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CLIMATE ADAPTIVE ACTION PLANS TO MANAGE HEAT STRESS IN INDIAN CITIES

FINAL TECHNICAL REPORT

IDRC Grant Number:108453-001

NDMC
नई दिल्ली नगरपालिका परिषद्

RAJKOT MUNICIPAL CORPORATION

INDIAN INSTITUTE OF PUBLIC HEALTH GANDHINAGAR

INDIAN INSTITUTE OF PUBLIC HEALTH BHUBANESWAR

BHUBANESWAR MUNICIPAL CORPORATION
BMC

ODISHA STATE DISASTER MANAGEMENT AUTHORITY
With You Always

CLIMATE ADAPTIVE ACTION PLANS TO MANAGE HEAT STRESS IN INDIAN CITIES

Final Technical Report
2017 – 2021

IDRC GrantNumber: 108453-001

Name of Research Institution:	Integrated Research & Action for Development (IRADe)
Project Consortium:	Indian Institution of Public Health (IIPH)-Gandhinagar Indian Institution of Public Health (IIPH)-Bhubaneswar Odisha Disaster Management Authority (OSDMA) Indian Meteorological Department (IMD) Indian Meteorological Society (IMS) Rajkot Municipal Corporation (RMC) Bhubaneswar Municipal Corporation (BMC) New Delhi Municipal Council (NDMC)
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Mr Rohit Magotra
Project Principal Investigator
Deputy Director, IRADe

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List of Acronyms

ASHA	Accredited Social Health Activist
BMC	Bhubaneswar Municipal Corporation
C-CUBE	Climate Centre for Cities
IEC	Information Education and Communication
IMD	India Meteorological Department
FGDs	Focus Group Discussions
GIS	Geographic Information System
GoI	Government of India
HAP	Heat Action Plan
HHs	Households
HSAP	Heat Stress Action Plan
NGOs	Non-Government Organisation
LSE	Land Surface Emissivity
LST	Land Surface Temperature
NDMA	National Disaster Management Authority
NDMC	New Delhi Municipal Council
NDVI	Normalized Difference Vegetation Index
NIUA	National Institute of Urban Affairs
ORS	Oral Rehydration Salt
OSDMA	Odisha State Disaster Management Authority
RHE	Evening Relative Humidity
RHM	Morning Relative Humidity
RMC	Rajkot Municipal Corporation
SAHHIN	South Asia Heat Health Information Network
SLD	Shared Learning Dialogues
SPSS	Statistical Package for the Social Sciences
TMax	Maximum Temperature
TMin	Minimum Temperature
UHC	Urban Health Centre
UHI	Urban Heat Island
ULB	Urban Local Body
WHO	World Health Organisation
WMO	World Meteorological Organisation

Executive Summary

The frequency and intensity of heatwaves is expected to rise in the 21st Century. It affects human health and often results in physiological stress in people even triggering mortality. The worrisome part is that heat waves affect a large population in a short span of time that may create health issues and produce cascading socioeconomic impacts such as work loss and a decrease in labour productivity. To add to this, low heat-health risk awareness among the citizenry, preparedness of governance systems to respond to heat-related threats, and lack of policies to improve system preparedness are creating repercussions of health emergencies, wellbeing and economy of the cities.

The ongoing and exponential threats to the environment and the recent wake-up call in the 6th IPCC report on heating of Earth's surface around 2.0 °F (1.1 °C) highlights that future global mean temperature and related heatwaves are only expected to increase. The world's seven-warmest years have all occurred since 2014, with 10 of the warmest years occurring since 2005 (NoAA, 2021).

In India, heatwaves are a silent killer and cause most deaths in cities compared to any other natural disaster in India. Cities are today experiencing an unprecedented increase in the number of heatwaves, which along with the Urban Heat Island (UHI) effect produce disastrous consequences, particularly for the vulnerable population. Around 26-37 million households in urban India reside in informal housing which makes them more susceptible to heat and other climate impacts (ORF, 2021). Street vendors, daily wage labourers, women and those who reside in slums are generally at a higher risk of heat-related morbidity and mortality. Here the role of the Urban Local Bodies (ULBs) is critical in laying down pre-emptive measures to respond to heatwaves while working in tandem with a range of stakeholders such as local and regional administrations, non-profit organisations, planners, policymakers, experts and scientists, political institutions, media and academic and research institutions.

Integrated Research and Action for Development (IRADe) in collaboration with Urban Local Bodies (ULB) has conducted the Action Research Project, "Climate Adaptive Heat Action Plan to Manage Heat Stress in Indian Cities" designed the first of its kind, spatially differentiated (ward level) and gender-sensitive Heat Stress Action Plans (HSAPs) for the cities of Delhi, Bhubaneswar and Rajkot, and implemented them. The HSAPs provide a framework for implementation, coordination, and evaluation of extreme heat response activities to mitigate their negative impacts. As a timely response, the three cities institutionalised heatwave risk reduction heat stress adaptive capacities by bringing about policy changes, engaging stakeholders and supporting citizen participation.

The heat reduction strategies are now driving its integration into broader urban disaster risk reduction plans beyond the project cities by helping them to make formed decisions. Benefits of Heat Stress Action Plan include prevention of heat strokes and other heat-related mortality, enabling government commitment to protect the poor and vulnerable citizens, making Indian cities future-ready and climate-resilient, improving the preparedness of hospitals/health centres and mitigating economic losses from the heatwave.

The project developed methodologies for developing the evidence-based HSAP by using three pillars of vulnerable population and areas, spatial and temporal climatological data, and scientific analysis. The project has produced climate change evidence on rising heatwaves and increasing temperature in the project cities on a spatial and temporal scale. It also confirmed that there are intra city variations in the temperature and relative humidity. For example, based on the recommendations of the project, heat stress thresholds used for early warning systems for the city of Rajkot were reduced.

This project has also captured the intra-city temperature variance as per land use at the ward level in order to undertake targeted measures. These variations were found to be pronounced in geographically disadvantaged areas like slums, which are usually characterised by deficient services, especially shortage of water and electricity during summer months and inadequate housing. The project developed methodologies for thermal hot spot mapping using climatological data, identifying urban heat islands. The climatological analysis indicated an increase in heatwaves over the years with an increase in the number of dry days and frequency of heatwaves. For example, hot days begin as early as March, resulting in an increased number of hot days and an expansion of hot months. The thermal hotspot maps has allowed preparation of a list of comprehensive measures (such as distributing water and white reflective paint on roofs to reduce the heat in homes by as much as 5 °C) to ensure preparedness to deal with heat risks while improving climate resilience.

These methodologies have been able to produce evidence on the impacts of heat stress on livelihoods and productivity. It is established that in the project cities, people working in the informal sectors lose more than 25 per cent of man days in a year due to heat stress. Furthermore, a comprehensive analysis of heat stress on the health and livelihoods of the vulnerable population such as occupational workers, women, children and senior citizens from vulnerable areas such as urban slums and indoor living conditions that aggravate people's vulnerabilities to heat stress was carried out. People living indoors, especially women, are more prone to heat stress than those who work outdoors in the informal sectors due to factors of housing structure, availability of services etc. Women who have an additional responsibility of caregivers in the house are further makes them vulnerable to heat stress.

This project also built the strength and skill of the cities to adapt and mainstream the heatwave planning and its management. Two-pronged strategies were adopted where not only the city/ state level public institutions were trained to develop and sustain the HSAPs but specialized training was provided to the medical practitioners, public health professionals, and frontline health workers to improve the preparedness of public health systems. Awareness workshops for occupationally exposed traffic police, hawkers, street vendors, construction workers and school children were conducted.

The city-level workshops and evidence sharing sessions with policy-makers and influencers sensitized a city's stakeholders about the need for Heat Stress Action Plans. For example, 'Measures to prevent heat stress-related illnesses' are added in prescription slips of hospitals under the New Delhi Municipal Corporation (NDMC). These initiatives helped in institutionalising this initiative and establishing processes. It will also support the continuity and sustainability of the HSAP's beyond the project period.

This project very well captured the power of the city-level institutions to connect and motivate its citizens to take collective actions on heat stress adaptation by carefully using the communication tools to disseminate knowledge on the heatwave and its consequences. The HSAPs developed a communication outreach to share key messages on do's and don'ts along with raising awareness through campaigns and outreach programmes for communicating risks associated with heat stress and its impact on health, livelihood and productivity and ways to mitigate them. To raise awareness, Heat Advisories were released through various media in regional languages. Press releases and campaigns on radio, TV and websites were used for message amplification. LED displays, hoardings, posters and pamphlets were displayed in key locations. The role of the door-to-door campaigns informing citizens about the heatwave and potential impacts and precautions was very crucial.

The project also built a network of South Asia Heat Health Information Network (SAHHIN) to build the capacity building of other South Asian countries which was further accredited by WHO & WMO. With South –Asia facing issues of increase in the intensity and duration of heatwaves, it's important that key messages are taken to the regional level to develop collective actions for heatwave impacts.

The network serves as a platform to promote scientific interventions, develop action plans and empower capacity building among stakeholders that can enable multidisciplinary participation in helping South Asian countries to tackle heat stress using better preparedness and planning measures.

Finally, this project has created a new narrative for heatwave preparedness for vulnerable populations in India by establishing approaches and pathways required at the City, State, National, and International levels for adapting and mitigating the risks of heat stress on the well-being of the citizens and productivity of the cities. It will help the city/state/ national level institutions to have better capacities to deal with the extreme impacts of the heatwave.

Partner's Inception Workshop, New Delhi. India 2018

1 Introduction

1.1 Project Overview

Heat-stress-related deaths in India are rising at a rapid pace. With climate change, average temperatures and the frequency and severity of heatwaves are predicted to increase. The heatwaves are likely to cause heat-associated morbidities. People in cities are particularly vulnerable to heat stress. There is little understanding and quantification of how heat stress affects health, work productivity, and livelihoods of the economically and socially marginalized population. This necessitates multidisciplinary research to formulate a Heat Stress Action Plan (HSAP).

The project studied the implications of heat stress and extreme heat on the health and livelihoods of vulnerable groups, especially occupational workers, women, and senior citizens living in urban slums – their poverty, dwellings with tin roofs, and poor sanitation make them particularly vulnerable. Evidence was gathered to develop spatially differentiated adaptation plans and support planning and execution in the three cities: Delhi, Bhubaneswar, and Rajkot chosen as representative of cities in India. HSAP is a bottom-up adaptation plan based on quantitative and qualitative measures, primary and secondary data, existing adaptation plans, and Shared Learning Dialogues (SLD) with stakeholders.

In the project cities, close collaboration with Urban Local Bodies like the Municipal Corporations, Development Authorities, other institutes, local NGOs, and residents helped develop HSAPs that are gender-sensitive. These contribute to India's medium-term development planning on adaptive resilience for climate-resilient smart cities' agenda.

HSAP improves people's resilience to heat stress, reduces the cost of adaptation, and impacts the health of women and men. It also enhances the capacity of stakeholders such as city officials, doctors, and health care providers to improve coordination and communication systems within city and state departments. This project may be replicated in other cities, and increase awareness and knowledge among policy-makers. The research established approaches and designs to inform the pathways required at the City, State, National, and International levels that are bracing the risks of heat stress. It has also reached out to the policy-makers to scale up projects these findings and implement the HSAP.

Research

Identification of Vulnerable Population

- Urban Poor
- Women & Children
- Elderly
- Working population – labourers, construction workers, drivers, traffic police like wise

Thermal Hotspot Mapping

- Landsat imageries -Demarcation of areas above 400C
- 10-11 Hotspots per city
- Thermal Hotspot maps for the cities (2017, 2018, 2019)

Impact Analysis of Heat Stress - Health, Work Productivity, and Livelihoods

- Household Surveys and Ward Level Analysis
- Comparative City Level Vulnerability Analysis
- Vulnerable Working Population Surveys and Analysis

Heat Stress Action Plans

HSAPs for 3 cities— Salient Features

- Climatological variance
- Thermal Hotspot Mapping
- Heat Stress Ward-level Vulnerability Mapping
- Impact of Heat Stress on Productivity and Livelihood
- Medical emergency preparedness - Pre-heat season, During heat season and Post heat season

Training

Capacity Building Workshops	• City, State and South Asia Level Workshops • Medical Stakeholders Training Module • ASHA Workers Workshop • SAHHIN Masterclasses

Dissemination

Project Outreach	• Publications / Modules • Advisory and Brochures • Working Papers • Journal Papers • Newspaper Articles (International and National) • Paper Presentation(s) (International and National) • Online Forums/ Networks • South Asia Heat Health Information Network – SAHHIN • Climate and Cities Website • SAHHIN Newsmailers • Collaboration with C-Cube, NIUA

1.2 Project Aim ans Objectives

The project aimed to **develop spatially differentiated and gender sensitive Heat Stress Action Plans (HSAPs) for Indian Cities- Delhi, Bhubaneswar, and Rajkot** for better management of heat stress risks. HSAPs will support medium term development planning of India, in prioritising and integrating adaptive resilience within the agenda of climate resilient smart cities.

Objectives

- **Identify spatial vulnerability of populations during extreme heat events in selected areas.**
- **Identify the impacts of extreme heat events on the health, work productivity and livelihoods of vulnerable population.**
- **Select appropriate, innovative and affordable climate adaptation measures for improving health and livelihood resilience for the urban population as well as gender-based implications.**
- **Strengthen the capacity of key stakeholders to facilitate the implementation of the Heat Stress Action Plans (HSAP) and their long-term sustainability in the selected areas through training opportunities**
- **Facilitate active use of information and evidence for policy-makers to drive the implementation of the HSAP in the cities.**

Project Period	**2017-2021**
Project Area/ Cities	**Delhi (Delhi), Rajkot (Gujarat), Bhubaneswar (Odisha)**

1.3 Study Areas / Cities

Climate change and variability, increasing temperature, and changing pattern of precipitation/ rainfall with temporal changes will affect people, exert pressure on the livelihood of vulnerable groups. Limited studies were conducted to understand and quantify the ramifications of heat stress affecting human health, work productivity, and livelihoods of economically and socially marginalized populations. Further research is required in various cities in South Asia to generate data and lead to substantiated conclusions about the economic impacts of heat stress on cities.

The project has conducted a comprehensive analysis of the implications of heat stress on the health and livelihood of the Vulnerable population in Delhi, Bhubaneswar, and Rajkot, heat stress adaptation options, to reduce heat stress.

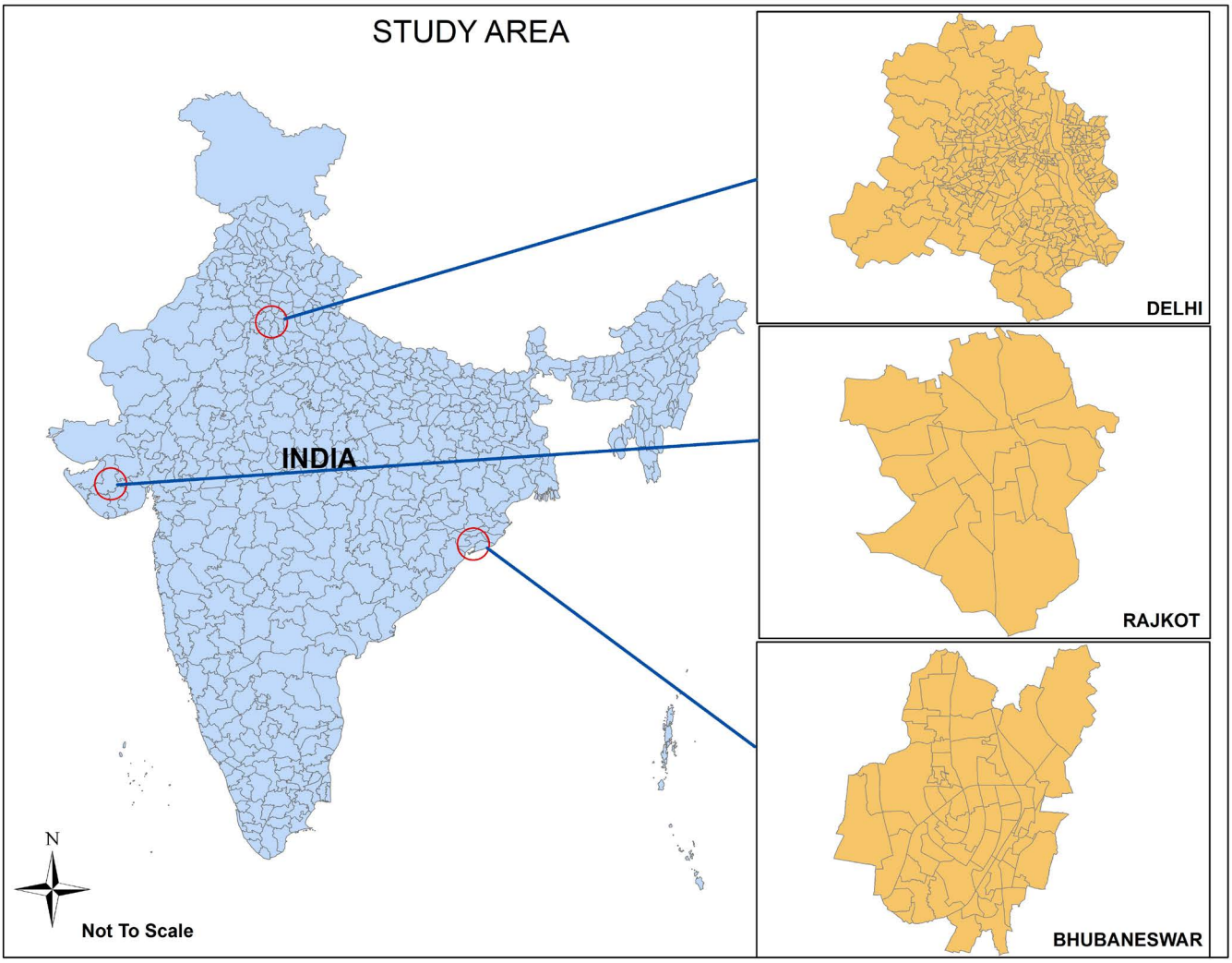

Fig 1: Study Area

Rajkot

Rajkot is the 4th largest city in Gujarat, extended over an area of 104. 85 sq. km (spread across 18 wards), with a population of 13.9 lakh, (Census- 2011) and decadal growth of 28.41 %. The population is projected to increase to 23.22 lakhs by 2030, with an annual percentage of change being 2.5% (UN Report). The city hosts more than 43000 **small and medium scale industrial units.**

City Characteristics	
Location	22.3°N 70.78°E
Height above main sea Level	134 mts
Total area (sq. km)	104.85 (Census, 2011), 170 (Present)
Total Population	13.9 lakh, (Census- 2011)
Population Density	12, 275 Persons per Sq. Km
Slum Population	145 slums as of 2017 (Gujarat) Government Gazette, 2017).

Table 1: Rajkot City Profile

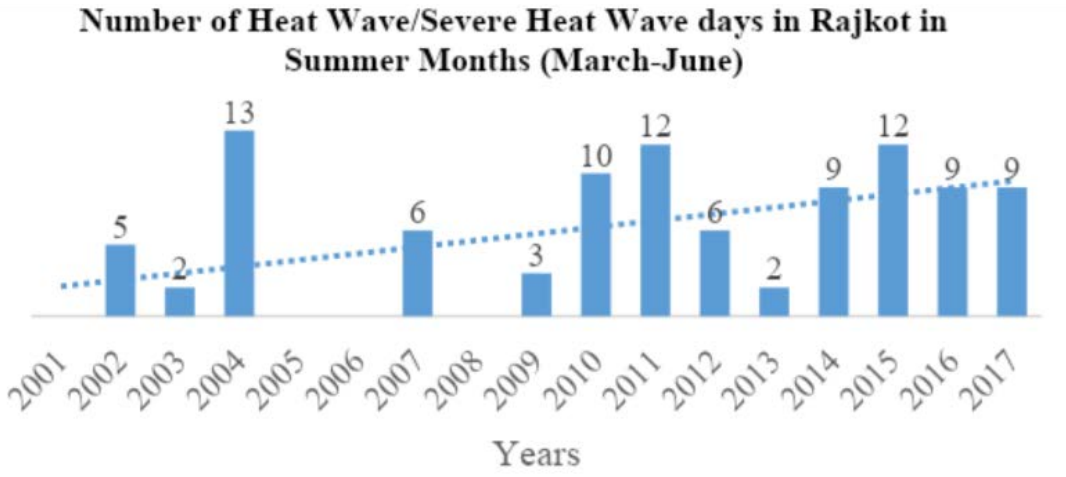

Figure 2: Heat Wave days, Rajkoot

Severe heatwaves gripped large parts of Gujarat since 2010, with temperatures crossing over 43°C in several parts. Of all the natural disasters the city of Rajkot is prone to heatwaves The trend of heatwaves, indicates a **gradual increase in the heatwave days** in the past decade (IMD), with severe heat days ranging from **2 to 13 days in the summer months (March – June).**

Bhubaneswar

Rajkot is the 4th largest city in Gujarat, extended over an area of 104. 85 sq. km (spread across 18 wards), with a population of 13.9 lakh, (Census- 2011) and decadal growth of 28.41 %. The population is projected to increase to 23.22 lakhs by 2030, with an annual percentage of change being 2.5% (UN Report). The city hosts more than 43000 **small and medium scale industrial units.**

City Characteristics	
Location	85°44' E to 85°44' 'E 20° 12' to 20 ˚25' N latitudes
Height above main sea Level	45 m above Mean Sea Level (MSL)
Total area (sq. km)	135 sq.Km (Census, 2011)
Total Population	8,40,834 (Census, 2011)
Population Density	of 6,228 per sq km
Slum Population	116 authorized and 320 un-authorized slum

Table 2: Bhubaneswar City Profile

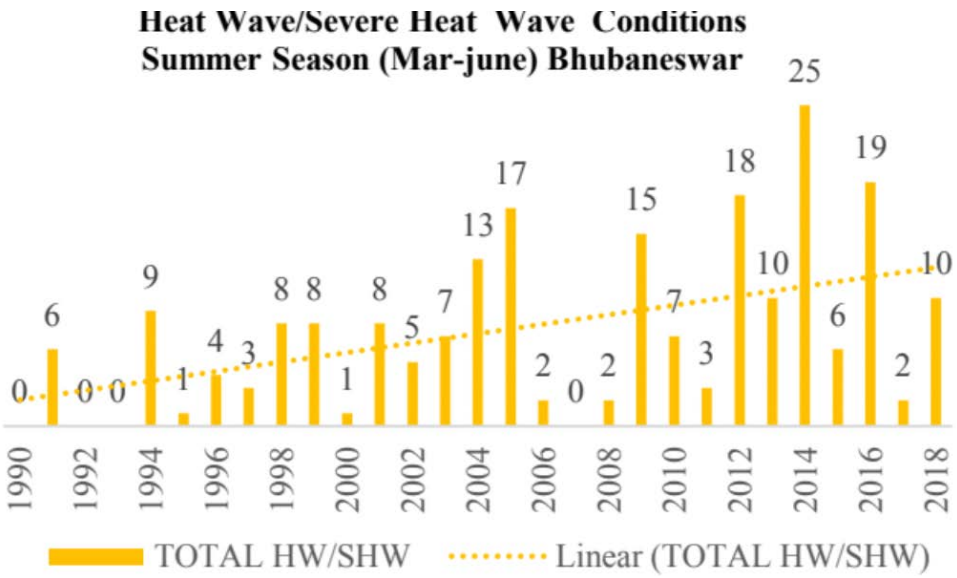

Figure 3: Heat Wave days, Bhubaneswar

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Delhi

Delhi, is one of the fastest-growing megacities in the world, spreading across approximately **1486.5 sq. km area and comprising of 11 districts, 33 tehsils/sub-divisions, 272 wards,** and five local bodies. It has a population of **16.78 million** with a population density of **11320** persons per square kilometre. Delhi recorded decadal growth rates of **21.20%** from 2001-2011. The Tertiary Sector has a pivotal role in the Delhi's economic development and constitutes a major part of the economy of the State both in terms of employment potential and its contribution to the State Income

City Characteristics	
Location	85°44' E to 85°44' 'E and 20° 12' to 20 ˚25' N
Height above main sea Level	45 m above Mean Sea Level (MSL)
Total area (sq. km)	1486.5 sq.km (Census, 2011)
Total Population	16.78 million (Census, 2011)
Population Density	of 6,228 per sq km
Slum Population	6343 slums

Table 3: Delhi City Profile

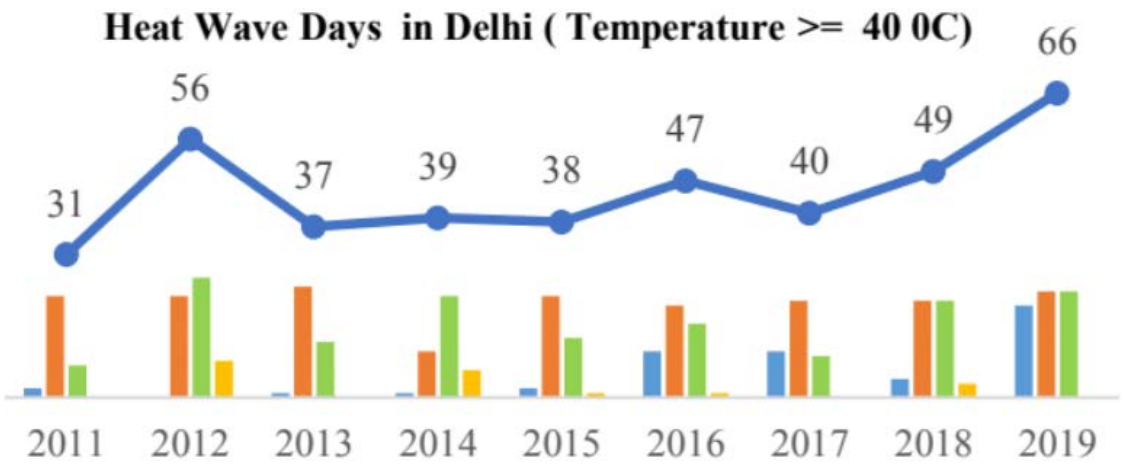


Figure 4: Heat Wave days, Delhi

The city of Delhi is reeled under severe heat wave days in the summer seasons every year. The trend in the Heat Wave days indicate the number of heat wave days have increased from 49 days (2018) to 66 days (2019) in 3 months (April, May, June), recording an increase by 35%

2 Project Approach

Research

Objective 1 Identify spatial vulnerability of populations during extreme heat events in selected areas

- Review literature and interviews with experts
- Develop vulnerability maps using GIS

Objective 2 Identify the impacts of extreme heat events on the health, work productivity and livelihoods of vulnerable population in selected areas

- Finalize primary research methodology (including area and population sampling, questionnaire design and reporting frameworks)
- Conduct household surveys and focus group discussions (FGD) to mine information and develop datasets to inform the proposed Heat Stress Action Plan
- Analysis of impact of heat induced health risk scenarios on health, work productivity and livelihoods to help build evidence-based action plans

Objective 3 Select appropriate, climate adaptation measures for improving health and livelihood resilience including gender-based implications.

