Proceedings of

International Workshop on Heatwaves 2025

Advancing City-Level Heat Action Plans: Multi-Sectoral Adaptation for creating Resilient Communities

February 13-14, 2025 | Vigyan Bhavan, New Delhi

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The organisation of the International Workshop on Heatwave 2025 and the development and dissemination of the proceedings document has been supported under the UNEP-SDC BeCool project supported by the Swiss Agency for Development and Cooperation (SDC) in addition to other knowledge partners.

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FOREWORD
HOD, NDMA

Building on the success of the National Workshop on Heat Wave 2024, the International Workshop on Heatwave 2025 is a continuation of its efforts to facilitate dialogue, share best practices, and enhance coordination among national and international stakeholders. Titled " Advancing City -Level Heat Action Plans: Multi-Sectoral Adaptation for Creating Resilient Communities" This workshop provided a critical platform for experts, policymakers, scientists, and practitioners to discuss emerging challenges, review progress, and explore innovative solutions for heat wave management.

India's Heat Action Plans (HAPs) have proven to be effective in reducing heat-related morbidity and mortality through a multi-sectoral approach involving early warning systems, public awareness campaigns, and targeted interventions for vulnerable populations. The insights gathered from this workshop will further strengthen HAPs by integrating advancements in climate forecasting, urban planning, and adaptive measures to protect at-risk communities.

The multidimensional inputs received from multi-stakeholders are considered highly insightful in reinforcing the ongoing heatwave efforts in India. NDMA dedicatedly will provide oversight in implementing these insights with all states and UTs for effective heat wave risk management in India. NDMA is dedicated to support effective implementation of HAPs in all the state and UTs of India through an all stakeholder inclusive approach. We will soon be collaborating in implementing pilot in one of the state/UTs in this regard.

As climate change continues to exacerbate extreme weather events, NDMA remains committed to fostering collaborative initiatives at national, regional, and global levels. By prioritizing risk-informed planning, capacity building, and policy implementation, we aim to build a resilient nation equipped to tackle the- challenges posed by heat waves and other climate-induced hazards.

I extend my gratitude to all participants and partner organizations who contributed their expertise and experiences to make this workshop a success. I am confident that the proceedings of this workshop will serve as a valuable resource in shaping India's future strategies for heat wave mitigation and resilience-building.

Rajendra Singh,
Member & Head of Department
National Disaster Management Authority (NDMA), Government of India

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CONCEPT OF THE WORKSHOP

India is experiencing a rise in extreme heat events, and urban areas are especially vulnerable due to rapid urbanization, high population density, and limited green spaces. Heatwaves have become increasingly severe in recent years, primarily because of climate change. In 2024, India experienced severe heatwaves and nearly a quarter of the country's territory (24%) has experienced one of the longest heat spells ever recorded, ranking within the top five in terms of duration. Northwest India has seen temperatures soar close to 50 degrees Celsius. In 2024, extreme hot weather conditions had proven to be exceptionally lethal, claiming over 150 lives and disproportionately impacting the health of thousands of people from marginalized communities such as the urban poor, informal settlements (slums), elderly, children, and those with pre-existing health conditions. Such impacts are due to factors like inadequate housing lacking basic passive cooling, lack of access to cooling facilities, heat being trapped in urban areas with lack of green cover and underlying health disparities.

A study from 2021 highlighted that India is projected to bear nearly half of the global labour productivity losses attributed to hot and humid conditions among the top 10 affected countries. In recent years, combination of intense heat and humidity is exposing the population to conditions that exceed human tolerance and survivability. This risk is further increased in cities, in large part due to the Urban Heat Island effect, where city landscapes have changed from green & blue to more built surfaces, which release absorbed heat making urban areas experience higher temperatures than surrounding rural areas. Cities tend to trap heat, leading to higher temperatures and this phenomenon intensifies during heatwaves, exacerbating the extreme temperatures. Urban citizens can have few opportunities to escape this heat with poor housing and lack of access to green and cooled spaces. Periods of high temperatures can strain infrastructure such as transport systems, power grids etc. leading to potential breakdowns and blackouts.

Between 1970 and 2018, India's urban population has increased fourfold to 460 million, therefore there is a need to design cities with green & blue spaces, urban forests, cool roofs and surfaces, and natural ventilation that can mitigate the urban heat island effect. Implementing heat action plans, providing subsidies for cooling technologies, and improving access to healthcare and improved early warning services during heatwaves are crucial. Upgrading housing quality to have proper ventilation, shading and passive design features, ensuring access to clean drinking water, ensuring reliable water and power supply, and enhancing public transportation to reduce reliance on walking during extreme heat events are essential steps.

In response to these challenges, developing city-level Heat Action Plans (HAPs) is considered extremely essential for advancing climate resilience and safeguarding public health. A comprehensive approach encompassing development and effective implementation of City (HAPs), enhanced awareness and education, capacity building programmes, engagement with the communities & knowledge partners, collaboration and coordination with the various stakeholders and annual evaluation of these activities can be the starting steps. Cities in India are developing Heat Action Plans that combine measures to lower urban

temperatures (such as urban greening and reflective roofs), provide reliable indoor thermal comfort through passive and active cooling and public health measures (such as heat-health early warning systems). . However, there is a key knowledge gap on the relative efficacy of these actions.

Understanding the need of hour, National Disaster Management Authority (NDMA) organised a two day International Workshop on Heatwave 2025 with the Theme “Advancing City-Level Heat Action Plans: Multi-Sectoral Adaptation for Resilient Communities”. The aim was to bring together urban planners, government officials, civil society organizations, researchers, and experts to explore innovative, multi-sectoral strategies for adapting cities to extreme heat. The workshop focused on strengthening the effectiveness of existing heat action plans and fostering collaboration between various sectors such as Early Warning, health, power, water, infrastructure, urban planning, and social welfare. UNEP Cool Coalition supported the workshop through bringing on board several international and national experts as well as champion cities globally to share their experiences and perspectives. The workshop created a platform for cross-country learning, across governance levels and multi sectors.

Key Themes, Structure, Objectives and Expected Outcome of the Workshop

Key Themes

The workshop was structured around the following themes under Six technical sessions:

Evolution and Implementation of City Heat Action Plans (HAPs):

- Monitoring, evaluation and Impact assessment of City Heat Action Plans.
- Integrating Health systems, Early warning system, urban heat Island, climate change impacts, and vulnerability of cities & communities into HAPs.
- Learnings from past experiences and knowledge sharing in preparation HAPs.
- Financing Heat Action Plans for sustainable implementation and visible impacts.
- Parametric Insurance

Multi-Sectorial Collaboration and Community Centric Approaches in Heat Resilience:

- Urban Planning, Sectorial impacts & collaboration and Infrastructure Adaptation.
- Role of communities to reduce the impacts of extreme heat events,
- Community Education and Awareness,
- Community-Led Cooling Solutions, Traditional Knowledge and Practices in building long term resilience.

Innovative Technologies for Heat Adaptation and Mitigation:

- Advances in science of smart cooling systems, urban greening initiatives, cool roofing materials for long term Heat resilience
- Heat-Health forecasting models and early warning system
- Monitoring and data collection, Heat vulnerability mapping
- Technologies in planning, development, implementation of HAPs and feed-back.
- Role of heat-resilient urban infrastructure, public transport, renewable energy technologies in mitigating heat.

Structure

The workshop consisted of the following sessions:

- **Inaugural Session:** Included welcome address, introduction to the workshop, review of 2024 proceedings, keynote speeches by experts in climate resilience with focus on Heatwaves.
- **Technical Sessions:** Experts shared successful case studies from Heat Action Plans implemented in India and international examples that could be adapted for Indian contexts. Sectorial heat resilient adaptation & mitigation strategies and specific challenges, opportunities, and cooling solutions in the context of heat resilience India were discussed. Panel discussions were held with government officials, urban planners, Knowledge Partners and civil society leaders to discuss policy, solutions for heat resilience, funding mechanisms, and partnerships for implementing heat action plans.

- **Closing Session:** Summarizing key takeaways, drafting action plans, and setting up mechanisms for follow-up collaboration and monitoring.

Objectives

- **Support City-Level Action Plans:** Provide technical guidance and tools for strengthening and scaling up HAPs for improving city level preparedness.
- **Promote Multi-Sectoral Collaboration:** Foster cross-sector collaboration between urban planning, public health, water management, EWS, disaster management, and infrastructure and other relevant sectors for heat mitigation.
- **Enhance Knowledge:** Share best practices and case studies of successful and replicable HAPs – local and global.
- **Build Capacity:** Equip local stakeholders with the necessary tools, resources, and strategies to address urban heat and improve resilience to heat waves.
- **Strengthen Adaptation and Mitigation Strategies:** Identify gaps in existing heat action plans and discuss strategies for overcoming these challenges with a focus on marginalized and vulnerable communities

Expected Outcomes

By the end of the workshop, the following outcomes are expected:

- **Strengthened Heat Action Plans:** Strengthening Heat Action Plans with inclusion of Urban Heat Island Mapping, vulnerability assessments and long term city specific heat mitigation strategies. Participants will return to their states, districts and cities with clear strategies and enhanced knowledge for improving and implementing their HAPs.
- **Collaboration Networks:** Establishment of new partnerships between government bodies, civil society organizations, and the private sector for the implementation of heat action plans & sustainable cooling in cities.
- **Actionable Recommendations:** A set of practical recommendations for advancing multi-sectoral adaptation to extreme heat, especially for vulnerable communities.
- **Monitoring and Evaluation Framework:** A framework for tracking the progress of heat action plans, including key performance indicators (KPIs) and guidelines for scaling up successful initiatives.
- **Policy Advocacy:** Identification of policy gaps and advocacy strategies to strengthen national and state-level policy on urban heat resilience.
- **Innovative Solutions:** Further development of Early Warning Systems, innovative financing for HAPs, affordable, replicable innovative cooling solutions for vulnerable populations were some of the other outcomes of the workshop.

Technical Schedule of the Workshop

Committee on Disaster Risk Reduction (CoDRR) 8: International Workshop on Heatwaves 2025

Day-1 (13th February 2025)

REGISTRATION (09.00-10.00)	
INAUGURAL SESSION (10.00 - 11.00)	
10.00- 10.10	Welcome Address and Context Setting: Sh. Rajendra Singh, Member & HoD, NDMA
10.10 – 10.20	Review of Last Year's proceedings: Ms. Mrinalini Shrivastava, Director, NDMA
10.20- 10.25	Address: Dr. Rajesh Gupta, Joint Secretary, DM Division, MHA
10.25- 10.30	Address: Sh. Marc Gordon, UNDRR
10.30 – 10.35	Address: Dr. Balakrishna Pisupati, UNEP India Country Head
10.35- 10:50	Inaugural Address: Ms. Sujata Saunik, Chief Secretary, Maharashtra
10.50- 10:55	Release of Publications: 1. Proceedings of National Consultative workshop on "Forest Fire and its Challenges" 2. A Landscape Study of Diverse Climatic Zones on "Anticipatory Action in Heatwaves – Indian Community Perspectives".
10.55 – 11.00	Vote of Thanks: Ms. Mrinalini Shrivastava, Director, NDMA
TEA BREAK (11.00 – 11.30)	
TECHNICAL SESSION I (11.30 – 13.30)	
Heat Wave – Early Warning Services **CHAIR: Sh.** Rajendra Singh, Member & HoD, NDMA **Co-Chair:** Dr. Mrutyunjay Mohapatra, DG IMD **Moderator:** Sh. Safi Ahsan Rizvi, Advisor, NDMA **Rapporteur:** Ms. Shalini Singh, Sr. Consultant and Sh. Abhinav Walia, Sr. Consultant	
11.30 – 13:30	**Thematic Areas:** • Integrating early warning systems, localised temperature thresholds and Heat Index into HAPs and common alert protocol (CAP) • Upscaling services and plans for the 2025 heatwave season • Long-term heat resilience in India: Preparing for a 1.5°C world • Mobilising communities for sustainable urban heat management • Inter-agency coordination • Role of knowledge partners in heat mapping
	Discussants: 1. Dr. Mrutyunjay Mohapatra, Director General IMD 2. Dr. Lucas Vargas Zeppetello, UC Berkeley (ONLINE) 3. Dr. Ashok Gadgil, UC Berkeley 4. Col. K.P. Singh, Advisor, NDMA 5. Sh. Abhiyant Tiwari, NRDC India 6. Ms. Minni Sastry, UNEP 7. Sh. Rohit Magotra, Deputy Director, IRADe 8. Prof. Sagnik Dey, IIT, Delhi 9. Dr. Susmitha Joseph, Scientist-F, IITM 10. Ms. Samhita, CEO, Resilience AI solutions

LUNCH BREAK (13.30 – 14:30)

TECHNICAL SESSION II (14.30 – 16.00)

Heat Action Plans- Indian Perspective
(Preparation, Implementation, Monitoring, Evaluating and Learning)
CHAIR: Ms. Sujata Saunik, Chief Secretary, Maharashtra
Moderator: Ms. Mrinalini Shrivastava, Director, NDMA
Rapporteur: Sh. Amit Tuteja, Sr. Consultant and Dr. Vazeem Iqbal, Consultant

14.30- 16.00	**Thematic Areas:** • Current Status of HAPs in India • Challenges and best practices in developing and implementing city HAPs • Methodology for assessing Urban Heat Island (UHI) effects • Integrating the vulnerability of communities • Assimilation of technology in HAP preparation and implementations • Inter-agency coordination • Community education and awareness campaigns • Occupational and gender-related considerations • Upscaling services, plans, and cooling solutions for the 2025 heatwave season **Discussants:** 1. Sh. Rajan Rawal, Professor (ONLINE) and Tej Chavda, CEPT University 2. Dr. Ritika Kapoor, NRDC India 3. Dr. Vishwas Chitale, CEEW 4. Sh. Aditya Valiathan Pillai, SFC 5. Sh. Mahesh Narvekar, Director, Disaster Management Department, BMC 6. Sh. Amit K Dongre, CFO, AMC 7. Ms. Sudha, State Planning Commission, Tamil Nadu 8. Sh. Manan Bhan, ATREE (ONLINE) 9. Prof. Ashfaque Jafari, SDMA Govt. of Telangana 10. Prof. Parmeshwar Udmale, IIT Bombay 11. Sh. Bhagwat Singh, Joint Secretary & Nodal Heat Officer, Govt. of Rajasthan 12. Ms. Sigy Thomas Vaidhyan, Commissioner, SDMA, Tamil Nadu 13. Ms. Prathigna Poonacha, IIHS

TEA BREAK (16.00 – 16.30)

TECHNICAL SESSION III (16.30 – 18.00)

Heat Action Plans- Global Perspective
(Preparation, Implementation, Monitoring, Evaluating and Learning)
Role of India in contributing to Global Framework
CHAIR: Sh. Uday Khemka, Khemka Foundation
Moderator: Sh. Marc Gordon, UNDRR
Rapporteur: Sh. Priyank Jindal, Sr. Consultant and Sh. Satya Kumar, Sr. Consultant

16.30 – 18.00	**Thematic Areas:** • Best practices for preparation, monitoring, evaluation, and impact assessment of city HAPs • Challenges, Scalability and Replicability • Community education and awareness campaigns • Learnings from past experiences, knowledge sharing, and challenges in heatwave management with future perspective • Mobilising communities for sustainable urban heat management • Performance Indicators for effective HAPs **Discussants:** 1. Dr. Satchit Balsari, Harvard University (ONLINE) 2. Dr. Lucas Vargas Zeppetello, UC Berkeley (ONLINE) 3. Sh. Eleni Myrivili, Chief Heat Officer, United Nations Human Settlements Programme (ONLINE) 4. Ms. Jane Gilbert, Miami-Dade, Chief Heat Officer (ONLINE) 5. Dr. Ashok Gadgil, UC Berkeley 6. Sh. Benjamin Hickman, UNEP 7. Sh. Tarun Garg, Principal, RMI India 8. Dr. Priyadarsini Rajgopalan, Associate Dean, RMIT Australia (ONLINE) 9. Sh. Shubham Tandon, UNDP 10. Sh. Sarabjit Sahota, UNICEF 11. Dr. Anshu Dogra, IIT Delhi

DAY-2 (14th February 2025)

TECHNICAL SESSION IV (10.00 – 11.30)

Heat- Health Adaptation
CHAIR: Sh. P N Rai, Member, BSDMA
Moderator: Ms. Soumya Swaminathan, MSSR Foundation, Former Chief Scientist, WHO
Rapporteur: Sh. Priyank Jindal, Sr. Consultant and Sh. Satya Kumar, Sr. Consultant

	Thematic Areas: • Understanding global advances in heat-health literature including all-cause mortality • Aligning policies and best practices for health system resilience to heat with specific focus on Hospital Fires owing to heat. • Occupational and gender-related heat-health considerations • Health and livelihood impact of indoor heat • Passive cooling and heat-resilient building design • Indigenous knowledge and community-led traditional cooling solutions • Animal health and crop adaption
10.00- 11.30	Discussants: 1. Dr. Poornima Prabhakar, Ashoka University 2. Dr. Satchit Balsari, Harvard University (ONLINE) 3. Dr. Vikas Desai, Urban Health & Climate Resilience Center of Excellence, Surat 4. Dr. Mahaveer Golechha, IIPH Gandhinagar 5. Dr. Aakash Srivastava and Dr. Purvi Patel, NCDC 6. Sh. R.C. Sharma, Former Director, Delhi Fire Service 7. Sh. Rama Shankar Sinha, JS - Department of Animal Husbandry & Dairying 8. Dr. V K Sehgal, Scientist IARI and Dr. S Bandyopadhyay, Director MNCFC 9. Sh. Piyush Narang, UC Berkeley

TEA BREAK (11.30– 12.00)

TECHNICAL SESSION V (12.00 – 13.30)

Indian Experience in Mitigating impact of Heat on Infrastructure Particularly Housing
CHAIR: Lt Gen Syed Ata Hasnain, PVSM, UYSM, AVSM, SM, VSM** (Retd), Member, NDMA
Moderator: Sh. Amit Prothi, Director General, CDRI
Rapporteur: Sh. Amit Tuteja, Sr. Consultant and Dr. Vazeem Iqbal, Consultant

	Thematic Areas: • Actionable urban planning • Heat resilient urban infrastructure • Innovative technologies for heat mitigation • Scalable heat resilient solutions like smart cooling systems, urban greening initiatives, cool roofing materials • Technological advances for data collection for long term planning • Architecture of Urban housing for heat mitigation • Affordable Heat resilient Housing

12.00 – 13.30	Discussants: 1. Ms. Sneha Sachar (ONLINE) & Sh. Siddharthan Balasubramanium, India Cooling Lead, CCC 2. Ms. Aarti Nain, NIUA 3. Sh. Parag Talankar, SEEDS 4. Sh. Amit Tripathi, Technical Advisor, CDRI 5. Sh. Alok Kumar, Grid India 6. Sh. S. V. Arunachalam, COO, DIAL 7. Prof. Ashok B Lall, Indian Institute of Architects 8. Ms. Tania Banerjee, BCG 9. Sh. Sanjay Kumar, Regional Director, Ministry of Labour and Employment (MoLE)

LUNCH BREAK (13.30 – 14:30)

TECHNICAL SESSION VI (14.30 – 15.30)

Financing Heat Action Plans
CHAIR: Dr. Krishna S. Vatsa, Member, NDMA
Moderator: Sh. Safi Ahsan Rizvi, Advisor, NDMA
Rapporteur: Sh. Shishir Agarwal, Sr. Consultant and Sh. Abhinav Walia, Sr. Consultant

	Thematic Areas: • HAPs funding mechanisms (Central and State Schemes) • Drawing finances from Finance Commission sources • Green bonds and climate bonds • Parametric insurance for coping with heat impacts • International best practices & PPP model
14.30 – 15.30	**Discussants:** 1. Dr. Sekhar Lukose Kuriakose, Member Secretary, Kerala SDMA. (ONLINE) 2. Ms. Tamanna, SFC 3. Dr. Sahil Hebbar, SEWA 4. Ms. Bijal Brahmbhatt, Mahila Housing Trust 5. Ms. Archana Chaudhary, Director, Climate Trends 6. Sh. Dinesh Arora (ONLINE) & Avdesh Gupta, ADB 7. Ms. Shubra Singh, Khemka Foundation 8. Ms. Jane Gilbert, Miami-Dade, Chief Heat Officer (ONLINE) 9. Sh. Autif Sayed, International Finance Corporation (ONLINE) 10. Sh. Marc Gordon, UNDRR

WRAP-UP SESSION (15.30 – 16.00)

CHAIR: Sh. Sanjeev Kumar Jindal, Additional Secretary, MHA
Co- Chair: Sh. Rajendra Singh, Member & HoD, NDMA
Rapporteur: Ms. Shalini Singh, Sr. Consultant

15.30 - 15.40	Key Take Aways: Ms. Mrinalini Shrivastava, Director, NDMA
15.40 - 15.50	Way Forward: Dr. Krishna S. Vatsa, Member, NDMA
15.50 - 16.00	Concluding Remarks and Vote of Thanks: Sh. Safi Ahsan Rizvi, Advisor, NDMA

TEA (16.00-16.30)

SPECIAL SESSION- FUTURE COLLABORATIONS (16.30 – 17.30)	
CHAIR: Sh. Sanjeev Kumar Jindal, Additional Secretary, MHA **Co- Chair:** Sh. Rajendra Singh, Member & HoD, NDMA **Moderator:** Sh. Safi Ahsan Rizvi, Advisor, NDMA **Rapporteur:** Dr. Vazeem Iqbal, Consultant	
16.30 – 16.40	Sh. Marc Gordon, UNDRR
16.40 – 16.50	Dr. Ashok Gadgil UC Berkeley
16.50 – 17.00	Sh. Amit Prothi, Director General, CDRI
17.00 – 17.10	Dr. Balakrishna Pisupati, UNEP India Country Head
17.10 – 17.20	Dr. Krishna Vatsa, Member, NDMA
17.20 – 17.30	Discussion & Q&A
Discussants: Representatives from NDMA, IMD, NCDC, Ministry of Agriculture/DARE, DAHD, Highway, Power, UNEP, NRDC India, SFC, CEEW, IRADE, SEEDS	

INAUGURAL SESSION:
Welcome and context setting

Rapporteur:

Shri Brahm Parkash Yadav,
Sr. Consultant (Drought and Heat Wave)

The inaugural session commenced with the welcome of Chief Guest and other dignitaries by Shri Rajendra Singh, Member and HoD, NDMA. Following this, a short video presentation showcased NDMA's commendable initiatives in mitigating the effects of heatwaves under the visionary leadership of Hon'ble Prime Minister of India, Shri Narendra Modi ji. The video illustrated India's proactive approach in addressing heatwave challenges through national workshops, widespread awareness campaigns, the establishment of early warning systems, and global recognition of the country's leadership in combating extreme heat.

WELCOME ADDRESS AND CONTEXT SETTING:

Shri Rajendra Singh,
Member & HoD, NDMA

Delivering the welcome address, Shri Rajendra Singh, Member & HoD, NDMA, extended a warm welcome to the distinguished national and international participants. He said that it is truly a privilege to gather with such an esteemed group of national and international professionals, experts, policymakers, and stakeholders here today, as we embark on this important workshop focused on **"Advancing City-Level Heat Action Plans: Multi-Sectoral Adaptation for Creating Resilient Communities."** National Disaster Management Authority is conducting such workshops on Heatwaves every year since 2017. However, this is the first time that we have escalated it to an international participation. This has come by after India's own efforts in preparedness and developing a framework for Heatwave Mitigation & Management, last year. India is home to a vast diversity of climates, and as our cities continue to grow and urbanize, the effects of extreme heat and climate change have become increasingly apparent.

His address underscored the increasing frequency and intensity of heatwaves due to climate change, posing significant threats to urban environments and disproportionately affecting the most vulnerable members of our communities. The challenges posed by rising temperatures are not just about discomfort but also about the immense health, social, and economic impacts they create for communities, particularly vulnerable groups. In a country with a rapidly growing urban population, the need for effective, city-specific heat action plans has never been more urgent than today He stressed the urgent need for multi-sectoral adaptation strategies to enhance climate resilience and safeguard populations from extreme heat stress. This workshop is an essential step in a shared journey towards finding sustainable, multi-sectoral solutions that address these challenges head-on.

He highlighted that through this forum, we hope to strengthen our collective understanding of how heat action plans can be developed and implemented in an integrated, cross-sectoral manner through knowledge sharing of global experiences and best practices for advancing the city heat vulnerability mapping and undertaking monitoring and evaluations about efficacy of HAPs in line with internationally accepted practices. As a nation committed to addressing climate change, India has taken decisive steps towards building adaptive and resilient urban landscapes through innovative heat action plans.

He further highlighted that rapid urbanization of Indian cities presents a unique set of challenges, including intensified urban heat island effects and disproportionate heat stress on vulnerable communities such as daily wage labourers, elderly populations, and those lacking access to cooling solutions. He emphasized that India has successfully developed over 250 Heat Action Plans, and introduction of Designated Heat Officers in several states has been a crucial step in ensuring structured implementation and governance of heatwave mitigation strategies. He emphasized that the process of adaptation should be inherently local. While global and national frameworks provide important guidance, it is the cities that must take the lead in tailoring responses to their unique contexts. He stressed that program of the workshop is structured to cover issues ranging from urban planning, especially housing, healthcare, early warning, energy systems, infrastructure resilience to community engagement and role of local governance in preparing, implementing and financing HAPs, all of which play a crucial role in tackling the heat impacts that are increasingly shaping urban life. He put forth the primary objectives of the workshop as follows:

1. Encouraging more Indian states to officially notify heatwaves as a disaster, thereby enabling better resource allocation and governance. Currently, only eight states have done so.
2. Facilitating the exchange of global best practices and lessons learned in extreme heat management.
3. Identifying barriers and opportunities for strengthening city-level Heat Action Plans (HAPs) and developing actionable recommendation to ensure HAP's effective implementation.
4. Fostering international collaboration among governments, civil society, the private sector, and local communities to advance heat resilience efforts.

While concluding his address, Shri Rajendra Singh hoped that conversations and outcomes of this workshop will serve as a stepping stone towards a more resilient and adaptive India and abroad—one where our cities are not only prepared to handle extreme heat but are designed to thrive in the face of it.

He encouraged all the delegates to engage actively and share their perspectives, experiences, and ideas, as it will be invaluable in shaping the way forward. While summing up, he set the target of zero mortality in India and across the globe for the upcoming heat wave season 2025.

REVIEW OF PREVIOUS YEAR'S ACHIEVEMENTS BY

Ms. Mrinalini Shrivastava,
Director, NDMA

Ms. Mrinalini Shrivastava, Director, NDMA, provided a comprehensive overview of the achievements and key discussions from the 2024 National Heatwave Workshop. She also emphasized the need for region-specific vulnerability assessments, particularly in addressing the compound risks of heat and humidity in various climatic zones.

Her presentation focused on the following key aspects:

- Early warning and climate services: She highlighted India's shift toward impact-based forecasting, which has significantly improved early warning capabilities and helped in timely response mechanisms.
- Health Sector Preparedness: Strengthening hospital infrastructure to handle heat-related illnesses and conducting public awareness programs.
- Urban Infrastructure & Energy Resilience: Enhancing the resilience of power grids, railways, and urban planning strategies to mitigate extreme heat impacts.

- Community Engagement: Experience sharing from vulnerable community and expanding outreach initiatives to ensure grassroots participation and empower vulnerable populations with heat risk information.

