected:

- Wear loose, lightweight, light-coloured cotton clothing.
- Cover your head with an umbrella, hat, cap, towel, or traditional headgear when exposed to direct sunlight.
- Always wear footwear while stepping out in the sun.

Stay Informed:

- Keep track of weather updates through radio, television, newspapers, or the India Meteorological Department (IMD) website: http://mausam.imd.gov.in/, and TN-Alert.

Limit Outdoor Exposure:

- Stay indoors in well-ventilated and cool areas.
- Keep windows and curtains closed during the day to block heat and open them at night for ventilation.

- Plan outdoor activities during cooler hours of the day (early morning or evening).

For Vulnerable Groups

Certain groups are at a higher risk of heat-related illnesses and require extra care:

- Infants and young children
- Pregnant women
- Outdoor workers
- Individuals with mental health conditions
- People with pre-existing illnesses, especially heart disease or high blood pressure
- Individuals traveling from cooler regions should allow a week to acclimatize and stay well-hydrated.

Precautions for the Elderly & Sick Individuals:

- Elderly or unwell individuals living alone should be monitored regularly.
- Keep homes cool using curtains, shutters, or sunshades and ensure good ventilation.
- Stay on lower floors during extreme heat.
- Use fans and damp clothes to cool the body.

Precautions for Outdoor Workers:

- Minimize exposure to direct sunlight.
- Avoid strenuous physical activities during peak heat hours.
- Take frequent breaks in shaded or cool areas.
- Drink water every 20 minutes to stay hydrated.
- Ensure proper ventilation in workspaces.
- Seek medical help if experiencing dizziness, headache, or signs of heat stress.

Don’ts

- Avoid stepping out in the sun, especially between 12:00 PM and 3:00 PM.
- Do not engage in strenuous outdoor activities in the afternoon.
- Avoid walking barefoot on hot surfaces.

- ❖ Refrain from cooking during peak heat hours; keep cooking areas well-ventilated.
- ❖ Avoid alcohol, tea, coffee, carbonated soft drinks, and sugary beverages, as they can lead to dehydration.
- ❖ Do not consume high-protein or stale food.
- ❖ Never leave children or pets in parked vehicles, as temperatures inside can become dangerously high.

Emergency Response

If someone exhibits signs of heatstroke, such as high body temperature, confusion, or unconsciousness, call 108 immediately for medical assistance. Stay safe and take necessary precautions to protect yourself and your loved ones from the heatwave.

9. Guidelines for the Protection of the Homeless during extreme heat incidents

To be practised by: **All local bodies including Greater Chennai Corporation and all other Urban Local Bodies.**

Context:

Homelessness is double jeopardy during extreme adverse climatic events, especially extreme heat incidents i.e. >40^{o}C observed temperature. Most homeless persons who work are engaged, inter alia, as daily-wage manual labourers, rickshaw pullers, hawkers of balloons and other wares at traffic signals, waste pickers and segregators, construction workers, street vendors, etc. These occupations expose them to extreme heat conditions directly. Extreme heat combined with humidity is uncomfortable and pose serious health risks, especially for infants, children, pregnant women, the elderly and those who suffer from many other co-morbidities. The needs of homeless people are taken care by the Local bodies to a certain extent. However, the Government is keen to address the issue comprehensively with strong support from all stakeholders in a systematic way. These Guidelines gain relevance in this context.

Problems faced by homeless people during extreme heat:

Lack of Safe Drinking Water:

Homeless individuals often lack access to safe drinking water, putting them at serious risk of dehydration, heat exhaustion and potentially fatal heatstroke.

Lack of Shade and Shelter:

With no permanent shelter to call their own, many of he homeless stay outdoors in direct sunlight for prolonged periods, increasing their exposure to extreme temperatures. This situation is a serious problem for the individual homeless and the mentally/physically ill homeless because they have hardly any familial support.

Sunburn and Skin Damage:

Without sun protection or proper clothing, prolonged exposure can cause painful sunburns, skin infections and increase the long-term risk of skin cancer among the homeless.

Deterioration of Pre-existing Health Conditions:

Extreme heat can aggravate conditions like asthma, blood pressure heart disease and diabetes, especially when there is difficulty in accessing public medical care.

Hygiene and Sanitation Issues:

Sweating without access to washing, bathing facilities and clean clothing, increases the risk of infections, rashes and heat-related skin problems.

Persons with disabilities:

Having become relatively immobile due their physical conditions, the homeless person with disabilities need special care and attention and ideally if they are ill, they should be in hospital environments. Shelters sometimes may not have basic facilities like customised toilets and wheel chairs. The homeless who have adopted begging as a way of life are mostly persons with disabilities.