- Analysis to prioritize the adaptation strategies based on cost effectiveness analysis
- Drafting HSAPs for the project cities
- Validation and Finalization of HSAPs

Training

Objective 4 Strengthen the capacity of key stakeholders to facilitate the implementation of the Heat Stress Action Plans and their long-term sustainability in the selected areas through training opportunities

Key stakeholder Training programmes

Dissemination

Objective 5 Facilitate active use of information and evidence for policy-makers to drive the implementation of the Heat Stress Action Plans into municipal disaster strategies in the selected areas

- City Level Workshops and evidence sharing sessions with policy-makers and influencers
- State level policy workshops
- National level policy workshops
- South Asia Regional workshop

Climate Adaptive Heat Action Plans for Indian Cities

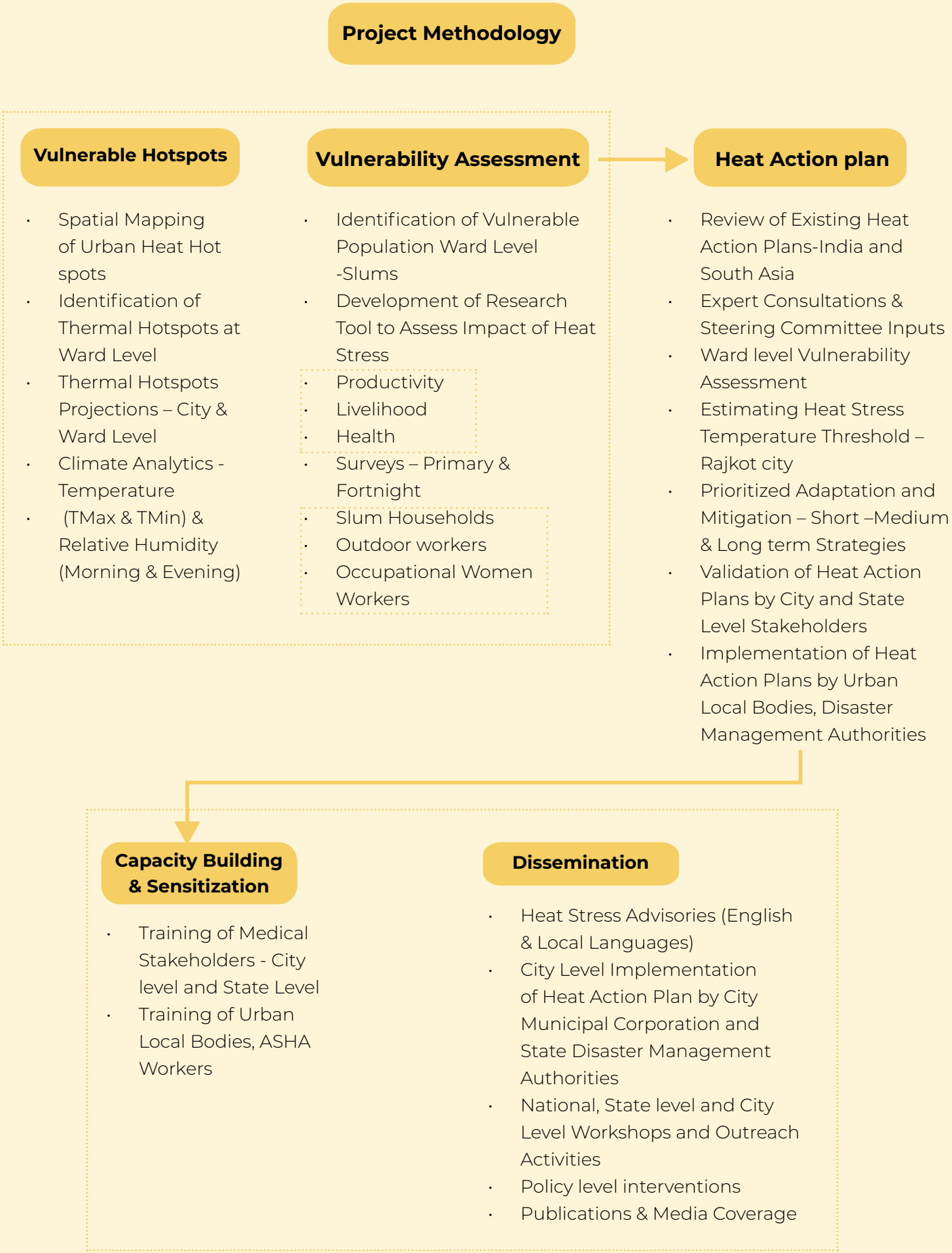
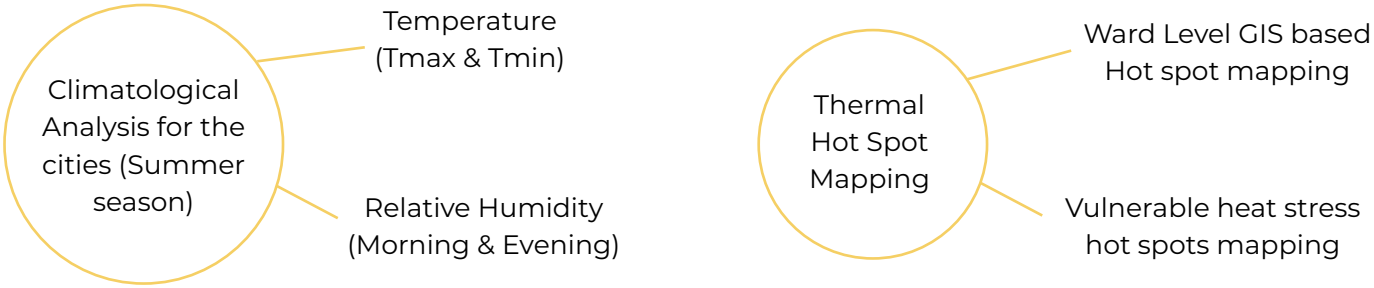


Figure 5: Project Methodology

3 Project Output

3.1 Research Output

Spatial vulnerability of population during extreme heat events in selected areas



Impacts Assessment of extreme heat events

- health,
- work productivity &
- livelihoods

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Climatological Analysis for Cities

The climatological analysis helps to determine the future climate expectations for a place. The analysis is based on available factors like Temperature and Relative humidity. Changes in surface temperature and humidity over land are important for climate-change impacts. By analyzing these two parameters, we were able to unearth past trends in temperature and humidity over the years for the selected cities and understand the changing pattern of Heatwaves over there.

The climatological changes during the last several years in the summer season for Rajkot, Delhi, and Bhubaneswar were studied. The ground recorded data for Daily Maximum Temperature (Tmax), Daily Minimum Temperature (Tmin), Relative Humidity measured in the morning at 8:30 AM (RH830) and that measured in the evening at 5:30 PM (RH1730) for summer months of March, April, May, and June were procured from IMD for the mentioned cities and analyzed. The changes were analyzed for individual months as well as cumulative seasonal changes for all four summer months over the last several years. The climatological parameters were compared against the long-term climatological mean published by IMD for all three project cities.

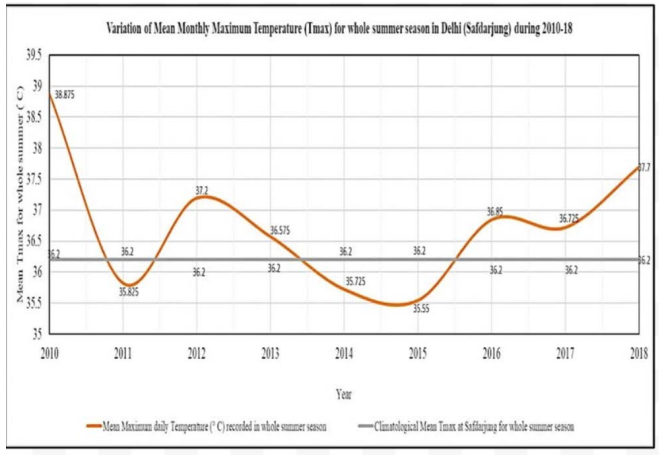
Climatological Data

	Temperature (Tmax & Tmin)	Relative Humidity
Delhi	2010 - 2018	2012- 2017
Rajkot	2008 - 2018	2008 - 2018
Bhubaneswar	2001-2017	2001- 2017

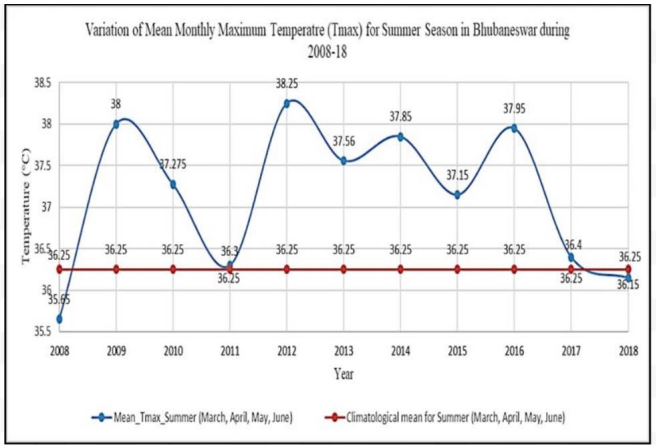
Table 2: Bhubaneswar City Profile

Variation of Tmax and Tmin for summer season

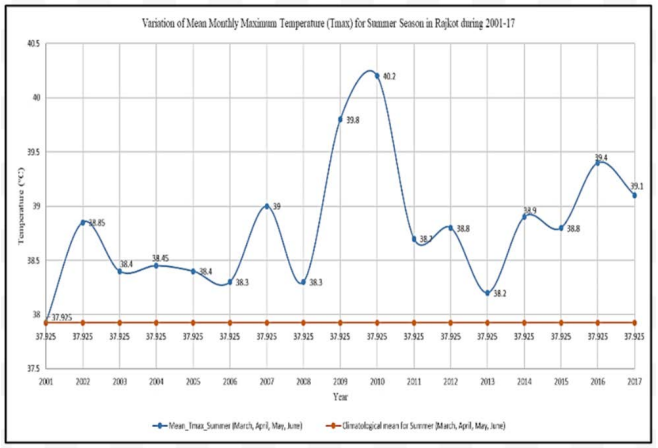
Delhi

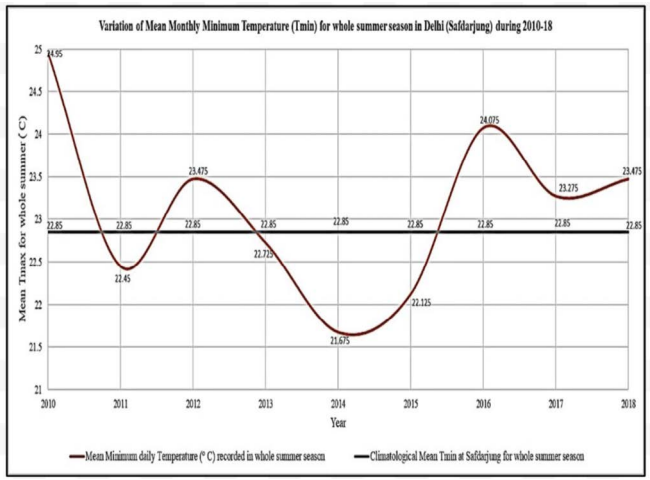


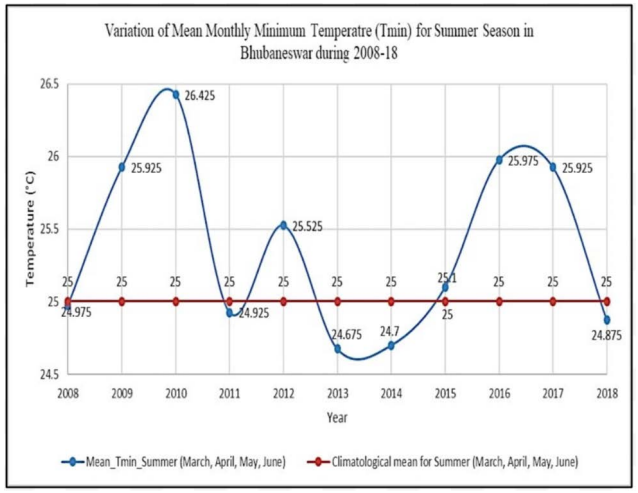
Bhubaneswar



Rajkot







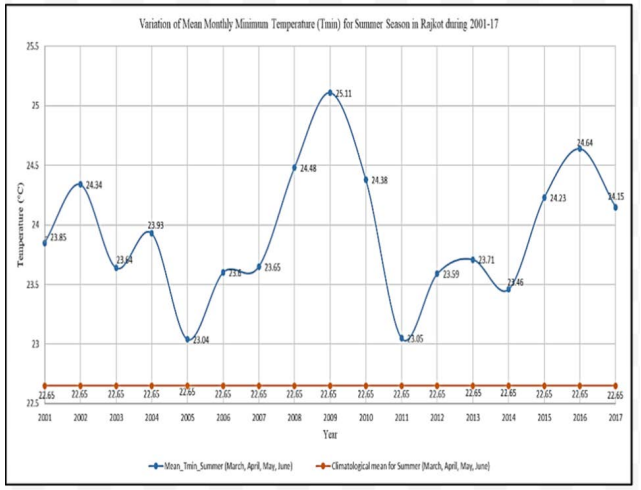
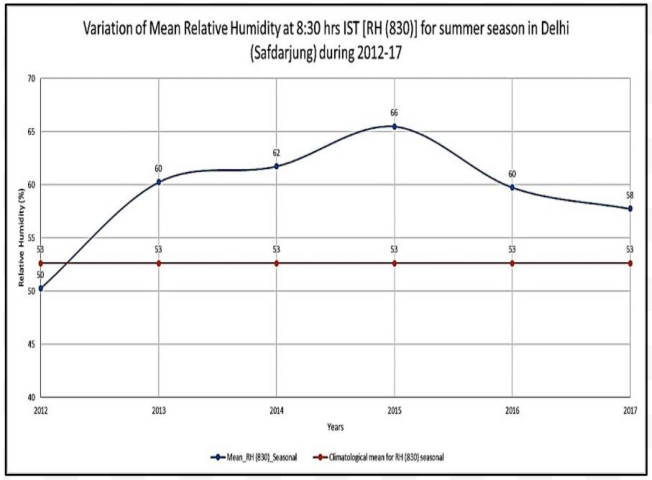


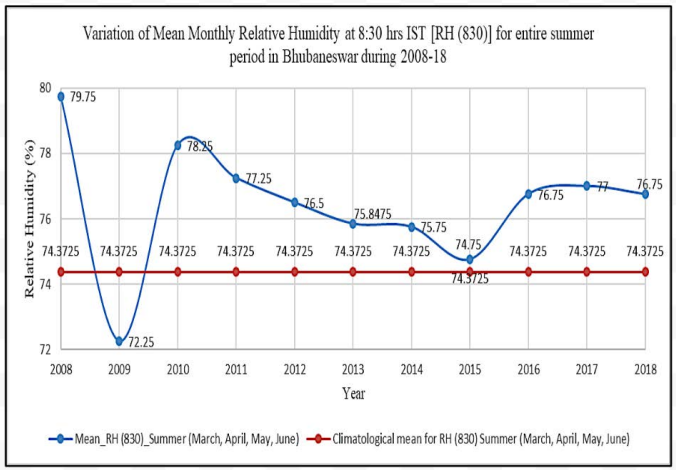
Figure 6: Variation of Tmax and Tmin for summer season, Delhi, Rajkot and Bhubaneswar

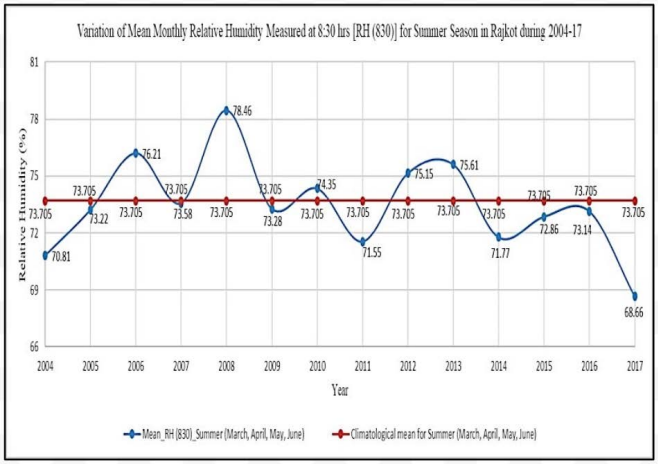
Delhi

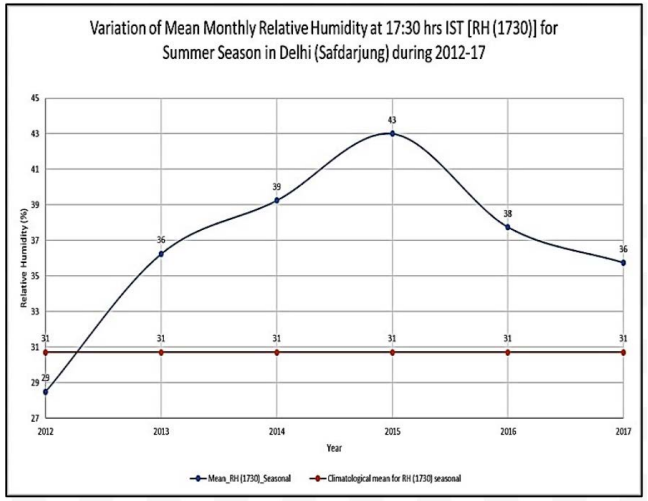
Bhubaneswar

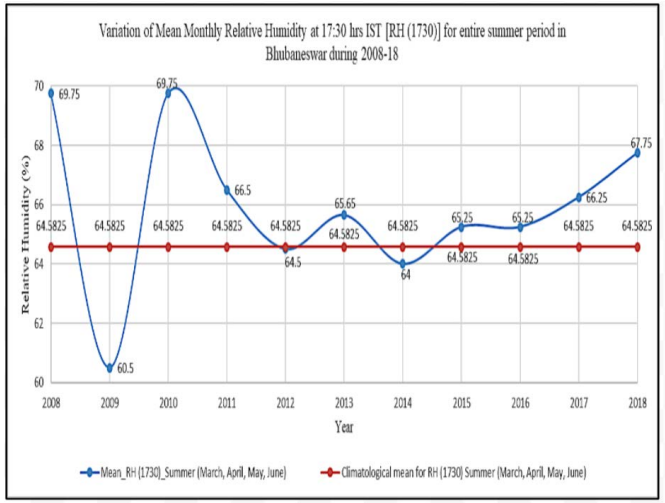
Rajkot











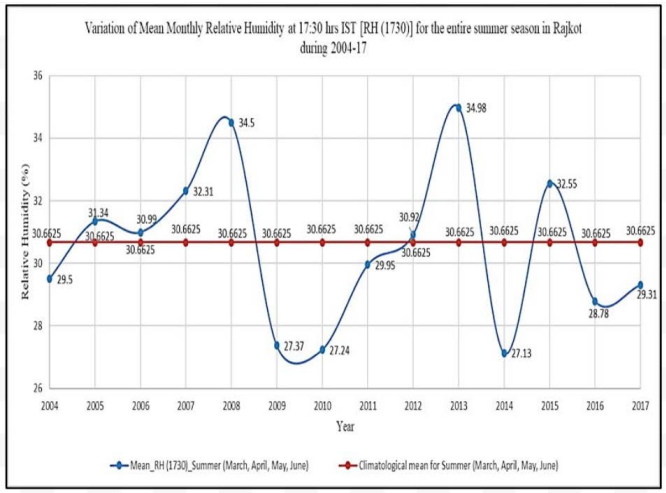


Figure 7: Variation of Mean Monthly Relative Humidity (RH) Delhi, Rajkot and Bhubaneswar

Rajkot

- Significant increase in the city's temperature and a moderate decline in its humidity levels indicates that the city is getting drier and hotter over time.
- March and April months had a significant rise in mean Tmax and Tmin and a decline in relative humidity.
- For 2001-2017, the mean Tmax for each of the summer months was above the climatological mean in 16 out of 17 years.
- Mean seasonal (March to June) minimum temperature was in excess of the climatological mean.
- Summers from 2014-2017 were drier in the morning hours, recording the RH values consistently below the climatological mean.
- Though the average deviation in the RH values (for both morning as well as evening) was very less, drier years were noticed in the latter half of the study duration.

Bhubaneswar

- The climate parameters, show a sharp increase in March, which suggests Bhubaneswar is experiencing relatively more heat in the month of March.
- Increase in minimum temperature along with evening humidity makes it difficult for urban areas to cool down in the evening causing heat-related discomforts.

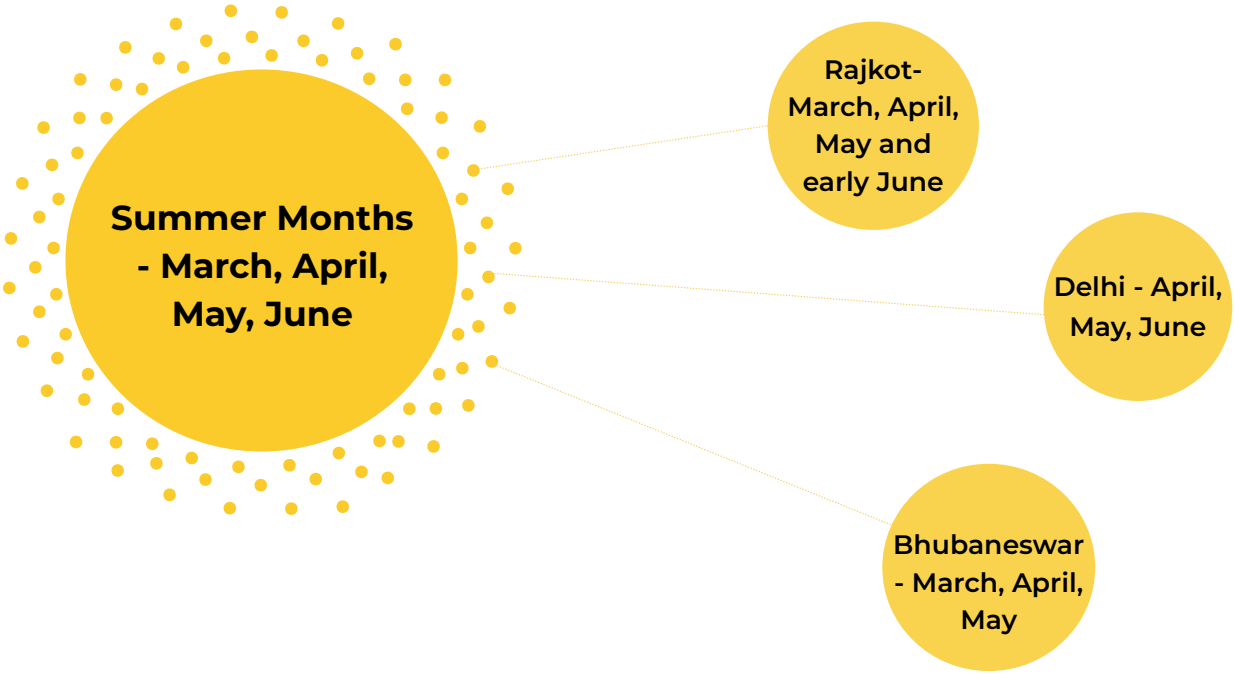
Delhi

- March is getting hotter than the rest of the summer months in Delhi, in terms of maximum as well as the minimum temperature.
- For the entire summer season, the maximum deviation from the climatological mean for Tmax and Tmin was observed in 2010, suggesting 2010 to be unusually warm for Delhi.
- Mean monthly relative humidity measured in the morning at 8:30 AM [RH (830)] was found to be higher than the climatological mean for all the years for March. Except for 2012, this trend was common for RH (5:30 PM) also.
- If we consider RH across the whole season, both morning and evening humidity values recorded higher values compared to the climatological mean value, consistently during 2013-2017.