Ms. Mrinalini also gave outline of the technical sessions for the upcoming International Workshop:

Technical Sessions for the Upcoming Workshop

Technical Session I: Heat Wave - Early Warning Services

Technical Session II: Heat Action Plans – Indian Perspective (Preparation, Implementation, Monitoring, Evaluation & Learning)

Technical Session III: Heat Action Plans – Global Perspective (Preparation, Implementation, Monitoring, Evaluation & Learning), Role of India in contributing to Global Framework

Technical Session IV: Heat-Health Adaptation

Technical Session V: Indian Experience in Mitigating impact of Heat on Infrastructure particularly Housing

Technical Session VI: Financing Heat Action Plans

Special Session: Future Collaborations

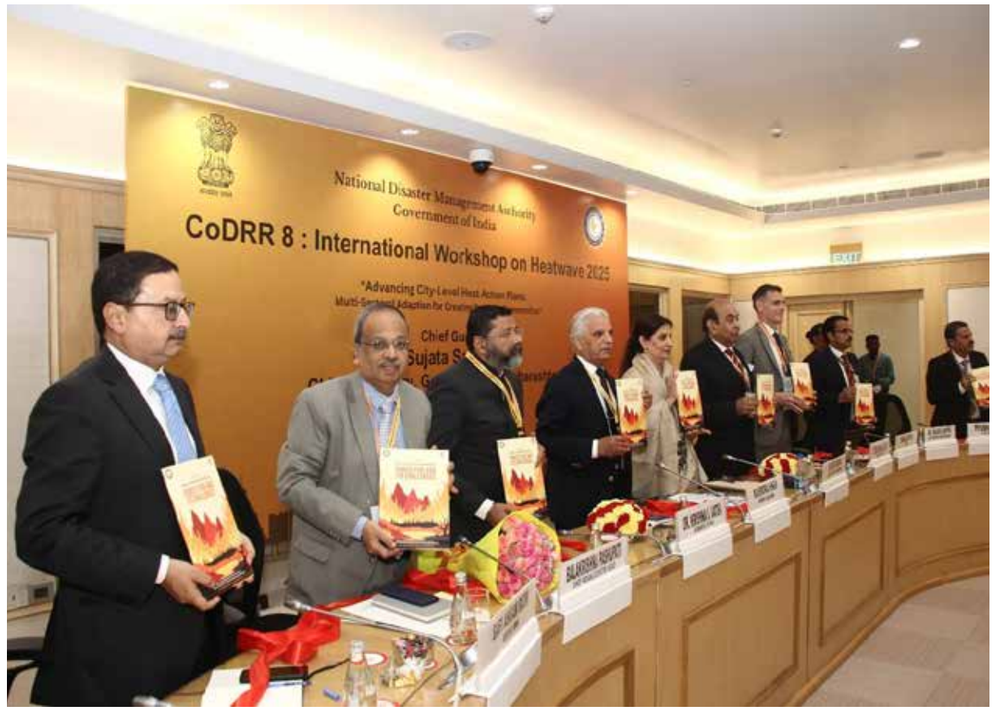
Fig.1. Technical sessions of International Heatwave Workshop-2025

She further highlighted India's leadership in heat risk governance has been acknowledged at international platforms such as the United Nations and the G20, reinforcing its proactive stance in extreme heat mitigation. She concluded her address by announcing that the National Heatwave Framework is in its final approval stage with the Ministry of Home Affairs, marking a significant milestone in institutionalizing heat risk mitigation policies in India.

Release of Publications

A significant moment in the session was the official release two very important publications:

1. Proceedings of National Consultative Workshop on "Forest Fire and its Challenges". National Consultative Workshop on Forest Fires, was jointly organized by NDMA and the Ministry of Environment, Forest, and Climate Change (MoEFCC) in October 2024. The workshop report, now available in an electronic format, provides key insights into India's evolving forest fire management strategies, best practices, and policy recommendations.
2. A Landscape Study of Diverse Climatic Zones on "Anticipatory Action in Heatwaves – Indian Community Perspectives". The report is prepared by ADRA.



ADDRESS BY

Mr. Marc Gordon,
Senior Coordinator, UNDRR

Mr. Gordon provided an insightful perspective on the global implications of extreme heat and the urgent need for proactive risk governance. He emphasized that extreme heat is now a planetary-scale risk, disproportionately affecting urban regions, which are warming at a rate faster than global averages. This escalation leads to increased mortality, productivity losses, and infrastructure strain. He stressed the need for integrated approach for adapting to extreme heat risk. The extreme heat is impacting all of the society including people, eco-system, built environment, infrastructure and socio-economic aspects. The heat risk reduction calls for integrated solution across sectors, timescales and jurisdictions.

He also provided an overview of the UN Secretary General's Call to Action on Extreme Heat (2024), urging governments and stakeholders to adopt risk-informed policies, increased investments in heat mitigation, and enhanced public awareness programs. Additionally, he highlighted that UNDRR, in collaboration with WHO, WMO, and national governments, is developing a Global Heat Risk Governance Framework, with India's contributions playing a pivotal role. This framework will improve cross sectoral and multi scalar heat risk management. He concluded his address by highlighting importance of investment in extreme heat risk management.

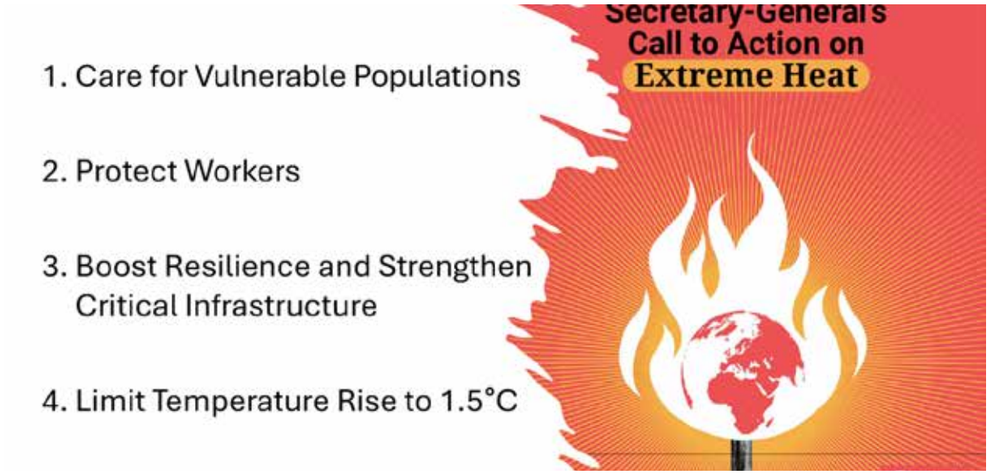


Fig. 2 . United Nations Secretary- General's call to Action on Extreme Heat

ADDRESS BY

Dr. Balakrishna Pisupati, Country Head, UNEP India

Dr. Balakrishna Pisupati talked about the evolution of the workshop from a national initiative to a significant international platform, underscoring the urgency of addressing extreme heat events globally. He emphasized that UNEP has been collaborating extensively with key stakeholders to advance solutions for heat mitigation and adaptation. with a focus on interdisciplinary and multi-sectoral approaches., which are crucial for developing effective solutions.

Dr. Pisupati highlighted that while technical solutions for managing extreme heat are already available, their effectiveness depends on supportive policies at global, regional, national, and sub-national levels. Stressing India's leadership in this domain, he noted that the country has implemented proactive policies and actions that serve as a model for others. He further emphasized the importance of collaboration while also strengthening coordination, synergies, and cooperation across sectors.

Dr. Pisupati also underscored UNEP's broader engagement in heating and cooling solutions, with active projects across Africa, Latin America, and Asia. He pointed out that India stands out as a leader in national and sub-national action. In particular, he highlighted UNEP's collaboration with the Government of Tamil Nadu, supporting the adoption of a District Cooling Action Plan in partnership with the State Planning Commission. This engagement, he noted, reflects UNEP's commitment to assisting state and district-level planning efforts to enhance heat resilience.

He further stressed the relevance of the workshop in the context of ongoing multilateral processes, including the UN Climate Change Convention and the G20. He pointed out that passive cooling solutions have the potential for significant economic benefits, with estimates suggesting savings of up to $3 trillion globally.

Dr. Pisupati concluded by emphasizing that the deliberations and expertise shared at this workshop will contribute to strengthening UNEP's work on heat mitigation. He noted that insights from the discussions will inform UNEP's broader engagement with global stakeholders, ensuring that lessons learned from India's experience are shared with international partners. Moving forward, he reiterated UNEP's commitment to expanding collaboration with national and sub-national governments, fostering knowledge exchange, and scaling up effective heat adaptation and mitigation measures.

ADDRESS BY

Shri Rajesh Gupta, Joint Secretary, DM Division, MHA

Shri Rajesh Gupta talked about some pressing questions on heatwaves to be taken up during deliberations of the workshop:

1. At what level should a heatwave be declared, –nationally, at the state level, municipal level, village level, or block level? We already have data on wet bulb temperatures, and with the right machine learning algorithms, predicting heatwaves is certainly within our reach. He highlighted the spatial variations in number of disastrous heatwaves and vulnerability index, which signifies the significant variation in heatwave impacts across the country.
2. Adaptation or Mitigation, - A central question to consider is the level at which we should act and intervene, - ex-ante or post facto. He emphasised about early warning, Heat stroke health care, moving from HAP to GRAP.
3. Financing, -. Given the unpredictable nature of heatwaves, what works in one district may not be effective the next year. This variability poses a challenge for infrastructure investments, which brings us to another important issue of funding. The financial resources allocated for heatwave response must be proportional to the estimated damage. We have to assess the financial needs at the national level, and ensure that funding is aligned with the real risks? We have yet to establish clear metrics for the cost-effectiveness of heatwave mitigation and adaptation measures.
4. Are we prepared for the future? The number of air conditioners sold in India has been rising steadily, but we are still far from being a nation equipped with adequate cooling infrastructure. With a large portion of our workforce employed in the informal sector, implementing heatwave protection measures in workplaces is challenging. We also face significant difficulties in terms of transportation, with a majority of people relying on non-air-conditioned two-wheelers and trains, further complicating the situation.

INAUGURAL ADDRESS BY

Chief Guest: Ms. Sujata Saunik, Chief Secretary, Government of Maharashtra

1. Ms. Sujata Saunik, Chief Secretary of Maharashtra, delivered a compelling keynote, highlighting the heat stress challenges faced by the Maharashtra state, where

over one-third of districts are at risk. She stated that temperatures have already exceeded 35°C and are projected to surpass 40°C in the peak summer months. She emphasized that HAP's provide only generic solutions and do not target City/ District specific heatwave management and Mitigation interventions.

2. She introduced Maharashtra's Heat Resilience Framework (HRF), which is based on the 5x5 CDRI model, focusing on:

- Physical Infrastructure Upgrades
- Economic Resilience
- Institutional Readiness
- Natural Systems Adaptation
- Social Vulnerability Assessments

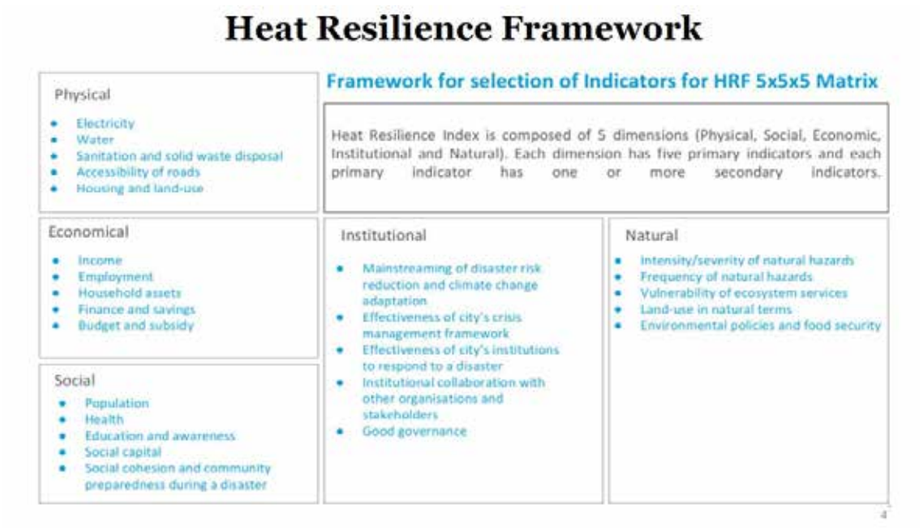


Fig. 3. Heat Resilience Framework

Findings from HRF pilot studies conducted in Mumbai, Nagpur, and Thane were presented, highlighting gaps in governance, urban planning, infrastructure and economic adaptation.

She called for localized solutions such as net-zero cooling shelters, shaded public spaces, and targeted heat alerts for vulnerable populations.

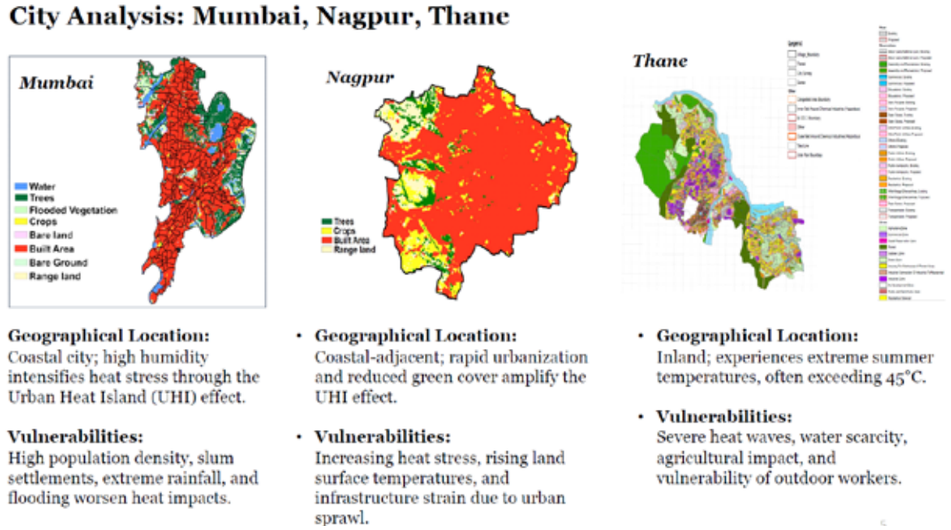


Fig. 4. City Analysis: Mumbai, Nagpur, Thane

She also presented Maharashtra heat preparedness plan for 2025 and concluded by advocating for the establishment of a National Centre of Excellence for Heat Risk Management and scaling up collaborations between state governments, research institutions, and global partners to create sustainable and scalable heat adaptation solutions.

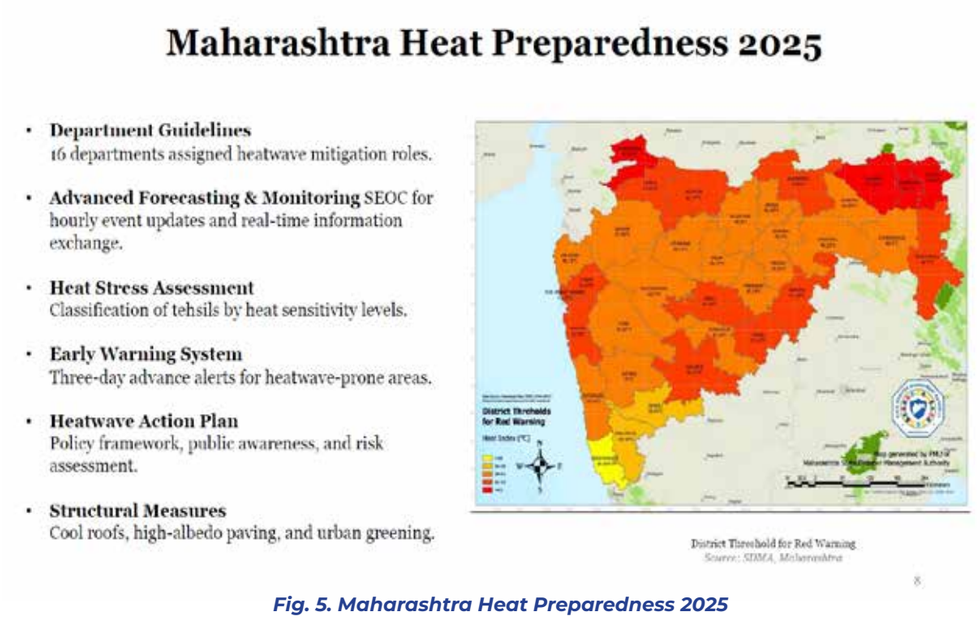


Fig. 5. Maharashtra Heat Preparedness 2025

VOTE OF THANKS BY

Ms. Mrinalini Shrivastava,
Director, NDMA

Ms. Mrinalini Shrivastava, Director, NDMA, delivered the vote of thanks, acknowledging the valuable contributions of all the dignitaries, experts, invitees from states & central ministries, and the international partners. She emphasized the importance of multi-stakeholder collaboration in shaping India's heat resilience agenda and urged active participation in the upcoming technical sessions.

Conclusion & Way Forward

The inaugural session concluded with a strong commitment to:

- Achieving a zero-heatwave mortality target by 2025.
- Strengthening international collaborations in heat risk governance and management.
- Expanding district-level and city level Heat Action Plans across India.
- Scaling up financing and investment in heat adaptation and mitigation strategies.
- Heat Action Plans should not be generic and should comprise of local and context specific solutions to prepare and manage heat.
- Establish National Centre of Excellence for Heat Risk Management with local and global partnerships.

The workshop then proceeded with technical sessions covering:

1. Heat Wave – Early Warning Services
2. Heat Action Plans- Indian Perspective (Preparation, Implementation, Monitoring, Evaluating and Learning)
3. Heat Action Plans- Global Perspective (Preparation, Implementation, Monitoring, Evaluating and Learning) Role of India in contributing to Global Framework
4. Heat- Health Adaptation
5. Indian Experience in Mitigating impact of Heat on Infrastructure Particularly Housing
6. Financing Heat Action Plans
7. Special Session- Future Collaborations

TECHNICAL SESSION I
Heat Wave -Early Warning Services

Chair:

Shri Rajendra Singh,
Member and Head of the Department, NDMA

Co-Chair:

Dr Mrutyunjay Mohapatra,
DG, IMD

Moderator:

Shri Safi Ahsan Rizvi,
Advisor, NDMA

Rapporteur:

Ms. Shalini Singh,
Sr Consultant
Shri Abhinav Walia,
Sr Consultant, NDMA

Dr Mrutyunjay Mohapatra,
Director General, IMD, Chair

General, India Meteorological Department (IMD), highlighted the significance of early preparedness for heat waves before the onset of the summer season. He emphasized that this year's workshop has taken on an expanded dimension with the inclusion of international experts and organizations, fostering new initiatives, ideas, and strategies to enhance heat wave management.

He reiterated India's commitment to the United Nations' Early Warning for All initiative, outlining four key components of an effective early warning system:

Risk Knowledge: Understanding hazards, vulnerabilities, and exposures, particularly in the context of heat risk assessment. This requires analyzing past historical data to improve preparedness and risk mitigation strategies.

Observations, Modeling, and Forecasting: IMD has been enhancing its dense observational network, including satellite-based and land-based monitoring systems, to improve heatwave forecasting at different spatial scales (city, district, and block levels). However, gaps remain in hilly, desert, and coastal regions, necessitating further expansion of observational infrastructure.

Early Warning Generation and Dissemination: IMD has improved dissemination mechanisms, including SMS alerts and a Common Alerting Protocol (CAP), ensuring that at-risk populations receive warnings 24 hours in advance. Efforts are underway to expand multilingual communication, particularly for tribal and rural populations, and integrate audio-visual dissemination tools for greater accessibility.

Training and Capacity Building: IMD, in collaboration with NDMA, state governments, NGOs, and other agencies, has been strengthening community-level preparedness through workshops, drills, and public awareness campaigns. Given the increasing frequency and intensity of heat waves due to climate change, capacity-building efforts need to be expanded further at individual, community, and governmental levels.

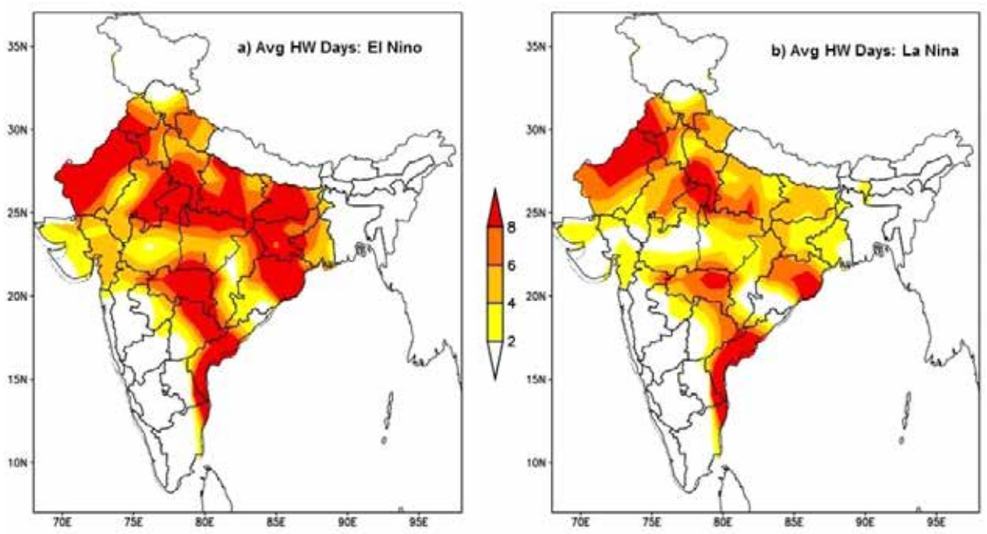


Fig. 6. Average heatwave days during El Nino and La Nina years

Dr. Mohapatra highlighted the shifting geographical trends in heatwave occurrences, with Southern India, including Kerala, Tamil Nadu, and Karnataka, now experiencing more frequent and severe heat events. He cautioned against underestimating the impact of weak La Niña conditions, as heatwaves can still be intense even in such years.

IMD has introduced new forecasting products to aid anticipatory action, including:

- Extended-range heatwave forecasts (15 days in advance),
- District-level impact-based forecasting,
- Cumulative heat stress assessment tools,
- GIS-based interactive platforms for tracking heat risk.

Additionally, sector-specific impact forecasts are being developed, with targeted information for agriculture, health, transport, and disaster response agencies. A notable initiative involved providing localized heat forecasts for parliamentary constituencies during elections and for railway and highway networks, enabling proactive mitigation measures.

Dr. Mohapatra concluded by stressing the need for a collaborative, multi-sectoral approach, integrating expertise from academia, research institutions, and operational agencies to refine impact forecasting and risk communication. He underscored that expanding observational networks, improving digital data accessibility across sectors, and strengthening community-driven preparedness are crucial for mitigating heatwave risks effectively.

Shri Rajendra Singh,
Member and Head of the Department, NDMA

Shri Rajendra Singh emphasized the critical role of early warning services in mitigating heatwave impacts, stating that a well-communicated and timely warning can mean the difference between life and death. He outlined three essential factors—Accuracy, Accessibility, and Actionability (3A Framework)—as the foundation of an effective early warning system.

Accuracy: The effectiveness of an early warning system depends on precise predictions regarding the severity, geographical area, and duration of a heatwave. Accurate forecasting enables authorities to assess the intensity of heatwaves and plan mitigation measures accordingly.

Accessibility: Warnings must reach the most vulnerable populations, including villages, migrant workers, daily wage labourers, and infrastructure workers, at the taluka and block levels. He stressed the importance of multiple communication channels—such as mobile alerts, community radio, local governance networks, newspapers, TV, and public announcements—to ensure widespread awareness.

Actionability: Effective warnings must trigger coordinated actions at every level, from hospitals and primary healthcare centers (PHCs) to block-level administrations, water resource management, and emergency relief provisions. This includes ensuring medical preparedness, access to water, rations, and cooling shelters to minimize heatwave-related casualties.

Shri Singh also highlighted the importance of learning from global

best practices and developing a culture of knowledge-sharing. He encouraged the panel to explore international strategies that could be adapted for India's unique socio-economic and climatic conditions, ensuring that heatwave preparedness becomes a national priority.

He concluded by urging all stakeholders to work collaboratively in enhancing India's early warning infrastructure and response mechanisms to safeguard vulnerable communities.

Dr Ashok Gadgil,
Professor, UC Berkeley

Dr. Ashok Gadgil provided a physics-based perspective on heat stress, emphasizing the need for accurate assessment methods that account for physical labor and humidity. He introduced an improved heat index model to better predict the impact of extreme heat, particularly for vulnerable workers.

Core Temperature and Heat Stress:

Human core temperature remains at 37°C (±3-5°C), and exceeding this range leads to heat illness, organ failure, coma, and death. The body regulates temperature through sweating, vasodilation, and increased heart rate, but under extreme heat and humidity, these mechanisms fail.

Limitations of Traditional Heat Index Models:

The widely used Stadman Heat Index (1979) was developed for first-world industrialized settings, assuming:

- People remain in the shade
- Engage in low-intensity activity
- Are in prime health

These assumptions do not apply to many Indian workers, who labor in the sun, exert high physical effort, and may have pre-existing health conditions.

Introducing the Extended Heat Index (EHI-350):

EHI-350 accounts for higher physical labor (350W/m²) and removes unrealistic assumptions about sweating and blood flow.

It highlights dangerous heat zones where core temperature rises uncontrollably, leading to heat stroke and death.

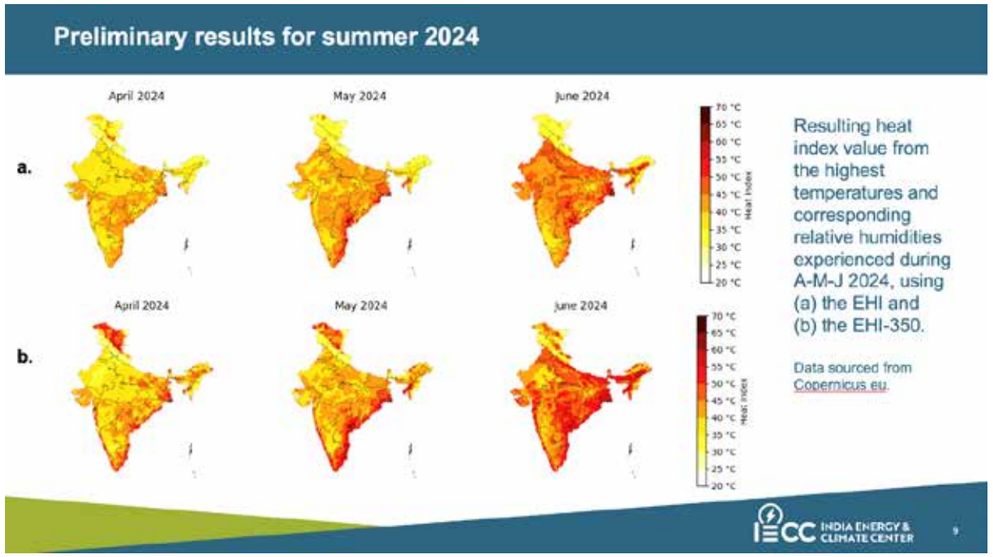


Fig: 7 – Comparison of standard vs. EHI-350 for summer 2024 for IndiaComparison of standard vs. EHI-350 models for India (April–June 2024) shows that regions marked "moderate heat stress" under traditional models shift to "severe or fatal heat stress" when accounting for physical labor.

Impact on Heatwave Preparedness and Response:

Workers engaged in moderate-intensity labor are at greater risk than previously estimated. EHI-350 enables better heat stress warnings by predicting time to exhaustion, heat stroke, and death under varying conditions.

Urgent Actions to Reduce Heat-Related Fatalities:

Pre-hydration and rehydration: Drinking ample water before and during the day to prevent kidney damage.

Seeking shade: Avoiding direct sun exposure whenever possible.

Scheduling work strategically: Shifting strenuous labor to early mornings, late evenings, or nighttime.

Prioritizing vulnerable groups: Protecting children, the elderly, and individuals with health conditions from extreme heat.

Dr. Gadgil emphasized the need for mass communication campaigns to instil these habits, akin to commercial advertisements, ensuring that people receive repeated reminders. His research underscores the necessity of revising heat stress indices to

reflect real-world working conditions and integrating these insights into early warning systems and policy interventions.

Dr Sushmitha Joseph, Scientist-F, IITM

Dr. Sushmitha Joseph, from the Indian Institute of Tropical Meteorology (IITM), emphasized the institution's role as the research arm of IMD, particularly in extended-range weather prediction. She highlighted that IITM has been providing experimental heatwave forecasts since 2018 and played a key role in developing the current extended-range prediction system, which was handed over to IMD for operational use in 2016. The current system has a predictive skill of up to two weeks for maximum and minimum temperatures during the hot season. Additionally, IITM is working on the second-generation version, which improves predictability to three weeks and will soon be transitioned to IMD for operational use.

Dr. Sushmitha Joseph was asked what factors go into predicting heat 14 days in advance and how the process works. She explained that the current heatwave forecast relies primarily on maximum temperature, as per IMD's existing definition. However, research has shown that wet-bulb temperature (WBT) is a crucial factor, especially in coastal regions. Additionally, trends indicate that while maximum temperatures are decreasing over the Indo-Gangetic Plain, minimum temperatures are becoming increasingly significant. Given these insights, IITM is actively working on revising the heatwave definition to incorporate WBT and minimum temperature, aiming for a more comprehensive and accurate prediction system.