Mental Health Stress:

The physical discomfort and danger of heat amplify feelings of anxiety, irritability and hopelessness.

Suffering of Young Children:

Extreme heat can lead to detrimental effects on children's health like susceptibility to heat exhaustion, dehydration, heatstroke and respiratory illnesses. The children who are dropouts from schools and are made to wander in the open, suffer for want of water, shade and shelter.

Limited Access to Cooling Centres:

Cooling centres may not be socially accessible to the homeless, or may be too far away, overcrowded or inaccessible due to transportation issues or a lack of information.

Preparedness and Response for Homeless people during extreme heat incidents:

The above difficulties make it imperative that the homeless need focussed response during extreme heat events and the local bodies are best equipped to arrange for such response and co-ordinate among all relevant stakeholders.

All local bodies including the Greater Chennai Corporation and other Urban Local Bodies in the State are expected to undertake the following steps in this regard. With over 51% urbanisation in Tamil Nadu, homelessness is very outwardly visible in urban settings, but not unknown in rural settings.

Survey and mapping of homeless population:

Every Local Body must conduct a survey of persons in homeless situations and update it every year. Specific details related to the high-risk categories of persons including the unemployed migrant homeless, the elderly, children, pregnant women, lactating mothers, persons with chronic medical conditions, persons with disabilities and wandering mentally ill

should be maintained in the local body and the hotspots for the homeless persons should be geographically marked for compulsory location of physical response measures listed below.

Mapping of facilities:

1. Assess the existing number of shelters to accommodate the identified high-risk categories.
2. Availability of Special centres for the high-risk category of persons including recovery shelters for non-emergency heat-related illnesses.
3. Assessment of requirement for 'cooling spaces' and 'water dispensers' (Thanneer pandals) for persons in homeless situations especially in 'hotspot' locations for persons who are not willing to move to shelters due to occupational commitments.
4. Availability of Mobile medical units to address immediate health concerns of those in homeless services including heat cramps, heat exhaustions and heat stroke.
5. Awareness materials to encourage public to reach the local bodies to report persons in homeless situations who are in distress or in immediate need for assistance.
6. A directory of organizations/institutions/agencies providing care and support for the persons in homeless situations should be prepared and regularly updated by the local body to reach out for their specialised services, as and when needed.
7. Setting up of hydration facilities and shaded (cool) sitting areas in all homeless hotspots is a non-compromisable duty of each local body with the onset of extreme heat events. The local bodies can join with NGOs, civil society organisations and social organisations in ensuring that the "'cool' thaneer pandals" are stocked with necessary resources and manpower between 11 am to 4 pm every day.

Special Task Force:

A Special Task force Team needs to be formed at the local body, say., at the Corporation office and Zonal Level under designated Officials, to attend to the Drinking Water, Sanitation, Health and Shelter requirements of the homeless. The Call Centre of the Corporation must attend the requirements with due care and speed.

24x7 Rescue Team:

Every urban local body and as per requirement, the rural local bodies, should have a 24-hour an outreach/rescue team with rescue vehicles to identify and rescue homeless persons in distress situations or those who need assistance due to extreme heat events. The team ideally could comprise of persons who could speak multiple languages.

Ensuring essential services and facilities in case of gatherings by local bodies working along with police forces:

If possible, gatherings of people should not be permitted once extreme heat situation sets in into Tamil Nadu during the summer months. If not possible, police and the local bodies should insist and ensure that water, ORS and other essential cooling arrangements are made by the organisers of gatherings to prevent dehydration for the high-risk categories of persons including the elderly, children, pregnant women, lactating mothers, persons with chronic medical conditions, persons with disabilities and wandering mentally ill because the homeless could aggregate in general gatherings.

This applies to all MGRREGS work sites, similar government and private work sites throughout Tamil Nadu.

Utilise the services of Peridarkaala Nanban (Aapda Mitra) Volunteers and Ilam Peridarkaala Nanban (Yuva Aapda Mitra) Master Trainers

Local bodies can effectively use the Peridarkaala Nanban Personnel for generating awareness and imparting training.

Co-ordination with Stakeholders

A Co-ordination meeting shall be conducted by the local bodies with the following stakeholders for coordination.

1. Police - To get the support of "Kaval Karangal" – an initiative by the TN Police Department for rescue and rehabilitation of persons in homeless situations.
2. NGOs (providing food, medical, rescue, rehabilitation and shelter services)
3. Health Department
4. Social Welfare Department (Elderly, Transpersons, Child Protection)
5. Commissionerate for Welfare of the differently abled
6. Academic institutions to help in Surveys.

