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Urgency of Urban Heat Adaptation

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INTRODUCTION

Passive Cooling for Extreme Heat Adaptation and Mitigation

*By **Minni Sastry,** Advisor, Extreme Heat & Sustainable Cooling, Climate Change Division, United Nations Environment Programme (UNEP) India*

"Extreme heat amplifies inequality, inflames food insecurity, and pushes people further into poverty. We must respond by massively increasing access to low-carbon cooling; expanding passive cooling – such as natural solutions and urban design; and cleaning up cooling technologies while boosting their efficiency. UNEP [Global Cooling Watch] estimates that, together, these measures could protect 3.5 billion people by 2050, while slashing emissions and saving consumers $1 trillion a year"
UN Secretary-General Antonio Guterres, July 2024, Launch of Extreme Heat Call to Action (unsg_call_to_action_on_extreme_heat_for_release.pdf)

According to the UNEP Cool Coalition's Global Cooling Watch report, (Global Cooling Watch 2023 | UNEP - UN Environment Programme) investing in the triple strategy of passive cooling (nature, climate sensitive urban design, reflective surfaces and smart buildings), improved energy efficiency of buildings and cooling equipment and phase-out of climate-warming gases used in cooling equipment – in line with the Global Cooling Pledge at COP 28 will reduce cooling emissions by 60% while enabling billions to be protected from the impacts of extreme heat

Cities and subnational governments globally are critical to this effort. An opportunity for cities to act towards extreme heat and sustainable cooling exists through becoming signatories for the subnational Global Cooling Pledge.

In this Pledge, subnational governments commit to develop a heat action plan by 2026, increase the area and quality of green and blue spaces in urban areas for cooling, and pursue public procurement of low-global warming potential and high-efficiency cooling technologies by 2030. All these actions help cities to adapt and mitigate extreme heat. This Pledge is a strong signal of a city's commitment and could potentially unlock access to greater technical assistance if required to help deliver on the commitment.

UNEP is implementing a global program to help regions, countries, and cities "Be Cool" in the face of extreme heat. The program focuses on adaptive thermal comfort and passive cooling approaches in buildings and at the urban-scale and is currently supporting India, ASEAN countries, Vietnam, Cambodia, Cote d'Ivoire, and Brazil in these efforts.

India is one of the most at-risk countries in the world from rising temperatures and increasing extreme heat due to climate change. The vulnerabilities are aggravated in urban areas due to the urban heat island effect, lack of outdoor shading and nature, homes that are not heat-proof and lack of equal access to cooling equipment.

Nature has the power to cool down cities. Development authorities, policy makers, financial institutions need to work together to bring nature back into cities as critical adaptation to rising heat. Urban Heat Island assessment studies are providing the scientific justification that neighbourhoods in a city with denser vegetation, reflective surfaces and shading have the potential to be 5 – 7°C cooler than the hot spots of the city. Similarly, buildings with passive cooling (shading, cool roofs, cross-ventilation, insulation) have the potential to maintain cooler and thermally comfortable spaces indoors. Passive cooling in buildings and urban spaces needs to become the norm and increasingly mandatory in order to prepare cities for the coming heat extremes. ■

This issue of *Southasiadisasters.net,* "Urgency of Urban Heat Adaptation", focuses on the urgent need for urban heat adaptation across South Asia. It features expert insights, local solutions, and policy innovations to address rising temperatures, protect vulnerable communities, and promote heat-resilient cities through nature-based strategies, early warning systems, and inclusive planning.

With record-breaking heatwaves and growing climate risks, cities are at the frontline of this crisis. This issue explores a wide range of responses—from cool roofing and green infrastructure to heat action plans and climate-smart urban design. Contributors from India, Nepal, Bangladesh, and beyond highlight both challenges and practical solutions that can be scaled, shared, and sustained.

Urban Heat Islands: Strategies for Mitigating the Effects in India

*By **Mihir R. Bhatt**, All India Disaster Mitigation Institute (AIDMI), India*[1]

The Urban Heat Island (UHI) effect is a growing concern in cities across India, where urban areas experience significantly higher temperatures than their rural surroundings due to dense infrastructure, fuel-based industrial manufacturing or transport, limited vegetation, and heat-absorbing materials such as concrete and asphalt.

As climate change intensifies, extreme heat events are becoming more frequent and severe, posing serious risks to life, livelihoods, public health, infrastructure, and overall urban livability.

To mitigate the UHI effect, cities must implement a combination of local nature-based, technological, and policy-driven solutions at large scale.