DEVELOPMENT OF HEAT INDEX

Remarks by **Dr Mohapatra**

Dr. Mrutyunjay Mohapatra was asked about developments in the heat index and its effectiveness. He acknowledged the limitations of the existing heat index, which is currently based on temperature and humidity but lacks verification for Indian conditions. To establish a more realistic heat index, comprehensive health data—particularly on mortality and morbidity—must be available. However, a key challenge is that heat-related deaths are often misattributed to causes like heart attacks rather than heat stress itself.

He highlighted ongoing efforts by NDMA, NCDC, IMD, and other institutions to collect and analyze health data to better understand the relationship between heat index and health impacts. Additionally, research is being conducted in urban areas such as Ahmedabad, Nagpur, and Bhubaneswar to determine localized thresholds for issuing heat warnings. Since different cities have unique climatic and socio-economic conditions, the goal is to develop a localized, integrated heat warning system that tailors thresholds based on city-specific studies. For this, continuous collection and analysis of mortality and morbidity data are essential.

Prof Sagnik Dey, IIT Delhi

Professor Sagnik Dey was asked about the findings of his study submitted to IMD and the remaining challenges in developing an effective heat index. He clarified that rather than a specific report, his research aimed to identify suitable heat tolerance thresholds for different target populations across India's diverse climate zones. He emphasized the need to shift from a generic heat index to a more health-based warning system, aligning with points raised by Professor Ashok Gadgil.

One of the primary challenges is the lack of comprehensive health data, as mentioned by Dr. Mohapatra. To address this, Professor Dey's team conducted preliminary studies using secondary health data from the National Family Health Survey. They analyzed different health outcomes, primarily morbidity, and also examined all-cause mortality in three cities—Delhi, Varanasi, and Chennai. Their findings reinforced the significant role of humidity in heat-related health impacts.

He also referenced a recently published 10-city study involving multiple institutions, including PHFI. This study further confirmed the need for robust health data collection. A crucial step toward this goal is the National Centre for Disease Control's (NCDC) health surveillance system, which now collects data across 80+ cities. One key metric being recorded is "suspected heat strokes" at primary healthcare centers. While this data is not yet medically confirmed, it provides valuable insights into heat-related health impacts. Over time, as more medically certified cases are recorded, the analysis will improve, helping to define precise heat stress thresholds for different cities.

Mr Abhiyant Tiwari, NRDC

Mr. Abhiyant Tiwari from NRDC was asked about the practicality of early warning systems and heat action plans, particularly from his on-ground experience in villages. He emphasized that establishing accurate and actionable early warning systems depends on setting appropriate heat thresholds, as mentioned by other panelists. However, a key challenge remains accessibility—whether these thresholds are effectively integrated into localized early warning systems and heat action plans. In several cases, even when thresholds are developed for specific cities and districts, they are not actively used in operational heat action plans, limiting their effectiveness.

Beyond heat-health early warning systems, he pointed out that thresholds are also critical for other applications, such as parametric insurance for heat illnesses. However, there is no one-size-fits-all methodology for determining thresholds. He suggested adopting a pragmatic approach, referencing the "Ockham's razor" philosophy—using existing knowledge and methodologies where available.

Mr. Tiwari highlighted that the World Health Organization (WHO) published heat-health early warning guidance in 2015, which is currently being revised. This guidance suggests that in the absence of impact data for epidemiological studies, percentile-based methods could be used to establish thresholds—a practice IMD is already applying for both maximum and minimum temperatures. However, he pointed out that current early warning systems still rely primarily on maximum temperature forecasts, and he urged a shift toward incorporating both maximum and minimum temperature thresholds into early warning mechanisms for better public health preparedness.

Dr. Mohapatra discussed the incorporation of extreme percentiles in weather bulletins but emphasized the challenge of interpreting and integrating this data at the local level. Localization remains a key issue, particularly in adapting forecasts to meet the specific needs of municipalities.

Mr Abhiyant Tiwari suggested that local meteorological offices should have the flexibility to modify their forecasts based on local requirements. For instance, if a municipality requests forecasts using specific thresholds, local offices should have the liberty to adjust warning levels accordingly–potentially using percentile-based approaches to enhance operational effectiveness.

Dr. Mohapatra highlighted the case of Ahmedabad, where such localized adjustments were successfully implemented. He clarified that while IMD provides a general heat warning when temperatures exceed 40°C and are 5°C above normal, localized studies might indicate that a lower threshold–such as 37°C–could be more appropriate for triggering heat warnings in specific areas. Allowing for such adjustments could improve the relevance and effectiveness of heat warnings for different regions.

Dr. Sushmitha Joseph elaborated on the heat wave criteria developed, emphasizing that it considers not just the actual maximum temperature (T-Max) but also its departure from climatological norms. The criteria incorporate both absolute temperature values and percentile-based thresholds, typically the 90th or 95th percentile, to determine heat wave conditions.

She highlighted that by using percentile-based approaches, the methodology inherently accounts for geographical variations to some extent, ensuring that localized climatic patterns are reflected in heat wave assessments.

Ms. Samhita,
CEO, Resilience AI Solutions

Ms. Samhita emphasized the power of AI in synthesizing intelligence into actionable insights that are accessible to everyone. As a coder, she defined intelligence as meaningful synthesis, arguing that this knowledge should be placed in the hands of the common people.

She highlighted how technology has advanced to provide heat risk assessments at a hyper-local level, stating that their system can generate a heat risk score within eight hours for any location worldwide. She envisioned a future where AI-powered dashboards, as simple as Google Maps, could be used by municipal officials, small businesses, and vulnerable labor forces–such as textile workers and those in coastal industries–to understand and mitigate heat risks effectively. This, she emphasized, is the true power of accessibility.

Ms. Samhita highlighted the role of AI and ML in heat risk assessment, emphasizing the importance of accessibility and actionable intelligence. Her system uses three key data sets: spatial data (land surface temperature, slope, proximity to water), climatic data (weather patterns and thermal bands), and building indices (how different materials affect indoor temperature). The model has been tested on 1 million data points across 30 Indian cities and even validated in São Paulo, Brazil.

She stressed the importance of accuracy in AI models, noting that their system has achieved 96% accuracy, making it a reliable tool for decision-making. The technology can guide redevelopment efforts for schools, hospitals, and livelihoods in high-risk areas.

Regarding early warning systems, she pointed out that while general alerts create panic, AI-powered, localized heat advisories can deliver targeted intelligence at 72-hour, 48-hour, and 24-hour intervals. This allows for better preparedness and mitigation efforts.

She concluded by offering a 100-day challenge to all states, inviting them to pilot the system and demonstrate its effectiveness in building-level heat risk assessment.

Col. K. P. Singh,
Advisor, NDMA

Col. K.P. Singh addressed the challenges and improvements in early warning systems (EWS) for heatwaves, emphasizing the need for better accuracy, granularity, and timely dissemination. While early warnings are generally effective, delays or inaccuracies tend to get exponentially highlighted when they occur.

He stressed that data integration is a major gap in India's heat warning system. Currently, scientific agencies, historical records, crowd-sourced data, and international datasets are not standardized or well-integrated. A lack of localized impact assessment is another challenge–heat affects different demographics (children, adults, elderly) and work environments (indoor vs. outdoor labour) differently, but current systems do not account for these variations.

Public behavior, communication, and infrastructure resilience also play a crucial role. Heatwaves strain power grids, increase water demand, overload hospitals, and intensify heat-related illnesses. Early warnings must be sector-specific, addressing health, agriculture, economy, and labour.

Col. Singh outlined three key stakeholders in improving heatwave preparedness:

- **The scientific community** – for data collection, research, and impact analysis.
- **The society** – which experiences and responds to heat impacts.
- **Technology** – which must bridge the gap between science and societal impact through better data processing.

To enhance early warning effectiveness, he emphasized the need for:

- Data aggregation and integration – Standardizing and normalizing diverse datasets.Real-time data processing – To refine impact modeling.
- Localized warnings – Moving from city-wide alerts to neighborhood-level precision, factoring in green zones, urban density, and microclimates.
- Actionable insights for policy and ground-level response – Ensuring heat alerts lead to meaningful interventions.

He concluded by stating that efforts are already underway to address these challenges, and in the coming months,

improvements in data standardization and predictive modeling will help refine early warnings, making them more localized, actionable, and effective.

Col. K.P. Singh discussed the efficacy and challenges of early warning dissemination in India - Common Alerting Protocol (CAP) and its ability to integrate, process, and distribute warnings from multiple agencies. He acknowledged that agencies such as IMD, FSI, NCS, and CWC are issuing timely warnings, but the real challenge lies in ensuring these warnings effectively reach the intended audience.

Key Challenges in Early Warning Dissemination

Dissemination Delays – While warnings are timely, large areas and high recipient numbers (over 400 million SMS alerts sent in two years) sometimes slow distribution.

Limited Public Engagement – Many early warning messages are ignored, buried under commercial SMS spam.

Low Adoption of Alert Apps – Despite launching both Android and iOS apps, downloads have remained below 10 million, prompting efforts to scale up infrastructure and increase adoption.

Improvements and Future Enhancements

Multi-Channel Alerts – CAP currently disseminates warnings via SMS, social media, websites, RSS feeds, and satellite alerts for offshore audiences. Plans are underway to expand to: DTT TV, OTT platforms, railway stations, and highways for broader reach.

Enhancing Attention & Response – Addressing concerns raised by Dr. Gill, Col. Singh acknowledged the need for a balance between frequent alerts and alert fatigue, as excessive notifications may be ignored.

Cell Broadcast for Heatwaves & Rapid-Onset Disasters

The moderator inquired about cell broadcast (used in the U.S. and Europe for high-impact alerts). While not yet deployed for heatwaves, Col. Singh explained that cell broadcast is highly effective for rapid-onset disasters like:

- Earthquakes – Where a few seconds' warning can reduce fatalities by 50% (as seen in Japan).
- Chemical Leaks & Industrial Disasters – Where immediate public action is required.
- Upcoming Rollout – Cell broadcast has been approved and will be implemented in the coming months for such high-risk scenarios.

Ms Minni Sastry,
UNEP

Ms. Minni Sastry congratulated NDMA for elevating the conversation on heat management to the international level, bringing in global stakeholders. She shared insights from her work in urban heat mapping (UHM) and urban heat island (UHI) assessments, emphasizing their critical role in heat action plans, early warning systems, and long-term heat mitigation strategies.

Key Insights on Urban Heat Mapping & Its Importance

Integration into Heat Action Plans:

Urban heat mapping should be a mandatory component of heat action plans to improve both early warnings and long-term resilience. Cities experience localized temperature variations (e.g., a significant difference between an airport and a residential area), making high-resolution city-level heat mapping essential.

Case Studies & National Methodology:

Work conducted in Chennai (Tamil Nadu) led to the development of a National Standard Methodology for urban heat mapping. This simple, scalable methodology has been submitted to NDMA for inclusion in national Heatwave Management Guidelines. International examples, such as Madrid, Spain, showcase how UHM helped target tree plantation and urban greening efforts in the hot spots of the city, thus prioritizing vulnerable locations for implementation of heat adaptation and mitigation measures.

Future Implementation & Pilots:

Collaborations with CEPT University and NRDC are underway to pilot urban heat mapping in multiple cities.

The goal is to ensure that all future heat action plans integrate UHM/UHI assessments, strengthening scientific, evidence-based decision-making for heat preparedness and mitigation.

Ms. Sastry concluded by reaffirming UNEP's commitment to further collaborat and welcomed continued discussions with NDMA on advancing these initiatives.

Dr Krishna S. Vatsa, Member, NDMA

Dr. Krishna S. Vatsa emphasized the critical distinction between Heatwave Early Warnings and Heatwave Advisories, highlighting the need for collaborative protocols between meteorological agencies and disaster management authorities. While early warnings are issued by meteorological agencies to forecast heatwave events, advisories are the responsibility of disaster management agencies and must provide clear, actionable guidance to help communities prepare and respond effectively.

He stressed that heatwave advisories must be highly targeted and differentiated, taking into account location-specific and audience-specific needs. Different communities, occupational groups, and vulnerable populations experience heat impacts differently. Therefore, advisories must address specific risks for at-risk communities, outdoor workers, and critical infrastructure while outlining appropriate preparedness measures at household, institutional, and government levels.

Dr. Vatsa also underscored the importance of local-level monitoring to ensure that advisories remain relevant and effective. By continuously assessing conditions on the ground, authorities can refine advisories to be more responsive and actionable. He further stressed that inter-agency collaboration must be strengthened to establish seamless communication and response mechanisms between early warnings and advisories.

Question to **Dr Mohapatra** about Heatwave Early Warnings and Advisories

Dr. Mohapatra responded to the moderator's question by emphasizing the distinction between Heatwave early warnings issued by the India Meteorological Department (IMD) and Heatwave advisories. He clarified that when both are considered together, they form an impact-based forecast and disaster warning system.

IMD formulates impact-based forecasts and disaster warnings, while the advisory component is structured according to NDMA guidelines. These guidelines are periodically updated, and based on the discussions in the workshop, Dr. Mohapatra suggested that further updates should be made to ensure that advisories are more realistic, localized, and action-oriented.

Question to **Mr. Abhiyant Tiwari** about outreach of advisories issued related to heatwave alert

Mr. Abhiyant Tiwari addressed the moderator's question by acknowledging that advisories do reach district and city authorities. However, he highlighted a critical gap in ensuring that these advisories reach the most vulnerable communities at the last mile.

He emphasized the importance of percolating advisories down to the taluka and panchayat levels, as mentioned earlier by Dr. Mohapatra. While the Common Alerting Protocol (CAP) helps with dissemination, many vulnerable populations—especially those in informal settlements—still do not receive timely information.

Mr. Tiwari underscored the crucial role of grassroots organizations and local community groups in bridging this gap. These organizations not only help disseminate advisories but also translate them into local languages, making them accessible to non-literate populations. He cited examples from Jaipur, where slum communities—especially women with limited access to newspapers or mobile phones—received advisories through community networks.

He noted that warnings categorized as red, orange, or yellow in heat advisories are translated into Hindi and displayed on community notice boards. This ensures that people can understand the forecast for the next five days and take appropriate action.

Question to **Col K.P. Singh** about advisories

Col. K.P. Singh clarified that advisories are indeed pushed out along with early warnings through the Common Alerting Protocol (CAP). As a rule, all advisories issued by the National Disaster Management Authority (NDMA) are pre-approved and included as part of the message. These advisories are clearly distinct from the early warning component, ensuring that recipients can differentiate between the two.

Shri Rajendra Singh, Member and Head of the Department further explained that advisories are developed in consultation with multiple agencies, including the Ministry of Health, PTI, and other relevant stakeholders. Their inputs are incorporated before finalizing the advisories. Additionally, advisories are not issued reactively but proactively—before the onset of any hazard, whether it be a cyclone, cold wave,

heatwave, or forest fire. This pre-season advisory approach ensures preparedness and effective risk communication.

Question to **Dr Ashok Gadgil** regarding heatwave alerts and advisories in the USA

Dr. Ashok Gadgil provided insights into the heat advisory systems used in the United States, particularly in Berkeley, California. In response to the first two questions, he confirmed that heat advisories are indeed issued through multiple channels, including cell phone SMS messages and voicemail alerts. These advisories help individuals take precautions against heat exposure to the best extent possible.

Regarding the development of a separate heat index, he explained that while the specific heat index he presented (for 350) is not in use in the U.S., general heat warnings are issued based on existing temperature and heat stress indicators. Since a significant portion of the workforce in the U.S. is engaged in indoor office jobs rather than manual outdoor labor, advisories primarily focus on recommendations such as staying indoors, staying hydrated, and ensuring children do not engage in outdoor activities during extreme heat events.

Dr. Gadgil also highlighted the redundancy in communication methods, where individuals receive the same message through multiple channels to ensure at least one reaches them. Additionally, a useful heat risk communication tool used in Berkeley is large roadside billboards displaying simple visual indicators of heat threat levels. These billboards categorize daily heat risk into color-coded zones—green (no threat), yellow (moderate caution), orange (high caution), and red (severe threat). While they do not provide detailed text-based advisories, they serve as an effective public awareness tool that people encounter in their daily commute.

Question by **Dr Nitin Gera,** Assistant Director, Industrial Hygiene, Directorate General of Factory Advisories, Ministry of Labour and Employment

Dr. Ashok Gadgil elaborated on the evolution of heat stress indices in response to a question from Dr. Nitin Gera regarding the relationship between the extended heat index (350) and Wet Bulb Globe Temperature (WBGT).

He explained that while dry bulb temperature (air temperature) alone is not an adequate measure of heat stress, meteorologists initially shifted focus to wet bulb temperature, which accounts for both air temperature and humidity. The assumption was that a wet bulb temperature of 35°C would indicate the upper threshold before heat exhaustion or heat stroke begins. However, later research demonstrated that radiant heat—such as the infrared heat experienced under a corrugated tin roof—also plays a critical role in heat stress.

This realization led to the development of the Wet Bulb Globe Temperature (WBGT), which integrates three factors: dry bulb temperature, wet bulb temperature, and globe temperature. The globe temperature is measured using a thermometer placed in a black, heat-absorbing sphere, which allows it to reflect the effects of radiant heat.

Dr. Gadgil pointed out that despite these advancements, neither WBGT nor wet bulb temperature alone account for critical physiological factors such as the body's own heat production, limits on sweat evaporation, or the maximum capacity of vasodilation (the body's ability to expand blood vessels to dissipate heat). The extended heat index was developed to incorporate these additional physiological constraints.

His team further advanced this index by incorporating a labor intensity factor of 350 Watts, though he emphasized that this parameter could be adjusted. Their model includes upper limits on vasodilation and cardiac output, making it more reflective of real-world human heat tolerance. However, he acknowledged the inherent variability in human physiology, noting that the model is based on a fit young adult. More vulnerable populations, such as children, the elderly, and individuals with pre-existing heart conditions, require even stricter heat protection measures.

Remarks by **Shri Meghanad Behera,** Sr DRR Consultant, Odisha SDMA

Shri Meghanad Behera from the State Disaster Management Authority explained the communication strategy for disseminating weather forecasts and advisories.

He highlighted that the India Meteorological Department (IMD) forecasts are directly sent to a dedicated WhatsApp group at the state level. From there, the information is further relayed to media groups and district-level WhatsApp groups. These district groups include key stakeholders such as cyclone shelter secretaries and community leaders, ensuring wider dissemination.

At the district level, the forecasts and advisories are sent directly to the public, and this approach is also effective at the city level. By utilizing multiple channels, including WhatsApp and SMS, they are building redundancy in their communication strategy, ensuring that critical information reaches people through secure and efficient means.

Remarks by **Shri Rohit Magotra,** Deputy Director, IRADe

Shri Rohit Magotra emphasized the need to enhance the effectiveness of early warning systems by integrating impact-based forecasting. While scientific advancements have significantly improved forecasting methodologies, the key challenge now is ensuring that these forecasts translate into actionable early warnings that help vulnerable populations.

In collaboration with IMD, two pilot projects have been launched in Odisha and Uttar Pradesh, regions particularly affected by humid heatwaves. These pilots focus on assessing the impact of extreme heat on low-income households living in slum-like conditions. By monitoring their health, livelihoods, and productivity in real time, the initiative aims to gather critical data that will be fed back to the IMD to refine forecasting models.

Shri Magotra stressed the importance of focusing on regions in the Indo-Gangetic Belt and coastal areas, where humid heat poses a significant challenge. Developing a more precise heat index that accounts for both

humidity and temperature will be crucial in improving city-level early warning systems. Moving forward, these efforts will be expanded to additional cities and states, with the hope of collaborating with more agencies interested in advancing impact-based heat forecasting.

Remarks by **Shri Ramesh Babu,** EFICOR

Mr. Ramesh Babu, reflecting on past heatwaves, highlighted instances where temperatures reached record highs—52.3°C in DHI and even 53°C in parts of erstwhile Andhra Pradesh (now Telangana). He stressed that while communities have traditional coping mechanisms, heatwave advisories must integrate these existing practices. Citing examples like the practice in Khammam District, where street activities are voluntarily minimized during peak summer months, he argued that advisories should align with such local strategies.

Mr. Babu emphasized that information and advisories are two sides of the same coin. For advisories to be truly effective, they must be made available in local languages and in accessible formats, ensuring that even marginalized communities can benefit. He praised NDMA's efforts in bridging the gap between policy and practice, particularly through initiatives like CSOs.

To further improve dissemination, he suggested adopting a model similar to e-Choupal, where digital platforms could be used to spread critical heatwave information at the panchayat or village resource center level. Engaging young people in this process would ensure better awareness and more effective community-level action, ultimately contributing to the goal of zero mortality during heatwaves.

Remarks by **Mr Akhil Shrivastav,** IMD

Shri Akhil Shrivastav from the India Meteorological Department highlighted the need to consider wind speed as a crucial factor in heatwave analysis. While discussions often revolve around maximum temperature, minimum temperature, and humidity, wind speed is frequently overlooked despite its significant impact on heat stress.

He pointed out that wind speed is an essential parameter in calculating the Wet Bulb Globe Temperature (WBGT), which is a critical index for assessing heat exposure. Additionally, he referenced the concept of Loo—the hot, dry winds prevalent in North Indian states—stressing its considerable influence on heatwaves. However, he noted that there has been limited research and focus on how wind affects heatwave severity.

Shri Shrivastav called for more studies and greater emphasis on understanding the role of wind speed in heatwave impact assessments to enhance forecasting accuracy and preparedness strategies.

Response by **Dr Mohapatra,** IMD

Dr. Mohapatra stated that the India Meteorological Department (IMD) is already providing wind forecasts. However, he acknowledged that there is significant scope for research on this aspect, particularly in Northern India.

He emphasized the need to study the combined impact of Loo—the hot, dry winds prevalent in the region—along with extreme heat conditions. Understanding how this combination affects human body stress could improve heatwave impact assessments and early warning systems.

Response by **Dr Sushmitha Joseph,** IITM

Dr. Sushmitha highlighted that, in addition to temperature and humidity, wind conditions are now being considered in heatwave forecasting. She noted that efforts are underway to improve Wet Bulb Globe Temperature (WBGT) forecasting, which accounts for not just temperature and humidity but also radiation and wind effects.

She emphasized that, as Dr. Ashok Gadgil pointed out, incorporating radiation into WBGT makes it a more comprehensive indicator of heat stress. By factoring in wind conditions as well, WBGT can serve as a better tool for assessing heat impact and improving advisories.

Remarks by **Mr. Marc Gordon,** UNDRR

Mr. Marc Gordon, drawing from his experience with the European Commission and early warning systems for flooding in a river Basin, highlighted the complexity of developing effective warnings at the local level. He emphasized that while issuing warnings may seem straightforward, determining the right messaging and ensuring appropriate action in response is highly challenging.

He pointed out that much of the

discussion has focused on human actions following warnings. However, he stressed that responses vary depending on the context—whether it is a farmer managing livestock or someone whose livelihood requires alternative planning. Given the diverse needs across different sectors, he expressed interest in learning from India's experiences in tailoring advisories for different communities and economic activities.

Remarks by **Prof Sagnik Dey,** IIT Delhi

Professor Sagnik Dey emphasized the need to strengthen collaborations between early warning systems and public health centers. He pointed out that while discussions have focused on improving warnings, it is equally important to ensure that public health centers are adequately prepared to respond.

He highlighted that the disease surveillance program initiated by the NCDC collects valuable health data through public health centers. If these centers receive timely warnings, they can remain vigilant and use the data effectively. However, he noted that data collection often becomes inconsistent, especially during critical periods when healthcare systems are overwhelmed. Strengthening partnerships between public health centers and warning systems would enable better preparedness, ensuring that even a general heatwave warning—before it becomes an advisory—can help them take proactive measures.

Remarks by **Ms Minni Sastry, UNEP**

Ms. Minni Sastry emphasized the need to integrate cooling strategies into advisory services and adopt a long-term vision for heat resilience. She highlighted that with rising temperatures and increasing reliance on air conditioning, urban areas are becoming even more vulnerable to extreme heat.

She pointed out that cooling demand is expected to triple in the coming years, further exacerbating urban heat stress. Given this challenge, she urged NDMA to leverage its leadership role in advocating for passive cooling solutions. NDMA is rightly positioned to coordinate between Ministries for mandatory integration of heat resilience into urban design and building measures to planning frameworks, such as town and country planning organizations and municipal corporation guidelines, for ensuring long-term heat mitigation.

Question by **Shri Meghanad Behera,** Sr DRR Consultant, Odisha SDMA

Shri Meghanad Behera highlighted the tragic loss of 45 truck drivers last year due to extreme heat, particularly in Odisha's industrial regions of Jharsuguda, Sundargarh, and Sambalpur. These drivers, while waiting to unload goods, were exposed to severe heat conditions.

He posed a critical question to IMD and the forum: How can we effectively reach this vulnerable group with heat advisories and early warnings? He sought insights on the best strategies to ensure truck drivers receive timely information and protection measures to prevent such fatalities in the future.

Response by **Shri Safi Ahsan Rizvi**

Building on Dr. Gill's suggestion, Shri Safi Ahsan Rizvi emphasized the potential of using billboards to display real-time heat and precipitation warnings. This approach could serve as an effective public communication tool, ensuring that people, including vulnerable groups like truck drivers, receive immediate and clear information about current weather conditions and necessary precautions.

Response by **Col K.P. Singh**

Col. K.P. Singh highlighted two key strategies for improving heat advisories based on past experiences. First, he referenced the use of simple printed advisories at toll booths during winter months along the Yamuna Expressway to mitigate fog-related accidents, demonstrating how clear, location-based messaging can effectively enforce safety measures. Second, drawing from military practices in desert mobilizations, he emphasized the importance of scheduled hydration breaks, known as "water parades," where convoys halt every three hours to ensure proper hydration. He suggested that similar practical, innovative, and localized approaches should be explored to enhance heatwave preparedness and response.

Remarks by **personnel from NIDM**

Given the diversity of communities, advisories—not just early warnings—must be simplified and tailored to different audiences rather than being standardized. Additionally, the focus should extend beyond merely disseminating warnings; it is crucial to assess how people perceive, react to, and respond to them. The effectiveness of early warnings should be measured not just by their reach but by whether they lead to meaningful action and behavioral change.

Remarks by **Representative from IIT Delhi**

At IIT Delhi, the Robaa Index was used in a study that incorporates temperature, wind speed, humidity, and thermal radiation. Another published study compared various thermal indices, including PET and UTCI, with the Robaa Index. Since the Robaa Index is specifically designed for tropical and subtropical regions, including India, it was initially applied in Istanbul. The study found that when comparing the Robaa Index with physiological parameters indicated by UTCI and PET, there was a notable temperature difference of about 3°C. This highlights the variations between simple thermal indices and more complex physiological-based assessments.

Closing Remarks by **Shri Rajendra Singh,** Member and Head of the Department, NDMA

Shri Rajendra Singh emphasized that while this is an international conference, the focus must be on addressing heat waves in India, as they are both predictable and preventable. He outlined five key points for effective heatwave management:

Early Warning Must Translate to Early Action – IMD now issues specific heat wave warnings twice daily, considering factors like humidity. However, these warnings must lead to concrete actions at both community and government levels.