Suggested Roles of NGOS and Voluntary Organisations

1. NGOs can identify vulnerable populations at specified hot-spot zones and recommend specific mitigation measures.
2. NGOs can complement the State Government's measures to mitigate adverse impacts of heatwave on homeless people and take up specific hotspots for provision of response measures, under the coordination of the local body.
3. NGOs can play a significant role in mobilizing homeless people through generating critical awareness on 'preparedness measures for extreme heat events.
4. Disseminate IEC digital posters, early warnings, alerts, advisories and any other risk information to homeless people across the State.
5. Imparting psychosocial support to children, elderly, pregnant women and differently abled.
6. Identify the service delivery gaps and interface with the relevant Government departments for redressal.
7. Provide the data pertaining to the movement of homeless people to local bodies.

Suggested Role of Academic and Research Institutions

1. Academic institutions can train and familiarize their students every academic year on preparedness to manage events like extreme heat events.
2. Extend support to TNDRRA and Local Bodies by conducting research studies to evolve new strategies for adaptation.
3. Through NSS programs, academic institutions can conduct public awareness campaigns to generate critical awareness among homeless people about heatwave risks, prevention measures and responding during heatwave.

End Note:

The local bodies have a significant role to provide a humanitarian response to the homeless population not only during extreme temperature and humidity situations but also during other natural calamities. They are welcome to record their experiences and share best practices and

difficulties with TNDRRA so that these guidelines will be continuously improved. (Contact e-mail of TNDRRA: tnsdma.director@gmail.com)

10.Heatwave Advisory for Livestock

Extreme heat is a major challenge for animal health. Heat exhaustion is one of the most common stressors in livestock, causing significant discomfort and physiological changes.

Symptoms of heat exhaustion:

- Seeking shade
- Drinking excessively
- Breathing with the mouth open
- Excessive salivation
- Loss of appetite
- Rapid breathing
- High body temperature

Symptoms of severe heat exhaustion:

1. Shivering
2. Falling down / Collapsing

Summer care management for dairy cattle:

During the hot season, milk production decreases in dairy cattle and crossbred cows that produce a lot of milk (more than fifteen liters per day). If proper summer care methods are not followed, such dairy cows can suffer from heat stroke and die.

Water management for dairy cattle in summer:

- Clean, potable drinking water should be provided to the cattle at least 4 or 5 times a day. A water tank should be set up so that the dairy cattle always have access to water.
- Sprinkle a little mixed feed in the water so that it will increase the amount of water that the cows drink.
- In dry, hot areas or when fodder crops are not growing, livestock consume more dry and fibrous food. In these conditions, livestock will drink more water. During such times, hang salt licks in cattle sheds. The cattle will lick, which in turn will increase the water intake of the livestock and protect them from salt-deficiency illnesses.

- Installing water sprinklers, sprinkling chilly water on the cattle and installing electric fans can help prevent heat exhaustion in the summer.
- Water sprinklers can also be installed on the roof of the cowshed. The water sprinklers installed in this way should be turned on for about 15-20 minutes during hot weather. This will help the cows to avoid heatstroke and consume more feed. This will also increase milk production.
- The shed area can be kept cool by planting fast-growing shade trees around the shed. Trees like Subabul Agathi, Neem, Gliricidia, Kalyana Murungai, and Poovarasu can be planted.
- Buffalo farmers can protect buffaloes from heatstroke by making bathtubs and letting them sit in them during hot weather. By doing so, milk production can also be increased.

Planning for fodder management in summer

- In summer, cows should be sent for grazing between 6 am and 10 am and between 3 pm and 7 pm.
- To meet the fodder requirements of cattle during summer, soilless hydroponic fodder production **(hydroponics fodder production)** and Asola fodder production can be carried out.

Summer care management for Goats:

- In areas with dry pastures, agricultural surpluses or tree leaves or sawdust can be provided as fodder.
- Dairy goats require nutrients such as sodium and potassium. For this, the necessary mineral salts can be provided to the goats by tying salt lumps in goat sheds.
- Wood fodder: The leaves of trees like Kodukapuli, Vagai, Neem, Karuvel, Supapul, Mango, Jack , Agathi, and aras are the best food for goats. Velvel and Karuvel dry seeds, which are available in villages during summer, are good protein-rich food for goats.
- Drinking water: A goat needs 8 to 12 liters of water daily.