3.2 Thermal Hotspot

The increase in temperature within the urban centres relative to surrounding rural areas gives rise to popularly known as Urban Heat Island (UHI). The UHIs sometimes experience such a high in temperatures over most human beings' normal physiological temperature ranges, resulting even in deaths. Therefore, it is important to identify such areas where the UHI phenomenon is manifested regularly during the harsh summer months, especially at the finest administrative scales so that that appropriate policy measures can be adopted for mitigation and adaptation purposes.

Highest Summer Temperature 2017, 2018 & 2019



The thermal hotspot maps show the hot spot distribution within a city to help in designing targeted interventions most needed during heat waves. 'Hot-spots' are areas within the city which experience ambient land surface temperature in excess of the LST values of surrounding non-urban areas. Thermal maps provide information about the areas which have hotspots indicating population living with high health and socio-economic risks due to thermal stress. These maps help in taking targeted measures for addressing heat stress. In addition, a comparative study of thermal hot-spot maps for each season will help to identify the months in which precautions need to be taken.

Step 1 **Data Identification:** Landsat 8 data with 11 spectral bands

Step 2 **Conversion of DNs to Spectral Radiance values:** Band 10 of Landsat 8 data used for retrieval of LST

Step 3 **Computation of Land Surface emissivity (LSE):** NDVI (Normalized Difference Vegetation Index) based approach

Step 4 **Converting .tiff file to shape file:** Covert the .tiff file to a .shp file in ArcGIS 10.1

Step 5 **Converting the data from the obtained shape-file in the Hotspots:** areas having the land Surface Temperature more than 400C

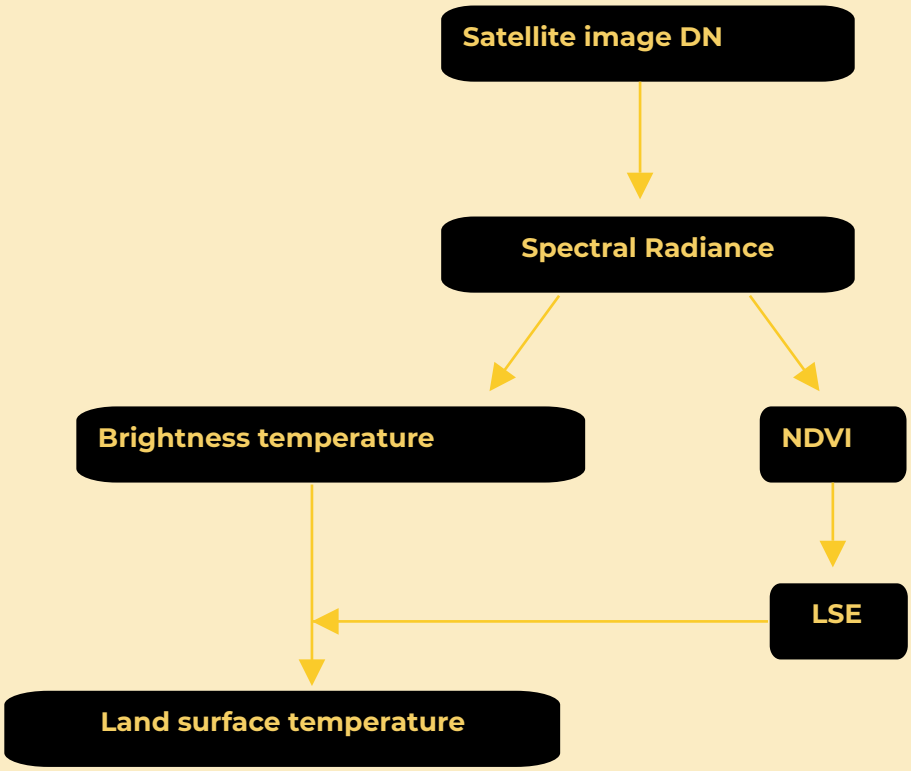


Figure 8: Mapping flowchart

Hotspot Delineation

1. To delineate the hotspots, the percentile method was adopted. In this approach, first the areas experiencing temperature above 95% of highest LST observed on a particular date were extracted. These areas represent the thermal hotspots at temperatures in excess of 95% of highest LST measured on the particular date.

2. Extraction of hotspots based on percentile of highest temperature observed in the LST map. For each LST map, areas experiencing LST more than 95%, 90%, 85% of the highest LST range were extracted.

3. Process continued to extract hotspots in all the project cities.

Category 1

Wards having more than 50% of the area as thermal hotspot

Category 2

Wards having 25-50% of the area as thermal hotspot

Category 3

Wards having 10-25% of the area as thermal hotspot

Category 4

Wards having less than 10% of the area as thermal hotspot

Delhi

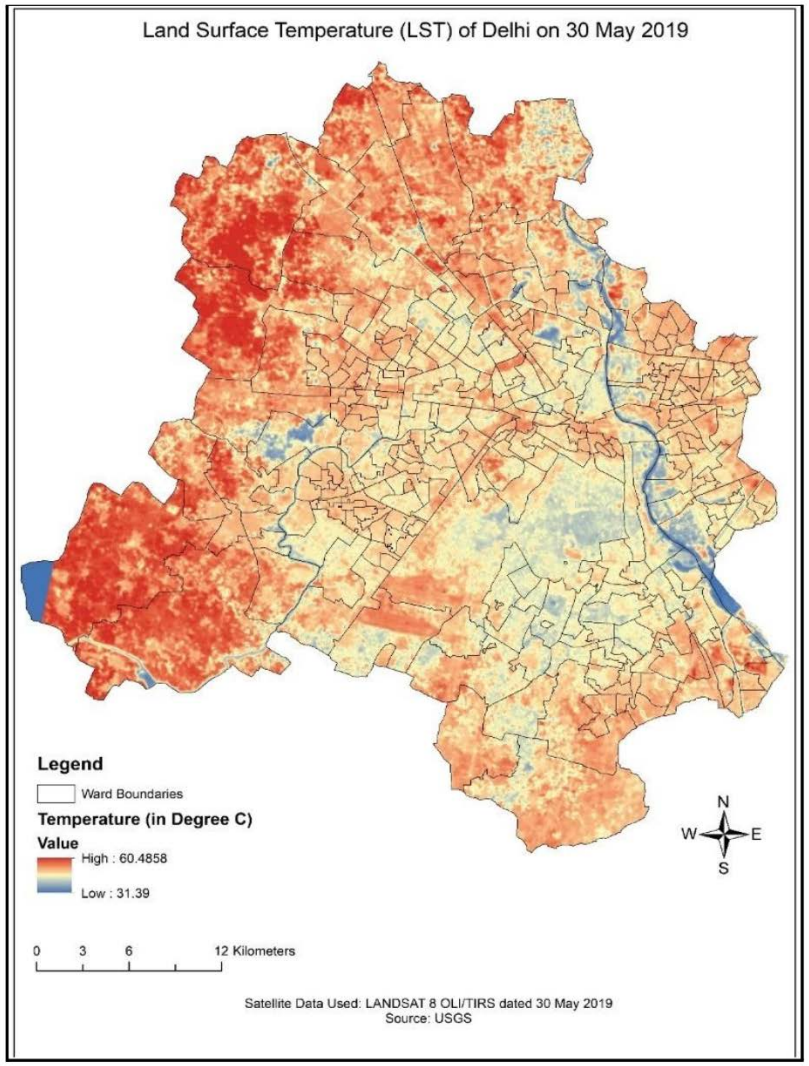
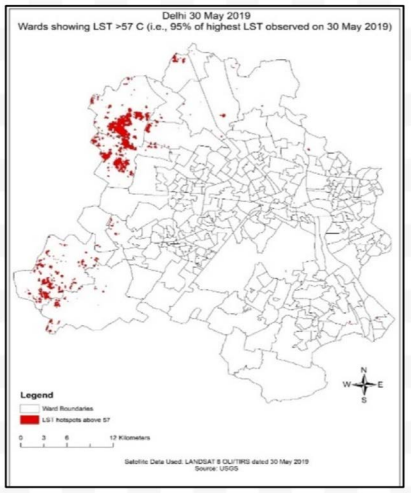
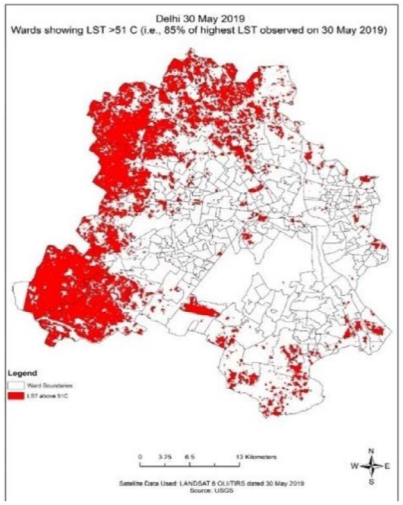


Figure 9: Thermal Hotspots, Delhi



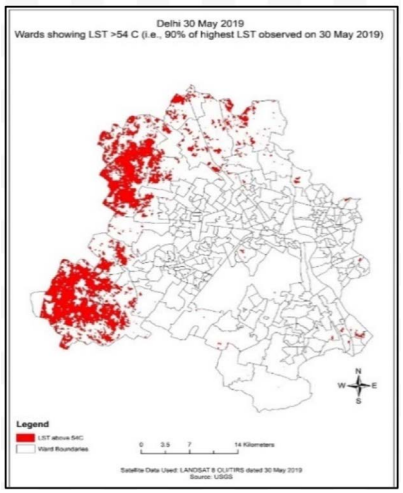
Thermal hotspot map of Delhi showing wards with LST >57.45°C

Nearly all the wards have 0-25% of area as thermal hotspot Nangal Thakaran and Kanjhawala, belonged to category III.



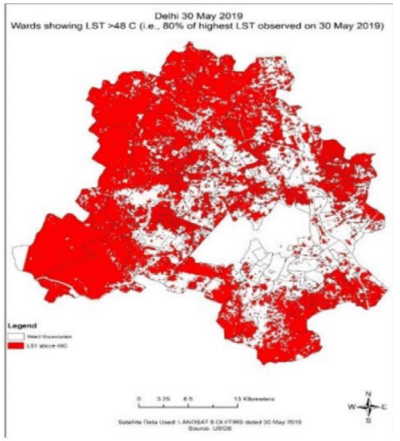
Thermal hotspot map of Delhi showing wards with LST >48°C

At 80% of the highest LST, all the wards of Delhi showed UHI, with 167 wards falling in category 1



Thermal hotspot map of Delhi showing wards with LST >54°C

Wards, Isapur and Kanjhawala, Dichaon Kalan, Ghuman Hera and Nangal Thakaran have above 25% area as thermal hotspot



Thermal hotspot map of Delhi showing wards with LST >51 °C

171 wards showed UHI with LST more than 51 °C, with 8 wards belonging to Category I and 21 wards belonging to Category II

Rajkot

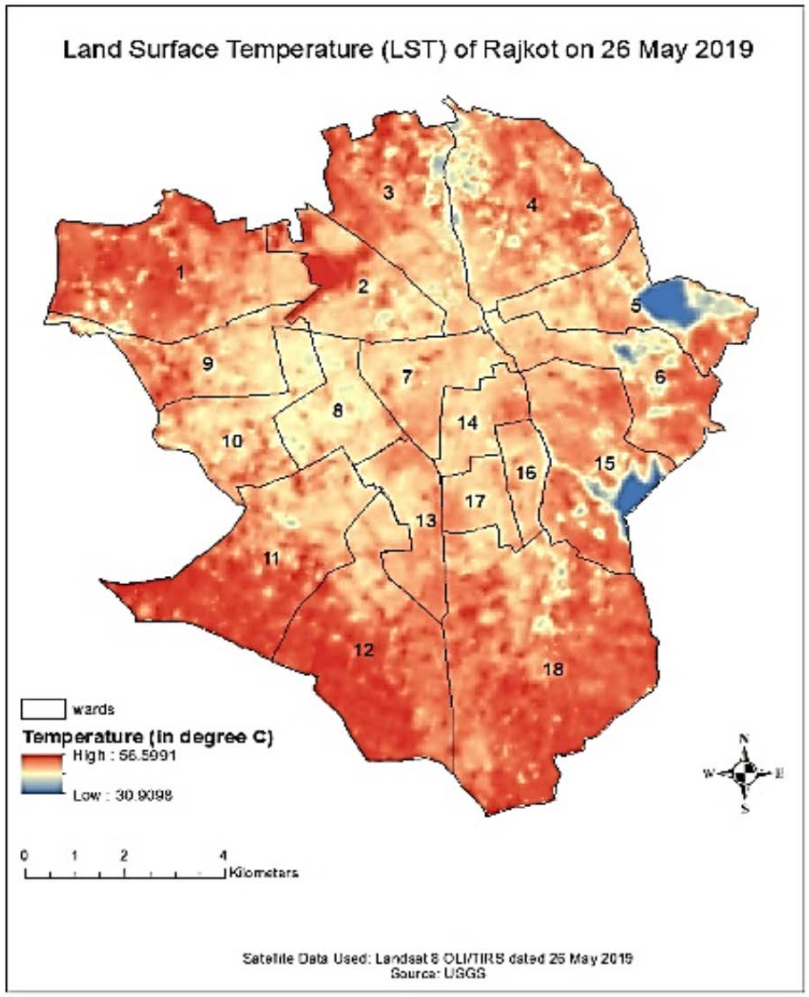
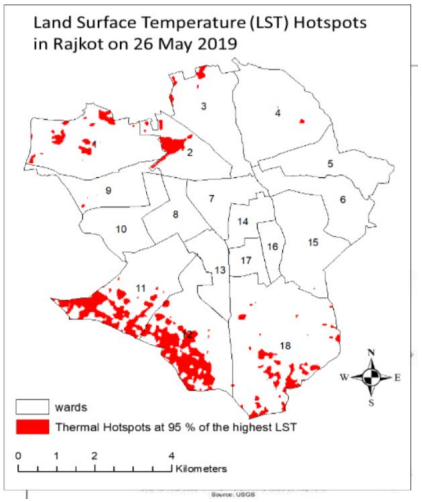
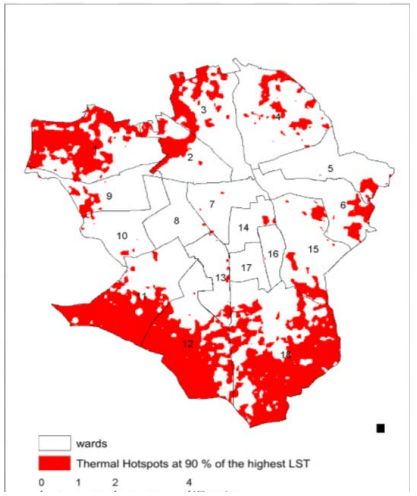


Figure 9: Thermal Hotspots, Rajkot



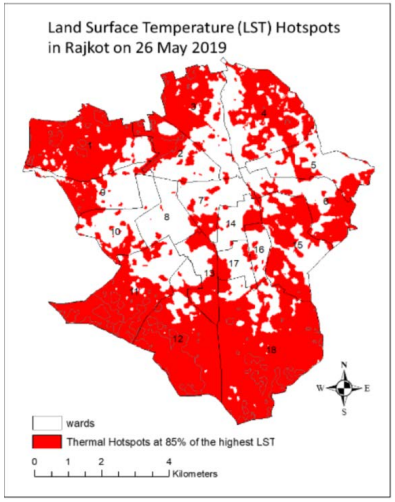
Thermal hotspot map of Rajkot showing wards with LST >53.77°C

Wards 11 and 12 have areas falling in Category II, with roughly 26 and 34 % areas with LST in excess of 53.77°C



Thermal hotspot map of Rajkot showing wards with LST >50.94°C

Almost 16 wards indicate thermal hotspots at 90% of the highest LST range. Ward number 12 has nearly 68% area covered as hotspot



Thermal hotspot map of Rajkot showing wards with LST >48.11°C

Except, 7 and 8 all the wards have hotspot areas in Category I and II. Wards 1, 2, 11, 12 and 18 show areas with LST more than all the percentile ranges (95-85%)

Bhubaneswar

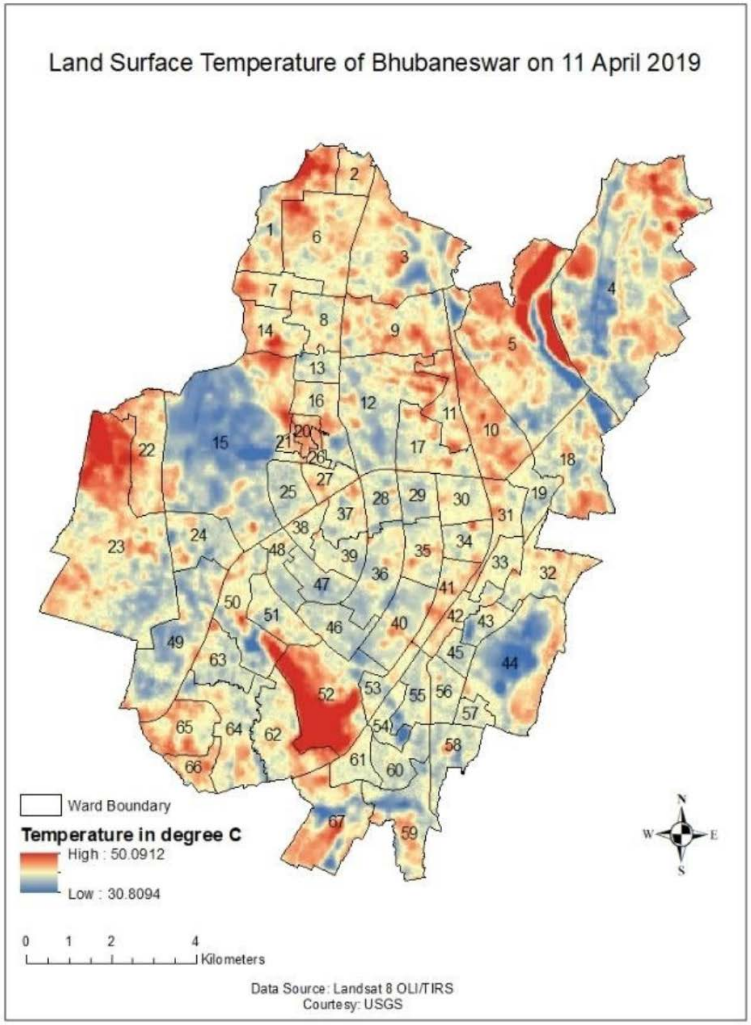
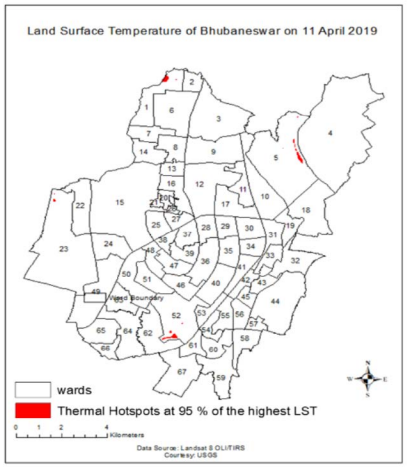
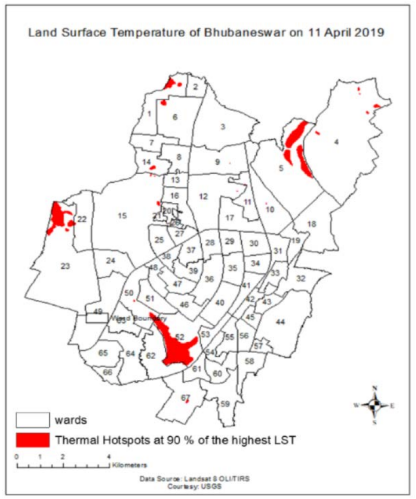


Figure 9: Thermal Hotspots, Bhubaneswar



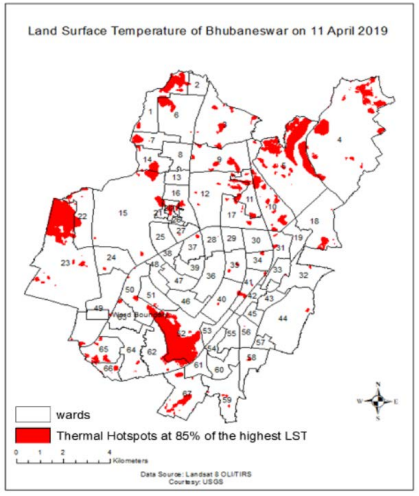
Thermal hotspot map of Rajkot showing wards with LST >53.77°C

No significant area experienced LST in excess of 47.59°C



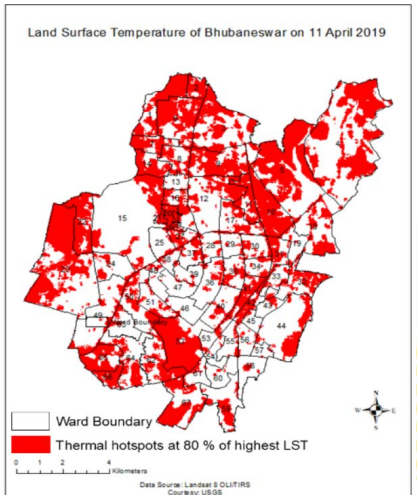
Thermal hotspot map of Rajkot showing wards with LST >45.08°C

Hotspots found in 11 wards. 52 Ward showed almost 43% of the total area experiencing LST > 45.08°C



Thermal hotspot map of Rajkot showing wards with LST >42.58°C

Ward 52 falls in Category I with nearly 64 % of the area experiencing temperature above 42.58°C. Ward 1, 5 and 20, have 28%, 32% and 31 % area showing above 42.58°C



Thermal hotspot map of Rajkot showing wards with LST >40.07°C

Nearly 28 wards fall in Category I, ward 10, 21, 22, 26, 65 and 66 had more than 90% of their entire area with LST > 40.07°C

4 Vulnerability Assessment & Socio-economic Impact of Extreme Heat

4.1 Primary Research Methodology

Figure 12: Research Methodology Workshop, New Delhi, 2018

Research tools and survey platforms were developed for assessing the impact of heat stress on health, work productivity, and livelihoods of vulnerable populations in the three cities.

The sample size for each city was 250 – 300 households (HHs) and a set of questionnaires/ research tools were used to capture the basic information of the HH members and fortnightly information about the impact of heat stress on health, livelihood, and productivity.

Primary (single/ one time) Surveys

Covered nearly 300 households (HHs). It recorded the nature of work, working hours, occupational pattern, mode of transportation, coping capacity to heat stress etc.

Time Variant (Fort-night) Surveys

Covered the same HHs every 14 days to capture the impact of the heat stress experienced by the household on health, work productivity and livelihoods.