Cool and Reflective Urban Surfaces

Traditional urban surfaces like asphalt and dark rooftops absorb and retain heat, exacerbating the UHI effect. Replacing these with cool roofs and cool pavements—materials designed to reflect more sunlight and absorb less heat—can significantly reduce surface temperatures.

White or light-coloured roofs, for instance, reflect solar radiation and can decrease indoor temperatures, lowering energy demands for cooling. Similarly, permeable pavements not only reflect heat but also reduce surface runoff, helping manage urban flooding.

Such transformation of surfaces can generate new skills and employment.

Green Technological Innovations for Heat Mitigation

Emerging technologies offer new opportunities to cool urban heat. Smart sensors and real-time heat mapping allow cities to monitor temperature variations and identify hotspots.

Advanced cooling technologies, such as passive cooling systems and heat-resistant building materials, working with solar or wind or other renewable energy, can further improve urban climate resilience.

The integration of renewable energy sources, particularly wind and solar-powered cooling solutions, can help offset the increased energy demands caused by rising temperatures.

Water-Based Cooling Solutions

Water plays a crucial role in heat mitigation. Incorporating water bodies, fountains, and urban wetlands helps cool the surrounding environment. Encroached up on city lakes and ponds and re-generating riverbeds are a way ahead to cool cities.

> *India's cities must urgently address the Urban Heat Island (UHI) effect – a key driver of rising urban temperatures – by implementing nature-based, technological, and policy-driven cooling solutions at scale.*

Cities can also implement sustainable water management practices such as rain gardens, bioswales, and retention ponds to mitigate heat while also improving stormwater management.

Urban planning strategies that increase access to shaded waterfront areas can create natural cooling zones for residents.

Community-Based and Policy-Driven Mitigation Approaches

Addressing the UHI effect requires collaboration among city planners, policymakers, businesses, academics, and communities.

Local governments should implement policies that incentivise green roofs, reflective materials, and urban forestry programmes.

Heat action plans, early warning systems, and public awareness campaigns can educate communities about heat risks and adaptive measures.

Cooling business plans, early warning, and related actions add to urban cooling. Governments can also support low-income communities—often the most vulnerable to extreme heat—by providing water sources, cooling centres, subsidies for home

[1] Presented at National Workshop on Proactive Heatwave Response: Charting a Path for Anticipatory Action and Community Resilience, March 11, 2025. For details on anticipatory actions, be in touch with Jyoti Agarwal at support@aidmi.org or look up AIDMI website (https://aidmi.org/).

insulation, and access to affordable cooling technologies.

Green Infrastructure and Urban Forestry

Expanding green spaces such as parks, green roofs, and tree-lined streets is one of the most effective ways to reduce urban heat. Vegetation provides shade, absorbs heat, and cools the air through evapotranspiration.

Urban tree-planting initiatives—horticulture, floriculture, forest, and other varieties—can significantly lower local temperatures while improving air quality and enhancing biodiversity.

In addition, vertical gardens and green walls in densely built areas can contribute to cooling while maximising space usage.

These measures cannot be taken overnight, but with a five-year plan, such initiatives can take root and in fact, generate green skills, assets, and jobs.

Heat Smart Urban Design and Planning

Cities can be designed or re-designed to promote natural ventilation and reduce heat retention.

Implementing shaded walkways, using high-albedo materials for buildings and roads, and designing compact yet well-ventilated urban layouts can help mitigate heat accumulation.

Heat smart city layouts with open spaces and wind corridors allow air to circulate, reducing trapped heat.

In addition, integrating climate-responsive building designs—such as insulated walls, cross-ventilation, adequate plantation, suitable water bodies, and energy-efficient construction—can lower indoor temperatures.

Conclusion

Mitigating the urban heat island effect in India requires a multifaceted approach that combines natural solutions, technological advancements, and community-driven policies.

By prioritising green infrastructure, sustainable urban planning, water management, and heat-resilient design, cities can create cooler, more livable environments.

As climate change continues to exacerbate heat-related challenges, proactive and inclusive strategies will be essential in ensuring urban heat resilience and safeguarding public health in India's cities. ■