- Since the temperature is high in summer, it should be ensured that there is good clean drinking water in the grazing area. The number of drinking troughs should be according to the number of goats. All the goats do not drink water at the same time. Therefore, the width of the drinking trough should be 50 cm per goat. A drinking trough that is 50 cm long, one-foot-deep & 50 cm wide can provide water for ten goats.
- If the heat is very intense for a few days in the summer, spreading straw or coconut husk on the roof of the shed and sprinkling water on it can reduce the heat and prevent death.
- Depopulation of goats: The number of cattle should be reduced according to the availability of fodder and pastureland. By reducing this, excessive maintenance costs can be saved.
- Health care: Goats should be vaccinated against measles, mumps, cholera, and sheep pox.

Summer care management for Chickens:

Most of the time, when the temperature increases, the amount of feed consumed by chickens increases. To dissipate body heat, chickens end up suffering from excessive heat exhaustion. This causes the body weight of the chickens to decrease. They will sit around the water tank or in a corner alone or bury their bodies in the husks placed on the ground. They will open their mouths and start breathing rapidly. As the body temperature increases, the heart pumping rate also increases. The waste will be excreted in water, and a nervous breakdown will occur. Finally, the temperature of the blood going to the brain will increase, increasing the mortality rate.

- Chickens should not be fed during the peak of the day. Feed should be given at night, in the early morning and under the light of the lamp. This will help the chickens to get more food during the low sunny time.
- In summer, if the litter becomes thick due to wet residue, it will cause excessive heat.
- In summer, chickens should be given more space than usual. That is, 20 percent less chicken should be kept in a room than usual.

- Mixing vitamin C in the drinking water of chickens at the rate of ten milligrams per chicken, can reduce the fatigue of the chickens to some extent. B. Complex vitamins, glucose, etc., which relieve fatigue can also be mixed with drinking water.
- In places where the summer is more intense, the height of the chicken house should be higher. The height of thatched roof houses should be twelve feet on average, and the height of asbestos and Mangaluru tile roofs should be at least fifteen feet on average. The width should not exceed twenty-four feet.

Precautions to take while transporting livestock in vehicles during hot weather:

Transferring livestock should be well planned and conducted in a way that does not affect their welfare.

- The journey should be undertaken after identifying resting places with shade and water on the route.
- It is best to transfer livestock in the early morning or late in the evening or at night.
- At resting places, the vehicle should be parked in the shade, against the direction of the wind. By doing so, ventilation can be increased among the livestock. Also, the vehicle should be parked at resting places for a brief time only to prevent heat shock in the air.
- To ensure good ventilation among the livestock, the livestock should be loaded to only 85 percent of the capacity of the vehicle.
- By following the management methods mentioned above, the effects of high heat stress on livestock can be reduced. Awareness of heat stress is the first step in heat stress management for the livestock.

Model Advisories for use by Departments, District Collectors and Local Bodies.

11. General Precautions for all the public to protect themselves from heat wave

- If it is necessary to go out of the house, avoid going out from 12.00 noon to 3.00 pm when the sun is at its peak and go out in the morning or evening.
- Elderly, sick, children, pregnant women, and those who need medical assistance should go to the hospital with the help of autos, rented cars, and 108 ambulances for emergency assistance.
- When going out from their place to their daily offices and workplaces and for essential tasks, carry water, water buttermilk, lemon juice, and salt and sugar solution.
- It is desirable that children wear hats, carry water, and drink it regularly and wear shoes that do not absorb the heat of the ground.
- For men, a white umbrella, a white cloth, turban, or hat to protect their heads from direct heat are desirable.
- For women, a white umbrella, hat, or shawl covering their head and neck are desirable.
- Wearing shoes is very essential to prevent the heat from the roads for protecting yourselves.
- Wearing soft lose cotton clothes will reduce the impact of heatstroke.
- Check local weather reports on temperature through newspapers, radio and television and TN-ALERT app and plan your activities for the day.
- If someone is dehydrated, provide first aid immediately. In case of dehydration, wipe the affected person's body with a wet cloth / pour chilly water over their clothes and give them ORS to drink. If necessary, take them to the nearest primary health centre or health sub-centre.
- For medical assistance, call 108 ambulances.

12. Heatwave Advisory for Pregnant Women

Please be aware of the risk of complications:

Overheating during pregnancy can increase the risk of preterm birth, gestational hypertension, gestational diabetes, miscarriage, and stillbirth.

Impact on baby's development: Extreme heat exposure can negatively impact the baby's development, potentially leading to low birth weight, early birth, and other health problems.