Figure 13: Research Methodology, Partners Consultation, New Delhi, 2018

Figure 14: Research Tool & Methodology workshop, Bhubaneswar, 2018

4.2 City Level Thermal Hotspots

- **Spatial mapping of the heat hot spots within the cities delineated wards with slums and scattered settlements with temperatures above 40 °C. Nearly 10-11 such hot-spots were identified in each city in the primary and fortnight surveys.**
- **The surveys were initiated in May 2018 after the pilot surveys for questionnaire testing was completed and reviewed were conducted in each city. Multi-level stratified sampling was used for selecting around 250 households within the hotspots.**
- **Hotspots were identified based on the surface temperature recording during April- May 2016,2017. Indicators such as geographic locations (ward level) and the socio-economic strata, residence, and working in the areas were used in delineating hotspots, identify areas having lesser means to adapt to heat stress.**

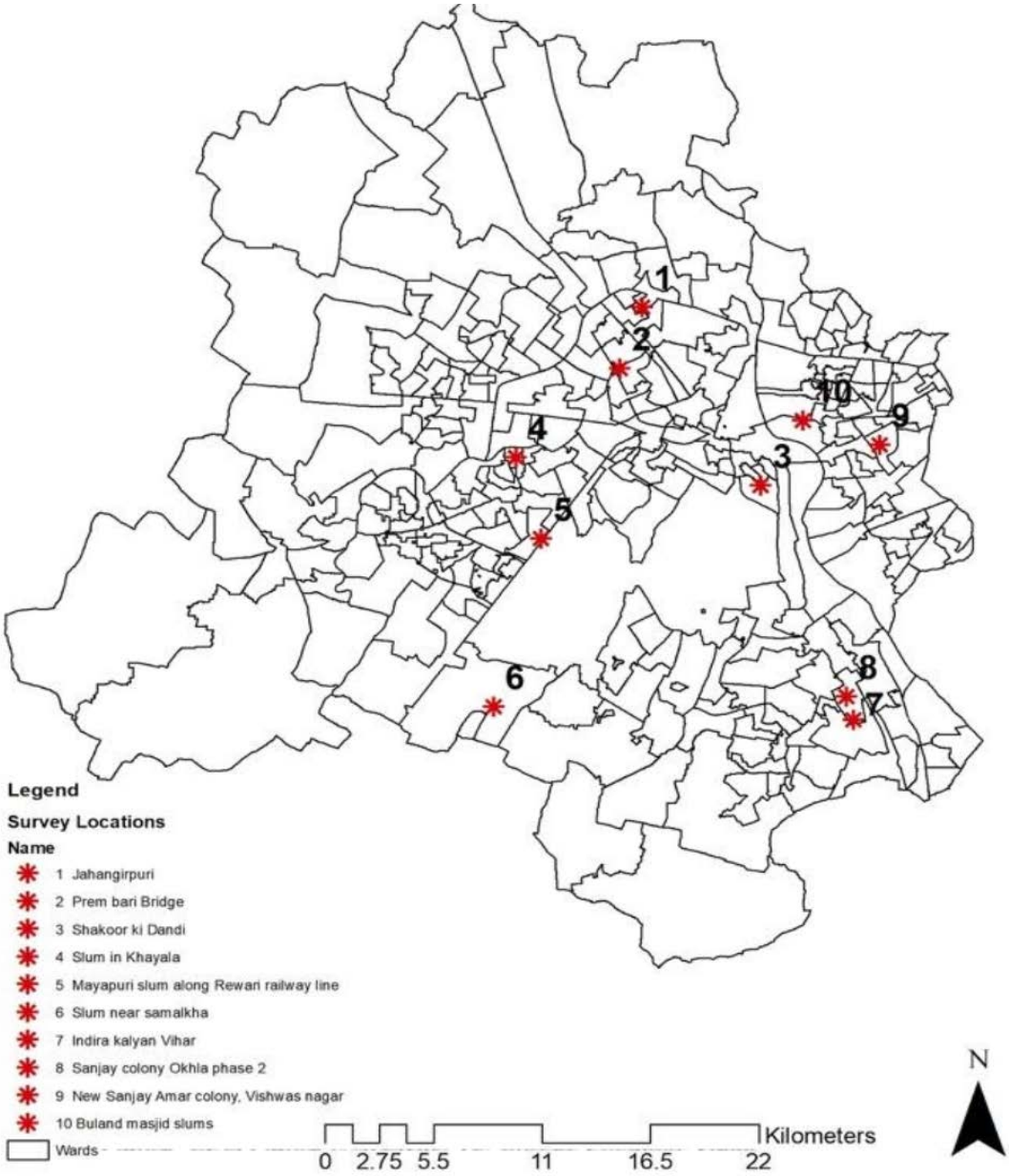


Figure 15: Survey Location, Delhi

Delhi

New Ward No	Ward Name
Harkesh Nagar 092S	Indira kalyan Vihar
Harkesh Nagar 092S	Sanjay colony Okhla phase 2
Khyala 008S	Slum in Khayala
Wazir Pur 072N	Prem bari Bridge
Bijwasan 048S	Slum near Samalkha
Vishwas Nagar 017E	New Sanjay Amar colony, Vishwas nagar
Harinagar A 010S	Mayapuri slum along Rewari railway line
Jahangirpuri 021N	Jahangirpuri
Delhi Gate 088N	Shakoor ki Dandi
Shastri Park 025E	Buland masjid slums

Figure 4: Survey Location, Delhi

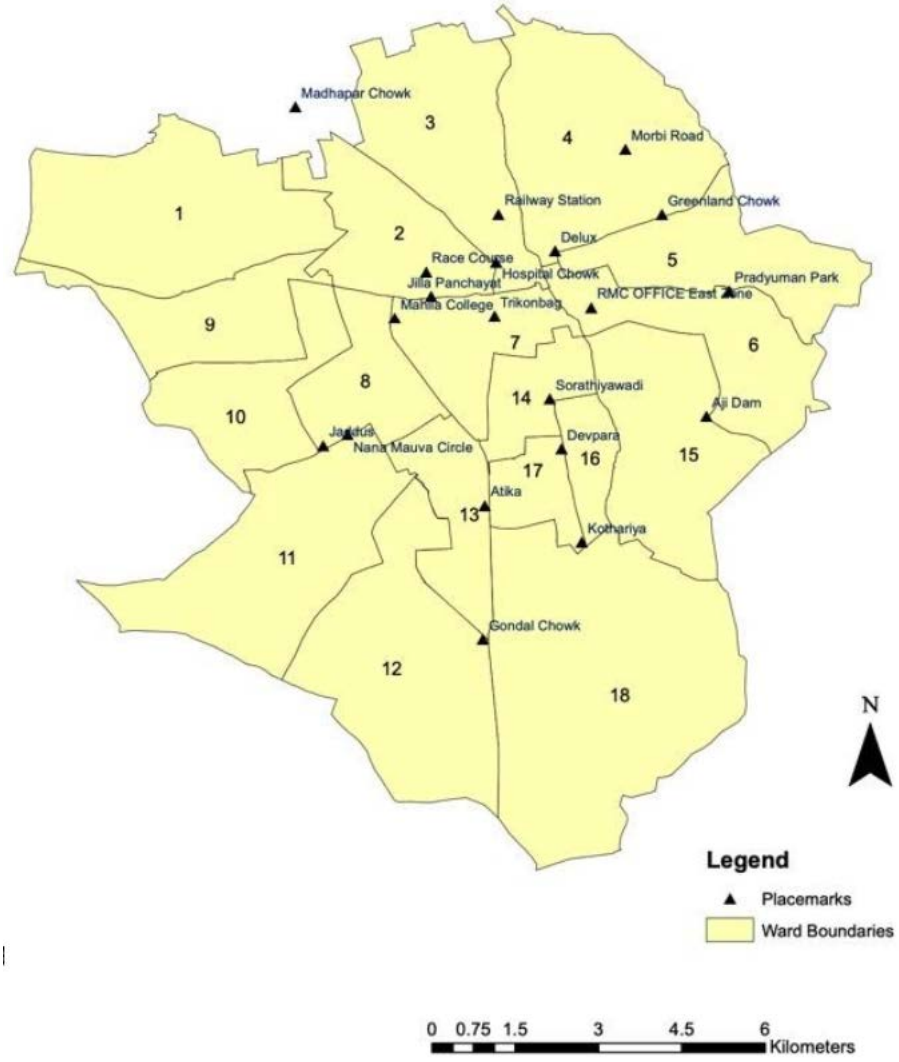


Figure 16: Survey Location, Rajkot

Rajkot

Ward No	Ward Name
1	Rajyadhar
5	Bhimrav Nagar, Pradyuman Park, Sadhu Vasvani Road
10	Jay Bhimnagar
11	Bharatnagar,
12	Bajrang Society Rashulpura
13	Ambedkar Nagar
14	Liludiwonkdi
15	Bharatnagar 1
18	Shitaldhara

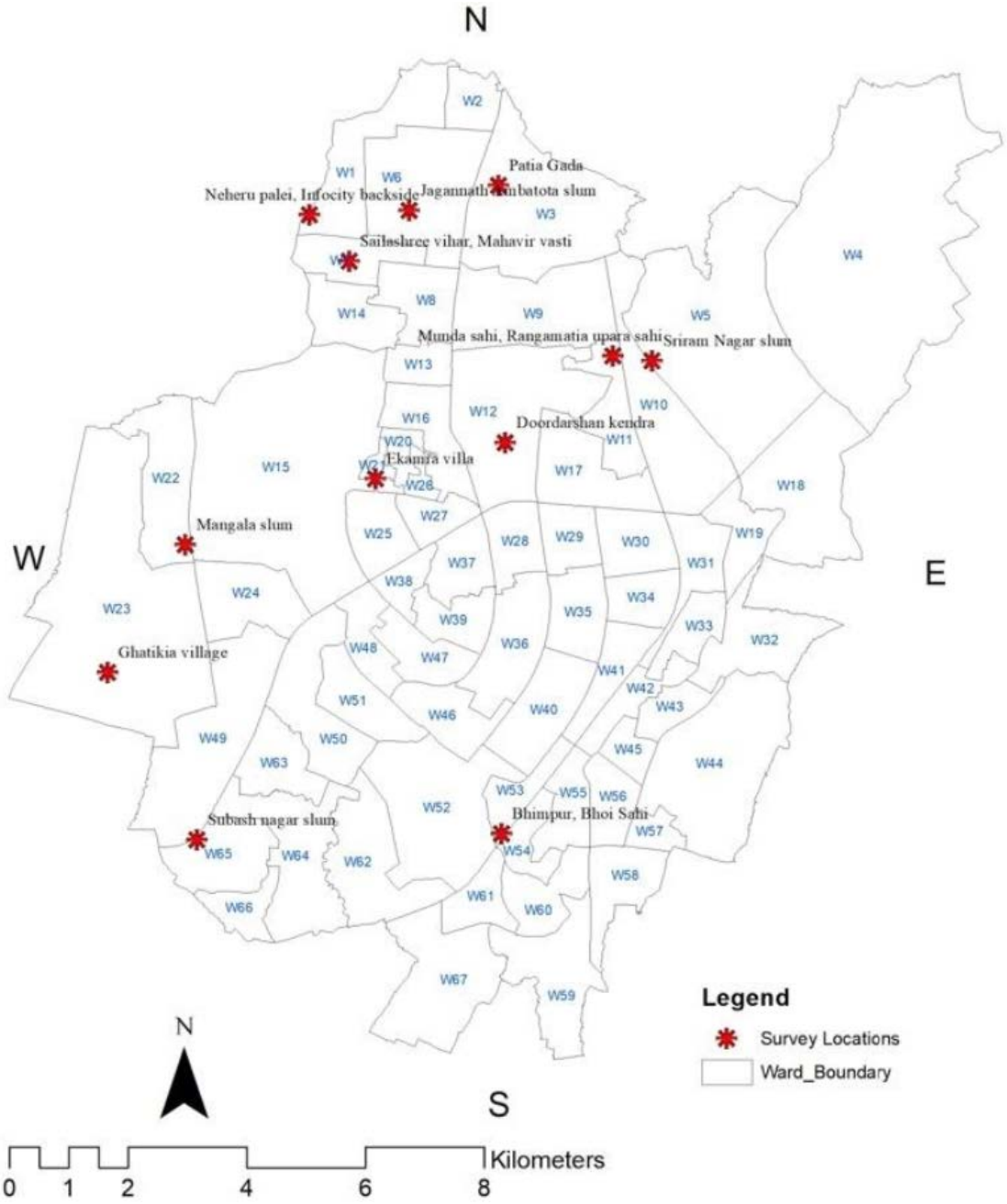


Figure 17: Survey Locations, Bhubaneswar

Bhubaneswar

Ward No	Ward Name
1	Nehru Place, Behind Infocity
5	Sriram Nagar slum
6	Jagannath Ambatota slum
7	Sailashree vihar, Mahavir vasti
9	Munda sahi, Rangamatia upara sahi
12	Doordarshan kendra
15	Ekamra villa
23	Ghatikia village
20	Mangala slum
65	Subash nagar slum

4.3 Vulnerability Mapping

Street vendors, hawkers, construction workers, sweepers or others involved in the occupations having high sun exposure are highly vulnerable to heat stress. The research tool captured the impact on health, livelihood and productivity of the people who are highly exposed to heat. Pilot surveys were done to field test the questionnaires in Delhi and Rajkot cities. Based on the results the tool was revised and translated into regional languages–Hindi and Gujarati to conduct the surveys.

Vulnerable areas

- Less urbanized, slums and scattered settlements
- Minimal access to water and sanitation,
- Minimal presence of household amenities

Vulnerable groups

- Economically weaker sections
- Elderly, Children, Women
- Working individuals – construction workers, factory workers, transportation, sweepers, labourers and street vendors

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Canada

Household Vulnerability Assessment

Detailed questionnaires for Household (HH) surveys were developed in SPSS and a stratified random sampling technique was used to conduct surveys in the selected slums. In addition, structured interviews were carried out through door to door survey at the HH level.

1

Identification of vulnerable areas

- LST Maps prepared
- Areas experiencing LST >400 C selected as hotspots
- Zeroed on less urbanized areas, slums and scattered settlements

2

Identification of vulnerable population

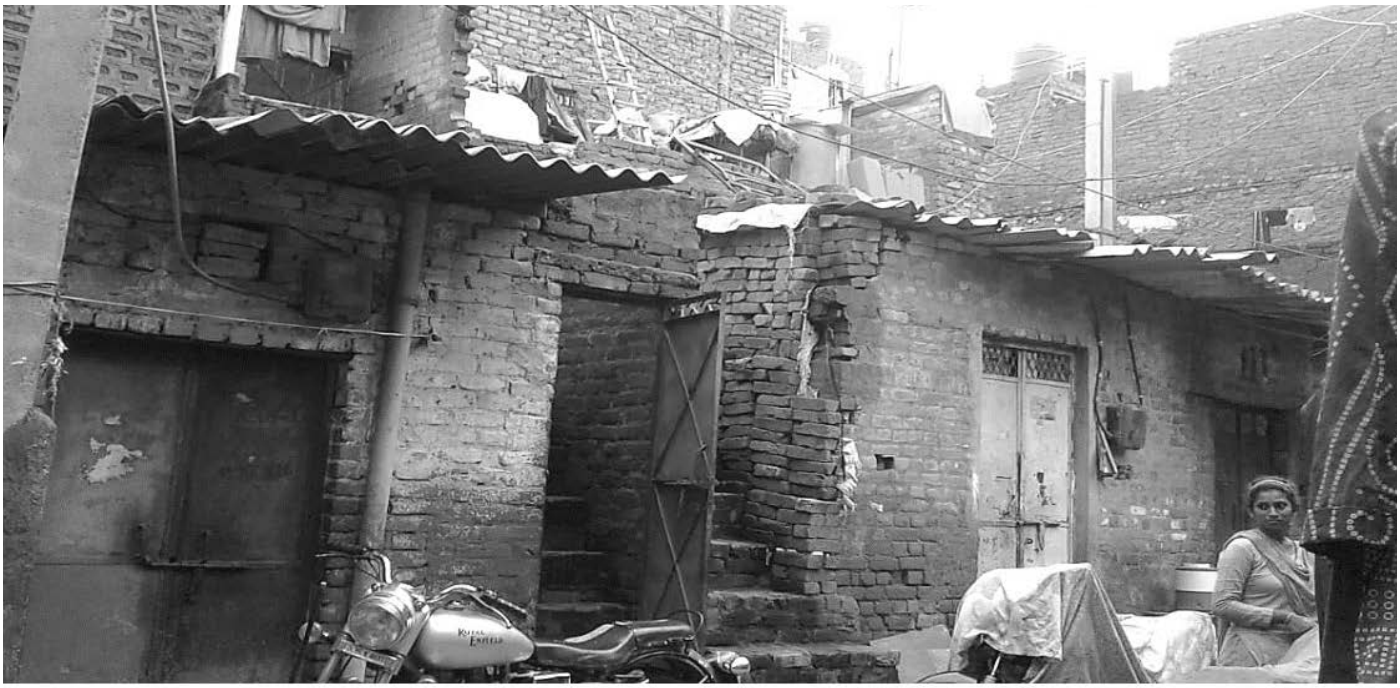
- Identified vulnerable population
- Economically weaker sections
- Elderly, children, women
- Working individuals

3

Identification of Hotspots

- Wards identified by overlapping of hotspot criteria over vulnerable population location.
- HH survey was conducted to measure vulnerability

The impacts of extreme heat events on health, work productivity, and livelihoods of the vulnerable population were determined using a comprehensive index of compounding factors that tend to exacerbate climatic impact. It comprised a total of nine sectors and 26 respective sub sectors.



Sectors	Sub-Sectors	
Sanitation	Type of Toilet	
Water	Water Source Water Source Location Water Collection Time Frequency Water Supply	
Electricity	Electricity Cut-off	
Health	Access to Health Infra- Public/Private/Both Distance Hospital Health Insurance	
Transportation	Preferred Mode of Transport	
Housing	Years of Occupancy Number of Rooms Type of House Floor Type	Roof Type Wall Type Number of Windows Wall Colour
Cooking	Cooking Place Cooking Fuel	
Awareness	Heat Stress Awareness Aware of Medical facilities for heat Aware of Medical measures ULB	
Heat stress symtoms	Heat Exhaustion Heat Stroke	

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Stratified Random Sampling Technique

Delhi	Rajkot	Bhubaneswar
Primary - 392	Primary - 290	Primary - 286
Fortnight - 392	Fortnight - 290	Fortnight - 283
Fortnight - 354	Fortnight - 281	Fortnight - 202

The analysis shows that the shortage of infrastructure services such as water and electricity especially during the peak summers, inappropriate housing structure, weak economic capacity to access health care and lack of awareness to manage heat stress are the key issues aggravating the impact of heat stress on vulnerable populations. The surveyed area lacked basic amenities like public toilets and water tanks with clean drinking water. Most people were working without any proper shelters or were taking shelter under trees to set up shops. The public health centers are far away and hence means loosing man days to visit the facility.

Delhi

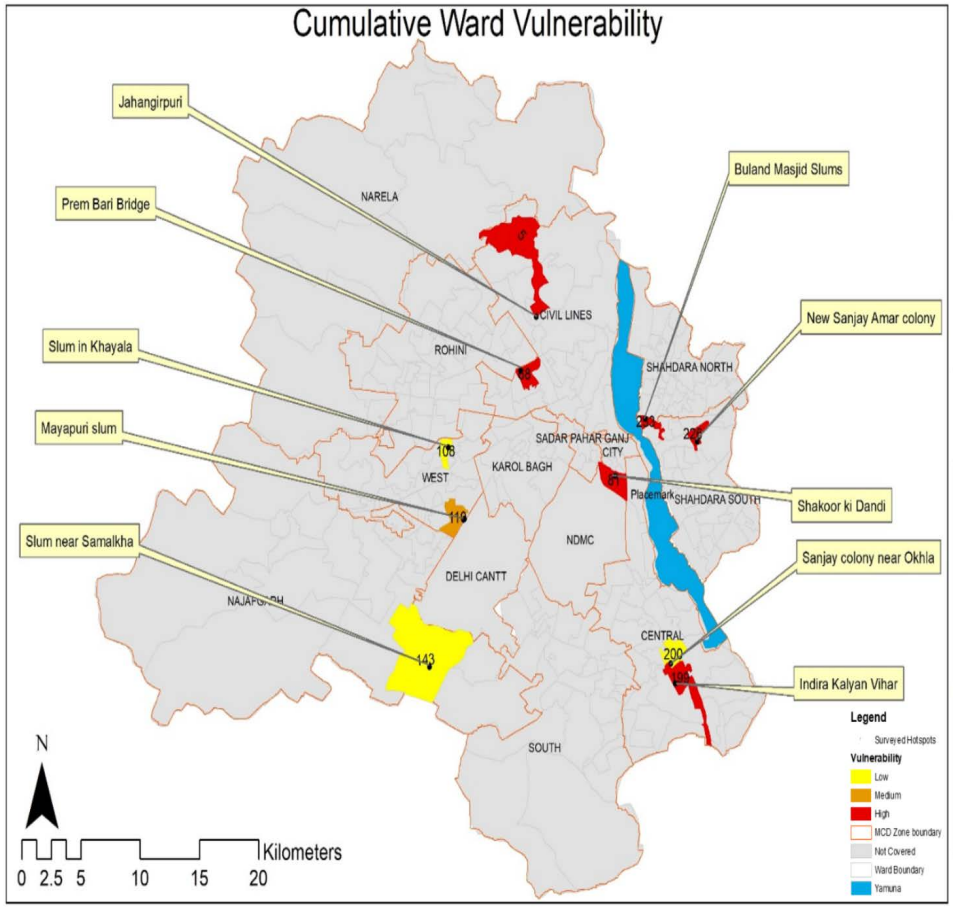
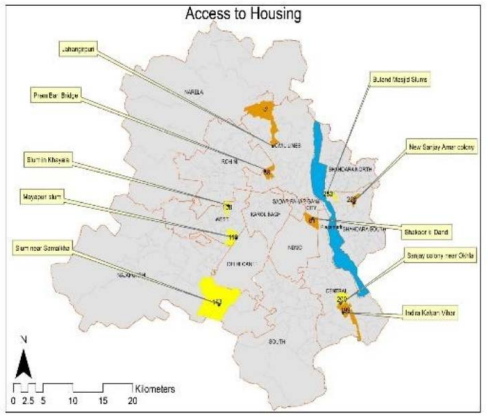
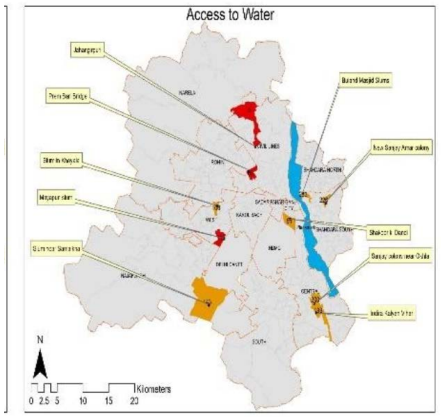
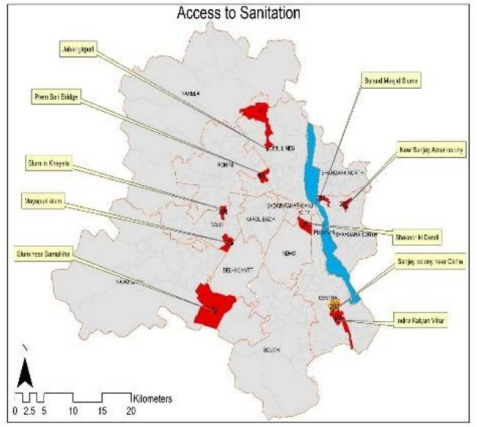
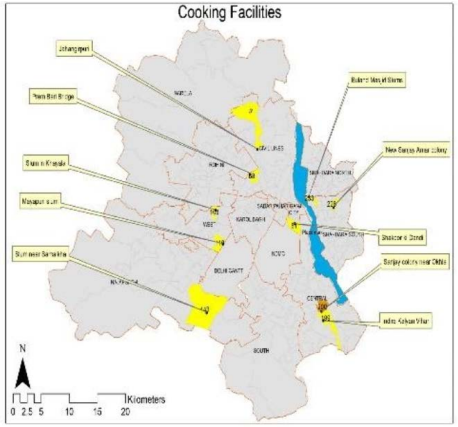


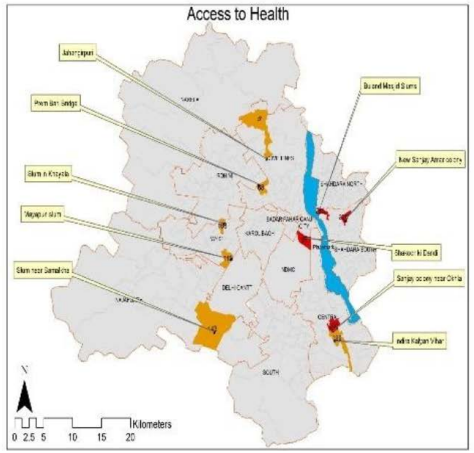
Figure 18: Ward level Cumulative Vulnerability, Delhi

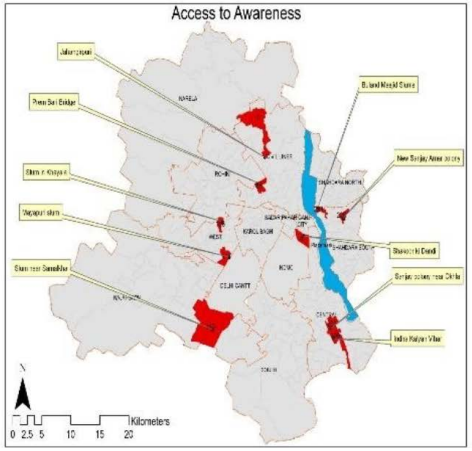












Rajkot

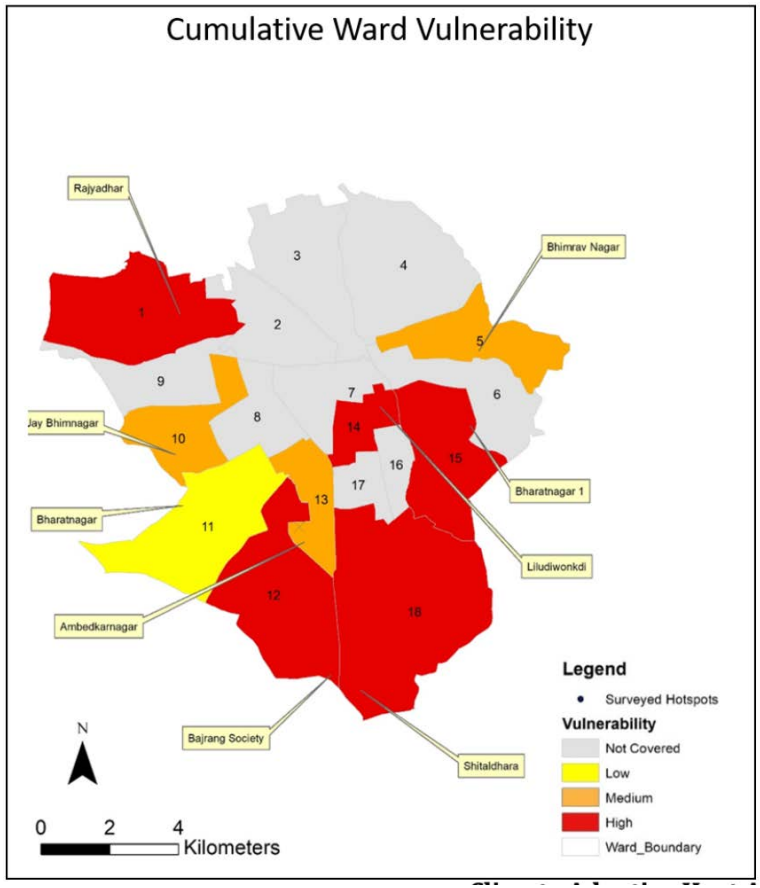
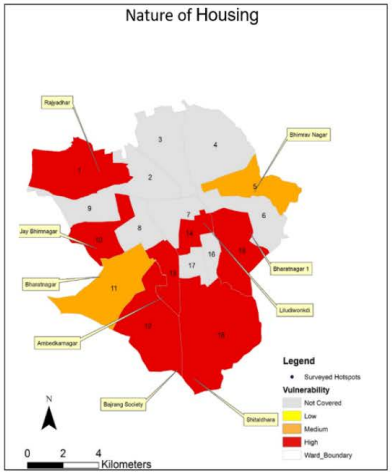
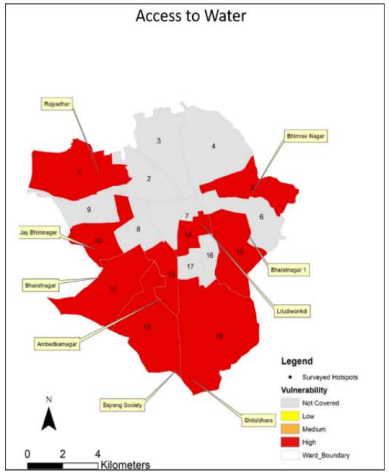
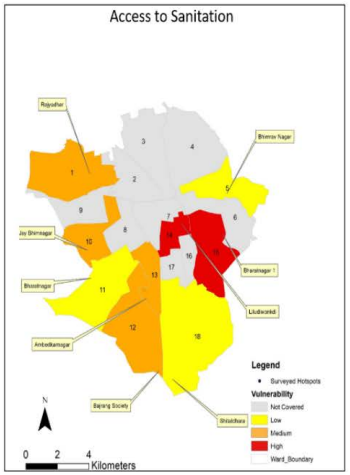
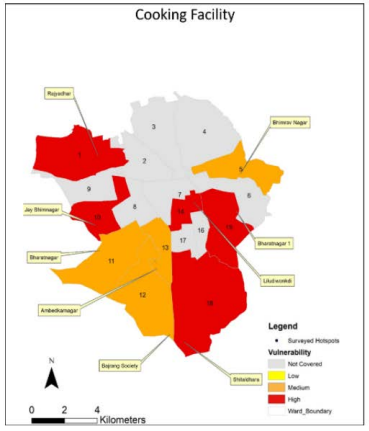