शहरी तप्त द्वीप : भारत में प्रभावों को कम करने की रणनीतियां

- मिहिर आर. भट्ट

भारत में शहर गरम से गरमतर होते जा रहे हैं और उनमें रहने वाले लोग बेहाल। ग्रामीण क्षेत्रों के मुकाबले यहां के शहरों में तापमान कहीं ज्यादा होता है और इसकी वजह है शहरों में घने बुनियादी ढांचे, ईंधन आधारित औद्योगिक विनिर्माण या परिवहन, सीमित वनस्पति और कंक्रीट और डामर जैसी ऊष्मा–अवशोषित सामग्री का बड़ी मात्रा में उपयोग। यही कारण है कि यहां शहरी तप्त द्वीपों (कम तापमान वाले गांवों से घिरे बेहद उच्च तापमान वाले शहर) की संख्या बढ़ती जा रही है और उनके दुष्प्रभावों से हमारा जीवन, आजीविका, सार्वजनिक स्वास्थ्य, बुनियादी ढांचे और समग्र शहरी जीवन–यापन जोखिमभरा हो चुका है। इन जोखिमों को कम करने के लिए शहरों को चाहिए कि वे बड़े पैमाने पर स्थानीय, प्रकृति–आधारित, तकनीकी और नीति–संचालित समाधानों को समन्वित करें, लागू करें।

ठंडी और परावर्तक शहरी सतहें

डामर और काले सीमेंट से बनी पारंपरिक शहरी छतों की सतहें गर्मी को अवशोषित कर अपने में समेटे रखती हैं, जिससे शहरी तप्त द्वीप का प्रभाव और बढ़ जाता है। इन छतों को, सूर्य के प्रकाश को ज्यादा परावर्तित करने और गर्मी को कम अवशोषित करने के लिए डिजाइन की गई सामग्री से निर्मित, ठंडी छतों और ठंडे फुटपाथों से बदल कर सतह के तापमान को काफी कम किया जा सकता है।

उदाहरण के लिए, सफेद या हल्के रंग की छतें सौर विकिरण को परावर्तित करती हैं जिससे घर के अंदर का तापमान कम हो जाता हैं। इससे घर को ठंडा रखने के लिए ऊर्जा की मांग कम हो जाती है। इसी तरह, पारगम्य फुटपाथ (छिद्रयुक्त फुटपाथ) न केवल गर्मी को परावर्तित करते हैं बल्कि सतही बहाव को भी कम करते हैं, जिससे शहरी बाढ़ को प्रबंधित करने में मदद मिलती है।

सतहों के इस तरह के परिवर्तन से नए कौशल और रोजगार भी पैदा हो सकते हैं।

गर्मी कम करने के लिए हरित तकनीकी नवाचार

उभरती हुई तकनीकें शहरी गर्मी को कम करने के कई नए अवसर प्रदान करती हैं। स्मार्ट सेंसर और रीयल–टाइम हीट मैपिंग से शहर तापमान में होने वाले बदलावों की

निगरानी और गर्मस्थलों की पहचान की जा सकती है।

सौर या पवन या अन्य नवीकरणीय ऊर्जा के साथ काम करने वाली निष्क्रिय शीतलन प्रणाली (कम ऊर्जा के उपयोग से गर्मी को नियंत्रित करने या बाहर निकाल देने वाली प्रणाली) और गर्मी प्रतिरोधी निर्माण सामग्री जैसी उन्नत शीतलन तकनीकें शहरी जलवायु सामर्थ्य को और बेहतर बना सकती हैं।

नवीकरणीय ऊर्जा स्रोतों, विशेष रूप से पवन और सौर ऊर्जा से चलने वाले शीतलन समाधानों का एकीकरण, बढ़ते तापमान के कारण होने वाली बढ़ी हुई ऊर्जा मांगों को पूरा करने में मदद कर सकता है।

जल–आधारित शीतलन उपाय

पानी गर्मी कम करने में महत्वपूर्ण भूमिका निभाता है। जल निकायों, फव्वारों और शहरी आर्द्रभूमि से आसपास के वातावरण को ठंडा करने में मदद मिलती है। शहर की झीलों और तालाबों को फिर से प्रतिष्ठित करना और नदी के किनारों को फिर से बनाना शहरों को ठंडा रखने का एक तरीका है।

शहर, गर्मी को कम करने के लिए वर्षा उद्यान, बायोस्वाल और प्रतिधारण तालाब (Retension Ponds) जैसी परंपरागत/स्थिर जल प्रबंधन प्रथाओं को भी लागू कर सकते हैं और साथ ही तूफानी जल प्रबंधन में भी सुधार कर सकते हैं।

शहरी नियोजन में छायादार तटवर्ती क्षेत्रों का निर्माण करने वाली रणनीतियों को शामिल कर ठंडक भरे प्राकृतिक क्षेत्रों का निर्माण किया जा सकता है।