By following the guidelines and staying proactive, pregnant women can help ensure their well-being and the health of their developing baby during a heatwave.

Specific recommendations for pregnant women during a heatwave:

1. Stay indoors & stay cool.
2. Avoid exposure to the sun, particularly between 11 am and 4 pm.
3. Keep your room cool. Use air conditioning or fans where possible.
4. If AC is unavailable, use fans, cool showers or wet towels on your neck and wrists to cool down.
5. Wear loose, light-colour clothing: Light-colour clothing reflects the sun's heat.
6. While outdoors, you are advised to cover your head using a light colour hat or white or light colour umbrella.
7. Keep taking fluids in sufficient quantities. Water, electrolyte drinks and other non-sugary beverages are good options.
8. Keep an eye on yourself. Be aware of dehydration. Dehydration can be extremely dangerous during pregnancy, so keep drinking water at regular intervals even if you are not feeling thirsty.
9. Restrict yourself from going outdoors unless it is necessary.
10. If you must go outside, do so during cooler hours and take frequent breaks in the shade or cool areas.
11. Be watchful for symptoms such as dizziness, nausea, rapid heartbeat, headache, or muscle cramps which can indicate overheating.
12. If you feel unwell or suspect you are overheating, seek medical attention immediately. In such cases, you must visit the nearest public or private health facility and while consulting the doctor, focus on your specific concerns and needs.

13.Advisory for Parents to Protect Infants from Heatwaves

Parents will have to observe infants during hot and humid conditions as they do not know what dehydration and heat stress feel like.
Infants under 6 months should be breastfed exclusively. Breast-feeding mothers should drink plenty of water as dehydration can affect breastmilk production.

- Do check regularly if your child is thirsty, sweating, feeling hot, vomiting, has a dry and sticky mouth, or experiencing headaches.
- If your child is not responding properly, has a high fever, is dizzy or is breathing fast, take them to the health facility immediately.
- Do make sure that your child is clothed loosely – this can help prevent heat rashes and overheating of body.
- Children aged 6 months and above should drink water regularly throughout the day.
- Enable them to have them rest every 30 minutes when exercising or playing outside.
- DO NOT give infants medication if they are showing signs of being overheated without consulting a health provider.
- DO NOT leave infants and children in closed spaces without ventilation, such as cars or rooms with closed windows.
- DO NOT let your children play outside for long hours when it is hot and without keeping an eye on them.
- It is better to avoid exercising or playing in elevated temperatures as it could lead to dehydration and grave consequences quickly.

14.Heatwave Advisory Home Makers / Housewives

Reduce the heat in your home:

- Keep curtains closed during the day.
- Keep windows open for good ventilation (spraying water can increase cooling).
- Use a fan or AC to keep a room cool.

Be careful in the kitchen:

- Avoid cooking during peak hours (12 noon – 4 pm).

- ❖ Keep the kitchen clean and well-ventilated.

Take care of your health:

- ❖ Take a break if you sweat a lot or feel thirsty.
- ❖ Take a cool bath or shower.
- ❖ Wear light cotton clothes.

Drink plenty of water and fluids:

- ❖ Drink water at regular intervals, even if you are not thirsty.
- ❖ Juice, fresh water, soft drinks etc. can be taken.
- ❖ Keep sufficient stock of 'salt-sugar mixed water' or ORS sachets which can be used when needed.

Keep equipment ready to use during extreme heat conditions:

- ❖ Fans, cooling devices, water bottles, wet clothes etc., should be ready for use, as needed.

First aid

- ❖ If someone is dehydrated, provide first aid immediately. In case of dehydration, wipe the body of the affected person with a wet cloth / pour chilly water on the clothes and make the person drink ORS. If necessary, take the person to the nearest primary health centre or sub-health centre.
- ❖ Seek 108 ambulance help for medical assistance

15. Mahatma Gandhi National Rural Employment Guarantee Scheme: Heatwave advisories for workers

1. Take sufficient drinking water from home. Keep drinking water at regular intervals, especially while working outdoors.
2. Refill the water bottle from the drinking water source which is made available at the work site.
3. Use light colour, preferably white colour clothes.
4. Wearing white clothing during summer offers an advantage as it reflects more sunlight and heat than dark colours.
5. Go to the shaded areas for rest and breaks, especially during the hottest part of the day.
6. Ensure that the Oral Rehydration Salts (ORS) readily available at work sites are used when needed.
7. Keep observing for any signs of heat-related illnesses