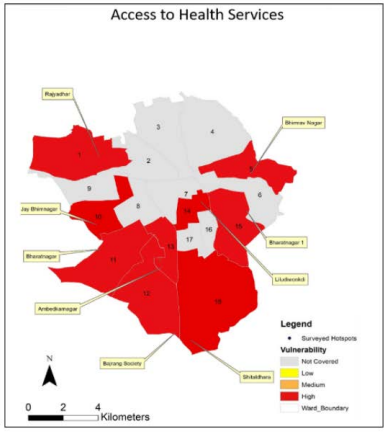
Figure 19: Ward level Cumulative Vulnerability, Rajkot

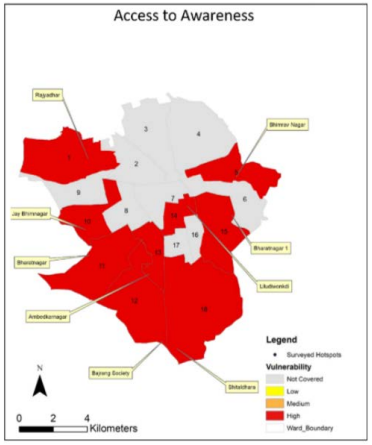




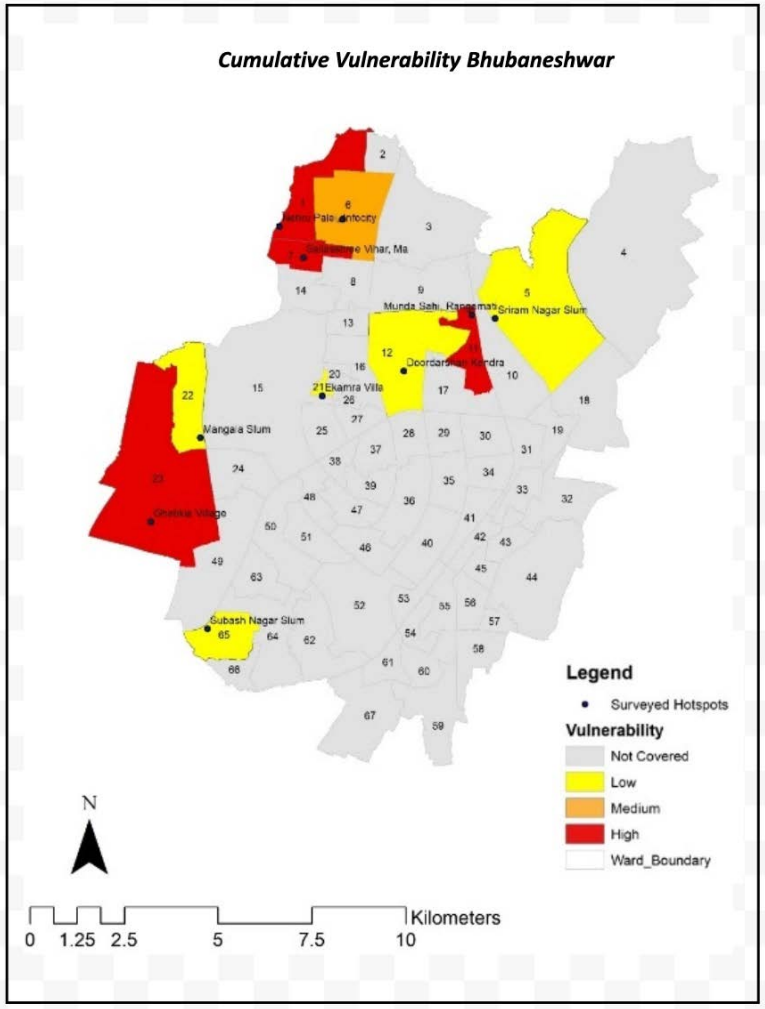


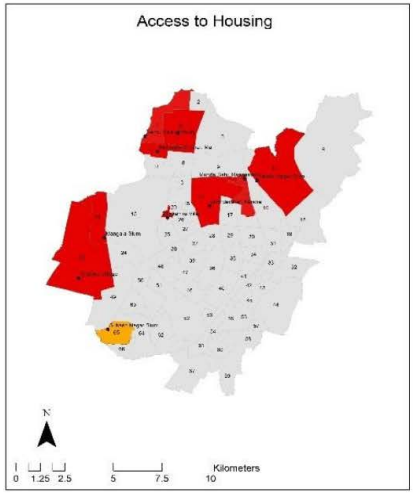


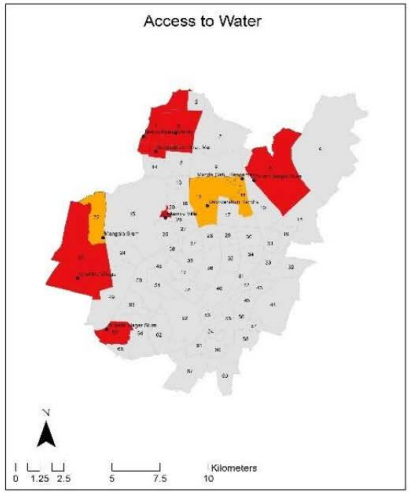


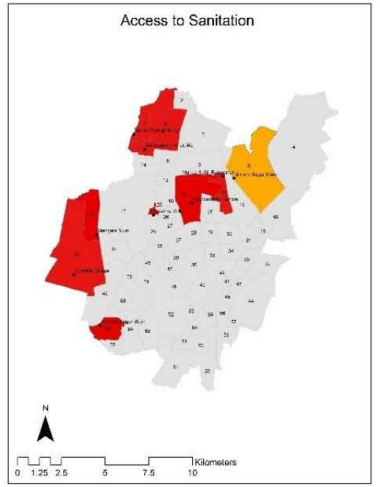


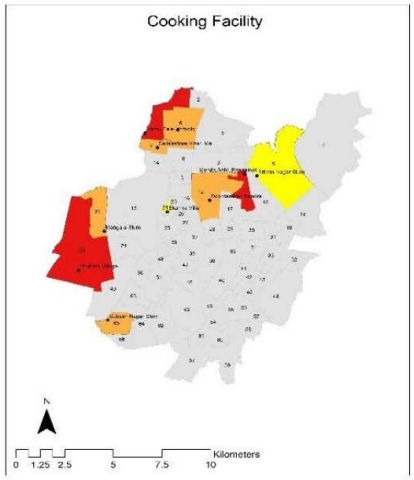
Bhubaneswar

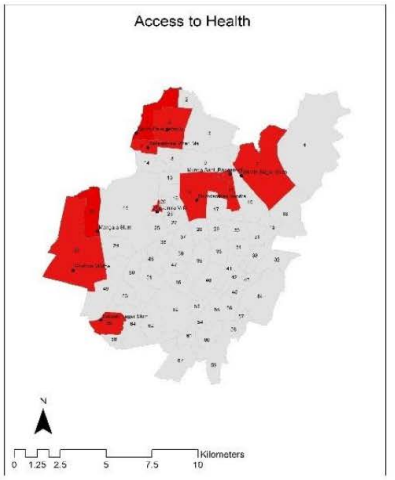












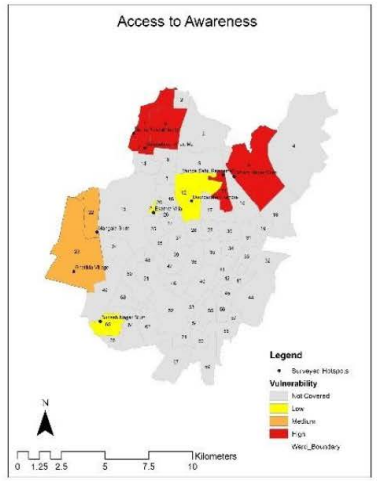
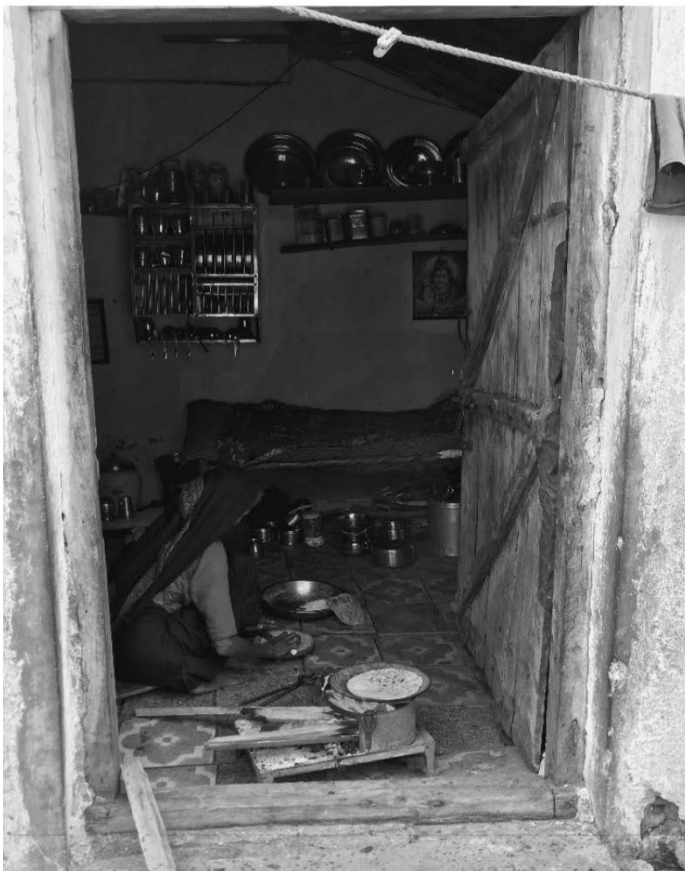


Figure 20: Ward level Cumulative Vulnerability, Bhubaneswar



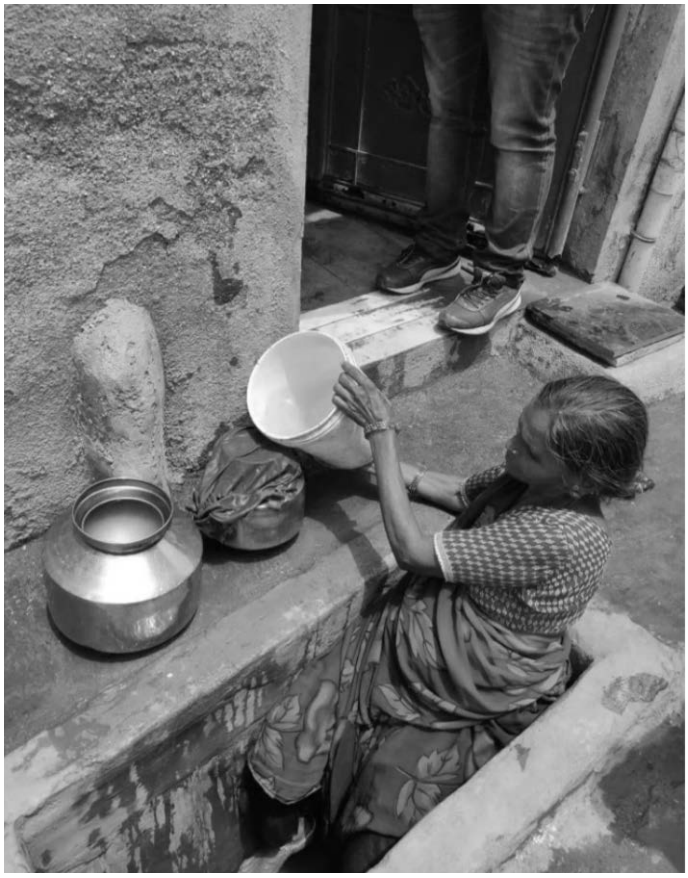
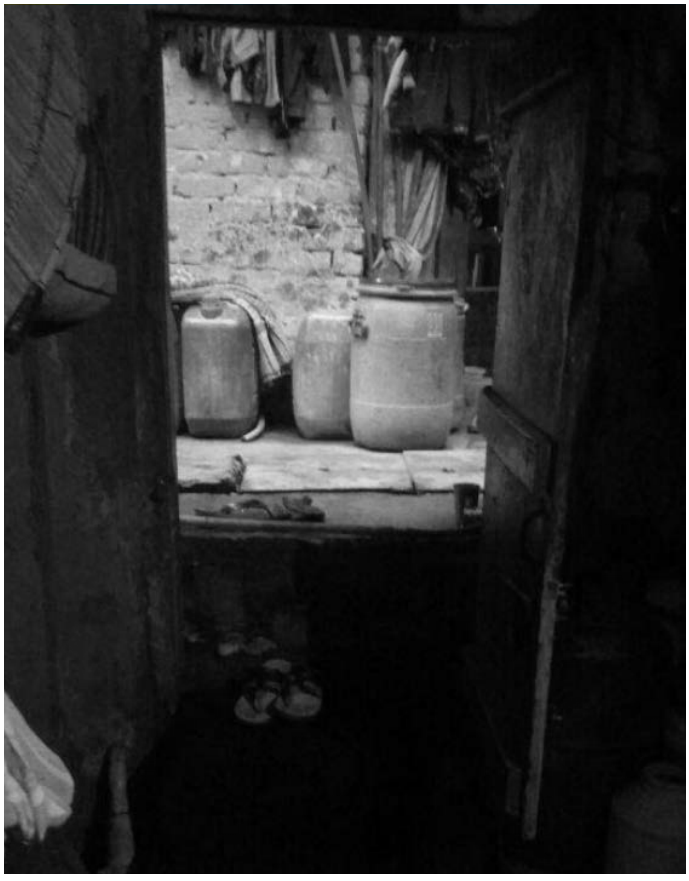


Figure 21: Housing and Basic Amenities



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IDRC · CRDI International Development Research Centre Centre de recherches pour le développement international
Canada

4.4 Heat Exposed Vulnerable Group

196 Heat Exposed Workers surveyed

- Transport workers
- Hawkers/Vendors,
- Construction workers,
- Daily wage workers/labourers,
- maids/sweepers, and
- engaged in other occupations like watchman, Gardening, Electricians and courier delivery agents

Areas covered lacked basic amenities like public toilets and water tanks with clean drinking water. Most of people were working without any proper sheds to work underneath or were taking shade under tree to spread open their shops.

Impact of heat Stress on Informal Sector Women Workers

Total **126** informal sector women workers surveyed cross the project cities

- Hawkers/Vendors
- Maids/Sweepers, and
- Daily Wage Workers.
- Construction workers/ helpers

The study indicated that during peak summer season most of the women face problems in sleep during the summer season. The study sheds light on the effects of occupational heat stress on women and as well as on their living conditions.

Most of the women reported that they spend between INR 1-500 for the treatment of heat-related illness. A few of the maids /sweepers (11%) reported that they have to bear the high cost of treatment (between INR 1501-2000) when they fall ill due to heat-related illness.

The presence of comorbidities and direct exposure to the sun makes the symptoms of these illnesses worse but they are helpless since they have to work outdoors regardless of the weather. It also documents the mitigation measures adopted by the women outdoor workers and the initiatives needed to be taken by the government regarding the problems faced due to heat stress.

The common problem amongst all of them was about the unavailability of clean, potable water.

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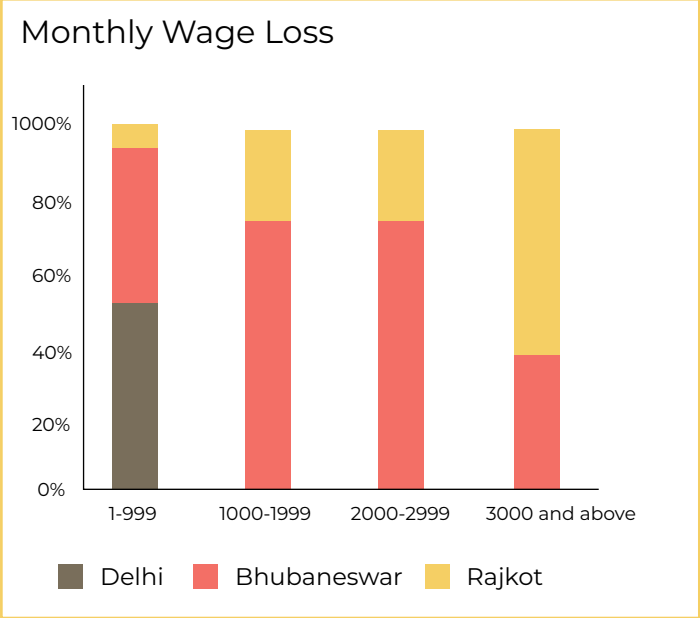
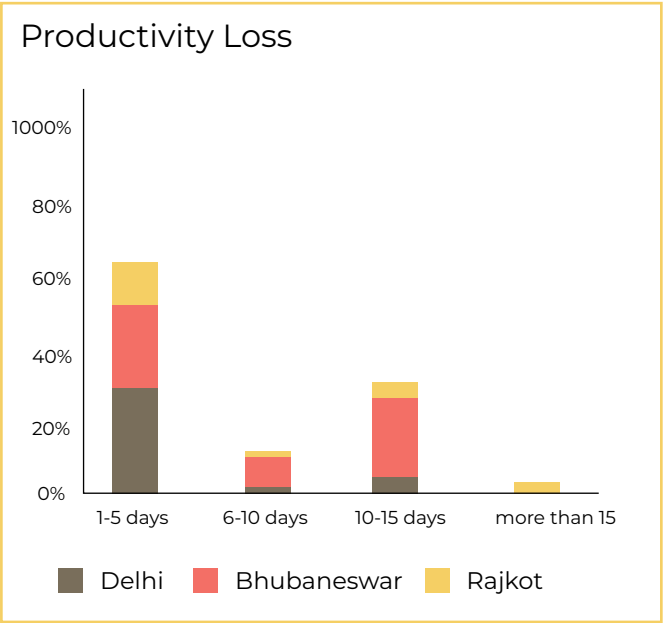
Wage Loss among the vulnerable groups



- Delhi holds the record for the highest wage loss as a result of heat at 36%, followed by Bhubaneswar and Rajkot. The average monthly wage loss accounted to INR 600.
- Gender-wise wage loss records that male workers in Delhi experienced the highest wage loss (90%), followed by Rajkot (76%) and Bhubaneswar (76%).
- Casual workers are the most affected, their wage loss is highest as compared to the other occupations as they are highly exposed to direct heat. Casual workers in Rajkot incurred the highest loss among all the cities.

Productivity Loss among the vulnerable groups



- Productivity loss can range anywhere between 1-5 days and 15 days, based on the intensity of heat stress. Delhi recorded the highest loss in productivity (36%), with almost 25% working days lost between 1-5 days. The cities of Rajkot and Bhubaneswar recorded over 25% productivity loss during periods of heat stress.

- Though the male working population recorded the highest productivity loss in Delhi (1-3 hrs), Bhubaneswar male and female populations recorded nearly a complete day of productivity loss. Like the wage loss, the productivity loss among casual workers is also high (30%), with Rajkot recording higher loss (33%).

Existing Adaptation Strategies by Households

- In **Delhi,** people opted for green roofing, installing false celling such as using soaked khus over windows as curtains to mitigate heat inside the house, hand fans, stay close to windows/ doors, if inside the house,. At work places, respondents preferred comfortable clothing, using hand fans and drinking plenty of water. For communications on heat stress, people prefer it through social media like WhatsApp and direct individual contact.

- In **Bhubaneshwar,** natural methods based on traditional knowledge were preferred, like covering roofs with sheds, using window blinds and watering walls and floors, consuming plenty of fluids and wearing comfortable light coloured clothing. At work using hand fans, frequent baths, using wet clothes are preferred. They prefer newspaper and radio for any heat stress communications (33%).

- In **Rajkot,** people preferred sleeping on the floor, using curtains and cooling themselves by pouring water on their floors. Most people said they took plenty of water and other liquids, multiple showers and used damp clothes to cool themselves at work.

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5 Heat Stress Action Plan

Heat Action Plans are designed as a critical adaptation measure to manage growing heat stress. Heat Action Plans aim to provide a framework for implementation, coordination and evaluation of extreme heat response activities that reduces the negative impact of extreme heat.

Some of the key components are:

- Building Public Awareness and Community Outreach on mitigative and adaptive measures through media engagement,
- Using Early Warning Weather Forecasts for Inter-Agency Coordination, Developing Capacity Among Healthcare Professionals to recognize and respond to heat-related illnesses,
- Reducing Heat Exposure and Promote Adaptive Measures through Identification of high-risk areas of the city, launching advocacy on preventive, adaptive and mitigative methods to deal with heat stress, collaborating with non-governmental organizations to expand outreach and communication with the city's most at-risk communities, and Developing heat emergency response plan.

Heat Action Plans

1. Review of Existing Heat Action Plans-India and South Asia
2. Expert Consultations & Steering Committee Inputs
3. Ward level Vulnerability Assessment
4. Estimating Heat Stress Temperature Threshold – Rajkot city
5. Prioritized Adaptation and Mitigation – Short –Medium & Long term Strategies
6. Validation of Heat Action Plans by City and State Level Stakeholders
7. Implementation of Heat Action Plans by Urban Local Bodies, Disaster Management Authorities

5.1 Heat Action Plan Framework

The Action Plan lays out essential components of preparedness for mitigation and adaptive measures

- Use Early Warning weather forecasts for inter-department coordination
- Develop capacity among healthcare professionals Build public awareness and community outreach
- Reduce heat exposure and promote adaptive measures

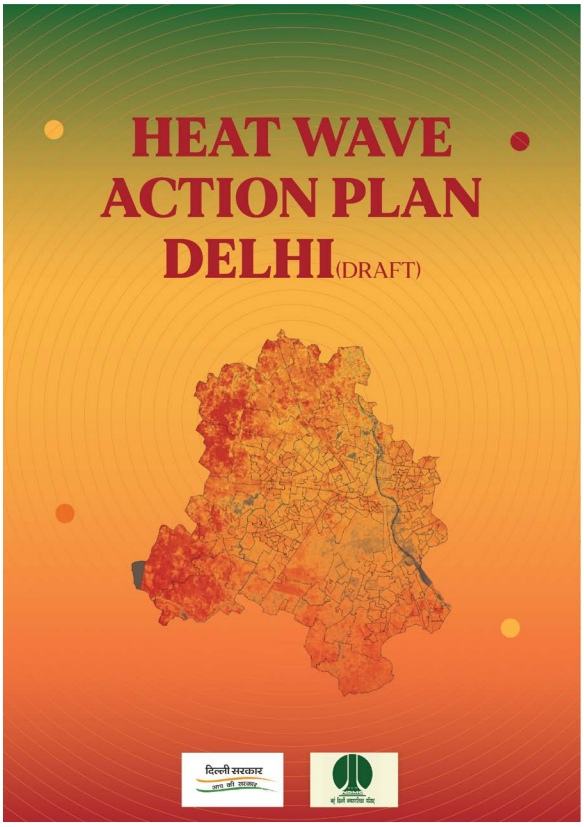
The Plan aims to effectively respond to health emergencies during the pre-heat seasons, during heat seasons, and post heat seasons.