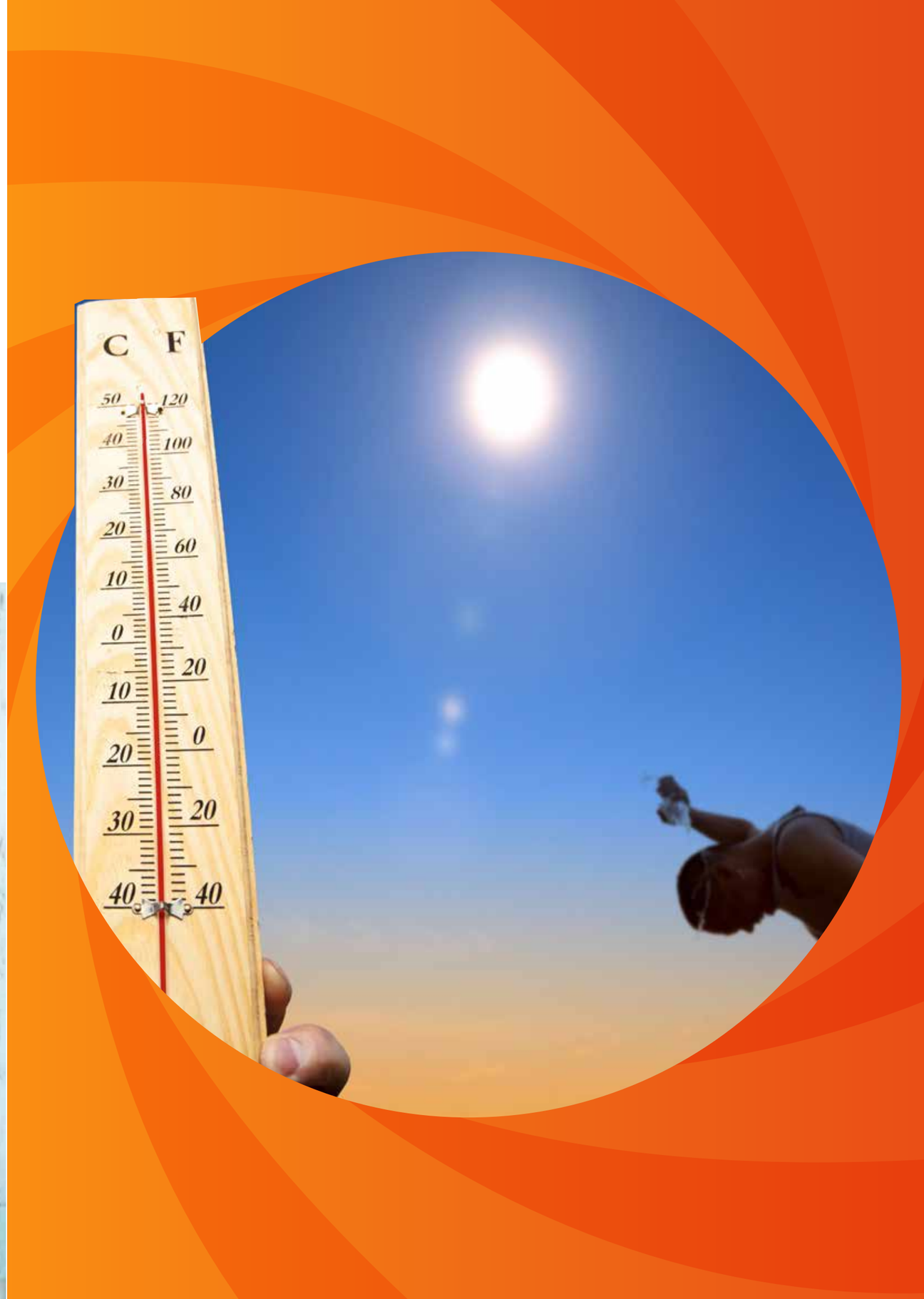
Local Context Matters – Heat waves impact different regions differently. Warnings and response plans must consider regional temperature thresholds, humidity levels, and socio-economic conditions.

Collaboration is Key – No single agency can handle heat waves alone. Strong coordination is needed between IMD, NDMA, urban planners, and public health centers to create a comprehensive response.

Technology and Innovation Should be Prioritized – AI and other advanced technologies should be leveraged to develop tools that aid heatwave management at building, community, and village levels.

Public Awareness and Behavioural Change are Critical – If people do not understand the risks, they will not respond effectively. Awareness campaigns should communicate warnings in local languages and at grassroots levels, ensuring that advisories are actionable for the common person.

He concluded that without proper risk communication and public adherence to regulations, extreme measures like midday lockdowns may become necessary.



TECHNICAL SESSION II
Heat Action Plans- Indian Perspective
(Preparation, Implementation, Monitoring,Evaluating and Learning)

Chair:

Ms. Sujata Saunik,
Chief Secretary, Maharashtra

Moderator:

Ms. Mrinalini Shrivastava,
Director, NDMA

Rapporteur:

Dr. Vazeem Iqbal,
Consultant and
Sh. Amit Tuteja,
Sr. Consultant

Ms. Sujata Saunik, Chief Secretary of Maharashtra, inaugurated the session on *Heat Action Plans: Indian Perspective* by welcoming participants and emphasizing the critical need for robust strategies to combat extreme heat. Highlighting the theme's pillars—preparation, implementation, monitoring, evaluation, and learning—she underscored Maharashtra's proactive measures in addressing heat-related risks amid rising temperatures and urbanization. Ms. Saunik stressed collaborative efforts between governments, NGOs, and communities to enhance resilience, sharing best practices like early-warning systems and cooling infrastructure. Her address called for adaptive, data-driven policies to safeguard vulnerable populations, urging stakeholders to prioritize scalable, inclusive solutions while fostering continuous learning to refine heat action frameworks across India's diverse climatic zones.

Speaker: **Sh. Rajan Rawal,**
Professor at CEPT University

Sh. Rajan Rawal along with Tej Chavda, outlined their work on heatwave action plans under the United Nations Environment Programme (UNEP) and World Bank collaboration. They highlighted a phased approach, termed “Phase One Priorities”, acknowledging that resource constraints (time, funding, technical capacity) limit universal city coverage. Cities in the initial phase adopt a “Level of Details One” methodology, focusing on mapping meteorological parameters (e.g., temperature trends, humidity) and infrastructure data to create baseline reports. Emphasizing city-specific strategies, they proposed indicators like energy consumption patterns and building heat emissions to tailor plans. Rawal cited Chennai’s Level 3 case study as a model, demonstrating granular insights into heatwave vulnerabilities and the effectiveness of localized Urban Heat Island Plans. This approach advocates adaptive, data-driven frameworks to address urban heat challenges. Figure below shows various study parameters for undertaking UHI Mapping & Assessment, depending upon the Level of Detail (LoD) and purpose to carry out UHI mapping.

FFP-UHIE study method: LoD characterization

Level of Detail	Study Parameters						
	Meteorology	Urban Infrastructure	Semantic	Operational profile	Energy consumption	Spatial resolution	Temporal resolution
LoD 1	Surface temperature	Land use land cover	Surface Characteristics	Deterministic-Single profile	Connected loads	1000 m.	Decadal
LoD 2	LoD1 + Air temperature	LoD 1 + Plot boundaries	LoD 1 + Building use and type	LoD 1 + Deterministic-Multiple profile	LoD 1 + Load profiles	100 m	Anaual
LoD 3	LoD 2 + Relative humidity + Mean wind speed and direction + Solar radiation	LoD 2 + Building footprint + Building height	LoD 2 + Age of property	LoD 2 + Stochastic-Space based	LoD 2 + Metered data	30 m	Monthly
LoD 4	LoD 3 + Wet bulb globe temperature + Cloud cover	LoD 3 + Sky view factor + Vegetation properties	LoD 3 + Building archetype	LoD 3 + Stochastic-Agent based	LoD 3 + Submeter end-use data	10 m	Daily/hourl

Note: Each parameter is assigned a colour palate to differentiate from the table, and the hues of the colour become darker as the LoD increases for the datasets concluded each parameter for mapping and assessing the UHIE.

Fig. 8, Study parameters for carrying out UHI mapping & assessments

Speaker: Dr. Ritika Kapoor
NRDC India

Dr. Ritika Kapoor emphasized to the panel that heatwave action plans transcend mere policy documents–they act as lifesaving frameworks when executed effectively. Highlighting implementation challenges, she cited Ahmedabad’s pioneering heatwave plan, where data gaps posed hurdles. Success, she stressed, hinges on hyper-local data: granular temperature, humidity, and health metrics (daily mortality, heat-related illnesses) to correlate with climatic trends and identify vulnerabilities. Dr. Kapoor underscored the necessity of integrating community voices and fostering multi-stakeholder collaboration–engaging civic bodies, healthcare networks, and local leaders–to ensure adaptive, inclusive strategies. Her insights reinforced the urgency of localized, data-informed approaches to mitigate heat risks and enhance urban resilience.

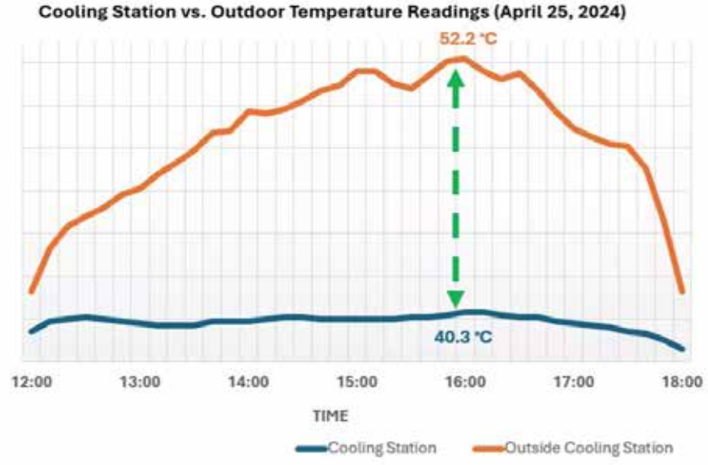


Fig. 9. Cooling station vs. outdoor temperature readings

Speaker: **Ms. Sudha,**
State Planning Commission, Tamil Nadu.

Ms. Sudha highlighted that the State Planning Commission previously developed a Heat Mitigation Strategy, leading the Tamil Nadu government to declare heat as a state-specific disaster. As part of this declaration, the government announced ex-gratia compensation of 4 lakh for families of deceased heat victims. Various departments have since initiated actions aligned with the strategy, which outlines short- and long-term action plans, roles, and responsibilities for stakeholders. Under the State Disaster Management Authority (SDMA), efforts are underway to create Heat Action Plans (HAPs) for Tamil Nadu’s smart cities. Collaborating with UNEP and CEPT University an analysis revealed critical insights, particularly the alarming rise in nighttime temperatures and high thermal discomfort due to urban heat islands

(UHI). These findings underscore the urgency of addressing heat risks, especially after a recent beachside event where five lives were lost due to extreme heat. To strengthen response systems, the Health Department now tracks heat-related health data, enabling better monitoring and intervention. On the mitigation front, the state is exploring active cooling solutions, such as District Cooling Systems (DCS) targeting industries with high air-conditioning demands. Simultaneously, passive cooling strategies are being developed with UNEP's support, including state- and city-level action plans. Innovative research is also linking solar rooftop potential with heat exposure reduction. By analyzing correlations between solar energy adoption and building heat resilience, the state aims to promote rooftop solar as a dual solution for energy and thermal comfort. Additionally, collaboration with IIT Madras is examining links between rising heat and vector-borne diseases. Given Tamil Nadu's tropical climate, this study aims to predict how increasing temperatures could exacerbate diseases like dengue and malaria, informing future public health strategies. In summary, Tamil Nadu is advancing a multi-pronged approach to heat resilience through policy, technology, data-driven health systems, and cross-sector partnerships, with ongoing efforts to integrate climate adaptation into urban planning and public health.

Speaker: **Dr. Vishwas Chitale,** CEEW

Dr. Vishwas Chitale addressed the question what is the most significant challenge in creating Heat Action Plans (HAPs) today, particularly given your involvement in developing plans for cities like Thane, Mumbai, and Nagpur?

Dr. Vishwas - When developing Heat Action Plans (HAPs), the foremost challenge is lack of awareness and clarity about their necessity at the city level. Stakeholders often do not fully grasp why HAPs are critical or who should lead specific actions. As Ms. Ritika highlighted earlier, defining clear roles and responsibilities is essential, but heat remains a "new" disaster type for many. Unlike floods or cyclones, its impacts—such as health crises or productivity losses—are less visibly destructive, leading to underestimation of risks.

A second challenge is data gaps, particularly granular and multi-temporal data (e.g., hyperlocal temperature trends, heat-related morbidity/mortality). However, initiatives like the National Program on Climate Change and Human Health (NPCCHH) are improving state-level efforts to systematically track heat-linked health impacts. This data will be vital for evaluating long-term HAP effectiveness.

Third, identifying context-specific solutions is complex. Solutions must account for regional variations—for instance, strategies for dry heat (e.g., Rajasthan) versus humid heat (e.g., coastal Tamil Nadu). Similarly, interventions for daytime heat (e.g., cooling centers) may not address risks from rising nighttime temperatures, which disrupt recovery and sleep. More research is needed to tailor strategies to these nuances.

Speaker: **Sh. Aditya Valiathan Pillai,** SFC

Sh. Aditya Pillai shared his perspective on the current status of Heat Action Plans (HAPs) in India and suggested 2-3 actionable steps for improvement for the coming summer. Mr. Aditya Valiathan Pillai presented a recently conducted study across nine Indian cities (representing 10% of India's most heat-vulnerable urban populations) to assess HAP implementation. Key findings are - Current HAPs are short-term actions dominate: Approximately 80% of interventions focus on immediate responses—awareness campaigns, ORS distribution, cooling centers, and drinking water provision. These have achieved near-universal coverage in surveyed cities, reflecting India's progress in mitigating acute heat risks over the past decade.

Long-Term Gaps Persist: Only 25% of actions are long-term and heat-intentional (e.g., urban greening designed explicitly for cooling). Most long-term measures (e.g., tree planting under schemes like Nagar Van Yojana) are incidental—executed without heat resilience as a primary goal. Funding Challenges Adequate for Short-Term: 68% of respondents reported sufficient funding for emergency measures, which are relatively low-cost. Inadequate for Structural Changes: Long-term mitigation (e.g., urban redesign, subsidized green infrastructure) remains underfunded. Central and state schemes (e.g., SDRF, NDMF) finance most actions, with limited private-sector involvement. Critical Gaps Sectoral Exclusion: 31% of urban development authorities (UDAs) and labor departments view heat as "not part of their mandate," relegating responsibility to health and disaster management agencies. This siloed approach hinders systemic change. Risk of Overwhelm: Reliance on short-term fixes risks failure as heatwaves intensify. Without intentional long-term planning (e.g., heat-resilient housing, green corridors), cities may face mass casualties during extreme events.

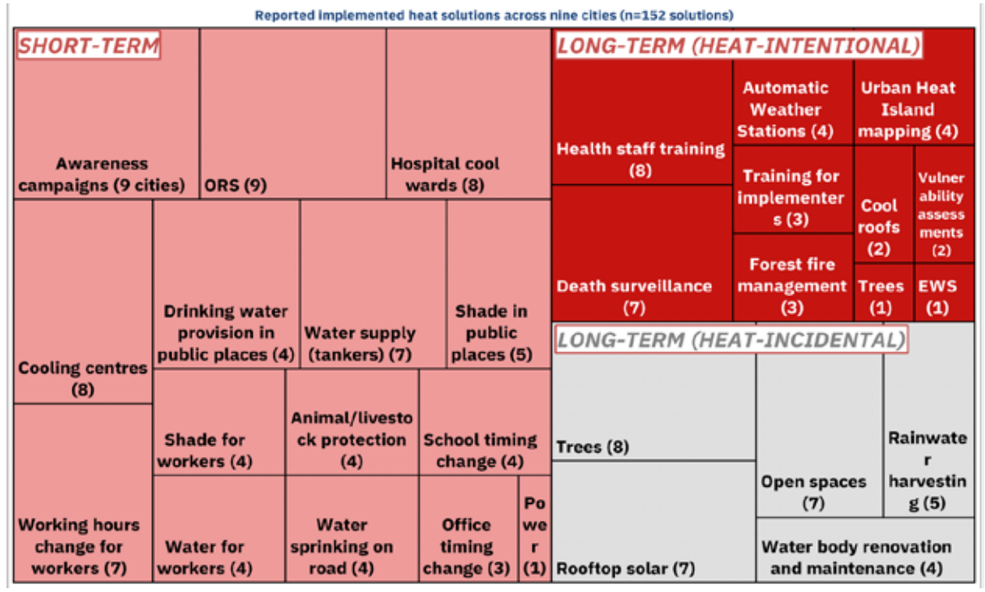


Fig 10: Reported implemented heat solutions across nine cities.

RECOMMENDATIONS FOR THIS SUMMER:

Integrate Heat into Urban Planning: Mandate UDAs to adopt heat-intentional designs (e.g., shaded walkways, cool roofs).

- Redirect Funding: Allocate dedicated budgets for long-term cooling infrastructure (e.g., urban forests, water bodies).
- Cross-DepartmentalCollaboration: Train labor departments to enforce workplace heat safeguards (e.g., adjusted working hours, hydration breaks).

Speaker: **Mr. Manan Bhan** from (ATREE)

Mr. Manan Bhan is based in Bengaluru, a city facing unique climate challenges despite its historically moderate temperatures. He outlined their work which focuses on advancing nature-based, low-cost heat resilience solutions that can be scaled across urban India. Mr. Bhan spoke about their recently organized national convening on heat resilience, which underscored three critical needs -

Multi-Sectoral Collaboration: Addressing heat requires expertise across ecology, urban planning, public health, and governance.

Urgent Funding Mobilization: Dedicated financial support is essential to pilot and implement localized solutions.

Evidence-Based Strategies: Prioritizing data collection and impact assessments to guide policy and design.

He added that as an outcome, they developed a Call-to-Action document outlining these priorities, which they will share with the group. He concluded by saying that their immediate focus is translating these insights into practice, starting with pilot projects in Bengaluru.

Speaker: **Prof. Ashfaque Jafari,** SDMA Govt. of Telangana

As an academic collaborating with SDMA on disaster assessments and Post-Disaster Needs Analysis (PDNA), Prof. Jafri emphasized that heat waves remain underprioritized due to their lack of visible infrastructure damage, unlike floods or earthquakes. To address this, he proposed systemic changes:

- Curriculum Integration: Current university courses on environmental studies and disaster management focus on earthquakes and floods, neglecting heat waves. He urged the National Disaster Management Authority (NDMA) and the Ministry of Education to mandate heat wave education in curricula, highlighting its health and economic impacts.
- Grassroots Awareness & SOPs: Develop Standard Operating Procedures (SOPs) for heat emergencies (e.g., heatstroke) and disseminate them widely. Unlike protocols for heart attacks, public knowledge on immediate heat-related first aid is limited.
- Blue-Green Infrastructure for Climate Resilience: In Hyderabad's 7,200 sq. km HMDA region, they are applying the Analytic Hierarchy Process (AHP) to identify optimal sites for blue-green infrastructure (BGI) to mitigate urban heat islands and flooding. By integrating temperature maps, humidity data, wind patterns, and land-use layers into GIS tools, they aim to synergize heat and flood resilience strategies.
- Telangana's Policy Innovations: Hyderabad's Net-Zero Vision (2050): The city is piloting a net-zero urban development in its southern corridor, emphasizing energy-efficient buildings, waste-to-energy systems, and cool roof technologies.
- Cool Roof Policy (2023): Mandates reflective roofs for: All government/commercial buildings. Residential plots >6,600 sq. yards. Retrofitting of existing non-residential structures within 3 years.
- Energy Conservation Building Code (2018): Promotes sustainable construction, including innovations like ventilated roof cavities with reflective surfaces to enhance passive cooling.
- Architectural Innovations: Redesign flat concrete slabs to include air circulation channels between roofing layers, allowing cool air to displace warm air. Such models can be simulated for efficacy before implementation.
- Call to Action: Interdisciplinary Collaboration: Merge urban planning, climatology, and public health expertise to mainstream heat resilience. Monitor Policy Impact: Track the effectiveness of Telangana's cool roof mandate and energy codes to refine scalable solutions.

Speaker: **Prof. Parmeshwar Udmale,** IIT Bombay

The chair asked about Mumbai's vulnerability to heatwaves, do the current efforts adequately address the needs of at-risk community focuses on bridging science and practice to address heatwave risks, particularly for marginalized groups. Addressing the question Prof. Parmeshwar said that:

MULTIDIMENSIONAL NATURE OF HEATWAVES

Heatwaves are often treated as standalone hazards, but their cascading impacts—such as water scarcity, drought, forest degradation, and socioeconomic strain—are overlooked. For instance, rising temperatures exacerbate water stress, disproportionately affecting rural livelihoods.

CHALLENGES IN RISK ASSESSMENT

Threshold Variability: Defining heatwave thresholds is complex due to India's climatic diversity. For example, in Maharashtra, IMD data reveals stark differences in maximum temperatures across regions like Konkan, Madhya Maharashtra, and Vidarbha. Coastal, plain, and hilly areas lack standardized definitions, complicating localized advisories.

Vulnerability Mapping: Existing indices (e.g., Multidimensional Poverty Index, Aspirational Districts Program) help identify at-risk communities but lack granularity. Rural areas, like those served by IIT's Sitara Center for Technology Alternatives, require participatory approaches to tailor advisories (e.g., adjusting farming hours during heatwaves).

BRIDGING TOP-DOWN AND BOTTOM-UP APPROACHES

While early warning systems and advisories are critical, community engagement is often missing. Through workshops and participatory rural appraisals, the learning has been that solutions must align with local realities. For example, Farmers need context-specific guidance on heat-resilient practices. Urban informal workers require accessible cooling infrastructure.

IIT BOMBAY'S HARIT HABITAT INITIATIVE

The HARIT Habitat project (Affordable, Resilient, Transformative, and Sustainable Housing) aims to address heat resilience in rural housing Prototype Development A campus-based model integrates passive cooling (e.g., ventilation, reflective materials), disaster resilience, and sustainable construction.AI-Driven Evaluation: Collaborating with resilience AI tools to assess thermal performance and scalability.

- Academic Integration Curriculum: IIT Bombay offers an institute elective on Hazard, Vulnerability, and Risk Assessment, covering heatwaves alongside floods and earthquakes. This ensures future engineers and planners prioritize multidimensional climate risks.

RECOMMENDATIONS

Localized Thresholds: Develop region-specific heatwave definitions using IMD data, Köppen classifications, and agro-ecological zones.

- Community-Centric Solutions: Strengthen grassroots networks to co-design heat advisories and cooling strategies.
- Policy Synergy: Align housing codes (e.g., cool roofs, energy-efficient designs) with heat action plans to ensure structural resilience.

Speaker: **Sh. Bhagwat Singh,** Joint Secretary & Nodal Heat Officer, Government of Rajasthan

Sh. Bhagwat Singh stated that in 2024, Rajasthan faced severe heatwaves, prompting rigorous implementation of the State Heat Action Plan (HAP). While the plan aimed to mitigate risks, several challenges emerged during execution:

1. Sector-Specific Implementation Gaps

Organized Sector Compliance: Adjusted working hours (early morning shifts) for factory and construction workers in the organized sector reduced heat exposure. However, this measure failed in the unorganized sector (street vendors, daily wage laborers, farmers), where outdoor work remains unavoidable.

Urban Vulnerabilities: Slum dwellers and homeless populations lacked access to cooling facilities and hydration. Despite provisions in the HAP, resource constraints limited outreach.

2. Urban vs. Rural Mitigation Disparities

Urban Interventions: In cities like Jaipur, measures such as water sprinkling on streets, green roofs at traffic junctions, and cooling centers in Central Business Districts (CBDs) provided partial relief.

Rural Neglect: Smaller towns and villages lacked infrastructure (e.g., water sprinklers, cooling hubs) due to limited municipal budgets and logistical hurdles.

3. Coordination and Awareness Deficits

Interdepartmental Fragmentation: Poor coordination among health, disaster management, urban planning, and municipal bodies hindered unified action.

Awareness Gaps: Rural communities and informal urban workers remained unaware of heat risks and preventive measures, despite awareness campaigns.

4. Medical Preparedness Shortfalls

Urban-Centric Resources: While major hospitals stocked ORS, cooling beds, and trained staff for 24/7 heat emergencies, rural healthcare centers lacked these facilities.

5. Enforcement Challenges

Guideline Non-Compliance: Private businesses often ignored mandates like hydration breaks or adjusted work hours due to productivity concerns.

6. Long-Term Structural Issues

Modern vs. Traditional Architecture: Transition to AC-dependent buildings worsened energy demands. Reviving traditional cooling techniques (e.g., thick-walled homes, courtyards) and greening initiatives are critical for sustainable resilience.

Speaker: **Ms. Prathigna Poonacha,** (IIHS)

Ms. Prathigna Poonacha addressed the risks and needs of vulnerable communities in Heat Action Plans (HAPs), Ms. Poonacha emphasized the required shift from short-term fixes to systemic, transformative strategies. Based on IIHS analysis of HAP implementation across cities, some key recommendations were provided:

1. Reclassify HAP Interventions

Incremental Solutions: Short-term reactive measures (e.g., cooling shelters, water distribution) dominate current HAPs but offer temporary relief.

Reformist Actions: Medium-term efforts like Ahmedabad's citywide cool roof program provide moderate benefits but lack longevity (e.g., paint-based roofs last 5–10 years).

Transformative Changes: Systemic shifts in urban planning, building codes, and multisectoral governance are critical for long-term resilience. Example: Redesigning cities to include heat-resilient infrastructure and green spaces.

2. Redefine Vulnerability

Expand Definitions: Move beyond generic categories (elderly, children) to include:

- Migrant workers, transgender communities, and those with health comorbidities.
- City-specific vulnerable groups (e.g., informal laborers in high-heat zones).

Localized Risk Assessments: Use

spatial mapping and hyperlocal data to identify heat hotspots and prioritize interventions.

3. Improve Communication & Outreach

Multilingual Advisories: Deliver heat warnings in languages spoken by migrant populations (e.g., Kerala's flood advisory model).

Community-Driven Design: Engage vulnerable groups in co-creating HAPs to align interventions with lived experiences (e.g., adjusting work hours for street vendors).

4. Strengthen Implementation

Policy Integration: Embed heat resilience in urban development frameworks (e.g., revised building codes mandating passive cooling).

Accountability Mechanisms: Monitor compliance with workplace guidelines (hydration breaks, adjusted schedules) and penalize non-compliance.

5. Invest in Long-Term Research

Study intersectional risks (e.g., heat + air pollution) and evaluate the efficacy of hybrid solutions (e.g., cool roofs paired with urban forestry).

Current HAPs prioritize immediate relief over structural change. By centering vulnerable communities in planning, adopting transformative policies, and fostering cross-sector collaboration, cities can transition from reactive measures to equitable, climate-resilient systems.

Speaker: **Dr. Soumya Swaminathan,**
Former Chief Scientist, WHO

Dr. Swaminathan emphasized that India is already confronting severe climate impacts, with 80% of its population vulnerable to climatic hazards, including heatwaves, floods, and droughts. Heat, however, stands out as a pervasive, year-round threat requiring systemic adaptation rather than episodic disaster response. Below are critical insights and recommendations:

1. Climate Change as a Chronic Challenge

Beyond Disaster Framing: Heatwaves are no longer sporadic events but a permanent reality, demanding daily resilience. The IMD reports rising heatwave days annually, signalling an urgent need for sustained adaptation.

All-of-Government Approach: Every ministry—urban development, health, labor, and industry—must prioritize heat resilience. Current urban construction often lacks climate-responsive designs (e.g., ventilation, green spaces), worsening heat risks.

2. Integrate Science & Traditional Knowledge

Building Design: Revive traditional architecture (e.g., thick walls, courtyards) alongside modern innovations (e.g., passive cooling) to reduce reliance on energy-intensive AC.

Healthcare Systems: Leverage India's Ayushman Bharat network to train health workers (ASHAs, CHO) in heat-related care, including early symptom recognition and hydration protocols.

3. Data-Driven Vulnerability Mapping

Hyperlocal Risk Assessments: Map districts/states by hazard type (heat, floods, cyclones) and overlay with socioeconomic vulnerabilities (e.g., poverty, gender, occupation).

Intersectional Vulnerabilities: Recognize that not all women or elderly face equal risks—focus on subgroups like informal workers, migrants, and those with comorbidities.

4. Economic & Labor Reforms

Industry Accountability: Update labor laws to mandate safe working conditions (e.g., shaded rest areas, hydration breaks) as heat threatens productivity and worker survival.

Wet Bulb Temperature Thresholds: Prioritize research on humidity-heat interactions, as wet bulb temperatures >35°C can cause fatal organ failure. Coastal cities (e.g., Chennai) face higher risks due to humidity.

5. Social & Health Equity

Mental Health & Gender Impacts: Chronic heat exacerbates domestic violence, malnutrition, and mental health crises. A 2023 MSSRF report highlights these cascading effects in climate-vulnerable districts.

Community-Led Solutions: Partner with NGOs to co-design localized advisories (e.g., multilingual alerts for migrants) and cooling strategies (e.g., community shade structures).

6. Governance & Accountability

Multi-Sectoral Governance: Establish state-level climate cells led by Chief Secretaries to coordinate departments, allocate budgets, and track progress via indicators (e.g., reduced heat-related mortality).

Financing Mechanisms: Create dedicated funding lines for heat resilience in urban planning, healthcare, and labor safety.