8. When you feel/see any heat-related illnesses, immediately report to the appropriate authorities
9. If someone is dehydrated, provide first aid immediately. In case of dehydration, wipe the body of the affected person with a wet cloth / pour chilly water on the clothes, make him/her drink ORS. If necessary, take him/her to the nearest primary health centre or sub-health centre.
10. Seek 108 ambulance help for medical assistance

16.Heatwave Advisory for Construction Workers Employers

- Construction work should be rescheduled to avoid the hottest hours of the day, with flexible work schedules and potential for slower work paces during extreme heat.
- Employers are expected to ensure access to sufficient drinking water and proper ventilation in workplaces, especially during prolonged heat periods.
- Providing shaded rest areas and implementing cooling measures, like fans or air coolers / air conditioners are important to help workers stay cool.
- Regular health check-ups for workers and availability of emergency ice packs and other heat illness prevention materials are crucial.
- The state government is emphasizing awareness campaigns to educate workers on how to protect themselves from heat stress, including the use of posters and banners at labor chowks.
- Oral Rehydration Salts (ORS) are readily available at government health facilities to aid in rehydration and prevent dehydration. Please make use of it. Employers are expected to keep ORS sachets in sufficient quantities.
- If someone is dehydrated, provide first aid immediately. In case of dehydration, wipe the body of the affected person with a wet cloth / pour chilly water on the clothes, and make the person drink ORS. If necessary, take the person to the nearest primary health centre or sub-health centre.
- Seeking 108 ambulance help for medical assistance.

Construction workers:

- Drink plenty of fluids, including water and ORS, throughout the day, even if you do not feel thirsty.
- Wear loose, light-coloured clothing that allows for good airflow.
- Take breaks in shaded areas and avoid prolonged exposure to direct sunlight. Take frequent breaks to rest and avoid overexertion.
- Recognize the signs of heat stress, such as dizziness, headache, and nausea, and seek immediate medical attention if you experience them. Visit a nearby public or private health facility.
- If someone is dehydrated, provide first aid immediately. In case of dehydration, wipe the body of the affected person with a wet cloth / pour chilly water on the clothes, and make him/her drink ORS. If necessary, take him/her to the nearest primary health centre or sub-health centre.
- Seeking 108 ambulance help for medical assistance.

17. Heatwave Advisory for workers engaged in Sanitary, Solid Waste Management.

1. Staff engaged in Solid Waste Collection and Management are advised to minimize exposure to the Sun.
2. Avoid prolonged exposure to the sun, especially during the hottest hours of the day (around 12:00 PM to 3:00 PM).
3. Keep drinking water at regular intervals, even if you are not feeling thirsty to prevent dehydration
4. Avoid sugary drinks and alcohol as they can worsen dehydration.
5. Wear light-coloured, lightweight, and porous cotton clothing to help regulate body temperature. Use protective goggles, hats, and shoes outdoors.
6. Strenuous activities should be avoided during hottest hours.
7. Working outdoors should also be avoided during hottest hours
8. If working outside, use a hat or umbrella and apply a damp cloth to the head, neck, face, and limbs to help cool down.
9. Take cool showers or baths to help lower body temperature. Use fans and damp clothing to help cool down.

10. Be aware of the signs of heat cramps, heat exhaustion and heat stroke, which include dizziness, nausea, and muscle cramps. If someone is experiencing these symptoms, seek immediate medical attention.
11. If someone is dehydrated, provide first aid immediately. In case of dehydration, wipe the body of the affected person with a wet cloth / pour chilly water on the clothes and make him/her drink ORS. If necessary, take him/her to the nearest primary health centre or sub-health centre.
12. Seek 108 ambulances for medical assistance

18. Heatwave Advisories for Salt Pan Worker

As temperatures are rising in Tamil Nadu, workers working in salt mining fields are more vulnerable to heatwaves.

The following advisories are shared with salt mining field workers for protecting yourselves from the heatwave.

- Avoid working between 11:00 am and 4:00 pm, which is the hottest hours of the day.
- Employees can be advised to work in rotation.
- If possible, shift work hours to early morning or evening hours.
- Take at least 10 minutes of rest in the shade or a cool place every hour.
- Wear light-coloured and breathable cotton clothing.
- Use hats or clothes on your head to protect yourself from direct sunlight.
- It is advisable to wear glasses to protect your eyes from sunlight and a mask to protect your eyes from dust.
- Drink water frequently even if you are not thirsty.