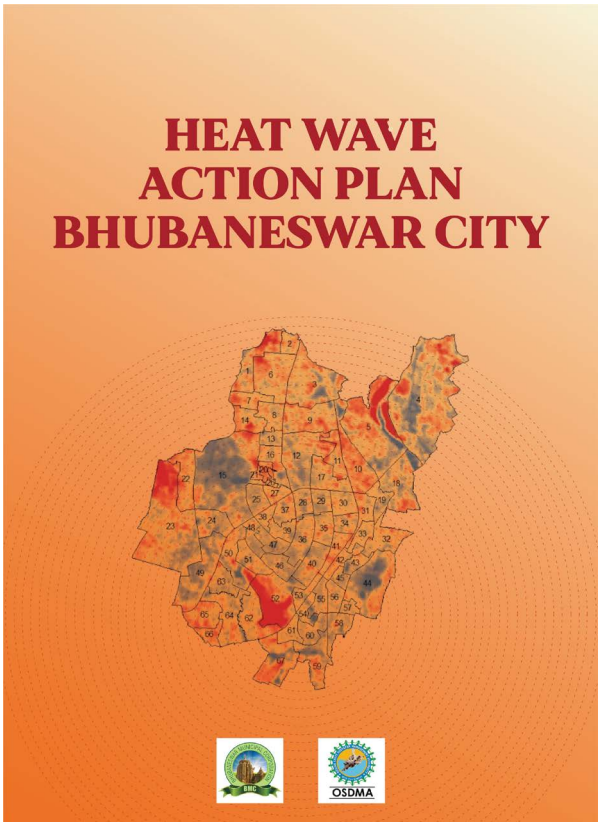
Adaption and mitigation measures classified into short term, medium-term and long-term measures.

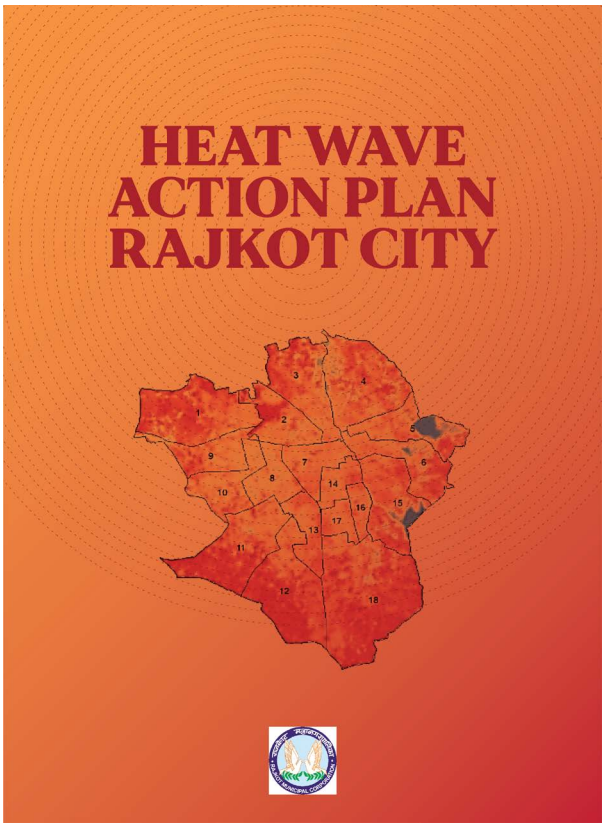
- Early warning communication
- Medical preparedness
- Awareness campaigns
- Mitigation measures Monitoring and analysis

Benefits of Heat Stress Action Plan

- Prevents deaths associated with heat strokes.
- Government commitment to protect the poor and vulnerable citizens.
- Reduces chances of illness due to heat waves.
- Making Indian cities future ready, Climate resilient cities.
- Better preparedness of hospitals/health centers.







Beat The Heat: Heat Wave Advisory

15 Integrated Research and Action for Development

YELLOW ALERT — ≥40°C — Actual maximum temperature ≥40°C or 4.5°C to 6.4°C above the normal maximum temperature

ORANGE ALERT — ≥45°C — Actual maximum temperature ≥45°C or 4.5°C to 6.4°C above the normal maximum temperature

RED ALERT — ≥47°C — Actual maximum temperature ≥47°C or ≥6.5°C above the normal maximum temperature

PREVENTIVE MEASURES


Drink four to five litres of cold water

Drink chaach, shikanji, ORS frequently


Wear loose cotton clothes


Shower with cool water


Avoid going outdoors during peak hours (12 pm to 4 pm)


Use limestone as paint or wet gunny bags on rooftops


Run cold water on your wrists


Take shelter during peak hours


Cover your face, head and carry an umbrella


Avoid intense physical activities


Do not leave children or pets in a parked car


Hang wet curtains on windows and doors

Highly Vulnerable Groups

- Infants and children
- Senior citizens
- Outdoor workers
- Pregnant women
- Traffic policemen

Symptoms of Heat Stress

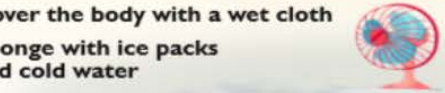
HEAT SYNCOPE
- Light-headedness
- Brief loss of consciousness
- Dizziness
- Fainting

HEAT EXHAUSTION
- Feeling overheated
- Light-headedness; headache
- Nausea
- Sweaty and thirsty
- Mildly elevated body temperature
- Muscle cramps
- Fatigue, dizziness

HEAT STROKE
- Throbbing headache
- Difficulty in breathing
- Rapid and strong pulse rate
- Nausea and vomiting
- Dry red skin
- High temperature but no sweating
- Fever above 104°F, which does not recede with paracetamol/ ibuprofen
- Unconsciousness

First Aid

1. Take the patient indoors and place him or her under a fan/cooler/AC
2. Lay the patient down and raise the legs and hips
3. Loosen clothes
4. Cover the body with a wet cloth
5. Sponge with ice packs and cold water
6. If conscious, give him or her cool water to sip
7. Give plenty of IV fluids and electrolytes
8. Immediate hospitalisation if body temperature does not go below 104°F after taking paracetamol or ibuprofen



Call 102 for emergency

6 Training and Sensitisation

- **Capacity Building Workshops**
- **Shared Learning**

- Briefing with the Environment and Forests Minister, Government of Delhi
- Stakeholder Workshop
- Medical Stakeholders Workshop
- Meetings with Municipal Corporations, Department of Health of Rajkot, Bhubaneswar and Delhi
- Heat Advisory Dissemination
- Interviews with city stakeholders and experts, press releases, meetings with stakeholders, newspaper articles.
- Communication with Government and Urban Local bodies for the use of cool roofs to improve thermal comfort and the covering or shading of rooftops.

- Workshops on project results/activities and sensitization of stakeholders (125 representatives from City ULBs, NGOs, Research and Academic Institutions)
- Medical Stakeholder Trainings (Delhi and Rajkot): First of its kind trainings for management of heat related illnesses (100 plus medical practitioners participated from Government and Private Hospitals)
- Training of ASHA Workers in Rajkot conducted at 6 Urban Primary Health Centres and 100 ASHSs were trained
- Stakeholder Workshops for developing Heat Action Plan of Rajkot City (75 plus representatives from various departments of Rajkot Municipal Corporation participated)
- Over 25 meetings with ULB representatives to orient them to the need of Heat Stress Action Plan
- Sensitization of 500 plus people through field surveys where people were informed about the potential impacts of heatwave
- Capacity Building and sensitization of 1000 plus stakeholders including those having high heat exposure.

Capacity Building

Capacity Building Events	Numbers
Training & Emergency Preparedness	
Medical Practitioners & Health Care Professionals (including doctors)	**305**
Frontline Health Workers (Accredited Social Health Activists (ASHAs) workers (ANM workers/ nurses)	**100**
Orientation to Heat Action Plan	
State & City level Stakeholders - Rajkot (Gujarat), Delhi and Bhubaneswar (Odisha)	**200**
Heat Stress Awareness & Heat Action Plan Development Master classes (South Asia)	
· Heat Threshold for Indian cities, · Climate Adaptive Heat Action Plans · Early Warning Systems for heat stress management	**4 Master Classes** **300 +** participation
Sessions & Workshops	
International Sessions & Workshops - UNFCCC COP 25, INSEE, GHHIN Forum, ICSD, GOBESHONA	**10**
National Sessions & Workshops – NDMA, ESRI	**4**
Heat Stress Awareness Drives	
Heat Advisory Dissemination across Rajkot, Delhi & Bhubaneswar in Gujarati, English & Hindi	**10,000 HHs & 16** healthcare centres under NDMC
Climate Adaptive Heat Stress Action Plan - Rajkot, Delhi & Bhubaneswar	**3**
Medical stakeholders Training Module on management of Heat-related illness and orientation to Heat Stress	**3 – English, Odiya & Gujarati**

6.1 Sensitisation of Stakeholders through meetings and consultations

Meeting with OSDMA officials

Meeting with Mr. Imran Hussain, Environment and Forest Minister, Govt. of Delhi

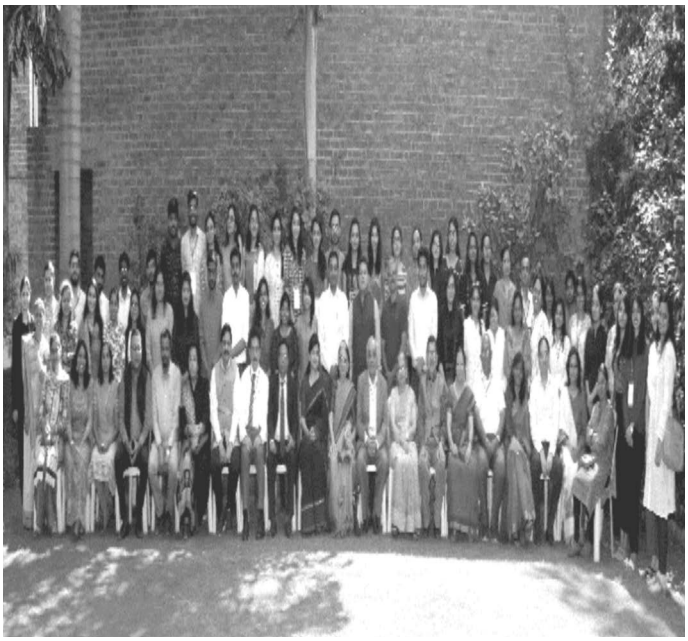
Meeting with RMC officials

Meeting with RMC officials

6.2 State Level Workshops for sensitising stakeholders about the need of Heat Stress Action Plans

Workshop on Climate Change and Health in Bhubaneswar

Attended by 50 plus participants *from; Bhubaneswar Municipal Corporation, Odisha State Disaster Management Authority (OSDMA) and Indian Institute of Public Health-Bhubaneswar, United Nations Development Programme (UNDP), Meteorological Centre Bhubaneswar, National Institute of Science Education and Research (NISER), Indian Institute of Technology Bhubaneswar (IIT-B).*



Session on Climate Change and Heat stress, Ahmedabad

More than 75 participants *from Gujarat ministry, state departments, research institutes, private companies and academic organizations attended the event.*

Interactive Stakeholders workshop to evolve HSAP of Rajkot,

Attended by75 plus *city/state level officials including the City Municipal Commissioner, Deputy Commissioners and Assistant Municipal Commissioners and officials from various departments; Health, Water works, Parks and Garden, Town Planning, Urban Development, Smart City, Disease control, Fire control*

6.3 Capacity Building of Medical Stakeholders through Trainings in New Delhi, Bhubaneswar and Rajkot

Medical Stakeholders Training in Rajkot
Trained more than 50 doctors and public health *professionals from Rajkot city.*

Medical Stakeholders Training in New Delhi
Trained more than 50 doctors and public health
professionals from the New Delhi Municipal Corporation

Capacity Building and Sensitization of Front Line Health Workers- Accredited Social Health Activists (ASHAs) for community
In consultation with Rajkot Municipal Corporation Health Department, workshops were conducted at 6 Urban Primary Health Centres and 100 ASHSs were trained.

Medical stakeholders Training Module on management of Heat-related illness and orientation to Heat Stress

It is a first-of-its-kind Training Module that aims to improve knowledge of medical stakeholders on the aspects of heat wave and its implications on human health. It seeks to enhance enduring and efficient participation of medical sector in addressing heat wave.

This training module is designed for the health care professionals who are engaged as heath care practitioners (doctors/ nurses/ para medics etc.), involved in management and decision making process during heat waves. This module will also equip the non-medical professionals (public health dept./hospital administration/ volunteers) in addressing the health challenges emerging due to heat waves.

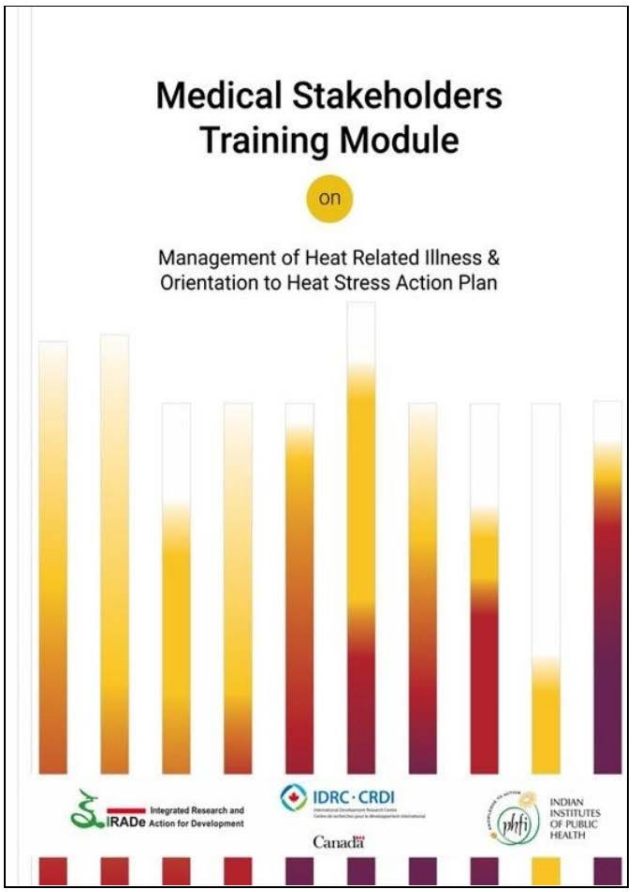


TABLE OF CONTENTS

7 Dissemination and Outreach

Heat Stress Advisory
Implementation of HAPs

- Dissemination of Heat Stress Advisory to over 15,000 people in Rajkot
- Advisory Translated in Hindi and Gujarati
- Dissemination in New Delhi Municipal Corporation and hospitals and dispensaries under NDMC
- Short term measures for heat stress management recommended to Rajkot and Bhubaneswar and Delhi Municipal Corporations

Workshops

International

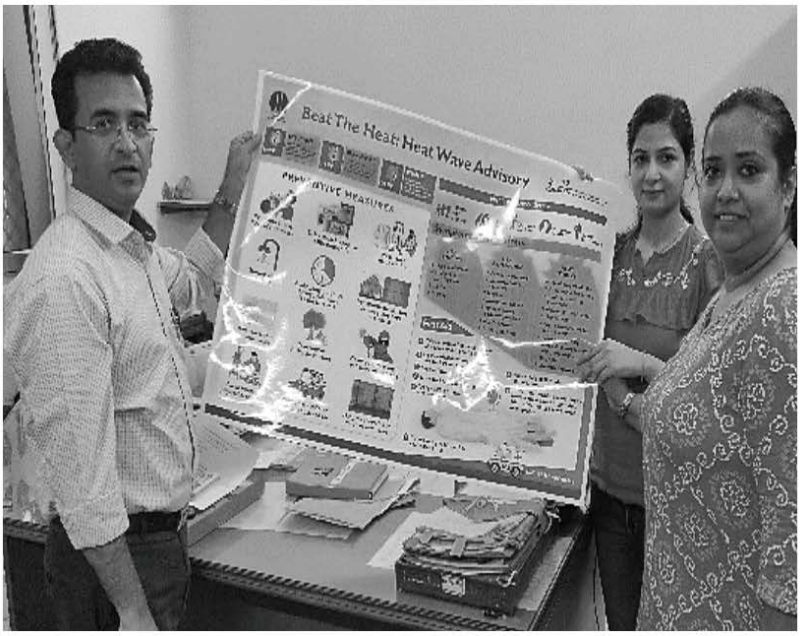
- UNFCCC COP 25 Chile-Madrid - India Pavilion and CBK2A Hub (5- 6 December 2019).
- Global Heat Health Information Forum - 2nd Global Forum on Heat and Health (14 February 2020, Pune).
- Indian Society for Ecological Economics (INSEE) International Conference (6 November 2019).
- Nature-Based Solutions for Heat Wave Management in cities. International Conference on Sustainable Development (8th ICSD) (21-22 September 2020, virtual).
- Climate Adaptive Heat Action Plans for Vulnerable Poor: A case study of Bhubaneshwar city, Odisha International Conference on Sustainable Development (8th ICSD) (21-22 September 2020, virtual).
- "Climate Adaptive Heat Stress Management in South Asia" at GOBESHONA Global Conference in January 2021.
- "Review of Heat Action Plans in South Asia and Adaptation Strategies" South Asia Regional Workshop on Heatwave Risk and Impacts Agenda, organized by Red Crescent Climate Centre (24 February, 2021, virtual).
- Heat Wave South Asia – (SAMA & SAHHIN), June 2021

National

- National Disaster Management Authority (NDMA) National Heat Wave Conference (5-6 December 2019)
- ESRI India Users Conference (29 August 2019)
- National Symposium on Innovation in Geospatial (20-22 November 2019)
- "Making Cities Resilient to Heat Stress" organized by CDKN, ICLEI, and TARU on "How Climate Resilient Initiatives can help cities in reducing heat stress" (29 January 2021(virtual)
- Jagrukta Abhiyan for COVID-19 Pandemic' organized by NASI HQ and NASI Kerala Chapter (12 February 2021 virtual).

7.1 Preparation and Dissemination of Heat Stress Advisory

Delhi



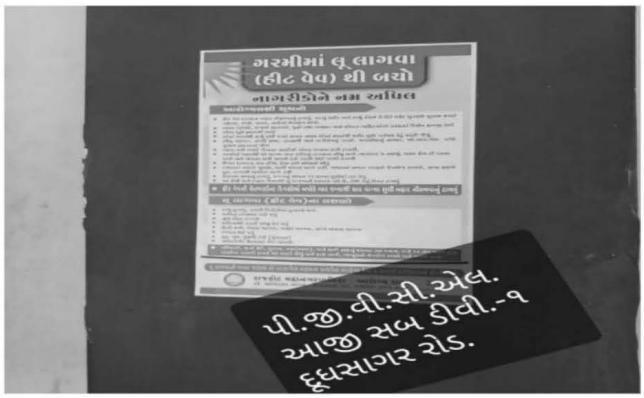
Handover of heat advisory posters to NDMC Medical Services Department

NDMC prescription slips with Measures to prevent heat stress related illnesses

7.2 Implementation of Heat Stress Action Plan in Rajkot

Hoardings at Public Places in Rajkot for heat stress awareness

LED Screen at different places displayed Heat Advisory



Posters and Pamphlets at different place of City

Distribution of 15784 Heat Advisory Pamphlets in Regional Language and Releasing Press Notes

Water Points and Buttermilk distribution at more than 300 locations, ORS corner and Rapid Response Team (RRT) at all Urban Health Centres (UHC)

Orientation meeting for Heat wave preparedness with GVK Emergency Management Research Institute (108), Doctors of Civil Hospital and Doctors of private hospital


ઓરેન્જ એલર્ટ
રાજકોટમાં વરસતો અગનગોળો
રાજકોટમાં અગ્નિવર્ષા: ઓરેન્જ એલર્ટ: તાપમાન ૪૨થી ૪૪ ડીગ્રી

Heat Wave Advisory in Newspaper by Municipal Corporation Rajkot

7.3 International Workshops

South Asia Heat Health Summit, 2020
Session on Local Interventions in South Asia: Impact of heat stress on Livelihoods, productivity, and Health

UNFCCC COP 25 Chile- Madrid 2019 – India Pavilion and CBK2A Hub

Climate & Disaster Resilient Urban Development Session at INSEE International Conference, 2019

GOBESHONA -Global Conference, 2021

7.4 National Workshops

Workshop on Urban Integrated Environment Modelling and Services for Indian Cities, 2020

National Workshop on "Preparedness, Mitigation & Management of Heat Wave 2020

8 Press and media Publications

The New York Times

In India, Summer Heat May Soon Be Literally Unbearable

By Somini Sengupta

July 17, 2018

NEW DELHI — On a sweltering Wednesday in June, a rail-thin woman named Rehmati gripped the doctor's table with both hands. She could hardly hold herself upright, the pain in her stomach was so intense.

Rohit Magotra, deputy director of Integrated Research for Action and Development, is trying to help the capital, Delhi, develop a plan to respond to the new danger. The first step is to quantify its human toll.

"Heat goes unreported and underreported. They take it for granted," Mr. Magotra said. "It's a silent killer."

On a blistering Wednesday morning, with the heat index at 111 degrees Fahrenheit, he and a team of survey takers snaked through the lanes of a working-class neighborhood in central Delhi. They measured temperature and humidity inside the brick-and-tin apartments. They spoke to residents about how the heat affects them. Figure 1:

A field worker on one of Rohit Magotra's survey teams spoke with women about coping with heat. Credit Saumya Khandelwal for The New York Times

New York Times, July, 2018

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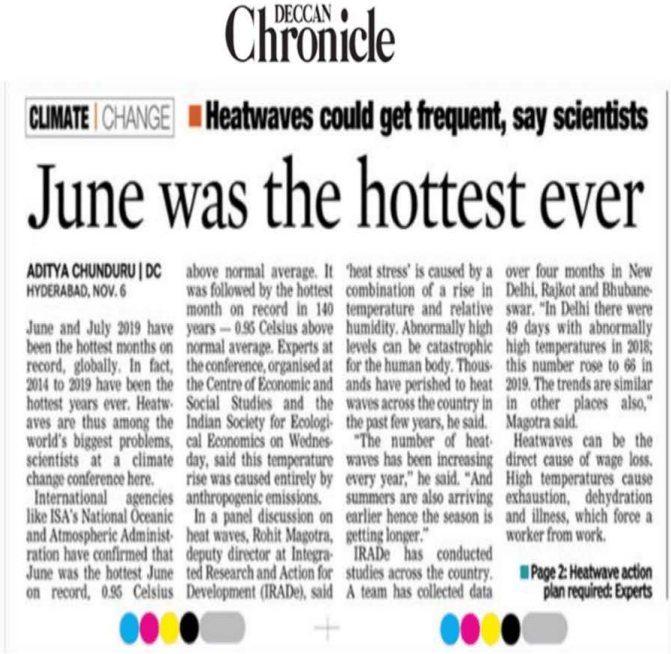
આરોગ્ય કર્મી.ઓ ઉપર હીટવેવથી થતી અસરો અંગે

મનપા ખાતે સારવાર અને ટ્રેનિંગ વર્કશોપ યોજાયો

- આરોગ્ય કેન્દ્ર, રેલવે હોસ્પિટલો, પ્રાઇવેટ હોસ્પિટલો સહિતના ૫૦ થી વધુ ડોકટરો તથા સ્ટાફ ઉપસ્થિત રહ્યો

Gujarat Mirror, May, 2019



DECCAN Chronicle

CLIMATE | CHANGE

Heatwaves could get frequent, say scientists

June was the hottest ever

ADITYA CHUNDURU | DC
HYDERABAD, NOV. 6

June and July 2019 have been the hottest months on record, globally. In fact, 2014 to 2019 have been the hottest years ever. Heatwaves are thus among the world's biggest problems, scientists at a climate change conference here.

International agencies like ISA's National Oceanic and Atmospheric Administration have confirmed that June was the hottest June on record, 0.95 Celsius above normal average. It was followed by the hottest month on record in 140 years — 0.95 Celsius above normal average. Experts at the conference, organised at the Centre of Economic and Social Studies and the Indian Society for Ecological Economics on Wednesday, said this temperature rise was caused entirely by anthropogenic emissions.

In a panel discussion on heat waves, Rohit Magotra, deputy director at Integrated Research and Action for Development (IRADe), said 'heat stress' is caused by a combination of a rise in temperature and relative humidity. Abnormally high levels can be catastrophic for the human body. Thousands have perished to heat waves across the country in the past few years, he said.

"The number of heatwaves has been increasing every year," he said. "And summers are also arriving earlier hence the season is getting longer."

IRADe has conducted studies across the country. A team has collected data over four months in New Delhi, Rajkot and Bhubaneswar. "In Delhi there were 49 days with abnormally high temperatures in 2018; this number rose to 66 in 2019. The trends are similar in other places also," Magotra said.

Heatwaves can be the direct cause of wage loss. High temperatures cause exhaustion, dehydration and illness, which force a worker from work.