Dr. Swaminathan concluded stating that India's survival hinges on treating heat as a public health and economic priority. By merging science, equity, and governance, states can transition from reactive measures to transformative, inclusive resilience.

Speaker: **Sh. Mahesh Narvekar,**
Director, Disaster Management Department, BMC

Sh. Mahesh Narvekar emphasized that Mumbai faces significant complexities in disaster management and climate adaptation. Nearly half its population resides in informal settlements (slums), leaving them highly vulnerable to hazards like heatwaves. As a rapidly transforming city with 96% developed area, extensive construction activity further exposes workers to heat-related risks.

Mumbai Climate Action Plan (MCAP) 2022 The BMC, under Sh. Mahesh Narvekar's leadership, is advancing the MCAP 2022, aiming for net-zero emissions by 2050. Key initiatives include:

Transitioning 800 wood-fired bakeries to electric alternatives through subsidies, reducing carbon emissions. Modernizing crematoriums by adopting efficient technologies, cutting wood usage from 500 kg to 100 kg per cremation.

Collaborative Risk Assessment

A UNDP-supported project, funded by the Maharashtra government, is conducting a multi-hazard vulnerability assessment, including heatwaves. This aligns with Mumbai's 2034 Development Plan, integrated into an RGIS (Regional Geographic Information System) platform for spatial planning and public access.

Data-Driven Public Awareness

Real-time weather data from 12 Automatic Weather Stations (AWS) and other sources are mapped onto the RGIS platform.

A mobile application shares temperature, heat index, and hazard risk indicators, empowering citizens to understand localized risks and adopt mitigation measures.

Budgetary Commitment

The BMC has allocated 32% of its annual budget to ensure all development projects align with the MCAP, integrating disaster risk reduction and climate resilience into urban planning.

Future Initiatives

A comprehensive Heat Action Plan, developed with 125 risk indicators, will soon be added to the RGIS platform. This will provide citizens and policymakers with actionable data to address heatwave risks proactively.

Suggestion to IMD

Ms. Sudha from the State Planning Commission, Tamil Nadu, highlighted a major challenge in climate data analysis at the city level due to insufficient IMD stations—only 17 across the state. This limitation forces a generalized approach, as variations in terrain and coastal proximity aren't well represented. She emphasized the need for more IMD stations to improve data accessibility and accuracy in both urban and rural analyses. She urged NDMA to address this issue, noting that increased stations would enhance evidence-based policymaking. she requested that this concern be included in the report.

Concluding Remark

Sh. Marc Gordon from UNDRR described the session as highly stimulating, raising key issues that will carry into upcoming discussions. He emphasized the evolving understanding of risk and vulnerability, highlighting how industries and society not only face extreme heat risks but also contribute to them. He pointed out a fundamental contradiction in risk reduction—protecting the same systems that generate risks, maintaining the status quo. He urged continued reflection on this throughout the sessions. Addressing finance, he noted the critical role of both public and private capital in shaping risk landscapes, emphasizing the need for risk considerations in investment decisions.

Way Forward

Holistic Risk Reduction: Move beyond short term reactive strategies and address systemic contradictions in risk reduction. Policies should not only protect against extreme heat but also mitigate its root causes.

- Integrated Governance: Establish cross-sectoral frameworks ensuring collaboration between urban planning, health, labor, and finance sectors to embed heat resilience into decision-making.
- Finance & Investment Reforms: Encourage both public and private capital to prioritize heat resilience through regulatory incentives, ensuring that investments consider long-term climate risks.
- Data-Driven Approaches: Expand and enhance meteorological data collection, ensuring localized urban heat mapping assessments for evidence-based policy responses tailored to varying climatic conditions.
- Sustainable Infrastructure: Promote urban redesign incorporating nature-based cooling solutions, passive cooling techniques in identified hot spots from UHI mapping, and climate-responsive construction norms.
- Community Engagement & Awareness: Strengthen grassroots involvement in policy-making and implement targeted communication strategies, ensuring vulnerable populations are included in resilience-building efforts.

TECHNICAL SESSION III

Advancing City-Level Heat Action Plans: Multi-Sectoral Adaptation for Creating Resilient Communities

Chair:

Sh. Uday Khemka
Khemka Foundation

Moderator:

Marc Gorden
UNDDR

Rapporteur:

Sh. Sathyakumar C J
Senior Consultant
Sh. Priyank Jindal
Senior Consultant

The Chair, Sh. Uday Khemka, welcomed all the panellists and participants to the session. He acknowledged the importance of India's leadership in developing an international framework for Heat Action Plans (HAPs) and emphasized the need for collaborative, multi-sectoral efforts. He highlighted that HAPs are strategic tools that require effective implementation, leveraging India's institutional capacity, policy frameworks, and traditional wisdom to mitigate heat risks.

Speaker: **Dr. Eleni Myrivili,** Chief Heat Officer, UN-Habitat (ONLINE)

Dr. Eleni Myrivili highlighted considering HAPs in an integrated way of approaching. The most successful HAPs across the globe are ones which follow an integrated approach, working with health, planning, communities, looking wholistic impact of heat across sectors. Also, very successful model of HAPs is to create positions of people like the Chief Heat Officers, who can lead efforts to address heat, advocate for raising awareness and work with policy makers to take right decisions as well as work on ground with communities and integrate sustainable ways of cooling cities. Few key pointers for success of HAPs, may include-

- Organising a heat office which can work with across departments on the subject of heat.
- Develop strategic partnerships with knowledge partners, private sectors, multi sectoral engagements.
- Multilevel governance is needed to facilitate heat plans at different levels.
- Localised solutions are required, standardization is also required, working with UNEP and Cool Coalition to work with subnational governments and address the needs of cities as well aligning cities efforts with National govts.

Speaker: **Dr. Ashok Gadgil,** UC Berkeley

Dr. Gadgil discussed Earth System Models, which predict future climate. Climate predictions are available for free by the European Union. But these are not available for Indian cities. Future Weather Generator helps generate local weather files. This work is carried out by University of Coimbra in Europe. Dr. Gadgil emphasised on use of forecasting tools to predict future weather and carry out planning and preparations for high risks related to heat accordingly. The predictions of climate can be created until 2100. Dr. Gadgil discussed historical temperature for Jodhpur maximum temperatures and also temperatures projected for 2050 and 2080.

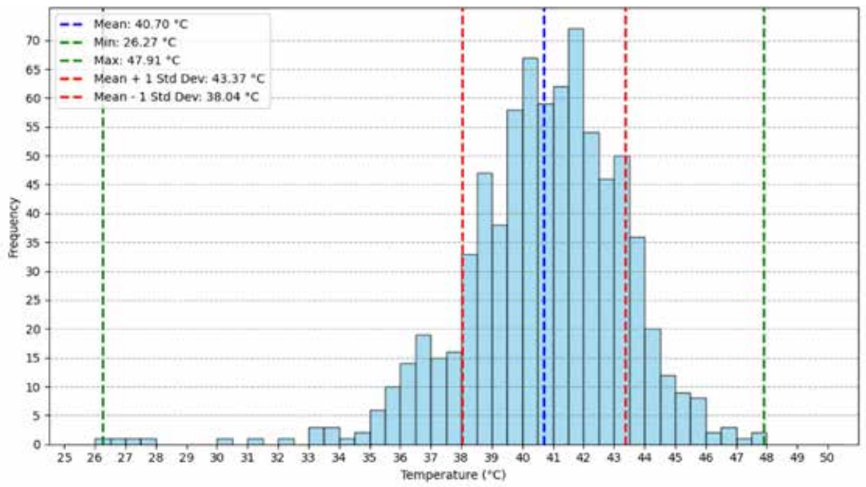


Fig. 11. Distribution of Temperatures at 12Noon hours in May, for 2000-2024, Jodhpur

Speaker: **Sh. Benjamin Hickman,** UNEP

Sh. Benjamin Hickman spoke about two aspects of heat waves. One is adaptation of heat waves and extreme heat through cooling, which is carried out through cooling buildings and cities using nature-based solutions. There is another side of heat waves, which is related to heat as a disaster and its impact on health. These two topics need to come together. At the UN, agencies are working to bring these different domains together. The preparedness for heat waves should be linked with how to redesign the city for passive cooling and heat resilience during heat waves.

India was the first country to publish its India Cooling Action Plan. Under the Cool Coalition, which is a global partnership network, 70 countries have committed to develop their National Cooling Action Plans. UNEP is supporting a few of them like Indonesia, Cambodia, Egypt etc. 30 countries have already developed their National Cooling Action Plan, following India's efforts. It is a multi-ministerial, multi partner approach. Same is the case for Heat Action Plans. United Nation's Secretary General's Call to Action on Extreme Heat highlights the need for development of Heat / Cooling Action Plan. The Heat/ Cooling Action plans with integrated approach of preparedness & redesign with sustainable cooling strategies. It is predicted that in BAU scenario, demand for air conditioning will increase 3 times globally, doubling the electricity consumption from cooling by 2050. Hence, passive cooling is the way forward, which reduces the demand for air conditioning, during the heat waves, passive buildings would take more time to heat up and would have the capacity to maintain cooler built environment even during power break outs. Like the India Cooling Action Plan, India can show the world, how to develop an integrated Heat/ Cooling Action Plans.

Speaker: **Sh. Tarun Garg, Principal,** RMI India

Sh Tarun Garg mentioned that current Heat Action Plans in India focus a lot of health rather than how mitigate heat at city level. Heat Impact Assessment Framework is essential to identify impact of heat on various sectors, various vulnerable populations. RMI is working with NDMA to develop this heat impact assessment framework. Tarun spoke about a few solutions like cool roofs, which have impact in mitigating urban heat. RMI would also be happy to share India work with Global South for others to learn from India experiences.

Speaker: **Dr. Priyadarsini Rajgopalan,** RMIT Australia (ONLINE)

Dr. Rajagopalan shared experiences on role of community engagement in mapping urban heat and integrating heat mitigation measures through public participation. Low-cost instruments/ sensors were developed and distributed to various local councils for mapping local air temperatures. Thousands of citizens were involved in mapping extreme heat which also helped them prepare and adapt better to extreme heat. When Mayors and Ministers join in monitoring the temperatures, it motivates local people to understand how their climates are changing.

Speaker: **Sh. Shubham Tandon,** UNDP

Sh. Shubham Tandon emphasised on local solutions as well as implementation of these solutions on ground. UNDP has a National Resilience Project approved with NDMA, under which UNDP is working with the States of Bihar & Maharashtra. Shubham emphasised that India is not just the first country for Cooling Action Plan, but also the first for integration of SFDRR into National Disaster Management Plans, development of State Climate Action Plans, so lots of planning is good to prepare India better, however, its also important that organizations come together for actual on ground implementation of solutions to make cities heat resilient.

Speaker: **Sh. Sarabjit Sahota,** UNICEF

Sh. Sarabjit Sahota highlighted that UNICEF works on Heat Action Plans and Health Systems. Major work of UNICEF focuses on healthy children, facing multiple risks. Framework developed by UNICEF for heat risk communication and training is called as BEAT. UNICEF is working with NCDC providing technical support on development of Climate Change & Human Health Plans for all States is already developed. UNICEF is also planning implementation of the plan in Rajasthan.

Speaker: **Dr. Anshu Dogra,** IIT Delhi

Dr. Dogra highlighted two projects carried out, one with Curtin University in Perth another University College London (UCL). In Delhi – Perth study looked at vulnerable communities with focus on differential vulnerability. UCL study brought together urban planners as well as disaster responders, to understand if the two groups talk to each other and how important it is for different departments to coordinate and engage to plan for disasters.

Dr. Dogra highlighted, for India, heat is a traditional aspect which gives us advantage as we have traditional knowledge to manage heat. Second, India's acknowledgment that traditional heat has now evolved into heat waves, and acknowledgement is also at governance level. There are over 600 plans across governance for disaster management across various levels of administration. A very important area is planning and coordination with various departments.

IIT Delhi is working on developing a multi scalar methodology, which looks at differential vulnerability from multi levels governance perspective, making vulnerable more structural in addition to response oriented.

Speaker: **Dr. Muktha Girdhar,** DDMA

Dr. Mukta informed about Delhi's existing Heat Action Plan, with 11 district level nodal officers and overall, 250 officers working with various inter departments. Each district of Delhi also has a hospital identified with cool rooms to treat heat stroke patients. There are cooling centres in all 11 districts and 350 shelter homes, which are working during summer season. Some of the key highlights of existing Delhi HAP & its on ground implementation –

- Delhi's Heat Action Plan (HAP) and its implementation through nodal offiers across various departments in Delhi government.
- The role of district nodal offices in coordinating heat emergency responses.
- The activation of shelters, medical facilities, and cooling centers during peak summer months.

Dr. Mukta concluded by stating that this year Delhi has plans to look at long term heat mitigation planning.

Speaker: **Piyush Narang,** UC Berkeley

Piyush Narang shared witnessing New York City HAP into actual actions on ground. Below are some key pointers shared –

- As soon as the forecast predicted heat emergency, all public buildings were monitored for indoor and outdoor temperatures as well as relative humidity. In schools for example, if the air temperature went beyond 35 deg C, teaching in classrooms will be stopped and children would be shifted to cooler zones of the school.
- Leverage community leaders for information dissemination and connecting to vulnerable residents with city services like welnness check ups etc.
- For worker safety hundreds of cooling shelters got build in a very short span of time. These cooling shelters included library, school, community centre, hospital and even swimming pools.
- Launched helpline, called as Cooling Centre Finder
- Financial assistance to homes through providing subsidy for buying in home cooling facility as well as to promote efficient cooling equipments.
- For long term cooling of the city New York city is investing in a big way to increase tree canopy across the city.

KEY ACTIONABLE POINTS FROM THE SESSION:

- Heat Action Plans must integrate multi-sectoral coordination, ensuring cross-ministries, multi institutional collaboration.
- Appointing nodal heat officers or Chief heat officers whose office could work across various departments to manage heat.
- India can demonstrate to the world Heat / Cooling Action Plans, integrating short term and long term heat adaptation, mitigation measures along with affordable sustainable cooling solutions.
- The adoption of energy-efficient building regulations such as the Energy Conservation Building Code (ECBC) is essential.
- There is a need for participatory governance models to enhance community-based adaptation strategies.
- Community involvement in implementation of heat action plans make citizens better prepared to handle extreme heat.
- Implementation of Cool Roof initiatives and long term sustainable urban planning integrating passive cooling in urban design must be prioritized.
- The development of forecasting tools and climate models is critical for predictive analysis and preparedness.
- Institutionalizing early warning systems and awareness campaigns can enhance community resilience.
- Localized, data-driven interventions are necessary for effective policy implementation.

The Chair concluded the session by emphasizing the importance of collaborative efforts in advancing city-level Heat Action Plans. He reiterated the necessity of integrating traditional wisdom with innovative solutions to create heat-resilient communities.

TECHNICAL SESSION IV

Heat-Health Adaptation

Chair:

Sh. P N Rai,
Member, BSDMA

Moderator:

Ms. Soumya Swaminathan,
MSSR Foundation, Former Chief Scientist, WHO

Rapporteur:

Sh. Priyank Jindal,
Senior Consultant
Sh. Satya Kumar,
Senior Consultant

SESSION SUMMARY

Sh. P N Rai, Member Secretary of the State Disaster Management Authority (SDMA) in Bihar, chaired the session and provided the welcome address. He highlighted that climate change is accelerating the risks associated with extreme heat, making it a growing concern. Rising temperatures, combined with atmospheric factors like humidity, are contributing to increased fatalities, particularly in states prone to lightning strikes. Bihar has been significantly affected by these climate-induced hazards.

He noted that states are well aware of the challenges posed by extreme heat. Government departments initiate heat management activities as early as January, ensuring a coordinated approach to prevention, mitigation, and response. Over the years, efforts to manage heat-related illnesses and fatalities have yielded positive results, with reported deaths remaining relatively stable. However, he acknowledged that 2024 was particularly challenging for many countries. Despite proactive initiatives by the NDMA and state governments, the rising trend in temperatures indicates a concerning future, with new heat records being set each year.

In Bihar, the number of districts and blocks severely affected by heat continues to grow. In 2021, 24 blocks were categorized as highly vulnerable, whereas in 2024, this number surged to 104 across the state. While state governments have been effective in reducing the immediate impacts of heatwaves, Rai emphasized the need to shift focus beyond emergency response toward long-term climate adaptation.

To enhance resilience against extreme heat, he outlined key priorities:

- **Robust illness management systems:** Establishing comprehensive monitoring mechanisms at state and district levels to detect early signs of heat stress and enable timely interventions.
- **Defining threshold levels:** Identifying and setting heat stress thresholds for the most vulnerable populations and healthcare facilities.
- Leveraging AI to project future heat-related risks over the next 5–10 years
- Evaluating the current healthcare system's ability to cope with rising temperatures and identifying gaps for future preparedness.

He noted that a major challenge in effective heat mitigation is the lack of localized data, which hampers early warning systems and targeted interventions. While cities face heightened risks due to the Urban Heat Island (UHI) effect, rural areas remain the most affected, with limited access to healthcare, lower awareness levels, and inadequate early warning mechanisms.

In Bihar, the Jal Jeevan Hariyali initiative serves as a strong example of climate adaptation. This program focuses on creating and maintaining water bodies, rejuvenating existing ones, and large-scale afforestation efforts, contributing to long-term heat mitigation and environmental sustainability.

Mr. Rai stressed that extreme heat is not just a health issue but a multi-dimensional challenge, exacerbating water shortages, increasing fire incidents, and others. He called for an integrated approach that considers these interconnected risks.

Ms. Soumya Swaminathan, session moderator, emphasized that the burden of heat-related illnesses in India remains underappreciated, largely due to the lack of a standardized system for classifying deaths and diseases where heat is a contributing factor. She highlighted the wide-ranging effects of extreme heat on human health, noting that it can exacerbate underlying cardiovascular conditions and significantly impact mental health. Individuals with psychotic disorders, for instance, experience both physiological dysregulation and altered drug efficacy due to heat exposure, worsening their conditions.

Ms. Swaminathan also pointed out the role of age and gender in heat vulnerability. Evidence suggests that prolonged heat exposure can lead to poor pregnancy outcomes, and breastfeeding can be affected by high temperatures. She cited a case study from Ahmedabad, where newborn mortality rates were higher in a non-air-conditioned maternity ward located on the top floor of a hospital. When the ward was relocated to a cooler section, newborn deaths decreased, underscoring the direct impact of heat on maternal and infant health.

She referenced a report produced for the Ministry of Women and Child Development, which examines the effects of climate change—including heatwaves, floods, and air pollution—on women and children in India. One of the first disruptions caused by extreme heat is school closures, which disproportionately impact children from lower socio-economic backgrounds who often have better access to shelter, food, and resources at school than at home. She emphasized the urgent need for climate-adaptive measures in anganwadis, schools, public offices, factories, and construction sites to ensure resilience to extreme heat.

KEY PRESENTATIONS AND DISCUSSIONS:

Poornima Prabhakar (Ashoka University):

Ms. Poornima Prabhakar presented research that utilized machine learning and AI-based analysis to predict temperature variations and their impacts. Her team developed a nationwide model for India, analyzing ambient air temperatures from 2008 to 2020. This model provides valuable insights into exposure levels across demographic groups, including the elderly, men, women, and occupational subgroups.

She explained that her research examined daily mortality data from 10 major Indian cities—Ahmedabad, Bangalore, Chennai, Delhi, Mumbai, Kolkata, Varanasi, Shimla, and Hyderabad—at the municipal corporation level. Findings revealed that India experiences an estimated 1,116 annual heatwave-related deaths, with urban populations facing higher risks due to the combined effects of heat and pollution. She emphasized the need for decentralized approaches to heat mitigation, as each city faces distinct challenges.

Poornima also highlighted the interaction between heat and air pollution, explaining that as temperatures rise, mortality rates from air pollution also increase, and vice versa. To support city administrators, her team developed the Climate-Health Risk Management in India (CHARISMA) tool, which helps cities develop customized heat-health adaptation plans.

Fig. 12. Information Decision Support System

Sh. Piyush Narang,
UC Berkeley

Sh. Piyush Narang from UC Berkeley expressed his appreciation for Poornima Prabhakar's insightful presentation on the assessment of heat waves and their associated mortality across India. He acknowledged the critical nature of her findings, particularly the alarming forecast that by 2050, nearly every child on Earth will experience more frequent heat waves.

Narang commended her approach to measuring environmental impacts through the use of monitoring stations that collect vital data on pollutants, satellite emissions, and weather conditions. He recognized the significance of her team's work in developing a nationwide model that employs machine learning and artificial intelligence to analyze the relationship between heat exposure and mortality in ten major cities in India.

Dr. Vikas Desai
(Urban Health & Climate Resilience Centre of Excellence, Surat)

Dr. Vikas Desai shared insights from Surat where her team analyzed local data to design and implement effective heat action plans (HAPs). She highlighted that while designing HAPs is relatively straightforward, implementation remains a significant challenge.

A major gap, she pointed out, is community participation. Despite having extensive knowledge about local climate risks, communities are rarely involved in decision-making. She stressed the need to offer communities various adaptation options based on their financial capacity and comfort levels.

Surat's high migrant population—with 80% of slum dwellers being migrants—adds another layer of complexity to community participation. She emphasized the importance of multi-stakeholder partnerships, involving government agencies, local organizations, and residents.

She advocated for including hospital patients as a vulnerable group in heat action plans. Lastly, she called for greater involvement of academicians, students, and interdepartmental collaboration, stressing that such coordination should not be limited to emergency situations but should be an ongoing effort.

Dr. Mahaveer Golechha
IIPH Gandhinagar

Dr. Golechha identified governance and leadership as the primary challenges in implementing heat action plans. He emphasized the need for political and administrative will, noting that proactive political leadership can set the right direction and ensure accountability across various government departments.

He highlighted the importance of institutional memory, as HAPs involve multiple agencies. Effective inter-agency coordination, collaboration, and monitoring are essential for success. He also stressed that heat does not impact all parts of a city equally, making localized action necessary.

Drawing from experiences in Ahmedabad and Rajkot, he noted that NGOs and religious organizations play a crucial role in heat resilience by ensuring water availability in heat hotspots and raising public awareness. He also advocated for urban forestry, private-sector engagement, and the development of blue-green infrastructure to enhance heat adaptation.

Dr. Golechha underscored the need to promote research on heat-health impacts and establish a monitoring and evaluation framework to assess the effectiveness of HAPs.

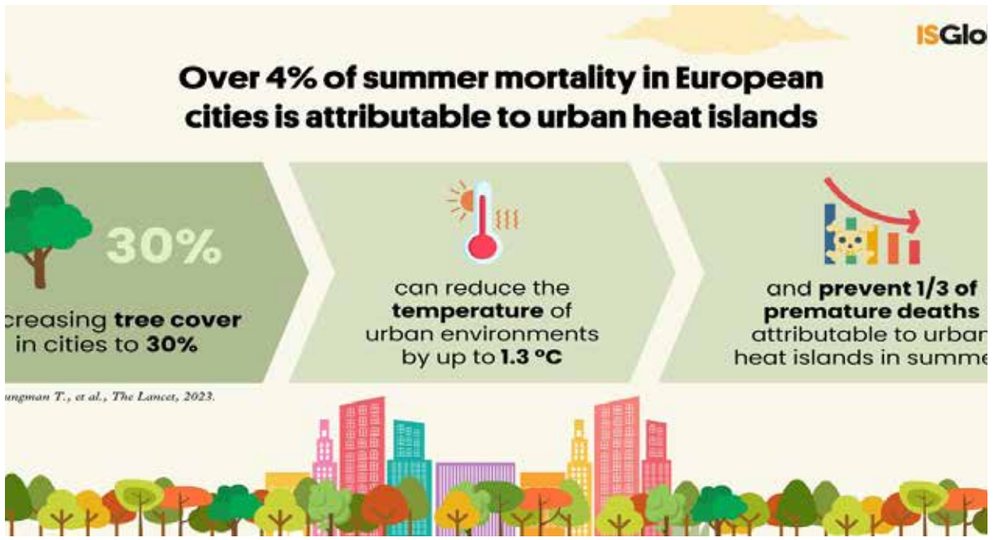


Fig. 13. Urban Heat Island Effect

Dr. Aakash Srivastava
NCDC

Dr. Aakash Srivastava is involved in the National Centre for Disease Control (NCDC) and plays a key role in health facility reporting related to heat wave cases. discussed the Integrated Health Information Platform, which has significantly improved real-time health surveillance.

- In 2023, over 40,000 health units (PHCs and above) participated in summer health surveillance, with 25% actively reporting heat-related cases.
- By 2024, another 8,000 units joined, increasing reporting rates to 55%.
- He highlighted a trigger system was introduced to flag clusters of five or more deaths in a specific geographical area, prompting immediate investigations.

One of the biggest challenges, he noted, is identifying heat stroke cases. Unlike other illnesses, heat stroke lacks a clear set of diagnostic signs, making it highly dependent on clinical judgment. To address this, doctors are being trained on criteria for diagnosing heat strokes.

Previously, autopsies were considered the primary method for diagnosing heat stroke deaths. However, national-level consultations revealed that autopsies are not always conclusive. Consequently, new guidelines advise doctors to rely on clinical judgment rather than autopsy reports.

Several states have moved from number-based to case-based reporting, providing more detailed patient data. If successful, this patient-based system will be rolled out nationwide in 2025.

Dr. Satchit Balsari,
Harvard University

Dr. Satchit Balsari presented findings from an ongoing research project conducted in collaboration with the Self-Employed Women's Association (SEWA). The study aims to bridge the gap between parametric insurance models, city early warning systems, and the lived experiences of vulnerable communities. His team deployed undergraduate researcher equipped with sensors to assess how heat exposure is measured—whether through remotely sensed data, weather station recordings, or other sources—and whether these measurements align with on-the-ground realities.

Dr. Balsari noted that initial assessments revealed cool roofs alone were ineffective in lowering perceived temperatures in extreme heat conditions. He stressed that comprehensive neighborhood-wide interventions—such as large-scale white roof painting—are necessary to create meaningful cooling effects. Significant temperature differences were observed between outdoor conditions and indoor environments, highlighting poor ventilation as a critical factor in sustained heat stress.

Dr. Balsari also talked about a study with a cohort of 1,000 women across eight trades in the informal sector, all members of SEWA. Participants are being monitored over 13 months across four seasons, wearing temperature and humidity sensors both at home and in their workplaces. Additionally, they are providing blood and urine samples to assess physiological responses to heat exposure.

The research seeks to answer how hot is too hot for human health and productivity, impact of heat exposure have on workers' wages and livelihoods, and if cool roofs or improved ventilation make a measurable difference. The project is currently in its second phase, with 100 additional participants recruited. By next summer, the study aims to expand the cohort to 800 participants, enhancing the dataset for more robust conclusions.

Preliminary Findings

- Night time temperatures remain dangerously high in low-income homes due to poor ventilation—a pattern observed globally in disadvantaged communities.
- Physiological stress indicators are alarming—heart rates remain elevated at 100-120 bpm for a significant portion of the cohort, even during rest.

Dr. V K Sehgal,
Scientist IARI

Dr. V.K. Sehgal, a scientist at the Indian Agricultural Research Institute (IARI), discussed the significant impacts of heat on agricultural productivity and the nutritional quality of crops. They highlighted that both human and animal health are affected by heat stress, with different crops responding variably to extreme temperatures. Winter crops, in particular, face greater challenges due to rising temperatures.

Their research has identified critical temperature thresholds that can adversely affect crop yields, emphasizing the need for ongoing studies to understand these vital issues. They noted that while the COVID-19 pandemic halted many activities, agriculture continued to operate, underscoring its essential role in the economy.

The WINDS program, which includes government crop insurance, aims to provide support to farmers facing climate-related challenges. They mentioned the importance of private weather stations and rain gauge data, which could be integrated into a centralized portal for better accessibility. However, they expressed concern about the impending unavailability of data within the next year and a half, which could hinder effective agricultural planning and response.

Dr. Sehgal highlighted the Gramin Krishi Seva, one of the largest agricultural programs in the world, which includes crop insurance initiatives designed to mitigate stress for farmers and the agricultural sector as a whole. Under the climate change program, they have implemented and documented water conservation technologies and agronomic practices in 100 villages, contributing to the food security of the country. Their work emphasizes the need for adaptive strategies in agriculture to ensure resilience against the impacts of climate change.