समुदाय–आधारित और नीति–संचालित शमन दृष्टिकोण

शहर तप्त द्वीप के प्रभावों को कम करने के लिए जरूरी है कि शहर के योजनाकारों, नीति निर्माताओं, व्यवसाइयों, शिक्षाविदों और समुदायों के बीच आपसी सहयोग हो। स्थानीय सरकारों को ऐसी नीतियां लागू करनी चाहिए जो हरित छतों, परावर्तक सामग्रियों और शहरी वानिकी कार्यक्रमों को प्रोत्साहित करें। ताप कार्रवाई योजनाओं, प्रारंभिक चेतावनी प्रणाली और जन जागरूकता अभियानों के जरिए समुदायों को ताप जोखिमों और उनसे निपटने के उपायों के बारे में शिक्षित किया जा सकता है।

शीतलन कारोबार योजनाएं, प्रारंभिक चेतावनी और उससे संबंधित कार्यवाहियां शहर को ठंडा रखने में सहायक होती हैं। जल स्रोत, शीतलन केंद्र, घर के इन्सुलेशन के लिए सब्सिडी और सस्ती शीतलन तकनीकों तक पहुँच प्रदान करके सरकारें कम–आय वाले समुदायों का भी सहयोग कर सकती हैं। ये समुदाय अक्सर अत्यधिक गर्मी के प्रति सबसे अधिक संवेदनशील होते हैं और इसलिए सबसे अधिक जरूरत मंद भी।

हरित अवसंरचना और शहरी वानिकी

पार्क, हरी छतें और पेड़ों से सजी सड़कें जैसे हरित स्थानों का विस्तार करना शहरी गर्मी को कम करने के सबसे प्रभावी तरीकों में से एक है। वनस्पति छाया प्रदान करती है, गर्मी को अवशोषित करती है और वाष्पोत्सर्जन के माध्यम से हवा को ठंडा करती है।

शहरों में वृक्षारोपण पहल

बागवानी, फूलों की खेती, वन और अन्य किस्में – स्थानीय तापमान को काफी हद तक कम कर सकती हैं, साथ ही वायु की गुणवत्ता में सुधार और जैव विविधता को बढ़ा सकती हैं। इसके अलावा, घनी आबादी वाले क्षेत्रों में लंबाकार उद्यान और हरित दीवारें अधिकतम स्थान का उपयोग करते हुए आसपास के वातावरण को ठंडा कर सकती हैं।

ये उपाय रातों–रात नहीं किए जा सकते। पर पांच साल की योजना से इन उपायों को जमीन पर गहरे में उतारा जा सकता है। ये उपाय हरित कौशल, संपत्ति और नौकरियां भी पैदा करते हैं।

हीट–स्मार्ट–सिटी : डिजाइन और नियोजन

शहरों को इस तरह से डिजाइन किया जाना चाहिए कि वे ताप का अव"ाोषण कम करें और प्राकृतिक वेंटिलेशन ज्यादा हो। इसके लिए उन्हें फिर से डिजाइन करना पड़े तो वह भी किया जाना चाहिए।

छायादार पैदल मार्ग, इमारतों और सड़कों के लिए उच्च–अल्बेडो सामग्री (सूर्य के प्रका"ा का ज्यादातर भाग परावर्तित कर देने वाली सामग्री) का उपयोग और कॉम्पैक्ट लेकिन अच्छी तरह से हवादार शहरी लेआउट गर्मी के संचय को कम करने में मदद कर सकता है।

खुली जगहें और हवादार गलियारे शहर को हीट स्मार्ट सिटी बनाते हैं। इस बनावट से खुले स्थानों पर हवा अपने आप बहती रहती है और अपने साथ गर्मी को भी बहा ले जाती है।

इसके अलावा, जलवायु–अनुकूलन भवन डिजाइनों को एकीकृत करके, जैसे कि इन्सुलेटेड दीवारें, क्रॉस–वेंटिलेशन, पर्याप्त वृक्षारोपण, उपयुक्त जल निकाय और ऊर्जा–कुशल निर्माण से भी अंदर के तापमान को कम किया जा सकता है।

निष्कर्ष

भारत में शहरी तप्त द्वीपों के प्रभाव को कम करने के लिए एक ऐसे बहुआयामी दृष्टिकोण की जरूरत है जो प्राकृतिक समाधानों, तकनीकी प्रगति और समुदाय–संचालित नीतियों को एक साथ लेकर चलता है/जोड़ता है।

हरित बुनियादी ढांचे, टिकाऊ शहरी नियोजन, जल प्रबंधन और तप"ा–अनुकूलन डिजाइन को प्राथमिकता देकर, शहर अपने आप को अपेक्षाकृत ठंडा और अधिक रहने योग्य बना सकते हैं।

जलवायु परिवर्तन, क्योंकि गर्मी से संबंधित चुनौतियों को लगातार बढ़ाता जा रहा है, इसलिए भारत के शहरों को शहरी गर्मी लचीलापन सुनिश्चित करने और सार्वजनिक स्वास्थ्य की सुरक्षा के लिए सक्रिय और समावेशी रणनीतियां अपनाना जरूरी होगा। ■