Page 2: Heatwave action plan required: Experts

Deccan Chronicle –November 2019

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HOME NEWS ARTICLES INTERVIEWS EVENTS SECTIONS RESOURCES SPECIAL

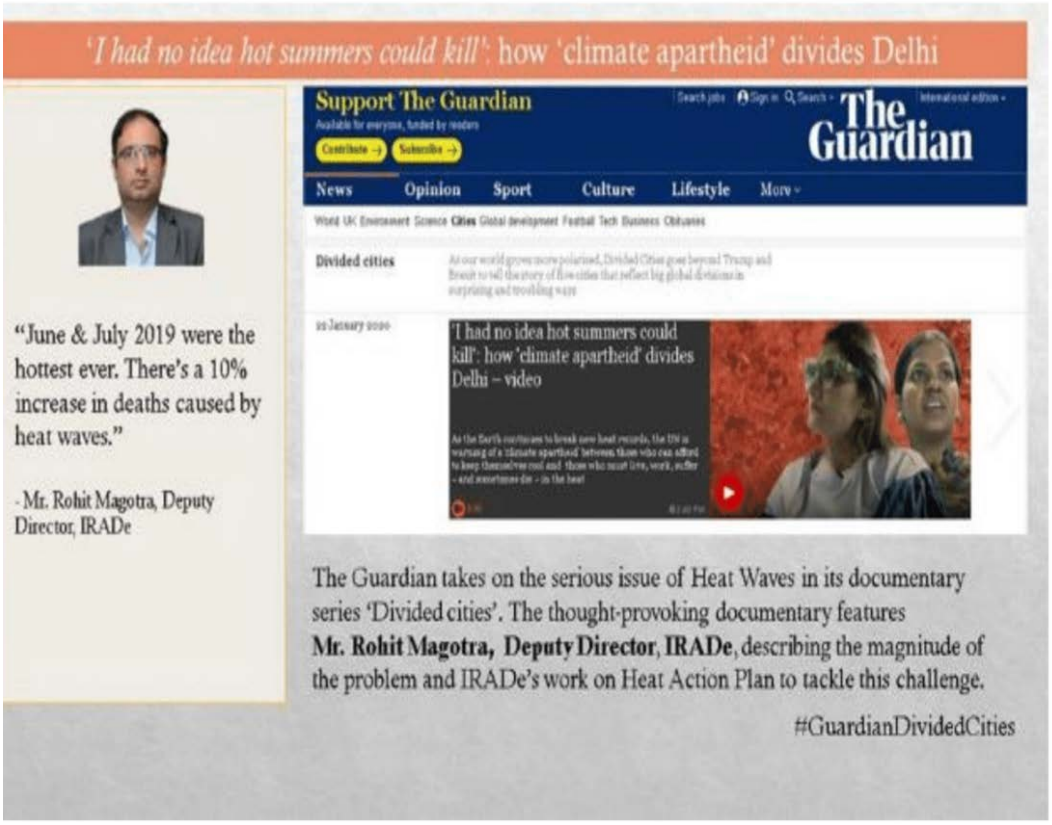
11th CSR Leadership Summit
May 8-9, 2020 | Mumbai

CSR FOR GOALS Achieving SDGs through Corporate Social Responsibility
Keynotes Thematic Sessions Fireside Chat Roundtables Masterclasses

Combating Climate Change in India – one urban city at a time

by ROHIT MAGOTRA — 2020/01/22 — in Articles, Environment

CSR Network - Combating Climate Change in India, May, 2020



'I had no idea hot summers could kill': how 'climate apartheid' divides Delhi

"June & July 2019 were the hottest ever. There's a 10% increase in deaths caused by heat waves."

- Mr. Rohit Magotra, Deputy Director, IRADe

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Divided cities

'I had no idea hot summers could kill': how 'climate apartheid' divides Delhi – video

The Guardian takes on the serious issue of Heat Waves in its documentary series 'Divided cities'. The thought-provoking documentary features **Mr. Rohit Magotra, Deputy Director, IRADe**, describing the magnitude of the problem and IRADe's work on Heat Action Plan to tackle this challenge.

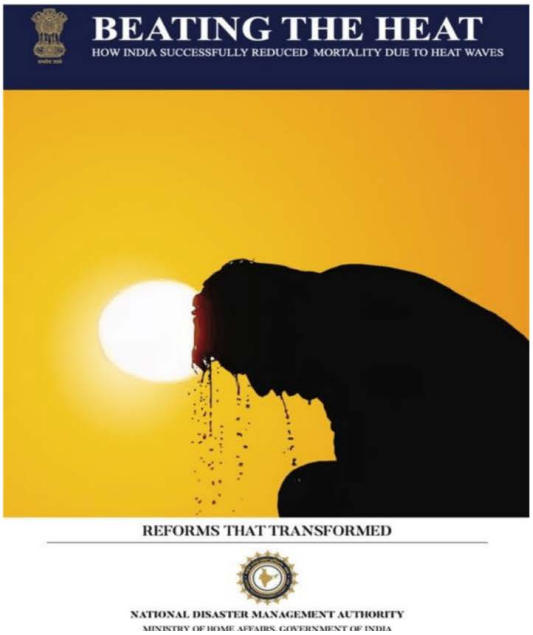
#GuardianDividedCities

The Guardian, 2019

20 YEARS Integrated Research and IRADe Action for Development
IDRC · CRDI
Canada

The Guardian, 2019

NRDC Annual Brief Report/ Fact Sheet, 2020 & 2021



Commitment

As soon as Hon'ble Prime Minister & Chairman of the National Disaster Management Authority (NDMA) Shri Narendra Modi assumed charge of the Authority, he gave due importance to management of this hazard and initiated various measures, which have resulted in significant reduction in loss of life due to heat waves. The decline in deaths due to heat waves has been remarkable—from 2,040 in 2015 to 4 in 2020.

The government also committed itself to work according to the priorities for action it had set so that India could contribute successfully towards achievement of the seven global targets set by the Sendai Framework.

'Beat the Heat' – National Disaster Management Authority (NDMA)

9 COVID 19 Dissemination

Two policy briefs were published, a few articles were published in the news media, partner agencies were communicated for research collaborations for framing future public health policies regarding COVID-19 recovery, the project team undertook capacity building measures to improve their relevance to the COVID-19 policy landscape and is in the process of developing a paper on the impact of COVID-19 on Gender disparity in India's vulnerable communities. The project team will continue to engage with the COVID-19 related policy landscape and identify the required avenues through which the impact of the IDRC project can be further strengthened through partnerships, publications, and research outputs.

Nature of Publication	Brief description	Publication link
	Policy Briefs	
Strengthening Public Health Systems for COVID-19 Response	This policy brief highlighted the need for strengthening the public health system to deal with the emerging health challenges like COVID-19, and recommended a number of policy changes in the healthcare system and the COVID-19 containment strategy. The brief also provided policy action pointers for better preparedness for future public health challenges.	https://www.greaterkashmir.com/news/opinion/strengthening-public-health-systems-for-covid-19-response/
Role of GIS in COVID-19	This highlights the application of GIS for COVID-19 incidence mapping at ward level in Delhi. We mapped the COVID-19 incidences reported in Delhi during 08 April -14 April 2020. Through mapping, it was identified that there were 47 COVID-19 hotspots distributed in 37 wards of Delhi. This analysis shows that containment measures should be more strictly implemented in these 37 wards distributed in nine infected districts. Combining socio-economic data of the infected wards, further potential population under risk can be estimated. Such an analysis is also the starting point of modelling the future spread of the disease.	https://www.researchgate.net/publication/344512066_SHORT_FEATURE_Role_of_GIS_in_Managing_COVID-19

Gendered response for tackling COVID-19 and its aftermath	The manifold impacts on the gender calls for a gendered approach to COVID-19 responses. Here it is important to highlight that aggregated data being managed currently is producing only gender-neutral policies to deal with COVID-19. To enable a gender sensitive response some steps should immediately to shape a more equitable landscape. To start off it is important to develop disaggregated data that also includes gender along with their age group, disabilities and ensure that policy making takes this data for putting in place a policy prescription. For this an engagement of existing women's network and their support could be sought to support connectivity and secure vital actionable information. Measures to be taken for the pandemic management should be based on strong gender analysis, considering gendered roles, responsibilities, and dynamics. The policy makers need to design gender sensitive action plans for relief, response and rehabilitation for this public heath disaster.	https://www.thetilakchronicle.com/policy-response-to-covid-19-needs-to-be-gender-sensitive-heres-why/
Policy approach and actions to manage and improve COVID Response	A pandemic like COVID 19 requires relief management and rehabilitation even before the infection peaks. It is of utmost importance for civil society and citizen engagement to spread awareness, provide access to real time information and knowledge in order to enable people and organisations to take appropriate action. The civil society has been a major contributor to the response to national disasters. In case of COVID 19, the civil society's potential has been under-utilized so far and the government must make use of the experienced and skilled response force available in its civil society.	https://www.thetilakchronicle.com/improving-the-response-to-covid-19-crisis-demands-an-innovative-policy-approach-and-implementation/

Partnerships and Research Contribution

Initiation of COVID-19 Policy and Implementation Support to Disaster Management Authorities and Urban Local Bodies in India	IRADe as policy think has experience and expertise on guiding public policy and action plans to implement public health measures necessary to tackle COVID-19. Hence, IRADe has initiated communication with National Disaster Management Authority (NDMA), Rajkot Municipal Corporation (RMC), and Odisha State Disaster Management Authority (OSDMA), offering support and contribution in the fight against COVID-19. IRADe has also expressed interest to carry out studies required to assess the socio-economic impacts of COVID 19 and Action plan for managing impacts of COVID in India.	

Research Paper

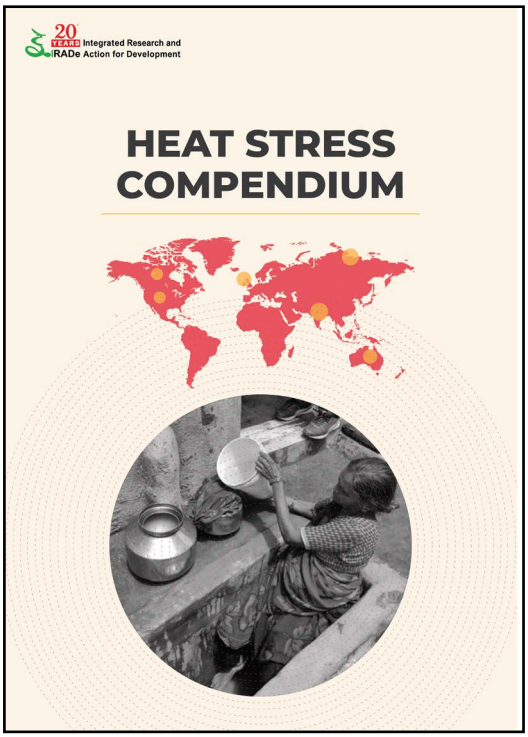
Research for a Paper on "Women, Covid and South Asia"	Emerging evidence indicates that while women often tend to be less vulnerable to the disease in terms of morbidity and mortality (barring comorbidities), they bear a disproportionately larger brunt of the economic and social disruptions that accompany these public health disasters. Existing gender and class inequalities also tend to get exacerbated all round. So far, the gendered impact of pandemics has been relatively under researched. There are at least five interrelated areas that merit further investigation: Poverty and livelihood vulnerability, food security, formal and informal employment, education, health care access. Some of these effects may be felt immediately, others in the long term as economies face recession, rising unemployment, and slow recoveries. How do these effects play out across gender, class and race intersectionality? What is the emerging data and evidence? What is the role of communities, the state and civil society in this regard, and what can be done to design public policy to tackle such challenges in the future.	

Capacity Building

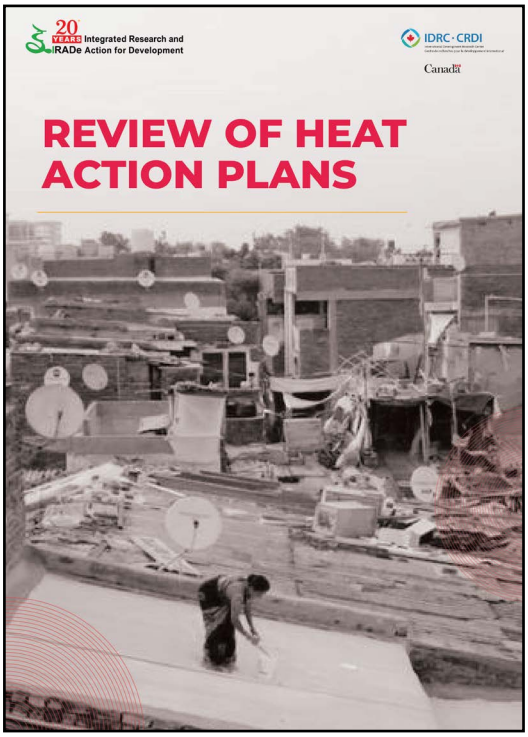
Webinar series on COVID-19 Outbreak: On the Frontlines	Project Team members attended Webinar on "Partnerships to advance Public Health and the Economy in the COVID-19 era", which was Episode 6 of a series of Webinars. The Harvard T.H. Chan School of Public Health – India Research Center and Project SANCHAR, co-hosted a webinar series titled, "COVID-19 Outbreak: On the Frontlines". Subject experts and leading public health practitioners to gain an insight into the spread and control of coronavirus, its impact on health and wellbeing of communities, and India's policy and health systems response to mitigate the crisis. The webinar provide a convening platform for a wide range of stakeholders, including NGOs, development agencies, journalists, and representatives from the Government, in partnership with faculty and researchers from the Harvard T.H. Chan School of Public Health.	

10 Documentations and Publication

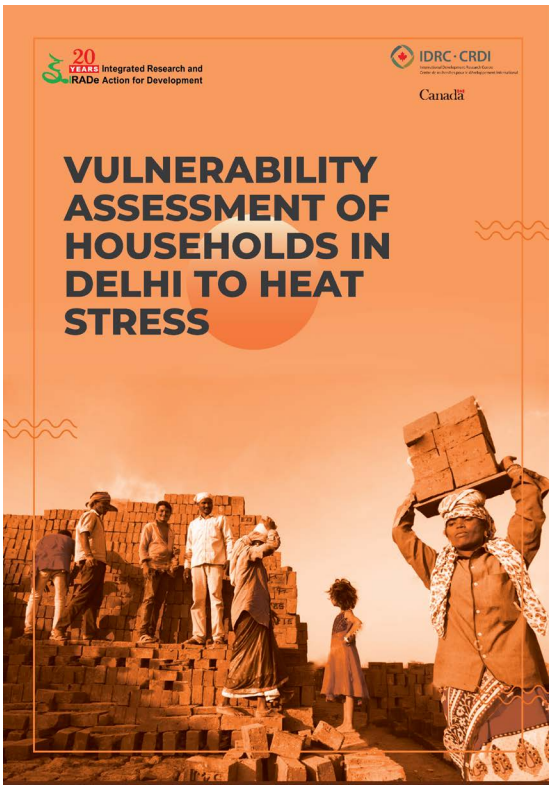
The Heat Stress Compendium – Heat Wave Incidences and Action Initiatives documented the global, South Asian and Indian level occurrences and events of Heat waves. The synthesis report includes heat event cases, mortality and related mitigation measures across the Globe and India in particular. It also enlists the Initiative taken by the various state Government and city administrators to mitigate the heat stress and their success stories along with the National framework for developing early warning systems to mitigate the same.

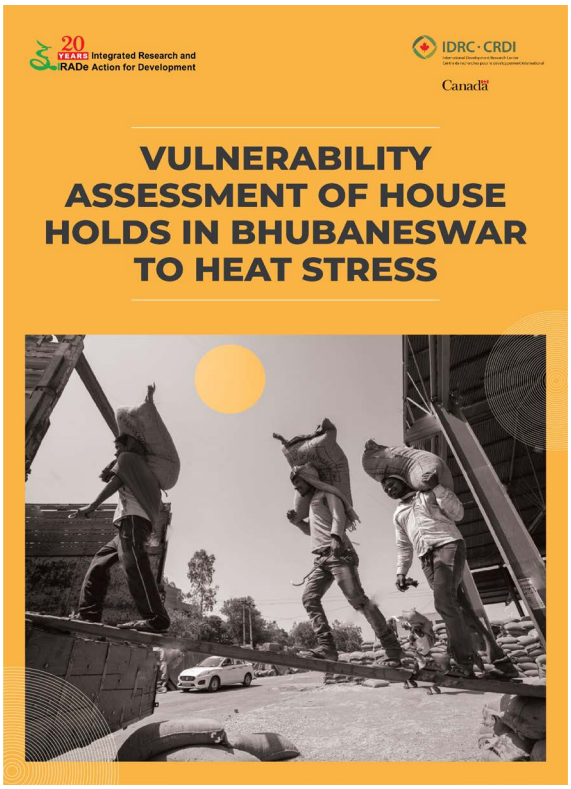


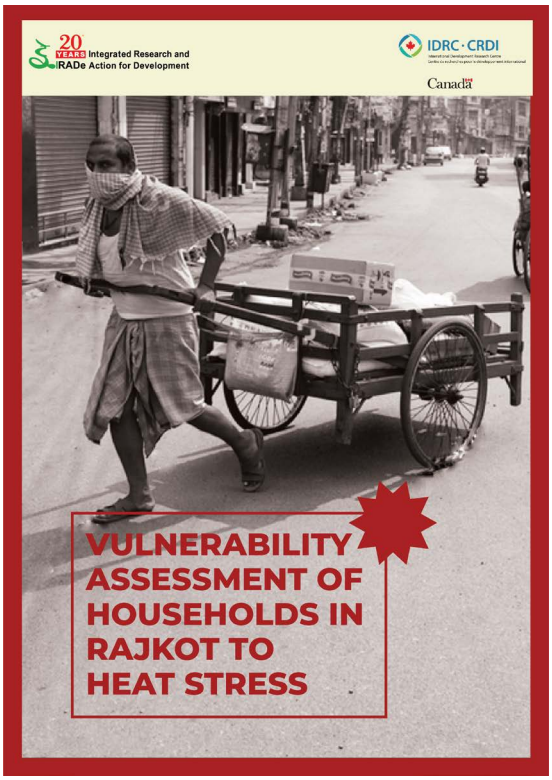
Review of Heat Action Plans A first-of-its-kind Review Documentation of the available Heat Action Plans across the globe, and in South Asia and India in particular. The Report is a qualitative review that identified key strategies introduced in the Heat Action Plans of different states and cities within India. It also highlights the need for a Climate Adaptive HAP that can increase the impact and efficiency of adaptation and mitigation efforts



Vulnerability Assessment of Households to Heat Stress aims to understand and analyse the implications of extreme heat on the health, productivity, and livelihoods of vulnerable groups, especially the working population (like construction workers, vendors, rickshaw pullers, factory workers, casual labourers, maids/helpers, and office workers.), women, children, and senior citizens in Rajkot, Delhi, and Bhubaneswar. The study has enabled the selection of appropriate, innovative, and affordable climate adaptation measures for improving health and livelihood resilience for the urban population. A detailed quantitative and qualitative framework for the assessment was adapted to develop adaptive mitigation strategies for the Climate adaptive Heat Action Plan and capacity building of people.







Publications:

Publications	Links
Heat Stress Action Plan Rajkot	2019- 2020 https://climateandcities.org/wp-content/uploads/2022/01/Rajkot-Heat-Action-Plan.pdf
Heat Stress Action Plan Bhubaneswar	2019- 2020 https://climateandcities.org/wp-content/uploads/2022/01/Bhubaneswar-Heat-Action-Plan.pdf
Vulnerability Assessment of Households in Delhi to Heat Stress	https://climateandcities.org/wp-content/uploads/2022/01/Delhi-Vul-Asses.pdf
Vulnerability Assessment of Households in Rajkot to Heat Stress	https://climateandcities.org/wp-content/uploads/2022/01/Rajkot-Vul-Assess.pdf
Vulnerability Assessment of Households in Bhubaneswar to Heat Stress	https://climateandcities.org/wp-content/uploads/2022/01/Bhubaneswar-Vul-Assess.pdf
Excerpts from ' Climate Adaptive Heat Action Plan for Bhubaneswar – Heat Action Plan for Odisha-2020'	https://www.osdma.org/preparedness/one-stop-risk-management-system/heat-wave/
Medical Stakeholders Training Modules on Management of Heat-Related Illness & Orientation to Heat Stress Action Plan	IRADe -PR-66(2020) https://climateandcities.org/wp-content/uploads/2022/01/IRADe_16june2021.pdf
Impact of Heat Stress on Informal Sector Working Women	2020 https://climateandcities.org/wp-content/uploads/2022/01/Impact-of-Heat-Stress-on-Informal-Sector-Women-Workers.pdf
Review of Heat Action Plans	2020-21 https://climateandcities.org/wp-content/uploads/2022/01/Review-of-Heat-Action-Plans.pdf
Heat Stress Compendium	2020-21 https://climateandcities.org/wp-content/uploads/2022/01/Annexure1.Heat-Stress-Compendium-Heat-Wave-Incidences-and-Action-Initiatives.docx.pdf
Review of Urban Heat Islands: Monitoring, Forecast and Impacts	http://imetsociety.org/vayumandal/?id=2021472&num=13
Climate adaptive heat action plans to manage heat stress in Rajkot city	https://climateandcities.org/wp-content/uploads/2022/01/CLIMATE-ADAPTIVE-HEAT-ACTION-PLAN-TO-MANAGE-HEAT-STRESS-IN-RAJKOT-CITY-IRADe-NIDM.pdf

Press/ Newspaper

International	Links
The Guardian - Divided Cities A short documentary featuring the HSAP project	https://www.youtube.com/watch?v=z4FEJJGWMt8&feature=emb_logo
New York Times In India Summer Heat May Soon be Literally Unbearable'	https://www.nytimes.com/2018/07/17/climate/india-heat-wave-summer.html
NRDC Annual Brief ' Expanding Heat Resilience Across India: Heat Action Plan Highlights	https://www.nrdc.org/sites/default/files/india-heat-resilient-cities-ib.pdf
'Beat the Heat' – National Disaster Management Authority (NDMA)	https://ndma.gov.in/sites/default/files/IEC/Booklets/HeatWave%20A5%20BOOK%20Final.pdf

National	Links
Deccan Chronicle – June was the Hottest Ever -Article on Heat stress capturing HSAP project in three cities	6th November 2019 https://www.deccanchronicle.com/nation/current-affairs/071119/telangana-june-was-the-hottest-ever.html?fbclid=IwAR21FeHj396bCSJHtkN4Cd_eJyeJvPeUZnBMaofOB_8zxatemW9OuBoEomk
CSR network's website Combating Climate Change in India – one urban city at a time	https://indiacsr.in/combating-climate-change-in-india-one-urban-city-at-a-time/?fbclid=IwAR0hVEothNmJdGXT_BBD2um9so6l1iFiG4k6xlF0-zk98NmtzzZLk7SzKUM
Gujarat Mirror (Gujarati) Covered the 'Medical Stakeholders Training for Management of Heat Related illness & Orientation to Heat Stress Action Plan' organized in Rajkot on 3rd May, 2019	15th May, 2019. https://climateandcities.org/wp-content/uploads/2022/01/Article-in-Gujarati-Newspaper.pdf
Delhi Jagran (Delhi) One-degree rise in temperature over a decade	4th June, 2019 https://www.jagran.com/delhi/new-delhi-city-ncr-clemate-change-delhi-temprature-increase-one-degree-19281908.html
The Tilak Chronicle · Policy Response to COVID 19 Needs to be Gender Sensitive · Improving the response to Covid 19 Crisis Demand an innovative policy approach and implementation	https://irade.org/website/wp-content/uploads/2020/04/Gendered-response-for-tackling-COVID-19-and-its-aftermath.pdf https://irade.org/website/wp-content/uploads/2020/04/Policy-approach-and-actions-to-manage-and-improve-COVID-Response.pdf
Mongabay Poor urban neighbourhoods more vulnerable to extended effects of heat'	https://india.mongabay.com/2019/06/poor-urban-neighbourhoods-vulnerable-to-extended-effects-of-heat/?fbclid=IwAR3BYxL4jX4iVgiloqsHWoUsTLUySPyppTnXBzjcDs-jJo1Vtr3QNQGTM4s

COVID-19

Strengthening Public Health Systems for COVID-19 Response	https://www.greaterkashmir.com/news/opinion/strengthening-public-health-systems-for-covid-19-response/
Role of GIS in COVID-19	https://www.researchgate.net/publication/344512066_SHORT_FEATURE_Role_of_GIS_in_Managing_COVID-19
Gendered response for tackling COVID-19 and its aftermath	https://irade.org/website/wp-content/uploads/2020/04/Gendered-response-for-tackling-COVID-19-and-its-aftermath.pdf
Policy approach and actions to manage and improve COVID Response	https://irade.org/website/wp-content/uploads/2020/04/Policy-approach-and-actions-to-manage-and-improve-COVID-Response.pdf
Webinar on 'Jagrukta Abhiyan for COVID-19 Pandemic' by NASI Kerala Chapter	https://irade.org/Webinar%20-NASI%20HQ%20&%20Kerala%20Chapter%20on%20Feb%2012,2021.pdf
Covid-19 in perspective	https://irade.org/website/wp-content/uploads/2020/06/jyoti-BS-june-7-20CovidPerspective-1.pdf
What the lockdown has accomplished	https://irade.org/What%20the%20lockdown%20has%20accomplished.pdf
A strategic testing regime: How to step up tests to ensure effective containment of corona	https://irade.org/A%20strategic%20testing%20regime-%20How%20to%20step%20up%20tests%20to%20ensure%20effective%20containment%20of%20corona.pdf

Project Workshops

Partners' Inception Workshop IRADe, IDRC, IIPH- G, IIPH-B, OSDMA, RMC	1st February 2018, Delhi https://climateandcities.org/wp-content/uploads/2022/01/Annexure22.-Proceedings-of-Partners-Inception-Workshop-Delhi-1st-February-2018.docx.pdf
Research Methodology Workshop IIRADeIPH G & IIP-B, OSDMA, IMD Bhubaneswar	19th March 2018, Delhi https://climateandcities.org/wp-content/uploads/2022/01/Annexure6.-Proceedings-Data-Workshop-Bhubaneswar-19th---21st-April-2018.docx.pdf
Data Workshop IRADe, IIPH G & IIP-B, OSDMA	19th – 21st April 2018, Bhubaneshwar https://climateandcities.org/wp-content/uploads/2022/01/Annexure37.Proceedings-of-Researcher-training-workshop.docx.pdf
Policy Dialogue on Climate Change and Development' at Indian Institute of Management Ahmadabad (IIMA) on 06th March 2019	6th March 2019 Ahmedabad https://climateandcities.org/wp-content/uploads/2022/01/Annexure28.Proceeding-of-Workshop-on-'Climate-Change-and-Heat-Stress-in-Ahmedabad-Gujarat-6th-March-2019.docx.pdf
Interactive Stakeholder Workshop IRADe, RMC, IIPH G	26th June, 2019, Rajkot https://climateandcities.org/wp-content/uploads/2019/06/Annexure29.IProceeding-of-Workshop-Interactive-Stakeholders-workshop-for-Evolving-Rajkot-Heat-Stress-Action-Plan-26th-June-2019-at-Rajkot.pdf