Vijay Kumar,
Animal Husbandry

Sh. Vijay Kumar outlined the critical need for heat wave management strategies in animal husbandry, emphasizing that approximately two-thirds of India's population relies on livestock for their livelihood. As climate change intensifies extreme heat events, livestock face increased health risks, reduced productivity, and higher mortality rates, making effective adaptation strategies essential.

Heat stress in animals is a growing concern, particularly in regions prone to drought-like conditions. Rising temperatures can lead to heat disorders, dehydration, and even death, impacting both farmers' livelihoods and food security. A structured approach is required to monitor, prevent, and mitigate heat stress to ensure the well-being of livestock.

Do's and Dont's :

Do's

- Regularly monitor weather updates to anticipate heat waves.
- Maintain adequate hydration by providing electrolyte-enriched water and balanced feed.
- Adjust milking schedules to cooler hours, preferably in the evening.
- Use sprinklers, fans, and shaded areas to lower ambient temperatures.
- Allow animals to rest between 12 PM - 4 PM, the hottest part of the day.
- Ensure cooling of heat-stressed animals through water immersion or misting.
- Use appropriate shelter materials—corrugated iron, timber, aluminum, or galvanized steel—to regulate temperatures.
- Designate safe burial areas for deceased animals, ensuring they are well-protected and distanced from water bodies and public areas.

Dont's

- Avoid overexerting animals during peak heat hours.
- Do not neglect veterinary care for animals showing signs of heat stress.

Mr. Kumar emphasized the need for stronger institutional collaboration to enhance preparedness and response. Key recommendations include:

- Multi-sectoral partnerships: Collaboration with State Disaster Response Forces (SDRF), local NGOs, and veterinary services can improve intervention effectiveness.
- Training programs: Animal Husbandry Departments (AHDs) should conduct training sessions in partnership with disaster response agencies to equip farmers with best practices for livestock protection.
- Community involvement is vital to building resilient livestock management systems. He advocated for:
- Youth and NGO participation to promote awareness campaigns on heat stress prevention.
- Educational initiatives targeting farmers, school teachers, and local communities to ensure proactive adaptation strategies are implemented at the grassroots level.

Jane Gilbert,
Heat officer

Miami Dade County is one of the signatories of the Subnational Global Cooling Pledge. Jane Gilbert shared insights on Miami-Dade County's approach to identifying and mitigating extreme heat risks, emphasizing the role of community engagement, data-driven decision-making, and multi-stakeholder collaboration in building resilience.

For six months of the year, Miami experiences a heat index exceeding 32°C, placing vulnerable populations at high risk. While air conditioning (AC) penetration is relatively high, affordability and maintenance remain significant challenges, particularly for lower-income households. To pinpoint where people are most at risk, Gilbert's team conducted a study analyzing heat-related emergency department visits and hospitalizations by zip code.

Using these insights, they developed a heat vulnerability map, enabling targeted interventions in housing, education, and urban heat island mitigation efforts. The findings revealed significant disparities in heat exposure between different neighborhoods, underscoring the need for localized adaptation strategies.

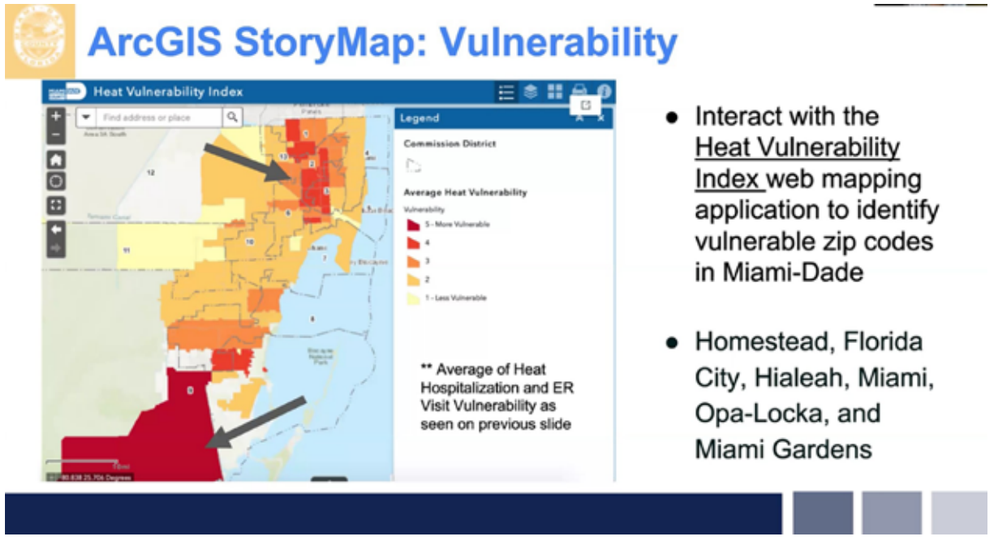


Fig. 14. ArcGIS Storymap: Vulnerability

To address extreme heat risks, Miami-Dade County established a 15-member Climate and Heat Health Task Force, co- chaired by the Chief Heat Officer. As part of this process, the task force hosted six public workshops, engaging 60-80 residents per session to collect community concerns and recommendations. These inputs shaped the County's Extreme Heat Action Plan, which focuses on three core goals:

- Inform, prepare and protect people
- Cool our homes and emergency facilities
- Cool our neighbourhoods.

Since implementing the action plan, Miami-Dade County has made significant progress in heat adaptation:

- Reached 2.8 million residents through targeted awareness campaigns.
- Provided heat-related training for at-risk communities.
- Installed 1,700 energy-efficient AC units in vulnerable households.
- Expanded education programs on low-cost and no-cost cooling strategies for homes.
- Strengthened indoor cooling standards to improve thermal comfort.
- Doubled funding for tree planting, prioritizing equity-focused greening efforts.
- Developed an urban forestry plan, set for release soon.
- Invested in bus shelters to provide shaded waiting areas for commuters

Sh. R.C. Sharma

Former Director, Delhi Fire Service

Sh. R.C.Sharma presented on the importance of building ventilation in preventing fire and heat-related hazards. He discussed the benefits of natural ventilation, breakable glass ventilation, and educational awareness initiatives to improve fire safety in high-temperature environments.

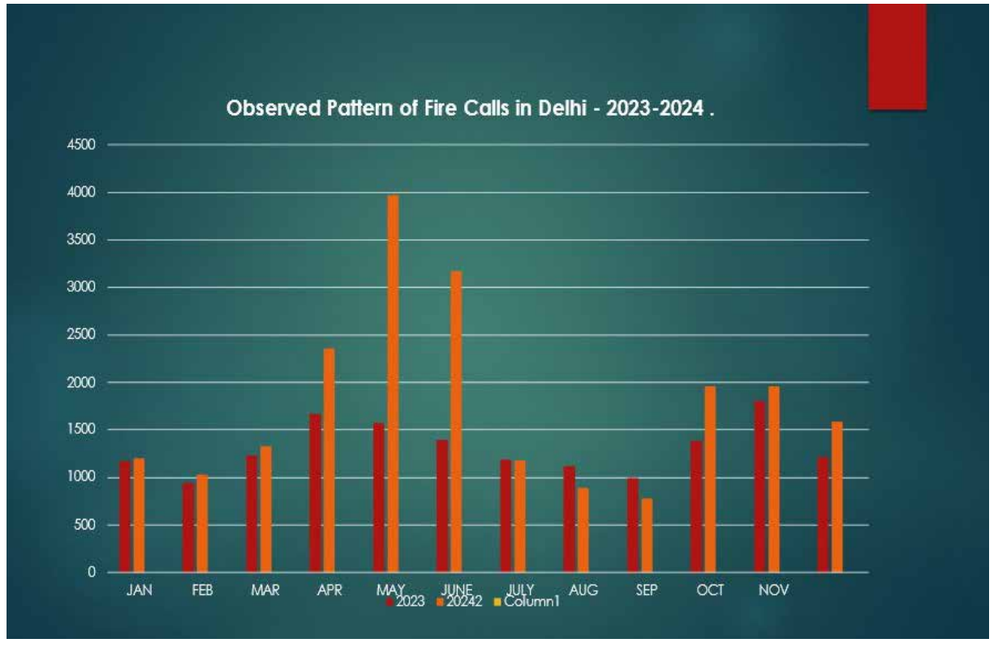


Fig. 15. Observed Pattern of Fire Calls in Delhi

KEY DISCUSSION POINTS FROM THE SESSION

- Heat-Related Mortality & Public Health: Need for better heat death classification and integration of heat-related illness data into national health records.
- Urban Heat Island (UHI) Mitigation: Implementation of cool roofs, afforestation, and urban planning strategies to reduce urban heat. Satellite data from NASA, can support local urban heat island maps for local context relevant actions.
- Taking example of Miami Dade County, all cities in India should look at organizing a Heat-Health Task Force, which is chaired by Chief Heat Officer for each city.
- Workforce Vulnerability: Enhanced occupational safety policies for outdoor workers, improved hydration, and cooling shelter access.
- Heat Action Plans (HAPs): Expansion of city-specific HAPs, political commitment, and ensuring long-term sustainability.
- Intersectoral Collaboration: Strengthening cooperation between meteorological, disaster management, health, and urban planning agencies.
- Technology & Data Utilization: Leveraging AI, GIS, and DSS for real-time monitoring and heat risk assessment.
- Community Awareness & Engagement: Education campaigns for vulnerable populations, particularly women, children, and the elderly.
- Fire Safety & Building Resilience: Improved ventilation in public infrastructure and enforcement of heat-resistant building designs.

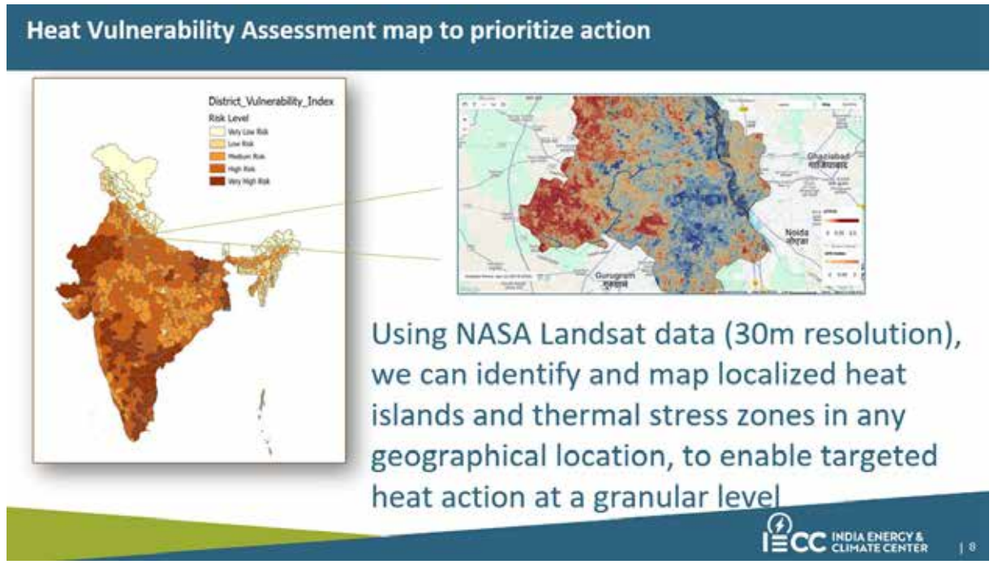
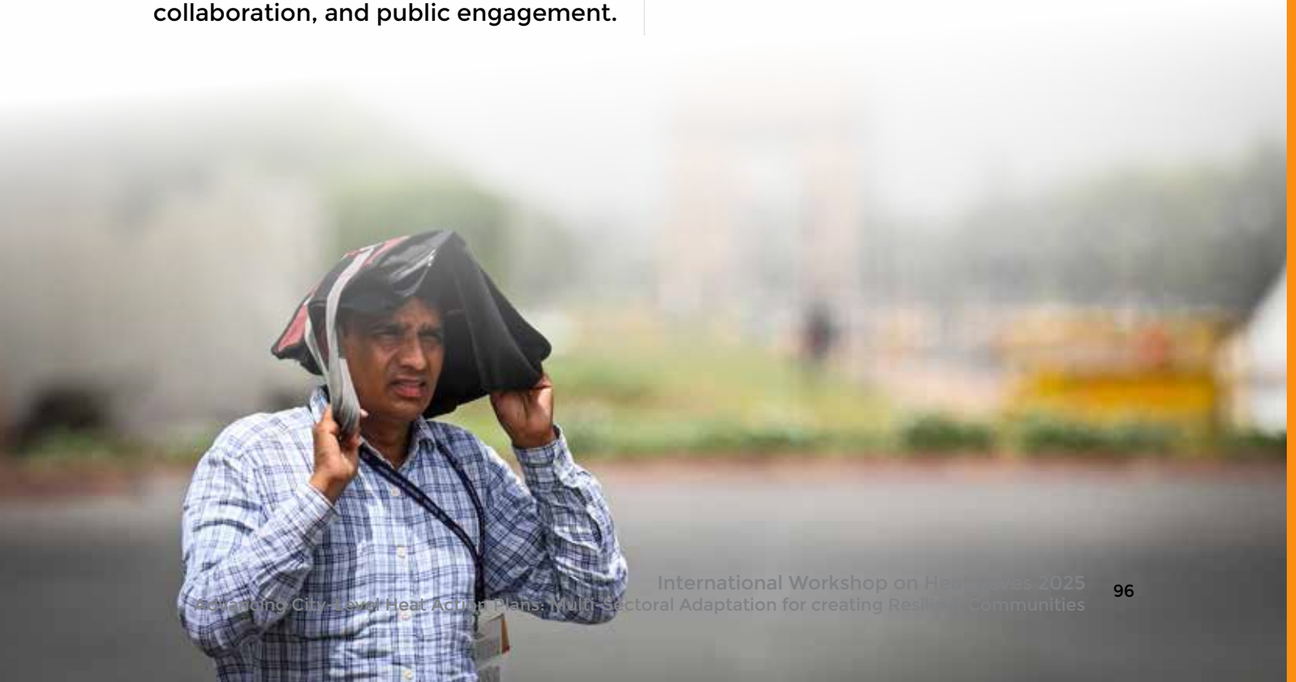


Fig. 16. Heat Vulnerability Assessment map to prioritize action

CONCLUSION

The session underscored the critical need for comprehensive heat-health adaptation strategies, particularly in rapidly urbanizing areas. Key takeaways included the importance of localized heat action plans, data-driven policy interventions, multi-stakeholder collaboration, and public engagement.

Institutionalizing these efforts through sustained political leadership and cross-sectoral partnerships will be crucial in mitigating the impacts of extreme heat on public health and infrastructure. Moving forward, leveraging technology and ensuring community participation will be essential in enhancing resilience against climate-induced heat stress.



TECHNICAL SESSION V

Indian Experience in Mitigating Impact of Heat on Infrastructure Particularly Housing

Chair:

Lt. Gen. Syed Ata Hasnain (Retd),
Member, NDMA

Moderator:

Shri Amit Prothi,
Director General, CDRI

Rapporteur:

Shri Amit Tuteja,
Senior Consultant
Vazeem Iqbal,
Senior Consultant

The Chair, Member NDMA, welcomed all the panellists and participants of the workshop to the Session five. The speakers of session were Ms. Arti Nain, NIUA; Prof. Ashok B. Lall, IIA; Shri Amit Tripathi, CDRI; Shri Sanjay Kumar, RD, MoLE; Shri Parag Talankar, SEEDS; Shri Arunachalam, COO, DIAL, Ms. Tania Banerjee, BCG; Ms. Sneha Sachar, CCC; and Dr Ashok Gadgil & Shri Piyush Narang, U C Berkeley.

The Chair highlighted the significance of wisdom of ancients, with a lot of rich experience behind, to deal with heat waves, giving thrust on mitigation. He also highlighted the importance of leadership to better understand the regulations in mitigating heat impacts and implement the same down the line.

Shri. Amit Prothi,
Director General, CDRI

Shri. Amit Prothi started by pointing out the usage of jalis – traditional Indian architectural technique which were highly effective in minimizing direct sunlight and managing indoor temperatures centuries ago. He added that climate conditions today are far more extreme. As a result, past solutions alone cannot fully address modern heat challenges, necessitating new, scalable adaptations. India has a wealth of traditional knowledge and historical best practices in heat mitigation, but Mr. Prothi stressed the need to document, refine, and share these solutions in a way that enables replication and large-scale implementation.

Speaker: Ms. Aarti Nain,
National Institute of Urban Affairs (NIUA)

Ms. Aarti Nain highlighted the crucial role of building bye-laws in ensuring heat-resilient construction. She highlighted that building constructions ought to be regulated as per prescribed building bye laws and regulations. She added that architects and designers need to design buildings to make them resilient to heat considering wet land, water bodies, and green areas in the surroundings.

She concluded by underscoring the need for capacity building among urban planners. While regulations and guidelines are critical, she argued that equipping professionals with the necessary technical knowledge and skills is equally important in advancing heat-resilient urban development.

Speaker: Prof. Ashok B. Lall,
Indian Institute of Architects (IIA)

Prof. Ashok B. Lall addressed the broader regulatory framework and allied aspects necessary for constructing heat-resilient buildings in Indian cities. He stressed the urgent need for policy adoption at all levels, particularly in residential construction, where widespread implementation of heat mitigation strategies is still lacking.

He emphasized that reducing discomfort hours in residential buildings can significantly lower heat stress on residents, improving both thermal comfort and energy efficiency. He also called for greater focus on urban planning regulations, particularly advocating for strict enforcement of Urban Development Control (UDC) Guidelines.

Speaker: Sh. Amit Tripathi,
CDRI

Sh. Amit Tripathi discussed the severe impact of heatwaves on the power sector, highlighting how rising temperatures drive up electricity demand and costs. He pointed out that addressing energy efficiency through the lens of heatwave management is crucial for long-term sustainability. He suggested that effective demand forecasting, enhancing the utility, and emphasis on the effective implementation of

Energy Conservation Building Code (ECBC) can enhance the resilience of the building. He also stressed the need to operationalize resource adequacy, ensuring that power infrastructure is prepared for extreme heat events. Additionally, he advocated that the equipment should be made as per customized heat requirements.

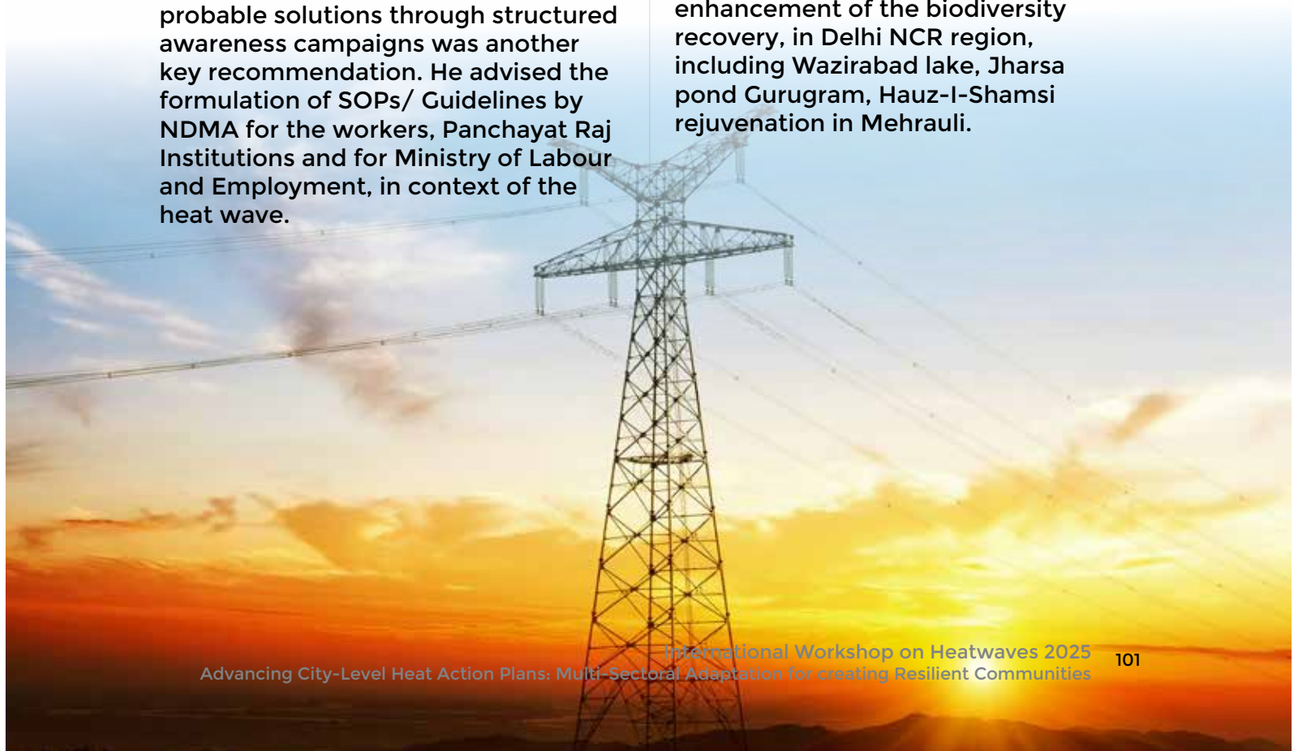
Speaker: Shri Sanjay Kumar,
Regional Director, Ministry of Labour and Employment (MoLE)

Shri Sanjay Kumar, Regional Director, MoLE, addressed the challenges faced by industrial and cluster-based workers during extreme heat conditions. He emphasized the need for effective implementation and monitoring of heatwave-related interventions to ensure worker safety. He highlighted the importance of direct interaction with heat-affected workers suggesting that face-to-face discussions would provide policymakers with a clearer understanding of their needs and challenges. Raising awareness among workers about heat-related health risks, potential consequences, and probable solutions through structured awareness campaigns was another key recommendation. He advised the formulation of SOPs/ Guidelines by NDMA for the workers, Panchayat Raj Institutions and for Ministry of Labour and Employment, in context of the heat wave.

Speaker: Shri Parag Talankar,
SEEDS India

Shri Parag Talankar presented findings from a community-based heat assessment survey conducted across all districts of Delhi, which highlighted the severe impacts of heatwaves on vulnerable populations, daily wage workers, and critical infrastructure. He pointed out that heatwaves exacerbate economic hardships, water scarcity, and infrastructure vulnerabilities. He emphasized that these findings underscore the urgent need for the targeted interventions in housing, employment support and water security to mitigate the overall heat wave impacts in the region.

He advocated the concept of promoting cool roof concept and street shading, through the use of locally available material and recycled material (including bamboos, bottles, sarees etc) by way of inclusive planning. He also shared examples of restoration of lake through bioremediation, creating green spaces, improved water flow enhancement of the biodiversity recovery, in Delhi NCR region, including Wazirabad lake, Jharsa pond Gurugram, Hauz-I-Shamsi rejuvenation in Mehrauli.



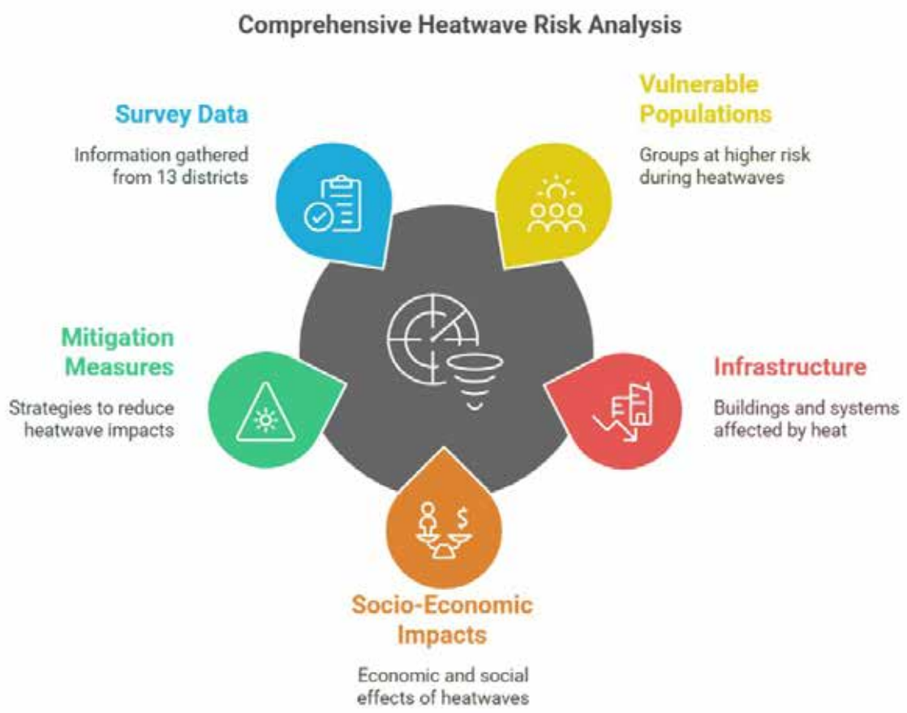


Fig. 17. Comprehensive Heat Risk Analysis

Speaker: Shri S.V. Arunachalam, COO, DIAL

Shri S.V. Arunachalam emphasized the importance of creating heat-resilient infrastructure at airports, particularly for passengers, workers, and airport personnel exposed to extreme temperatures. He detailed several heat management strategies in aviation, including modifying dress codes, monitoring tire temperatures, and restoring ambient temperatures within aircraft cabins to ensure passenger and crew safety. He also discussed procedural adaptations for ground staff and loaders, who are among the most exposed to extreme heat conditions.

DIAL is currently compiling comprehensive data on heat exposure at airports, which will be used to enhance heat adaptation strategies. He also highlighted ongoing measures to ensure that loaders and ground personnel receive adequate hydration to reduce heat-related illnesses.

Speaker: Ms. Tania Banerjee, BCG

Ms. Tania Banerjee addressed extreme heat as a growing global challenge, emphasizing its underestimated economic impacts. She noted that, until recently, heat had not been widely recognized as a direct economic risk, but its consequences are now becoming increasingly visible across sectors.

She advocated for smaller-scale solutions to address heat-related challenges, emphasizing the need for evidence-based policymaking. To support data-driven decision-making, she highlighted innovative financial instruments, such as blended financing, and the use of AI-powered tools to generate accurate, real-time heat risk assessments.

Speaker: Ms. Sneha Sachar, CCC

In a recorded presentation, Ms. Sneha Sachar highlighted that heatwaves affect all communities, necessitating integrated and collaborative solutions for housing and cooling interventions. She called for the alignment of heat action plans and cooling action plans, emphasizing that efforts must address both heat stress and humidity, as both factors significantly impact human health and comfort.

She underscored the importance of human-centric planning, stressing that housing and cooling solutions must prioritize vulnerable populations and be scalable, inclusive, and community-driven.

Speaker: Dr. Ashok Gadgil and Shri Piyush Narang, UC Berkeley

The speakers, Shri Ashok Gadgil and Shri Piyush Narang delivered the joint presentation and shared the insights about Mitigating Heat Impacts on Housing – Colling Shelters. The UC Berkeley team introduced the concept of low-cost, passive cooling shelters, which provide temporary relief during peak heat hours during the hottest parts of the day for outdoor workers and vulnerable population. They emphasized the potential of Prefabricated Structure Insulated Panels (SIPs) for cooling shelters, which enable fast, large-scale deployment while ensuring thermal comfort. Additionally, the team advocated for the use of Ice Slurry Machines as a cost-effective cooling intervention to prevent heat-related morbidities in extreme conditions.

KEY ACTIONABLE POINTS OF THE SESSION

Based on the technical discussions and key takeaways from the session, the following actionable points emerged, which can be referred/ adopted in mitigating the impacts of heat wave on the infrastructure, including housing etc:

- Building bye laws to be followed by the architects, planners and practitioners while designing heat resilient buildings, considering the wet lands, water bodies and the green areas in the surroundings.
- In planning regulations of the cities, the Urban Development Control (UDC) Guidelines need to be adopted rigorously.
- It is recommended to have face to face interaction with workers in context of heat related problems in practice and accordingly the formulation of customized SOPs/ Guidelines by NDMA for workers, Panchayat Raj Institutions and for Ministry of Labour and Employment, in context of the heat wave.
- It is advocated for the low cost passive cooling shelters, which provide the temporary relief during the hottest parts of the day for outdoor workers, and the vulnerable population. Further the use of prefabricated Structures Insulated Panels (SIPs) based cooling shelters, which enable the

fast on-site construction, making them ideal for the large-scale deployment in diverse regions across India.