To the attention of employers:

- Keep cold drinking water, lemon juice, buttermilk and fresh water, and ORS (Oral Rehydration Solution) in easy reach.
- Check the weather forecast and plan accordingly. Work may be assigned in rotation.
- Create shade using tents, cloth pavilions or mat pavilions for workers.
- Provide drinking water and toilet facilities for workers.
- Keep a first aid kit. If someone is dehydrated, provide first aid immediately. In case of dehydration, wipe the body of the affected

person with a wet cloth / pour chilly water on the clothes and make the person drink ORS. If necessary, take the person to the nearest primary health centre or sub-health centre.

- Seeking 108 ambulance help for medical assistance.

19. Heatwave Safety Advisories for Farmers

As temperatures are rising in Tamil Nadu, protect yourself by following the following safety measures to avoid being affected by the heatwave.

- It is advised to work between 6 am and 10 am and then after 4 pm
- It is better to avoid working between 11 am and 3 pm, which is the peak heat hours.
- Take at least 15 minutes of rest every hour.
- Wear light cotton clothes.
- A turban or a cloth headscarf is a desirable thing to do.
- Avoid doing strenuous agricultural work during the hottest hours.
- It is advisable for those who take goats and cattle to pasture to arrive before 11 am
- It is advisable to keep the cattle in the shade under trees or in shade tents to protect them from the heat.
- Keep water, lemon juice, buttermilk and ORS (Oral Rehydration Solution) with you so that you can have it when needed.
- Drink water frequently even if you are not thirsty.
- It is desirable to keep water in an earthen pot for those working in the field.
- If someone is dehydrated, provide first aid immediately. In case of dehydration, wipe the body of the affected person with a wet cloth / pour chilly water on the clothes and make the person drink ORS. If necessary, take the person to the nearest primary health centre or sub-health centre.
- Seeking 108 ambulance help for medical assistance.

General advice

- ❖ Check the weather forecast and plan accordingly.
- ❖ Be careful when going near bushes, as snakes are more likely to be present in shady and cool areas.
- ❖ It is advisable to take a cold shower after work
- ❖ If you feel too hot, take a break, and continue.

20. Heat wave Advisory for Visually Challenged Persons

Scan the below QR code to access the audio link of the advisory (Tamil)

To the kind attention of visually challenged people. As temperatures are raising in Tamil Nadu, you are advised to stay hydrated, cool and be protected from heat stress.

1. Drink plenty of water throughout the day, even if not thirsty, and consider electrolyte drinks or homemade options like lassi or buttermilk.
2. Minimize exposure to direct sunlight, especially during the hottest hours of the day (around 12:00 noon to 03:00 pm). If you are outside, seek shaded areas and take frequent breaks to cool down.
3. Wear a wide-brimmed hat and sunglasses that block 100% of UVA and UVB rays. If you are particularly sensitive to light, consider using protective goggles.
4. Explore assistive technologies that can help monitor temperature or provide guidance on navigating outdoor environments. For example, a temperature-indicating device or a navigation app with heat wave alerts could be beneficial.
5. Take cool showers or baths, use fans, and consider using damp clothing or a damp towel to cool the skin.

6. Reduce physical activity during the heat wave and take frequent breaks.
7. Be aware of signs of heat-related illness, such as dizziness, fainting or confusion. Seek medical attention if symptoms worsen or persist.
8. Wash hands frequently and avoid sharing personal items to reduce the risk of infection.

Additional Considerations:

- ❖ Individuals with pre-existing health conditions should consult with their doctor about any concerns related to heat waves and eye health.
- ❖ Ensure clear communication with caregivers or support systems to ensure that everyone is aware of the heat wave advisory and the necessary precautions.

To the kind attention of the care givers:

- ❖ Please be aware of the signs of heat stress such as dizziness, headache, and nausea. Please take the person for medical care immediately if you find these symptoms persist and worsen.
- ❖ If your care receiver is dehydrated, provide first aid immediately. In case of dehydration, wipe the body of the affected person with a wet cloth / pour chilly water on the clothes and make the person drink ORS. If necessary, take the person to the nearest primary health centre or sub-health centre.
- ❖ Seeking 108 ambulance help for medical assistance.

21. Heat wave Advisories for Physically Challenged Persons

Physically challenged people are advised to stay indoors or in shaded areas, especially between 12 PM and 3 PM, when the sun is strongest, to be safe. You are advised to stay hydrated by drinking plenty of fluids and avoid strenuous activities during the hottest hours of the day.

Specific Recommendations:

- ❖ Drink plenty of water, electrolyte-rich drinks and avoid alcohol, tea, coffee, and carbonated beverages.
- ❖ Wear light-coloured and loose-fitting cotton clothing.