Medical Stakeholder Trainings – Rajkot Press Release	**3rd May, 2019, Rajkot** https://climateandcities.org/wp-content/uploads/2019/05/Annexure24a.Proceeding-of-Workshops-for-training-Medical-Stakeholders-3rd-May-2019-Rajkot.docx.pdf
Medical Stakeholder Trainings – Delhi Press Release	**11th May, 2019, Delhi** https://climateandcities.org/wp-content/uploads/2019/05/Annexure24b.Proceeding-of-Workshops-for-training-Medical-Stakeholders-11th-May-2019-Delhi.docx.pdf
Climate Change and Human Health in Odisha in collaboration with (OSDMA) and IIPH-B	**30th January, 2019, Bhubaneswar** https://climateandcities.org/wp-content/uploads/2019/01/Annexure27.Proceeding-of-Climate-Change-and-Human-Health-in-Bhubaneswar.-Odisha-30th-January-2019.docx.pdf
Climate Change and Heat Stress' in Gujarat in collaboration with Mahila Housing Sewa Trust	**6th March 2019 Ahmedabad** https://climateandcities.org/state-level-workshops-for-sensitizing-stakeholders-about-the-need-of-heat-stress-action-plans-workshop-on-climate-change-and-heat-stress-2/
OSDMA Meeting and Publication	**24th February 2020, Bhubaneswar** https://climateandcities.org/wp-content/uploads/2022/01/Annexure30.Proceedings-of-2nd-Steering-Committee-Meeting-on-Preparation-of-Heat-Wave-Action-Plan-2020-24th-February-Bhubaneswar.docx-1.pdf
Medical Stakeholders Need Assessment Workshop	**24th February 2020, Bhubaneswar** https://climateandcities.org/wp-content/uploads/2020/02/Annexure25.Proceedings-of-Medical-Stakeholders-Need-Assessment-Workshop-Bhubaneswar-24th-February-2020.docx.pdf
Urban Integrated Environment Modelling and Services for Indian Cities	**19th February 2020, Bhubaneswar** https://climateandcities.org/wp-content/uploads/2022/01/Workshop-on-Urban-Integrated-Environment-Modelling.pdf
Sensitisation-Cum-Training workshop on Management of Heat Stress and Related Illness	**March, 2021, Bhubaneshwar** https://climateandcities.org/wp-content/uploads/2022/01/Annexure26.Sensitisation-Cum-Training-workshop-on-Management-of-Heat-Stress-and-Related-Illness-Bhubaneswar-March-2021-1.pdf

Presentations

International	Links
UNFCCC COP 25 Chile- Madrid - Indian Pavilion & CBK2A Hub	5th & 6th December, 2019, Chile https://climateandcities.org/wp-content/uploads/2019/12/IRADe_COP25-Presentation-051219-1.pdf
Indian Society for Ecological Economics (INSEE) International Conference	6th November 2019, Hyderabad https://climateandcities.org/wp-content/uploads/2022/01/Annexure32.-IProceedings-of-'Climate-Disaster-Resilient-Urban-Development-at-the-INSEE-CESS-Hyderabad-India-6-8-November-2019.pdf
Global Heat Health Information Forum - 2nd Global Forum on Heat and Health	14th February 2020, Pune https://climateandcities.org/wp-content/uploads/2020/02/Annexure31.Proceedings-of-South-Asia-Heat-Health-Summit-Pune-on-14-February-2020-.pdf
Preliminary Meeting South Asian Heat Health Information Network (SAHHIN)	https://climateandcities.org/wp-content/uploads/2020/03/Annexure45.Proceedings-of-SAHHIN-Preliminary-Meeting-and-Concept-Note-.docx.pdf
International Conference on Sustainable Development (8th ICSD) • Climate Adaptive Heat Action Plans for Vulnerable Poor: A case study of Bhubaneshwar city, Odisha • Nature Based Solutions for Heat Wave Management in cities	21st -22nd September 2020- online https://ic-sd.org/wp-content/uploads/2020/11/Rohit-Magotra_Climate-Adaptive-Heat-Action-Plans-for-Vulnerable-Poor-%D1%8FA-case-study-of-Bhubaneshwar-city-Odisha.pdf https://ic-sd.org/wp-content/uploads/2020/11/Rohit-Magotra_Nature-based-Solutions-for-Heat-Stress-Management.pdf
Climate Adaptive Heat Stress Management in South Asia - GOBESHONA Global Conference	18th -24th January 2021- Online https://climateandcities.org/wp-content/uploads/2021/02/Heat-Stress_Rohit_22.1.21_finalF1.pdf
Mr. Rohit Magotra Speaker at the webinar "Making Cities Resilient to Heat Stress" organised by CDKN, ICLEI and TARU on "How Climate Resilient Initiatives can help cities in reducing heat stress".	29th January 2021 https://talkofthecities.iclei.org/cdkn-programme-knowledge-accelerator-supports-various-initiatives-to-build-heat-resilience-of-the-cities-and-capacitate-school-students/
Mr. Rohit Magotra Speaker at 'Jagrukta Abhiyan for COVID-19 Pandemic' organized by NASI HQ and NASI Kerala Chapter.	12th February 2021 Online http://nasi.nic.in/NASI-Report%20on%20Feb.%202021%20Activities-merged.pdf
Webinar -Heat Wave South Asia – South Asia by South Asian Meteorological Association (SAMA), India Meteorological Society (IMS)- Jaipur Chapter and South Asia Heat Health Network (SAHHIN)	6th June, 2021 https://climateandcities.org/3805-2/
6th International Climate Change Adaptation Conference	https://climateandcities.org/wp-content/uploads/2022/01/Session-Proceedings-adaptation-futures-irade.pdf https://climateandcities.org/wp-content/uploads/2022/01/Session-Proceedings-adaptation-futures.pdf

National	Links
National Disaster Management Authority (NDMA) National Heat Wave Conference	5th -6th December 2019, Bangalore https://climateandcities.org/wp-content/uploads/2022/01/National-workshop-on-HSAP_PPT_5.12.19.pdf
ESRI India Users Conference	29th August 2019, Delhi https://climateandcities.org/wp-content/uploads/2022/01/FinalESRIposter2482019-1.pdf
National Symposium on Innovation in Geospatial	20th -22nd November 2019, Shillong https://climateandcities.org/wp-content/uploads/2022/01/Annexure40.National-Symposium-on-Innovation-in-Geospatial-Technology.pdf

SAHHIN Master Classes

Master Classes

Masterclass on Heat Threshold for Indian Cities, by Dr. SC. Bhan, Scientist, IMD, 2021	https://climateandcities.org/first-sahhin-global-masterclass-on-heat-threshold-for-indian-cities/ https://climateandcities.org/wp-content/uploads/2021/08/SAHHIN-Master-Class-Final_Dr-Bhan.pdf
Masterclass on Climate Adaptive Heat Action Plans, by Rohit Magotra, Deputy Director, IRADe, 2021	https://climateandcities.org/second-sahhin-global-masterclass-on-climate-adaptive-heat-action-plans/
Masterclass on Early Warning Systems for Heat Stress Management'', by Dr. Ajit Tyagi, Senior Advisor, IRADe, 2021	https://climateandcities.org/wp-content/uploads/2021/08/Master-Class_Heat-Action-Plan_V9_RM.pdf https://climateandcities.org/3835-2/
Master Class on 'Heat Early Warning Systems-Scientific Approaches for Estimating Thresholds' by Abhiyant Tiwari, Assistant Professor and Program Manager, GIDM, 2021	https://climateandcities.org/wp-content/uploads/2021/08/Heat-Wave-Dr-Tyagi-SAHHIN-Master-Class-rev-1.pdf https://climateandcities.org/fourth-global-master-class-on-heat-early-warning-systems-scientific-approaches-for-estimating-thresholds/

SAHHIN News-mailer

News Mailer Issues

Fortnightly Issue #1, Volume I: July 2021	http://eepurl.com/hCNjTX
Fortnightly Issue #2, Volume I: July 2021	http://eepurl.com/hDOEjn
Fortnightly Issue #3, Volume I: August 2021	http://eepurl.com/hD5PIX
Fortnightly Issue #4, Volume I: August 2021	http://eepurl.com/hGajlb
Fortnightly Issue #5, Volume I: September 2021	http://eepurl.com/hGL5Fn
Fortnightly Issue #6, Volume I: September 2021	http://eepurl.com/hIo4OH
Fortnightly Issue #7, Volume I: September 2021	http://eepurl.com/hJK8vD
Fortnightly Issue #8, Volume I: October 2021	http://eepurl.com/hKWA0
Fortnightly Issue #9, Volume I: October 2021	http://eepurl.com/hMb0UT
Fortnightly Issue #10, Volume I: November 2021	http://eepurl.com/hNp9cr
Fortnightly Issue #11, Volume I: November 2021	http://eepurl.com/hOTwpz
Fortnightly Issue #12, Volume I: December 2021	http://eepurl.com/hPzR0P
Fortnightly Issue #13, Volume I: December 2021	http://eepurl.com/hRekub

The Climate Centre for Cities (C-cube) within the National Institute of Urban Affairs (NIUA), instituted by the Ministry of Housing and Urban Affairs (MoHUA), has partnered with Integrated Research & Action for Development (IRADe), for developing climate-smart cities across India.:

https://climateandcities.org/wp-content/uploads/2020/11/Annexure35.Collaboration-with-Climate-Centre-for-Cities-C-Cube-at-NIUA_Press-Release_Final.docx-1.pdf

11 South Asia Heat Health Information Network (SAHHIN)

- **SAHHIN Master Classes**
- **SAHHIN News mailers**

• Over 4 master classes on Heat Stress Management, Action Plan, Early warning systems and heat threshold • Field Expert • Global Participation	• Over 9 news mailers published and circulated • Global Subscription • 20,000 Plus subscription

SAHHIN is an independent, voluntary, and member-driven forum of scientists, practitioners, and policy makers focused on improving capacity to protect populations from the avoidable health risks of extreme heat in a changing climate.

Vision

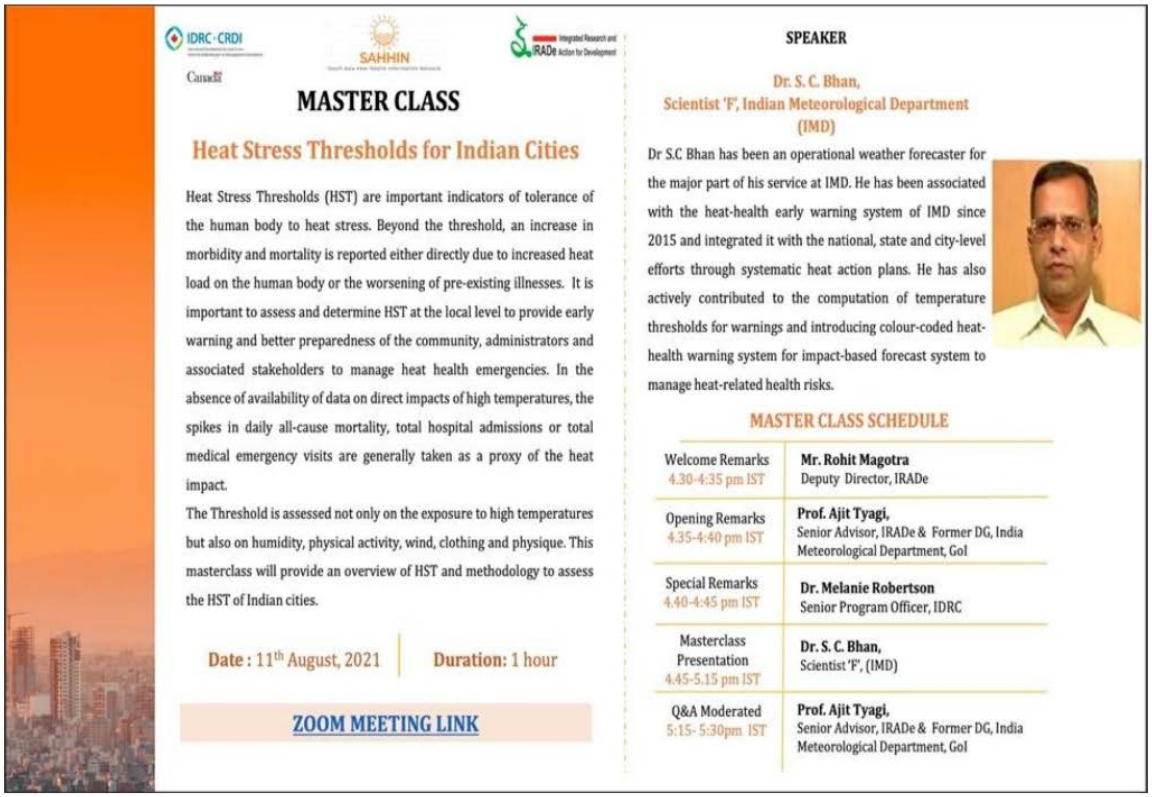
- Improved capacity of professionals, organizations, and governments to protect populations from the preventable health impacts of extreme ambient heat.
- The network aims to create a common space to promote evidence-driven interventions, shared-learning, co-production of information, synthesis of priorities, and capacity building that can empower multi-disciplinary actors to take more effective and informed life-saving preparedness and planning measures.

11.1 SAHHIN Master Classes

The goal of each masterclass is to share actionable information that can be used and applied by the cities for a better heat wave management in their city/state/country. The topics addresses the core areas that help mitigating and building adaptive capacities for management of heatwave.

Masterclass on Heat Threshold for Indian Cities, by Dr. SC. Bhan, Scientist, IMD, 2021

The class provide an overview of HST and methodology to assess HST of Indian cities, was attended by over 90 participants across the globe.

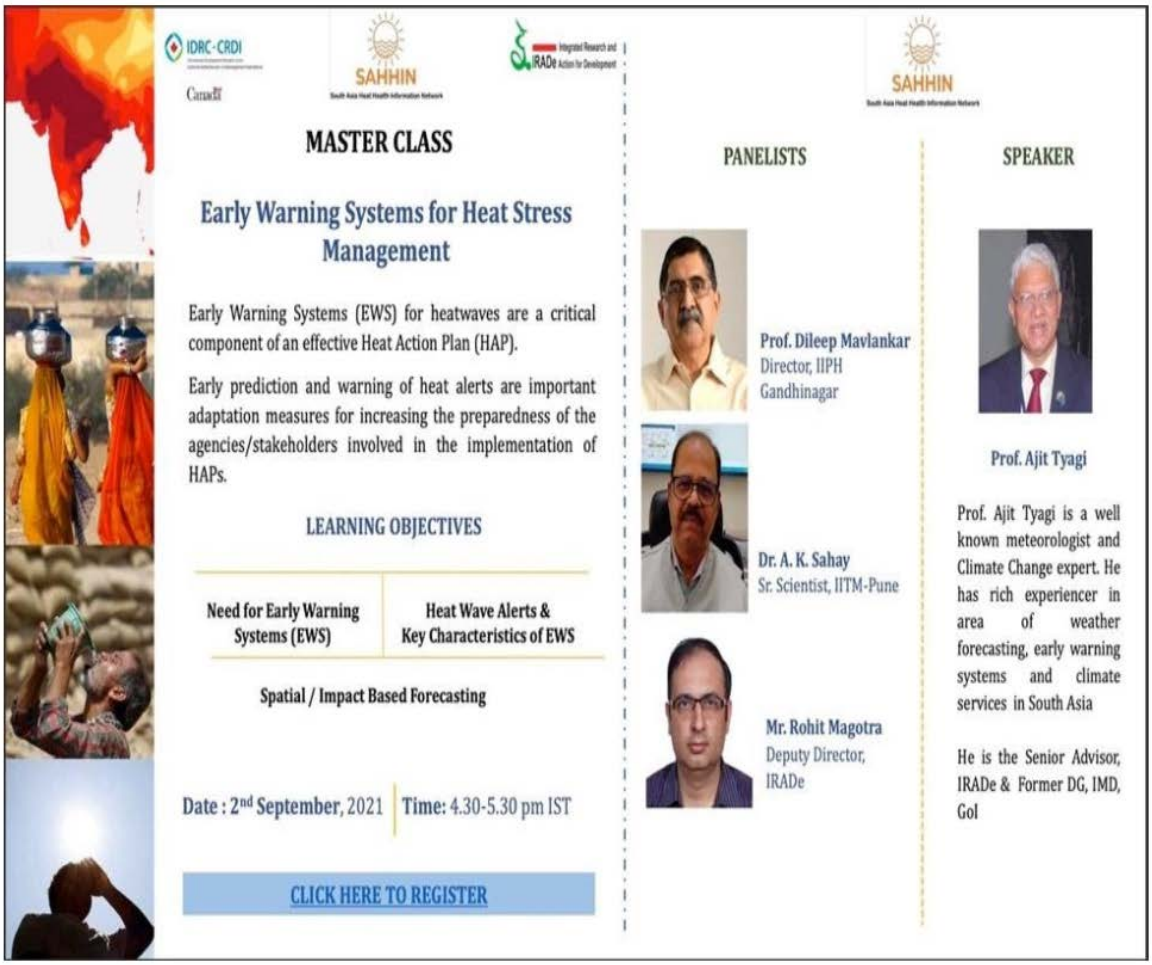


Masterclass on Climate Adaptive Heat Action Plans, by Rohit Magotra, Deputy Director, IRADe, 2021

The Master class provided an understanding of Heat Action Plan features, along with identification and mapping of heat hotspots and developing heat adaptation strategies for managing heat stress for cities. The Masterclass was attended around 70 participants (researchers, scientists, students, environment consultants, programme directors, academicians, climates researchers).

Masterclass on Early Warning Systems for Heat Stress Management'' by Dr. Ajit Tyagi, Senior Advisor, IRADe 2021

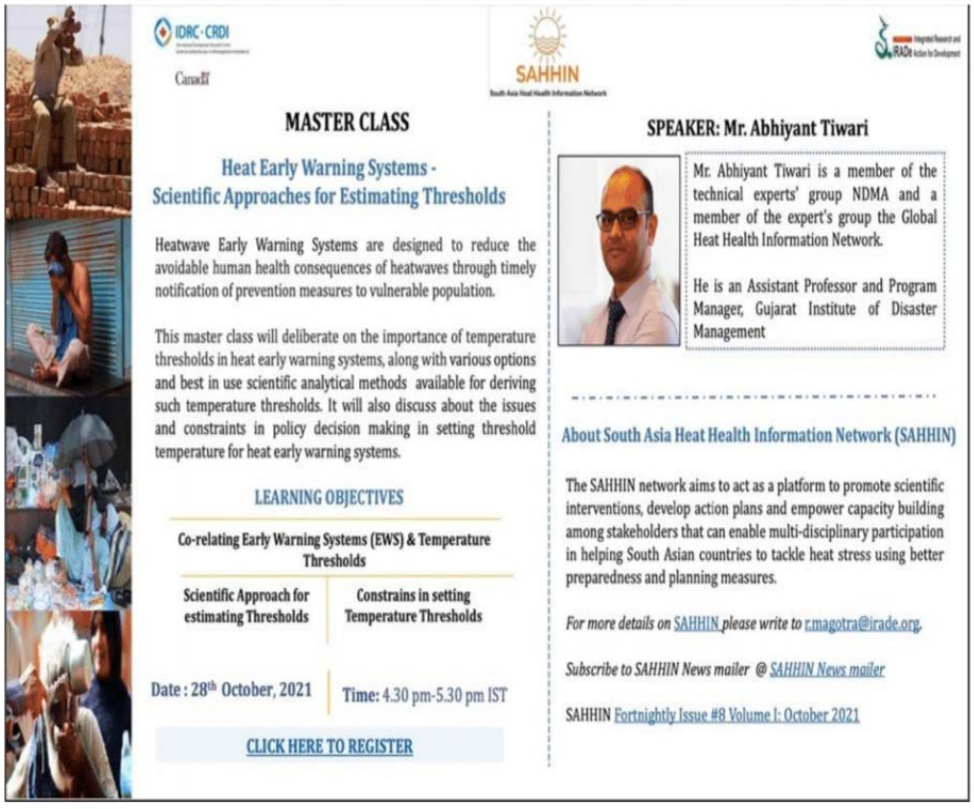
The master class discussed the components of early warning system for heat stress management. The session was attended by over 70 participants across the globe.



Master Class on 'Heat Early Warning Systems-Scientific Approaches for Estimating Thresholds' by Abhiyant Tiwari, Assistant Professor and Program Manager, GIDM, 2021

The Master class deliberated on the importance of temperature thresholds in heat early warning systems, along with various options and best in use scientific analytical methods available for deriving such temperature thresholds. It discussed issues and constraints in policy decision-making in setting threshold temperature for heat early warning systems.

The session was attended around 50 participants (researchers, scientists, students, environment consultants and academicians) across the globe.



The SAHHIN News mailer shares information with partners and stakeholders, provides details and news (global, regional and national level) on heat waves.
SAHHIN news mailer is a fortnightly on Heat Stress news from South Asia and across the globe.
Seven issues have been published and circulated to over 1000 people. (or 2000 ??)

12 Research to Action Impacts

Policy changes at the State/city level

- The **Odisha Heat Action Plan 2020** includes the heat wave impacts, heat spots and the vulnerability assessment of people to be better prepared for the heat stress management in the state.
- The **Rajkot Municipal Corporation (RMC)** lowered the standard heat wave alerts by half a degree to prevent mortality from heat stroke as well as other heat-related malaises.
- Delhi has developed a **Heat Stress Advisory for New Delhi Municipal Corporation (NDMC**) in consultation with the Director of Medical Services, NDMC. The heat advisory was also translated into Gujarati l in Rajkot.

Stakeholder's Capacity building

- **Module for medical stakeholders for management of Heat-related illness** was developed by IIPH-G and IRADe.
- The **Heat Stress Action Plans** for the cities of Bhubaneshwar, Rajkot and Delhi were developed for their wider dissemination to the policy makers, city level stakeholders and the communities.
- The Rajkot Municipal Corporation (RMC) in collaboration with IRADe **implemented the Heat Stress Action Plan (HSAP).**

Dissemination

- Advocacy for **incorporating 'Measures to prevent heat stress related illnesses' on prescription slips** of Hospitals under New Delhi Municipal Corporation.
- The door-to-door surveys as the respondents were informed about the heat wave and its impacts in nearly **970 households of the project cities** disseminated information about the potential impacts of heat waves.
- Workshops for training **over 200 Medical Stakeholders** were organized in Bhubaneswar, Rajkot and Delhi in collaboration with City Municipal Corporation and Indian Institute of Public Health, Gandhinagar (IIPH G).
- **Over 12 Workshops and evidence sharing sessions at National and International Conference** with policy-makers and influencers were held in Bhubaneswar, Rajkot, and Delhi to sensitize the city stakeholders about the need of Heat Stress Action Plans.

Socio-economic impacts (health, productivity, livelihood and gender)

- Heat Stress Action Plans for Delhi, Rajkot and Bhubaneswar has helped **in identification of socio-economic vulnerabilities and heat vulnerable hotspots.**
- Sector and the stakeholder specific impacts were recognised and targeted measures were planned as an **immediate, medium- and long-term measures for managing heatwaves.**
- The Heat Stress Advisory spread **awareness among the working class** on ways to **improve the productivity** during peak summer season.
- The ULBs set up **ORS corner and Rapid Response Team (RRT) at all Urban Health Centres (UHC)** and water points and buttermilk distribution at more than 300 locations during peak summer season.

Communication and IEC

- **Distribution of 15,784 Heat Advisory pamphlets** in regional languages and and release of press notes.
- **LED screen displays, hoardings, posters and pamphlets** on heat wave impacts at different places in the project cities. Project outreach through **press releases, articles and interviews** through print and electronic media.
- The **South Asian Heat Health Information Network (SAHHIN)** was created to share work and experiences with related organizations and institutions.

About IRADe

IRADe is an independent advanced research institute that aims to conduct research and policy analysis to engage stakeholders such as government, non-governmental organizations, corporations, academic and financial institutions. Energy, Climate Change, Urban Development, Poverty, Gender Equity, Agriculture and Food Security are some of the challenges faced in the 21st century. Therefore, IRADe research covers these, as well as policies that affect them. IRADe's focus is effective action through multidisciplinary and multi-stakeholder research to arrive at implementable solutions for sustainable development and policy research that accounts for the effective governance of techno-economic and socio-cultural issues. For more details, check www.irade.org.

About IDRC

IDRC was established by an act of Canada's parliament in 1970 with a mandate "to initiate, encourage, support, and conduct research into the problems of the developing regions of the world and into the means for applying and adapting scientific, technical, and other knowledge to the economic and social advancement of those regions." As part of Canada's foreign affairs and development efforts, IDRC champions and funds research and innovation within and alongside developing regions to drive global change. IDRC is governed by a board of up to 14 governors, whose chairperson reports to Parliament through the Minister of International Development. Learn More https://www.idrc.ca/en

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