- There is need to follow Energy Conservation Building Code 2017 (ECBC 2017) to enhance utility, it's effective implementation will be the key.
- Thrust may be given to the nature based local solutions such as rejuvenation of lakes and ponds through the bioremediation etc.

It is recommended to devise the smaller scale solutions to heat wave related problems and accordingly to lay emphasis on evidence generation

mechanism. There is need to promote the cool roof concept and street shading, through using the locally available material and recycled material by the way of inclusive planning.

It is recommended to the use of Ice Slurry Machine as compare to the cold water, and deploy the same at required locations to prevent the heat related morbidities.

There is need to give adequate attention to the humidity factor while addressing the heat wave, especially at the planning and designing stage, considering the surroundings. Humidity is observed quite high especially in mountain areas.

TECHNICAL SESSION VI
Financing Heat Action Plans

Chair:

Dr. Krishna S. Vatsa,
Member, NDMA

Moderator:

Sh. Safi Ahsan Rizvi,
Advisor, NDMA

Rapporteur:

Sh. Shishir Agarwal,
Senior Consultant
Sh. Abhinav Walia,
Senior Consultant

SESSION OVERVIEW

This session, part of Day 2 of the International Workshop on Heatwaves 2025, focused on financing mechanisms for Heat Action Plans (HAPs). Discussions emphasized the necessity of sustained and diversified funding sources, leveraging central and state schemes, public-private partnerships (PPPs), and international climate finance. The 15th Finance Commission's Mitigation Fund, with a reported utilization of only 2%, was identified as a significant yet underutilized resource. The session also explored green bonds, climate bonds, parametric insurance models, and international best practices for sustainable financing.

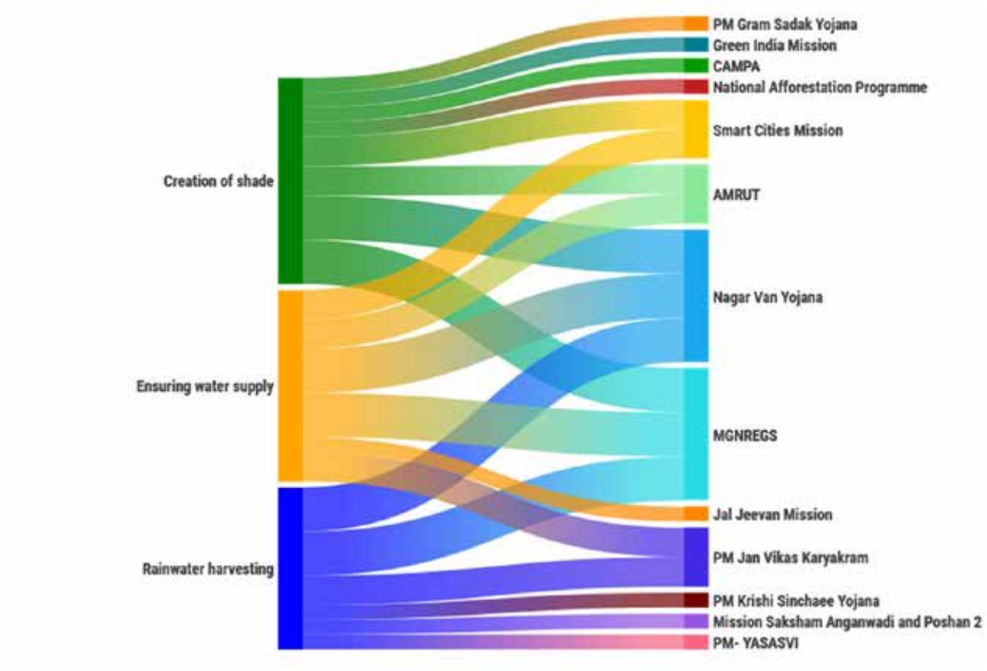


Fig. 18. Some solutions enjoy greater alignment with schemes than others

KEY ACTION ITEMS

Leveraging Government Schemes: Utilize funding mechanisms such as Finance Commission allocations, State Disaster Response Fund, and National Disaster Mitigation Fund to support HAPs.

- Exploring Climate Finance: Assess international funding sources, including GEF, Green Climate Fund, and Loss and Damage Fund, for financing HAPs.
- Public-Private Partnerships: Foster collaborations between governments, financial institutions, and private investors to scale HAP financing.
- Parametric Insurance Models: Investigate insurance-based solutions to provide financial protection against heat-related risks.
- Green & Climate Bonds: Examine the feasibility of climate bonds and carbon markets to generate long-term financing for heat resilience projects.
- Community & Non-Profit Engagement: Strengthen the role of NGOs and grassroots organizations in securing and managing funds for local-level HAP implementation.

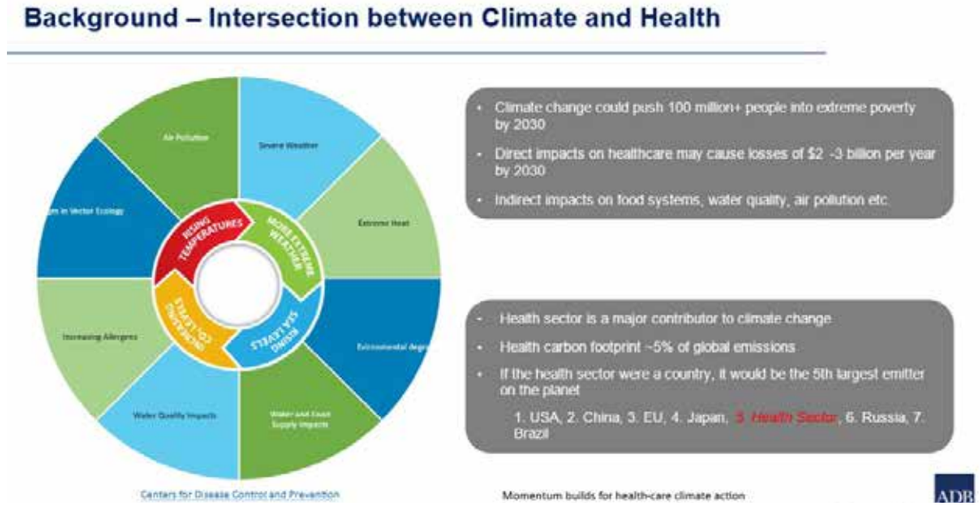


Fig. 19. Intersection between Climate and Health

DETAILED DISCUSSION SUMMARY

1. HAPs Funding Mechanisms (Central & State Schemes)

Dr. Krishna S. Vatsa initiated the discussion by emphasizing in the session it would be discussed how to finance various initiatives as part of the Heat Action Plans. During the two days there were that for all strategies discussed earlier to manage heat waves, whether it is increasing the urban forests, greening bus stations, hiring a Chief Heat Officer, all actions need resources. Within the Government, realization is there to support preparedness actions. How can we utilise State Disaster Mitigation Fund (SDMF) and National Disaster Mitigation Fund for HAPs. The progress can not only be nationally driven, they have to be locally driven, where local govts take ownership and national govt. takes role of providing supplementary resources. The session will see what are various sources of financing heat action plans. These could include international finance like GEF, GCF, Loss & Damage funds etc. He highlighted the challenge of developing a sustainable insurance model and underscored the need for a viable public-private partnership (PPP) model. How can CSR, foundations, climate market can support heat action plans? Discussion today will also be around development of framework to support financing of heat action plans.

Mr. Marc Gordon (UNDRR) stressed the importance of private and public funds to address extreme heat also shifting mindsets from standalone financing models to integrated and diversified funding approaches.

Ms. Shubra Singh,
Khemka Foundation

Philanthropies are already taking steps to extend assistance to govts on climate. Assistance can be extended for knowledge sharing, creating platforms for learning local and global examples.

On ground demonstration of actions is the need in case of extreme heat, so foundation is keen to showcase some of the demonstration projects at district level, so as to have evidence building for policy changes for heat action planning.

Dr. Safi Ahsan Rizvi suggested, Khemka Foundation to start by supporting a few districts in development of heat action plans.

Dr. Sahil Hebbar,
SEWA

In 2022, SEWA started the Climate Finance Program. Climate insurance program, which is a parametric insurance program is part of the Climate Finance Program. In 2024, average pay out was INR 300 per day to the members of the program. This product is triggered once temperature thresholds are exceeded by two days, each member gets INR 300/ day from insurance to member bank accounts. SEWA did heat insurance in 2023 & 2024. In 2024, 50000 members benefited from the program. In 2025, the program will extend to other climate disasters as well. In 2025, SEWA will pilot Climate Welfare Facility, where corpus fund in SEWA is distributed to members during a climate shock.

Dr, Safi Ahsan Rizvi suggested SEWA, since they have a very good city network, to use the risk pool funds for supporting some selected city heat action plans.

Dr. Oliver Milosch,
GIZ

Dr. Oliver Milosch from GIZ, recommended the adoption of a blended finance model for adaptation measures, advocating for greater private sector investment in heat adaptation initiatives.

Dr. Krishna requested GIZ to share experience of models of funds available immediately when a disaster strikes.

One effective financial instrument is savings, Dr. Milosch, has seen in some countries, Governments incentivising their citizens to invest in savings account, where Government also invests matching funds in the saving account. GIZ has worked with Micro Finance Institutions for selling insurance to customers for extreme weather events. They are piloting this with ADB.

2. International Climate Finance & Public-Private Partnerships

Mr. Marc Gordon (UNDRR) emphasized the potential of international funding sources such as the GEF, Green Climate Fund, and Loss and Damage Fund to supplement national and local financing mechanisms.

3. Parametric Insurance & Alternative Financial Instruments

Dr. Sahil Hebbar (SEWA) presented SEWA's model for heat insurance solutions targeted at daily wage earners. He demonstrated how a small insurance scheme introduced by SEWA in 2023 enabled 46,000 workers to receive 984 per worker in 2024.

SEWA is now developing a pooled financing mechanism, combining donor capital funds and premium contributions from daily wage earners. The proposed model will ensure that:

Claims are paid out during extreme heat days.

If claims are not triggered, the pooled funds can be used to provide micro-loans to daily wage earners.

Mr. Avdesh Gupta,
ADB

Mr. Avdesh Gupta from Asian Development Bank (ADB) presented its Climate and Health Initiative (CHI), which focuses on building resilience at the intersection of climate change and public health. HEAT is one of the pillars of this program, with key objectives including:

- Enhancing health system resilience
- Promoting low-carbon health systems
- Raising general knowledge and awareness
- Building capacity
- Mobilizing resources and partnerships
- Developing policy and actionable frameworks

ADB is also developing an Urban Heat Tool for mapping urban heat islands. This will support policy makers and will be an open source tool once fully developed.

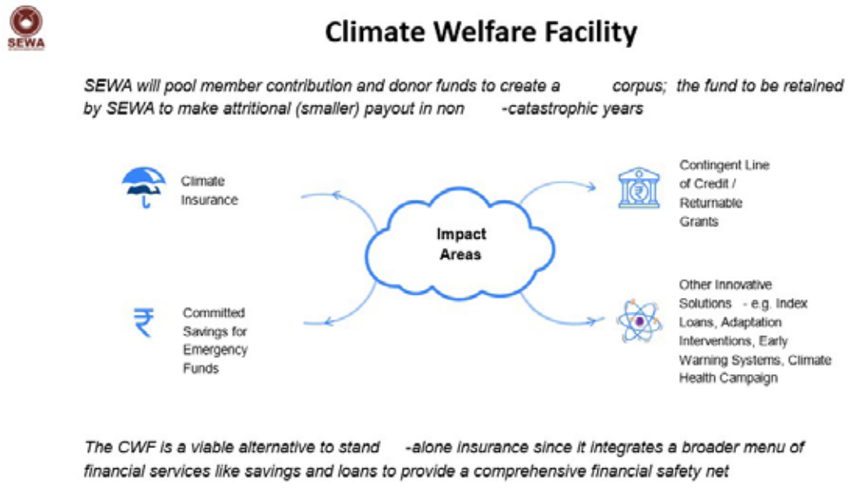


Fig. 20. Climate Welfare Facility

Dr. Archana Chaudhary,
Climate Trends

Dr. Archana Chaudhary, Director – Climate Trends, speaking on how private funds could be channelized towards management of heat , emphasised on data transparency required for companies to build their risk management strategies for heat, corporates, MSMEs and companies working in hot spots of a city, through HAPs should be made aware of extreme temperature expected, so they could plan investing for their workers, access to insurance on ground is another challenge.

4. Role of Non-Government Entities & Data-Driven Approaches

- GIZ discussed the significance

of microfinance institutions and savings-based instruments in risk transfer.

- ADB introduced an Urban Heat Tool to support policymakers in financing heat adaptation strategies.
- Climate Trends emphasized the need for transparent data-sharing frameworks to improve risk assessment and financing strategies.

Ms. Tamana,
SFC

Ms. Tamana from SFC provided insights of public funds available for heat action plans. She highlighted 18 of the 72 Centrally Sponsored schemes can be linked to support HAPs. MGNREGS, AMRUT, Jal Jeevan Mission, PMAY are some of these centrally sponsored schemes that support location action related to infrastructure and nature solution to manage heat. She emphasised using vulnerability assessment which is part of HAPs, local areas in a city with heat islands need to be focused for implementing solutions, this she explained was followed in Ludhiana city.

Mr. Aditya from SFC further added to unlock the funds from finance commission heat has to be notified as one of the climate disasters. Also, since the current HAPs are requiring finance for short term adaptation or mitigation measures, these are easily funded through private funds, however, once the HAPs start looking at long term heat mitigation measures, public funds would be essential for implementation.

Mr. Sandeep Raut,
TCPO

Mr. Sandeep Raut, Town and Country Planning Organization, highlighted on financing provided by MoHUA (Ministry of Housing and Urban Affairs) under Urban Planning & Reform Scheme and AMRUT for reinforcing natural ecosystems in urban areas, these include changing sustainable township policies and transforming building regulations and bye laws to mitigate urban heat islands. Dr. Raut also informed under AMRUT II, urban heat island maps will be tagged through GIS for development of city master plans.

Dr. Sekhar Lukose Kuriakose,
SDMA

Dr. Shekhar, SDMA & also Chief Resilience Officer from Kerala highlighted heat not be looked in silo as a disaster, it is accompanied with winds and also in certain cases lighting, so heat adaptation and mitigation solutions have to address wholistically other extreme weather scenarios associated with heat.

Sh. Autif Sayed,
IFC

Sh. Autif from IFC, World Bank Group, highlighted IFC initiatives for management of heat. Building Resilience Index open-source tool to assess climate risk for buildings and provides mitigation options to reduce climate risks. Helps to also inform finance required to reduce the risks. The model is scaled up to city level, where investment required are identified for various climate adaptation mitigation measures.

5. Conclusion & Future Directions

Dr. Krishna S. Vatsa called for the appointment of Heat Officers at the city and district levels to oversee financing and implementation of HAPs.

- Need to invest at local, city level for implementation of heat action plans.
- Commitment of resources for implementation of measures identified in heat action plans, public funding is a catalyst, however, pool of funds have to be initiated by municipalities and Sate govts for on ground implementation of heat mitigation projects.
- Funding should move from short term to long term mitigation with focus on most vulnerable and unorganised sector population.
- Key investment priorities to inckude cooling infrastructure, urban greening, and water conservation projects.

A Knowledge Center for Heat Wave Monitoring was proposed to support evidence-based policymaking.6. Closing Remarks & Future Collaboration

NDMA representatives emphasized the importance of translating discussions into policy implementation and financial commitments.

- The need for a structured approach to mitigate heat wave impacts on critical infrastructure was highlighted.
- Stakeholders were urged to collaborate on innovative financial models, aiming for zero casualties from heat waves through effective planning and investment.

WRAP-UP SESSION

Chair:

Sh. Sanjeev Kumar Jindal,
Additional Secretary, MHA

Co- Chair:

Sh. Rajendra Singh,
Member & HoD, NDMA

Rapporteur:

Ms. Shalini Singh,
Senior Consultant
Sh. Abhinav Walia,
Senior Consultant

Ms. Mrinalini Shrivastava synthesized the discussions held over the past two days at the workshop on advancing city-level heat action plans and multi-sectoral adaptation for resilient communities. She praised the discussions which were highly insightful. She highlighted, as the climate change intensifies, heat waves and extreme heat events are becoming one of the most pressing urban challenges, impacting health, infrastructure, and livelihoods. She also mentioned that building upon the last year's proceedings, this year's workshop featured six technical sessions covering crucial aspects of heat wave preparedness and mitigation.

The first session focused on strengthening early warning systems, emphasizing improvements in risk modelling, AI-based forecasting, and the expansion of observation networks to ensure last-mile dissemination of information in local languages. The second session explored ways to enhance heat action plans in India, with discussions centred on monitoring and evaluation, cross-sectoral coordination, urban greening, passive cooling, and heat-resistant infrastructure. It was highlighted that although 250 heat action plans exist, implementation at the ground level remains a challenge. The third session provided a global perspective, showcasing international best practices and underscoring the importance of clear governance structures, workplace safety policies, and financing mechanisms.

The fourth session delved into heat and health adaptation, addressing the disproportionate impact of climate change on vulnerable communities, particularly women, children, and labourers. A key takeaway was the need for improved data accessibility to support targeted interventions, as suggested by UNICEF. The session also highlighted the importance of appointing city-level heat officers to ensure accountability and coordinated response efforts. The fifth session focused on heat-resilient infrastructure, advocating for the integration of cool roofing, insulation, and ventilation solutions into urban planning. The Coalition for Disaster Resilient Infrastructure (CDRI) proposed developing a compendium on building typologies to guide heat-resistant construction. The final session addressed financing heat action plans, stressing that there are currently no earmarked funds for such initiatives in India. Discussions centred on sustainable financing models, including public-private partnerships and climate funds, with an urgent request for the Ministry of Home Affairs to consider dedicated funding.

Dr. Krishna S. Vatsa mentioned several key priorities which has emerged. The issuance of district-level early warnings, tailored advisories based on social and occupational factors, and improved health impact monitoring are essential. He emphasised the efforts that must be made to adjust working and school hours during heat waves while also focusing on long-term mitigation measures. Simple, user-friendly cooling solutions need to be developed and promoted, and discussions on effective cooling strategies are already planned for the coming months. The possibility of appointing dedicated heat officers at city and district levels was strongly endorsed, given the success of similar initiatives globally.

Additionally, strengthening data collection and establishing a dedicated knowledge centre for heat wave monitoring is crucial. The workshop emphasized the importance of year-round engagement on heat wave management, rather than seasonal preparedness alone. He also mentioned the NDMA commitment to continue working with stakeholders to drive heat wave mitigation initiatives, particularly as the inclusion of heat waves in the list of disasters eligible for mitigation funding presents an opportunity to scale up interventions. The need for demonstrable models of heat wave mitigation, which can be replicated across the country, was also highlighted.

Shri Sanjeev Kumar Jindal mentioned the government's commitment to reducing disaster-related mortality remains steadfast. While significant progress has been made, reducing heat-related deaths from over 2,000 in 2015 to fewer than 50 in recent years, the goal remains zero heatwave casualties. The successes seen in cyclone preparedness, where zero casualties were achieved in recent severe cyclones, should serve as a model for heat wave mitigation. However, achieving this goal will require improved early warning dissemination, enhanced public awareness, stronger health systems at the primary care level, and climate-resilient urban planning.

Furthermore, the discussion emphasized that mitigation must be integrated into all aspects of disaster management. While preparedness has improved significantly, mitigation efforts need to be strengthened, particularly with the availability of 45,000 crore under the National and State Disaster Mitigation Funds. However, the slow utilization of these funds is a concern, with states having accessed only 3,000 crore out of the 17,000 crore released so far. If mitigation does not become a priority now, future funding opportunities may be jeopardized. The urgency of implementing mitigation projects was reiterated, with a strong call for states to make full use of available financial resources to build long-term resilience against heat waves and other disasters.

In conclusion, the workshop underscored the need for a whole-of-society approach for heat wave management. By integrating evidence-based, scalable solutions, leveraging science and technology, and ensuring coordinated governance, India can build heat-resilient cities and safeguard vulnerable communities. Moving forward, an annual collaborative calendar will be developed to ensure continuous engagement and action on this critical issue.

SPECIAL SESSION- FUTURE COLLABORATIONS

Chair:

Sh. Sanjeev Kumar Jindal,
Additional Secretary, MHA

Co- Chair:

Sh. Rajendra Singh,
Member & HoD, NDMA

Moderator:

Sh. Safi Ahsan Rizvi,
Advisor, NDMA

Rapporteur:

Dr. Vazeem Iqbal,
Consultant

Ms. Mrinalini Shrivastava, Director, NDMA, addressed the session, emphasizing the importance of future collaborations. She introduced a brief presentation outlining the key takeaways from the discussions over the past two days and the proposed framework for a National Heatwave Risk Management Collaboration Strategy. This strategy aims to strengthen prevention, mitigation, preparedness, and response through a multi-stakeholder approach. She highlighted the need to institutionalize extreme heat risk reduction and management. The National Adaptation Plan, currently under development, includes a dedicated chapter on Disaster Risk Reduction (DRR). Key ministries such as Health & Family Welfare, Power, Transport, and Agriculture, and Finance will play critical roles, with state governments supporting implementation and community engagement.

BESIDES CENTRAL AND STATE GOVERNMENTS, THE COLLABORATION WILL INVOLVE THREE KEY GROUPS:

International Organizations & Multilateral Partners:

- UNDRR – Supporting integration of global DRR frameworks into national and subnational heat risk governance.
- UNEP and UNEP Cool Coalition– Assisting in redesigning the built environment and food systems for heat resilience, including through sustainable cooling, and linking to global heat risk governance.
- UNDP – Enhancing subnational capacity building for heat risk management.
- UNICEF – Focusing on child-centered protection measures and social protection programs.
- CDRI – Promoting climate-resilient urban planning and infrastructure.
- ADB – Supporting funding mechanisms for heat-resilient infrastructure and social protection.

Academic Institutions, Think Tanks and Civil Society:

- University of California, Berkeley – Providing research on forecasting models for heat, humidity, and compounding risks.
- CEPT University – Supporting urban planning for heat resilience.
- NRDC, SFC, CEEW – Assisting in policy research, pilot implementation, and standardization of India's 250 Heat Action Plans.
- ATREE, RMI India, SFC, CEEW – Piloting cooling solutions, offering technical assistance to governments, and refining policy provisions.

Private Sector:

- Supporting awareness campaigns, healthcare interventions, and green financing for heat-resilient infrastructure.
- Encouraging and scaling technology and financing innovations including through pilots.

Proposed Collaboration Methods:

- Establishing an Inter-Ministerial Joint Task Force and/or Working Groups for key sectors (e.g., power, forecasting & dissemination).
- Establishing stakeholder convening forum on extreme heat and cooling.
- Launching pilot projects and demonstration initiatives for scalable solutions.
- Co-creating data and knowledge-sharing platforms at subnational levels.
- Developing capacity-building and training programs.
- Structuring financing and investment models, enabling agencies to adopt cities for their Heat Action Plans.

The goal is to integrate scientific, academic, policy, and financial partners into a comprehensive collaboration strategy. With MHA's approval, formalized partnerships will be established, and a joint calendar plan will be developed. Ms. Shrivastava also acknowledged the need to include missing stakeholders, such as the World Bank and Harvard University's Dr. Balsari, who has been actively engaged in related work. She invited all critical partners to contribute to the initiative.

Sh. Marc Gordon from UNDRR remarked that the discussions over the past two days have contributed to an evolving working document, which UNDRR fully supports. He emphasized that the extreme heat risk management strategy must focus not only on coping with the next heat season but also on minimizing the creation of new heat risks across urban and rural systems.

He welcomed the engagement of key sectors such as food systems, agriculture, energy, and transportation, recognizing their role in addressing increasing urban heat and population demands. He stressed the importance of including non-traditional stakeholders in heat risk reduction, particularly the Ministry of Finance, as many sectors already invest in measures that align with heat risk reduction but are not explicitly categorized as such.

Citing a conversation with a professor from the Institute of Architects, he noted that many spontaneous heat-mitigating actions are already being implemented and can be amplified without requiring additional funds. The focus should be on redirecting and redeploying both public and private capital to recognize its relationship with heat risk.

Sh. Gordon highlighted that key domestic and international actors are yet to be fully included in this effort. He suggested adding organizations such as UN-Habitat and the International Labour Organization (ILO), which addresses occupational health and safety in both urban and rural contexts. He reiterated that the UN Secretary-General's Call to Action aims to integrate these elements and drive this initiative forward.

Additionally, he underscored the critical role of the private sector and the investor community, particularly in financial regulation and supervisory authority. He called for exploring how financial regulators can steer public and private investments in ways that not only address the threat of increasing heat but also mitigate the contribution of investments to rising heat risks over time.

He concluded by reaffirming that this is a living document that will continue to be updated, and he welcomed ongoing discussions to refine and strengthen heat risk governance and financial resilience

Member K.S.V stated that since the UN Secretary-General has issued a Call for Action on Extreme Heat, it should galvanize all UN agencies to collectively address heat-related challenges.

While India collaborates with various UN agencies, engagements currently occur individually rather than through a cohesive, integrated approach. Given the global call for action, he urged for greater coordination, coherence, and convergence in organizing UN support.

Mr. Marc acknowledged that the UN Secretary-General's Call for Action on Extreme Heat has rallied many UN entities, increasing awareness among institutions previously unaware of the depth and breadth of expertise in this field.

He highlighted the cross-UN effort on ongoing development of a Common Framework for Extreme Heat Risk Governance, inviting all stakeholders to contribute to ensure it provides the most viable support to countries. In India, he expressed hope that, with the continued support of the Indian government, a dialogue and consultation process could be facilitated to identify key components of an effective risk governance framework for extreme heat.

Marc emphasized the contributions of UNEP, who have significant experience on extreme heat and cooling in the Indian context, alongside key organizations such as the World Meteorological Organization (WMO) and the World Health Organization (WHO). He referenced the Global Heat Health Information Network, a well-established initiative from a heat-health perspective, which has recognized the importance of expanding discussions across multiple sectors and disciplines.

He assured India's stakeholders of UNDRR's commitment to supporting India's efforts and expressed hope for India's support in sharing its experiences with the world. He stressed that addressing extreme heat requires a collective global effort, ensuring that heat levels remain tolerable for both humans and all life.

Benjamin Hickman, UNEP, aligned with Mark's remarks, affirming that the UN system is working to improve its collaboration on extreme heat. UNEP will report back internally with the UN Country Team on this request for greater coordination of UN support and UNEP is already collaborating with several UN agencies in its implementation program. While many initiatives are underway in India, they remain siloed but in many cases are world leading, and UNEP, including through the UNEP Cool Coalition is working to share and integrate India's best practices into global efforts.

UNEP has a major focus on long-term climate adaptation, particularly in redesigning cities and food systems for heat resilience. As UNEP is neither a disaster agency, health agency, nor meteorological agency, its role with regards to extreme heat is primarily focused on long-term structural redesign and adaptation to extreme heat including through sustainable cooling while also reducing emissions and pollutants from rising cooling demand.

UNEP proposed the Government of India may consider establishing a dedicated platform on extreme heat and cooling for this work, similar to the Air Quality Action Forum, which UNEP has supported and brought together over 150 stakeholders. He emphasized the need for enhanced inter-ministerial coordination, and gave an example of the importance of Ministry of Housing and Urban Affairs in delivering urban design and affordable housing that can deliver heat resilience. He also pointed out that cold chain expansion for food system resilience should be part heat adaptation strategies.

UNEP welcomed any effort for creation of an inter-ministerial task force and expressed UNEP's willingness to support it.

Sh. Benjamin then presented UNEP's initiatives:

Cool Coalition – A global platform with working groups on extreme heat, passive cooling, district cooling, cold chain and nature-based cooling, contributing to the UN Secretary-General's Call for Action on sustainable heat adaptation.

Scientific Research & Financing – UNEP has developed global frameworks and methodologies on urban heat adaptation, sustainable cooling, and financing mechanisms, now being tailored for India.

Programs in India –

UNEP has designed a national program supporting implementation of the India Cooling Action Plan in consultation with the Ministry of Environment, Forests and Climate Change and includes several verticals:

- 'BeCool' Sustainable Urban Cooling & Extreme Heat Adaptation (Funded by the Swiss Agency for Development and Cooperation working with NDMA, Ministries of Power, Housing and Urban Affairs & Environment).
- Sustainable Cold Chain Deployment (in collaboration with the Ministry of Agriculture).
- District Cooling Projects (With the Ministries of Power & Environment).
- Urban Heat Assessments – Partnering with CEPT University, UNEP developed a national methodology for urban heat assessments and aims to integrate this into India's Heat Action Plans. They can support five cities with climate-based urban heat mapping in next year.