- Minimize exposure to direct sunlight and heat by staying in well-ventilated, cool areas.
- Take frequent breaks in shaded areas and consider using cool compresses or taking cool showers to lower body temperature.
- Limit physical activity, especially during the hottest hours of the day.
- Be aware of heat stress such as dizziness, headache and nausea and seek medical help immediately if they occur.
- If you go outside, limit exposure to the sun during cooler parts of the day, like early morning or evening.
- Cover your head with a hat or scarf while you are going out.
- For those who rely on wheelchairs or other mobility aids, ensure that the devices are shaded and that they can access cool spaces easily.

To the kind attention of family members:

- One of the family members should have been trained in first aid and be aware of signs of heat stress such as dizziness, headache, and nausea. Please take the people for medical care immediately.
- If a physically challenged person of your family is dehydrated, provide first aid immediately. In case of dehydration, wipe the body of the affected person with a wet cloth / pour chilly water on the clothes and make the person drink ORS. If necessary, take the person to the nearest primary health centre or sub-health centre.
- Seeking 108 ambulance help for medical assistance.

22. Heatwave advisories for Persons Engaged in Rag picking.

During heatwave conditions, people engaged in rag picking spend a lot of time outdoors may be exposed to extreme heat; so, it is important to follow the following precautions.

1. Keep your body cool:

- Drink water frequently before and during work. Drink natural beverages / juices.
- Try to avoid direct sunlight during peak hours (12 noon – 3 pm).

2. Proper clothing and protection:

- ❖ Wear light, airy clothing like cotton. Wear protective equipment like a hat or cloth covering for your head, goggles, and a hat. You can put a wet cloth around your neck to control your body heat.

3. Have a rest area at work:

- ❖ Take a break in the shade every now and then.
- ❖ Places should be identified for having water and taking a rest.

4. Know the signs of heat exhaustion:

- ❖ If you experience symptoms such as excessive sweating, dizziness, body aches, vomiting, and nausea, you should rest immediately.
- ❖ Do not hesitate to seek medical attention at the nearby public health facility

5. Safety of your children:

- ❖ Before you go to work, you should leave your children safely at your place of residence.

6. First aid

- ❖ If someone is dehydrated, provide first aid immediately. In case of dehydration, wipe the affected person's body with a wet cloth / pour chilly water over their clothes, and give them ORS to drink. If necessary, take them to the nearest primary health centre or health sub-centre. For medical assistance, call 108 ambulances.

23. Heatwave advisories for outdoor games

In Tamil Nadu, it is customary to organize outdoor games/tournaments in most villages and urban areas during the summer. This advisory is for both organizers of the tournaments and players.

1. Attention to the tournament organizers:

1.1 Adequate drinking water facilities should be ensured for the players. Adequate tumblers and drinking water bottles should be kept at the drinking water sources.

1.2 Adequate stocks of ORS or ORS sachets should be kept.

1.3 Sports competitions should be held in the morning and evening hours.

1.4 It is advised that competitions/games should not be held between 11.00 am and 3.30 pm, except in a covered/shaded place.

1.5 Adequate 'shaded roofs' should be arranged for the players to rest.

1.6 Some of the organizing members should be trained to provide first aid to the players in case of dehydration. In case of dehydration, wipe the body of the affected player with a wet cloth / pour chilly water over the clothes and make him/her drink ORS. If necessary, take him/her to the nearest primary health centre or health sub-centre.

1.7 Seek 108 ambulance help for medical assistance.

Note: Separate drinking water facilities must also be provided for spectators.

2. Attention Players:

2.1 Avoid playing and traveling to play between 11.00 am and 3.30 pm, except in covered and shaded places.

2.2 Carry a water bottle with you when going to participate in sports competitions.

2.3 It is best to wear white clothes. White clothes absorb the heat of the sun little, thus keeping the body cool.

2.4 Dark coloured clothes absorb more sunlight and make the body feel hot; therefore, it is better to avoid dark coloured clothes.

2.5 It is best to carry ORS sachets. You can use them when you feel the symptoms of dehydration.

2.6 From time to time, when the body temperature increases, it is advised to cool the body with a wet cloth.

2.7 It is advised you to stay in the shade before playing (while waiting).

2.8 If your teammate is dehydrated, immediately provide first aid. During dehydration, wipe the body of the affected person with a wet cloth / pour chilly water on the affected person's clothes and make him/her drink ORS. If necessary, take him/her to the nearest primary health centre or health sub-centre.

2.9 Seek 108 ambulance assistance for medical assistance.

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