Capacity Building & Scaling –

- UNEP has supported the establishment of a Center for Cool Cities established with NIUA.
- UNEP with Bureau of Energy Efficiency is establishing a national District Cooling Hub
- Large-scale training programs with state governments on sustainable cooling & extreme heat adaptation including for integrating passive cooling into building bye-laws for building energy code implementation, heat planning, and affordable housing programs with passive cooling, alongside NDMA's Heat Action Plans.

UNEP can support Financial Mobilization for technical assistance on extreme heat and cooling:

- Nature for Cooling Challenge (new project planned to be supported by the Global Environment Facility) – India is expected to be among three beneficiary countries for support on expanding nature in cities for extreme heat protection and reduction in cooling requirements.
- Bilateral funding from Switzerland, Denmark and Germany, philanthropic funding from the Clean Cooling Collaborative
- Accredited entity for the Green Climate Fund (GCF) – UNEP can support countries on mitigation and adaptation projects under the GCF e.g. an India heat adaptation proposal for climate financing.
- Platform & Convening – UNEP is ready to assist Government of India effort to establish a national coordination mechanism on extreme heat and cooling, led by the Government of India.

Sh. Amit Prothi, Director General, CDRI, emphasized the infrastructure linkages to heat, aligning with CDRI's

mission as the Coalition for Disaster Resilient Infrastructure. He highlighted ongoing efforts, particularly through Communities of Practice, which facilitate knowledge-sharing and rapid action.

CDRI has already released a guidance note on heat impact on rail and metro systems, helping practitioners ensure last-mile connectivity for passengers during heatwaves. These quick-to-develop resources are intended to kickstart practical implementation.

Additionally, CDRI launched an urban program, inviting cities from member countries to apply for funding on extreme heat-related infrastructure projects, including power, water, and transport. 87 proposals were received and are currently under evaluation, with RV also participating in the process.

On the data front, CDRI is enhancing its global data platform to include risk information, which will be available by year-end.

Capacity-building remains a key mandate for CDRI. While guidance notes exist, such as those developed by NIUA, there is a clear gap in training for implementation. CDRI is eager to collaborate on developing structured training programs.

CDRI also focuses on knowledge products, such as building typologies, which are initially addressed through Communities of Practice for quick knowledge capture. Some longer-term studies are being considered, but brief, actionable notes are prioritized for immediate impact.

He concluded by stating that CDRI already has one guidance note available and is happy to share it with stakeholders.

Oliver Milosch from GIZ shared an update on a project launched last Friday, following an agreement between the Deutsche Gesellschaft für Internationale Zusammenarbeit. This initiative focuses on addressing heatwaves at the micro level, targeting communities, households, and districts. The intervention will be implemented in both Delhi and Maharashtra, allowing for case studies in both urban and rural settings.

Key workstreams will include finance, training, and capacity-building within the framework of heat action plans. Additionally, there is an effort to collaborate with CDRI on infrastructure resilience. A decision is yet to be made on the specific infrastructure focus, whether it will be housing, hospitals, or another critical sector. Notably, GIZ has previously worked on enhancing hospital resilience against climate and disaster-related events.

Dr. Ashok Gadgil from UC Berkeley responded to Dr. KSV's earlier point about strengthening knowledge centers in India. He emphasized that the University of California, established in 1868, has always prioritized practical impact over being an "ivory tower" institution. Despite its 23 Nobel Prize winners and top global rankings across departments—including public policy, engineering, and business—UC Berkeley remains committed to social impact and resilience.

The university has played a crucial role in California's response to major challenges, such as the recent mega-drought, the 1970s oil embargos, and ongoing climate resilience efforts. While UC Berkeley does not engage directly in governance, it focuses on developing deep knowledge and innovative technologies that can be effectively deployed. Addressing heatwaves in India or globally requires new models and cutting-edge research, not just existing solutions.

Dr. Gadgil highlighted that knowledge transfer is not effective through emails or reports alone. Drawing from past experiences with Western European countries during the oil crisis, he stressed the importance of in-person engagement. To facilitate this, UC Berkeley is open to hosting selected individuals from India for a year to immerse themselves in California's governance, climate policies, and institutional frameworks. This hands-on experience would ensure a better understanding of key processes and cultural nuances.

Sh. Aditya Valiathan Pillai from SFC outlined its current focus on heat action plans and their implementation. Moving forward, the organization aims to create a working model of heat resilience by concentrating efforts on one state or city in collaboration with partners and foundations. Given how quickly ideas and successful examples spread within the Indian system, establishing a top-tier heat resilience initiative could serve as a blueprint for broader adoption across the country. This focused approach, leveraging technical and on-ground capacity, is expected to deliver the highest impact over the next four to five years.

Sh. Abhiyant Tiwari from NRDC India echoed the sentiments of Sh. Aditya Valiathan Pillai from expressing gratitude to NDMA for facilitating such a meaningful dialogue. Reflecting on the previous session's closing remarks by Jindal S and Dr. KSV, he shared that he and Vishwas Chitale, CEEW, had been discussing the importance of utilizing the available mitigation funds effectively.

While these funds have been frequently mentioned, there is a pressing need for a concrete working example. Among the seven states that have officially recognized heat as a disaster, identifying a city or district where a comprehensive heat action, mitigation, and management plan is proposed, approved, implemented, and evaluated would be a significant achievement. Such a successful model could serve as a benchmark, demonstrating effective implementation and potentially leading to increased funding in the next Finance Commission for heat resilience initiatives.

A representative from IMD, a partner organization of NDMA, expressed appreciation for the well-conducted discussions in this meeting. They highlighted IMD's role as a partner in the UN's Early Warning for All initiative and emphasized the distinction between a forecast and a warning.

Under the Multihazard Early Warning System, which is now a global initiative, heatwaves are a key focus. However, the upcoming season also brings the risk of thunderstorms, which are equally dangerous. Dr. KSV member NDMA will be conducting a separate meeting on this, but it is important to recognize that these hazards are interconnected. Severe thunderstorms or heavy rains often precede or follow heatwave conditions, requiring distinct warning mechanisms.

The key concern raised was the transition from forecasts to impact-based warnings. Speaking on behalf of IMD, the representative acknowledged that their knowledge is currently limited in understanding the specific impacts on various stakeholders. To improve this, IMD is seeking NDMA's support in conducting stakeholder-focused meetings to identify the demand for heat-related warnings. Factors such as heat persistence,

moisture content, and associated winds all play a crucial role in determining the impact, and a more comprehensive approach is needed to refine impact-based warnings for heatwaves and rising temperatures.

Sh. Sarabjit Sahota from UNICEF shared that last year, they were able to support the development of heat action plans in only three cities. Moving forward, UNICEF is committed to expanding its efforts and adopting a broader approach. He expressed gratitude for the valuable technical insights gained from the conference.

Their collaboration with the Ministry of Health and NCDC on climate change and human health—where heat is a major concern—has been ongoing for the past three years, and they are committed to continuing this work for another two to three years. Additionally, UNICEF's partnership with NIDM on social behavior change, which began three years ago, has now led to the establishment of a dedicated unit. They are now working to integrate heat-related issues into this agenda.

Dr. Vishwas Chitale from CEEW highlighted the urgent need to scale up heat action plans (HAPs) in India, given that nearly 40% of the population will be living in cities by 2030. With 4,500 small, medium, and large cities across the country, the current number of HAPs covers less than 1–2% of them.

To address this gap, CEEW aims to collaborate closely with cities to develop as many HAPs as possible. They also bring technological innovations, open-access tools, and datasets to support this effort, utilizing publicly available data from IMD and other sources. Through their experience in developing the Thane City Heat Action Plan, launched last year, they learned that creating a HAP is just the first step. Equally important is building the capacity of city officials to understand why HAPs are needed, how to implement them, and what financing options are available.

Dr. Chitale emphasized the importance of accelerating action. Even if 300 HAPs were developed, covering only 7–8% of Indian cities, a significant portion would still be left behind. He echoed Dr. Watsa's view that HAPs should be simple and easily understandable for cities, avoiding unnecessary complexities. A baseline assessment should be the priority, followed by implementing targeted solutions. He also supported the points raised by Aditya and Abhiyant, emphasizing the need for actionable solutions once the baseline is established. CEEW is committed to taking on the challenge of developing as many HAPs as possible.

Marc began by expressing gratitude for the opportunity to speak and extended the regards and compliments of the Special Representative of the UN Secretary-General for Disaster Risk Reduction to the Additional Secretary and the esteemed members present. The Special Representative commended India's leadership in disaster risk reduction, particularly through the G20, and encouraged continued sharing of its experiences and progress with the global community.

He further noted that with a full delegation of European Union Commissioners expected to visit India at the end of March, this presents a valuable opportunity to elevate discussions on extreme heat risk. Given the growing relevance of this issue to both Europe and India, this engagement could serve as a platform for deeper collaboration and shared learning.

Sh. Sanjeev Kumar Jindal, Additional Secretary, MHA, delivered the final concluding remarks, thanking all organizations for their valuable insights on the proposed strategic framework. On behalf of the Government of India, Ministry of Home Affairs, he reaffirmed full support for these initiatives.

He reiterated the key point raised by CEEW, emphasizing that any action plan must be simple, clear, and easily understandable for people on the ground. However, beyond just developing heat action plans, the real challenge lies in effective implementation. To ensure this, there is a need to institutionalize frameworks and systems that integrate mitigation plans across sectors, ensuring they are executed effectively at the local level.

With numerous discussions taking place at national and state levels, the real measure of success is how these deliberations translate into tangible actions on the ground. Only when these plans are effectively implemented can the intended goals be truly achieved.

Way Forward for Strengthening Heat Action and Mitigation Plans in India

Based on the discussions and key takeaways from the Special Session on Future Collaborations, the following strategic actions can help advance heatwave risk management and enhance the implementation of Heat Action Plans (HAPs) across India:

1. Institutional Strengthening and Governance

Inter-Ministerial Task Force: Establish a joint task force comprising key ministries (Health, Environment, Urban Development, Power, Finance, Agriculture) to coordinate heat resilience efforts.

National Heatwave Risk Management Strategy: Finalize and institutionalize a strategic framework for extreme heat risk reduction, integrating it with the National Adaptation Plan and Disaster Risk Reduction (DRR) initiatives.

State and Local-Level Policy Integration: Encourage states and urban local bodies to develop regulatory frameworks and mainstream heat risk management into city planning, infrastructure development, and social welfare programs.

2. Expanding and Standardizing Heat Action Plans

Increase HAP Coverage: Scale up the development of Heat Action Plans across cities and districts, focusing on vulnerable areas. Current coverage (1-2% of 4,500 cities) must expand rapidly.

Simplify Implementation Frameworks: Ensure that HAPs are designed to be clear, simple, and actionable at the grassroots level, avoiding unnecessary complexities.

Establish a Model City/District Initiative: Create a demonstration project in a selected city or district to showcase a fully operational heat mitigation and management system, which can serve as a template for broader adoption.

3. Strengthening Early Warning Systems and Risk Communication

Impact-Based Early Warnings: Enhance collaboration between IMD, NDMA, and local governments to develop impact-based warning systems that account for variables like humidity, wind, and urban heat island effects.

Community Engagement and Awareness: Increase outreach efforts through social behavior change programs, leveraging partnerships with UNICEF, UNEP, NRDC, and civil society organizations.

Localized Forecasting and Data Sharing: Establish data-sharing platforms to integrate local temperature trends, historical records, and real-time forecasting for precise risk assessment.

4. Enhancing Financing and Resource Mobilization

Dedicated Heat Resilience Fund: Advocate for increased funding in the next Finance Commission to support heat mitigation efforts at city and district levels.

Public-Private Partnerships (PPPs): Engage private sector stakeholders to invest in heat-resilient infrastructure, renewable energy-powered cooling solutions, and financing mechanisms for urban adaptation.

Leverage Multilateral Funding: Secure financial and technical assistance from ADB, World Bank, UNEP, and GCF (Green Climate Fund) for large-scale heat adaptation projects.

5. Advancing Research, Innovation, and Capacity Building

Research and Technology Deployment: Collaborate with UC Berkeley, CEPT University, CEEW, NRDC, and others to enhance forecasting models, open-access tools, and urban heat mapping.

Cooling Solutions and Infrastructure Resilience: Promote innovations in passive cooling, climate-resilient buildings, green infrastructure, and sustainable cold chains.

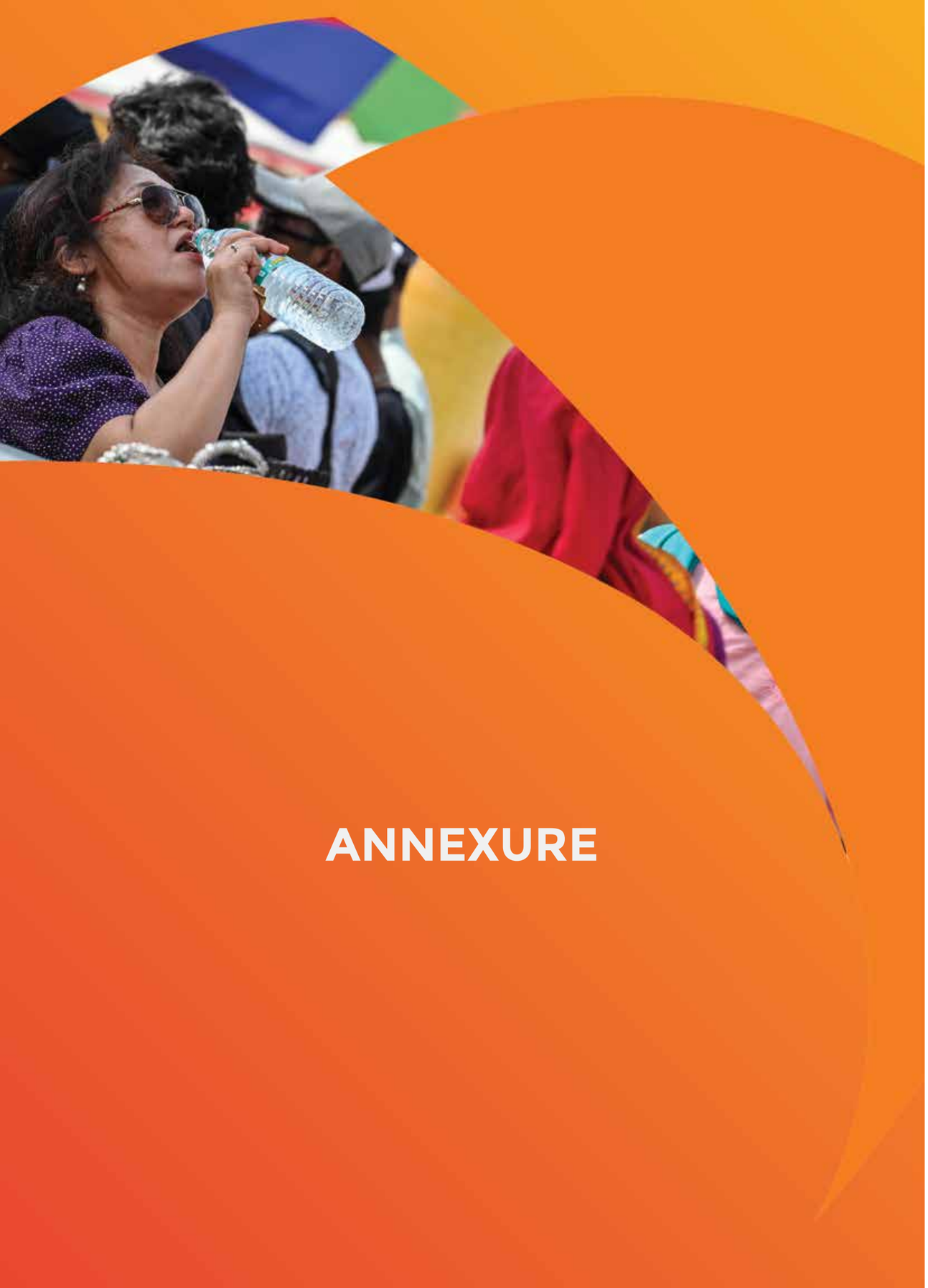
Capacity-Building Programs: Train government officials, urban planners, and emergency responders on heat mitigation strategies, financing options, and community-based adaptation measures.

6. Strengthening Global and Regional Collaboration

International Knowledge Exchange: Facilitate expert visits, training programs, and joint research projects through UC Berkeley, UN agencies, and global networks.

EU-India Climate Dialogue: Capitalize on the upcoming visit of European Union Commissioners to discuss extreme heat risks and collaborative solutions.

UN-Led Coordination Framework: Work towards a unified approach among UN agencies (UNDRR, WHO, WMO, UNEP) to align India's heat risk strategy with global best practices.



ANNEXURE

List of Participants
International Heatwave Workshop 2025

1. STATES

S.No.	Name/Designation	Organization
1.	Shri Papang Duggong, Dy. Director	Arunachal Pradesh
2.	Dr. Bhupen Mili, Sr. Consultant	Arunachal Pradesh
3.	Dr. Bebita Manjari Nayak, General Manager	Odisha
4.	Shri Meghanad Behera, Sr. DR	Odisha
5.	Shri Harpreet Singh Sudan (IAS)	Punjab
6.	Special Secretary-cum-Director	Punjab
7.	Shri Bhagwat Singh, Joint Secretary	Rajasthan
8.	Shri Makhan Lal, Privilege-First	Rajasthan
9.	Dr. S. M Subhani,	Telangana
10.	Urban Infrastructure Designer C/O Telangana State-Revenue (DM)	Telangana
11.	Prof. Ashfaque Jafari	Telangana
12.	Dr. Meera Sheik, Director for TGDPS, Khairtabad	Telangana
13.	Mr. Aanis Faizah	Telangana
14.	Dr. Dilip Kumar Singh, Dy. Director	Madhya Pradesh
15.	Ms. Sujata Saunik, Chief Secretary	Maharashtra
16.	Shri Parikshit Dongarsane, Data Analyst	Maharashtra
17.	Ms. Priyanka Dwivedi, Project Expert Agriculture	Uttar Pradesh
18.	Dr. Kaneez Fatima, Project Director (Drought)	Uttar Pradesh
19.	Shri Kunal Agarwal, IPS IG	West Bengal
20.	Dr. Sasmita Mohan	West Bengal
21.	Shri Balwan Chand, Additional Secretary	Himachal Pradesh
22.	Shri Amir Hussain, Chief Executive Officer	Jammu & Kashmir
23.	Shri Deepak Kumar, Research Officer	Bihar
24.	Shri Rajesh Kumar Sharma, (IAS) Secretary	Jharkhand
25.	Shri Jahamgeer S. Secretary	Kerala
26.	Dr. K Baswanth Reddy, Project Manager	Andhra Pradesh
27.	Shri Sushil Singh, Special CEO Dr. Mukta Girdhar, Sr. Consultant (DDMA),	Delhi

S.No.	Name/Designation	Organization
28.	Shri Vibhati Singh, Project Coordinator (DDMA)	Delhi
29.	Ms. Meera Rawat	DDMA (Haridwar U.K.)
30.	Shri Umashankar Negi	DDMA (Uttarakhand)
31.	Shri Virendra Kumar Srivastava, Joint MC,Nagar Nigam	Jhansi (UP)
32.	Shri Umang Pradhan, Fire Officer	Bhopal & Gwalior Madhya Pradesh
33.	Ms. S. Sudha (IFS)	State Planning Commission, Govt. of Tamil Nadu

2. CENTRAL MINISTRIES

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1.	Shri Arnab Dhaki, DS	Department of Agriculture and Farmers Welfare
2.	Shri Vijay Teotia, JC	Department of Animal Husbandry & Dairy
3.	Shri Pradeep Khasnobis, DDG	Department of Health & Family Welfare
4.	Shri Rabindra Kumar Jena, Sr. Economic Adviser	Ministry of Information & Broadcasting
5.	Shri M.L. Meena, Addl. Economic Adviser	Ministry of Information & Broadcasting
6.	Shri Subir Kumar Mandal GM, NHAI	Ministry of Road Transport & Highways
7.	Shri Bidur Kant Jha	Ministry of Road Transport & Highways
8.	Dr. Vandana Singh, Scientist F	Department of Science & Technology
9.	Dr. Swati Jain, Scientist D	Department of Science & Technology
10.	Smt. Athira S. Babu,	Ministry of Tribal Affairs
11.	Economic Adviser	Ministry of Tribal Affairs
12.	Shri Lakhmi Chand	MOWCD
13.	Shri Aakash Shrivastava	MOWCD
14.	Dr. Rajesh Gupta, Joint Secretary Shri V. Seha Kr	DM Division, MHA
15.	Dr. M. Ravichandran, Secretary	MoES
16.	Shri Akhilesh Srivastava	India Met Dept
17.	Shri Soma Sen Roy	IMD
18.	Shri Arvalan	IMD

3. INTERNATIONAL ORGANIZATIONS

S.No	Name/Designation	Organization
1.	Shri. Marc Gordon	UNDRR
2.	Shri.Benjamin Hickman	UNEP
3.	Shri. Ravi Krishnani	UNEP
4.	Dr. Saurabh Dalal	WHO
5.	Dr. Vidhya Chandramohan	WHO
6.	Shri. Amit Tripathi	CDRI
7.	Ms. Raina Singh	CDRI
8.	Ms. Meghana K.	GIZ
9.	Shri Oliver Milosch	GIZ
10.	Shri John Entwistle	IFRC
11.	Shri Avdesh Gupta	ADB
12.	Shri Manish	UNDP

4. RESEARCH INSTITUTIONS AND KNOWLEDGE PARTNERS

S.No.	Name/Designation	Organization
1.	Shri Tarun Garg	RMI
2.	Shri Akhil Singh	RMI
3.	Ms. Tamanna Dalal	SFC
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5.	Ms. Ishita Shrivastava	SFC
6.	Shri Ishan Kukreti	SFC
7.	Shri Escandita Tewari	SFC
8.	Dr. Bhargav Krishna	
9.	Ms. Ritika Kapoor Shri Abhiyant Tiwari	NRDC India
10.	Shri Ajit Rajiva	Ashoka University
11.	Ms. Priya Dutta	Ashoka University
12.	Shri Ajit Tyagi	Ex- IMD
13.	Shri Tapash Kr Saha Roy	Indian Red Cross Society
14.	Ms. Rishika Das Roy	ICC
15.	Ms. Sagnik Dey	IIT Delhi
16.	Ms. Anshu Ogra	IIT Delhi
17.	Shri Manju Mohan (Retd)	IIT Delhi

S.No.	Name/Designation	Organization
18.	Shri Urooj Iqbal	IIT Delhi
19.	Dr. Sandeep Kumar Rawt	TCPO
20.	Ms. Prathijna P. Kodira	Indian Institute for Human Settlement
21.	Ms. Divyanshi	Indian Institute for Human Settlement
22.	Shri Parmeshwar Udmale	IIT Bombay
23.	Shri Shashank Kumar Anshu	
24.	Shri Imran Majid	ADRA India
25.	Ms. Sonia	ADRA India
26.	Shri Rohan Jain	ADRA India
27.	Shri Prakash Thakur	ADRA India
28.	Ms. Lubna Irfan	CROPC
29.	Ms. Nikita Pal	CROPC
30.	Shri Uday Khemka	Khemka Foundation
31.	Shri Shubhra Singh	Khemka Foundation
32.	Dr. Aarthiy Ramaisawy	MSSRF
33.	Dr. Soumya Swaminathan	MSSRF
34.	Shri R.C. Sharma, Former Director	Delhi Fire Service
35.	Shri Vishwas Chitale	CEEW
36.	Shri Shravan Prabhu	CEEW
37.	Shri Sahil Ashok Hebbar	SEWA
38.	Dr. Pankaj Kumar Singh	SEWA
39.	Shri Sadaf Sanavllan Khan	RAI Pvt. Lt.
40.	Shri Rimjhim Sharma	RAI Pvt. Lt.
41.	Ms. Samhita R	RAI Pvt. Lt.
42.	Shri Praveen Pandey	VVGNLI
43.	Shri Saptarshi Choudhary Paramount	Paramount
44.	Ms. Tania Banerjee	BCG
45.	Ms. Maitrieye	BCG
46.	Ms. Sushmita Joseph	IITM Pune
47.	Shri Raju Mandal	IITM Pune
48.	Shri Shalaka Kumar	SEEDS
49.	Shri Parag Talankar	SEEDS
50.	Shri Surender Singh	NDRF
51.	Ms. Kartiki Negi	Climate Trends
52.	Shri Sanat Gandhi	Greentech knowledge Solution Pvt. Ltd
53.	Ms. Ritu Parchure	MPH, Prayas Health Group, Pune

S.No.	Name/Designation	Organization
54.	Ms. Shweta Kulkarni	MPH, Prayas Health Group, Pune
55.	Dr. Ashok Gadgil	UC Berkeley
56.	Dr. Piyush Narang	UC Berkeley
57.	Shri Mayura Gadkari	Artha Global
58.	Shri Vinay K Sehgal	IARI, Pusa New Delhi
59.	Shri Maanas Bajpai	16th Finance Commission
60.	Shri Liankhankhup Juite	16th Finance Commission
61.	Ms. Saswati Gandhi	GKSPL
62.	Dr. Mahaveer Golechha	IIPH-G
63.	Dr. Purnima Patel	NCDC
64.	Dr. Samarpan Nanda	EFICOR
65.	Shri Jitender Meena	Save Earth Mission
66.	Shri Ashok B. Lal	ASLA
67.	Shri Aditya Naraiyan	US, DC
68.	Shri Vineet Arora	US, DC
69.	Mrs. Swati Sulagana	CII-CESD

5. NDMA

S.No.	Name/Designation	Organization
1.	Shri Rajendra Singh (Member & HoD)	NDMA
2.	Dr. Krishna Swaroop Vatsa (Member)	NDMA
3.	Lt. Gen. Syed Ata Hasnain (Member)	NDMA
4.	Ms. Sreyasi Chaudhuri (JS)	NDMA
5.	Mrs. Sumita Singh (Advisor)	NDMA
6.	Col. K.P. Singh (Advisor)	NDMA
7.	Shri Safi Ahsan Rizvi (Advisor)	NDMA
8.	Shri Rakesh Kataria (Dir)	NDMA
9.	Ms. Mrinalini Shrivastava (Dir)	NDMA
10.	Shri Ambuj Bajpai (Dy. Dir)	NDMA
11.	Mrs. Rakhee Sadhu (Dy. Dir)	NDMA
12.	Shri Nawal Prakash (JA)	NDMA
13.	Dr. Pavan Kumar Singh (JA)	NDMA
14.	Dr. S.K. Jena (JA)	NDMA

S.No.	Name/Designation	Organization
15.	Shri Vivek Jayaswal (US)	NDMA
16.	Mrs. Sreetama Samanta (US)	NDMA
17.	Mrs. Saroj Kujur (US)	NDMA
18.	Shri Santosh Singh (Mit IT)	NDMA
19.	Prof Pooja Saxena	NDMA
20.	Shri Anand Sengupta	NDMA
21.	Shri Kunal Chakrbarti	NDMA
22.	Shri Prakash	NDMA
23.	Shri Abhishek (SRO)	NDMA
24.	Shri Chandan Singh (US)	NDMA
25.	Dr. Sweta Baidya	NDMA
26.	Mrs. Ranu Chauhan	NDMA
27.	Shri Ashok Kumar	NDMA
28.	Shri Antony Joh Moothedan	NDMA
29.	Ms. Dipali Jindal	NDMA
30.	Ms. Susmita Goswami	NDMA
31.	Dr. Twinkle Sharma	NDMA
32.	Dr. Kajal Joshi	NDMA
33.	Shri Vijay Lokesh Singh	NDMA
34.	Shri Likun Patra	NDMA
35.	Shri Suvas Chandra Mohanty Lead Consultant)	NDMA
36.	Shri Prava Kumar (AFA)	NDMA
37.	Shri Bhupender Singh (AA Ops)	NDMA
38.	Mohd Saqib Ansari (SO)	NDMA
39.	Shri Abhishek Biswas (US)	NDMA
40.	Shri Mujaffar Sadiq (ASO)	NDMA
41.	Shri Vivek Pratap Singh (Cosultant Legal)	NDMA
42.	Ms. Mridusmita Choudhary	NDMA

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