UNDRR Agenda for Cool Cities

*By **Sanjaya Bhatia,** Head of Office Incheon, UN Office for Disaster Risk Reduction (UNDRR), Republic of Korea*

The effects of extreme heat are most acutely felt in urban centres. On average, cities are up to 7°C warmer than the surrounding countryside during the daytime (Gregory, 2021). With this challenge in focus, the UNDRR is promoting an Extreme Urban Heat Risk Management Resource Package under the Making Cities Resilient 2030 initiative. https://www.undrr.org/publication/urban-heat-risk-management-resource-package

The Extreme Heat Challenge

A key barrier to urban cooling is the lack of awareness. There is limited information on best practices, coupled with a lack of data regarding how extreme heat is impacting communities. These gaps make it difficult for city officials to design and implement cooling action plans.

Another key challenge is financial hurdles. Urban heat reduction strategies, such as cool roofs, vertical greenery, and ventilation corridors, offer long-term benefits compared to immediate cooling responses like air conditioning. Decision-makers are often deterred by the high fixed start-up costs associated with these solutions, leading them to favour traditional cooling methods.

Cities face limited institutional capacities. Implementation is hindered by a lack of resources, expertise, and data. For instance, gaps in data regarding citywide heat levels and shade coverage can obstruct the success of many cooling programmes.

The variety of cooling strategies available can also make decision-making more complex as cities attempt to determine which strategies are most suitable for their specific needs, leading to indecision.

Successful implementation of cooling strategies requires collaboration across various sectors, which can be complicated. For example, increasing urban tree cover involves coordination between the city's transportation, parks and recreation, planning, and zoning departments.

Finally, the lack of community involvement is a barrier. Without active community engagement, the risk management efforts may not address the needs of the people most affected by extreme heat.

Key Recommendations

Conduct a city baseline assessment: A heat assessment of risk and vulnerability is a first step in effective planning for extreme heat. This means identifying populations and assets most at risk and taking stock of existing green, blue, and grey infrastructure.

Set clear heat-planning goals: It is important to design targets that respond to the needs identified in the baseline assessment. For example, when implementing nature-based solutions, cities could set targets for the total area of green space per resident or for residents' proximity to that space.

Prioritise equitable access: Low-income communities tend to be more exposed to the dangers of extreme heat and they need to be actively engaged in planning to ensure that the initiatives suit their actual needs.

Build awareness on heat risk reduction: Capacity development programmes to promote understanding of heat risks can help in the better implementation of long-term solutions.

Establish a heat alert system: Using a tiered alert system to inform the public of periods of extreme heat can mitigate the risks.

Engage all stakeholders: Key departments to engage with include those for city planning, budgeting, buildings, environment, parks, land use, public works, utilities, and roadways. Successful implementation requires cross-sectoral agency participation.

Adopt a variety of heat resilience strategies: Cities can reduce urban heat by using reflective surfaces and materials, adding shading structures, increasing street tree coverage, preserving and establishing green and blue spaces, and increasing ventilation through cooling urban geometry.

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CLIMATE RESILIENCE

What Can Indian Cities Learn from Action in 2025 from a New Study on Residential Heat and Energy Burdens in Miami?

*By **Vishal Pathak,** AIDMI, India*

A recent study on residential heat and energy burdens in Miami highlights critical challenges in urban heat resilience. It reveals how rising temperatures disproportionately impact low-income households, increasing electricity costs and exposing residents to dangerous indoor heat levels. Indian cities, which face similar extreme heat risks, can draw valuable lessons urgently from this research to improve their heat mitigation strategies and energy policies for the summer of 2025.

1. Intersectionality of Heat and Energy Burdens

The study in Miami highlights two key issues:

- **Heat burden:** Residents, especially in low-income neighbourhoods, experience higher indoor temperatures due to poor housing conditions and lack of access to cooling solutions.
- **Energy burden:** Rising temperatures increase electricity demand, making cooling expensive for vulnerable populations. Even a small fan runs all day and night. This leads to a situation where many households either overpay for cooling or endure unsafe indoor temperatures to save money.

Indian cities, particularly in states like Rajasthan, Gujarat, Uttar Pradesh, Maharashtra, and Delhi, but also in Assam and Tamil Nadu face similar challenges, making it crucial to address both heat and energy burdens in urban planning.

2. Housing, Heat, and Resilience

The study finds that poorly designed homes in Miami trap heat, worsening indoor temperatures. Indian cities can learn from this by:

- **Retrofitting informal settlements** with heat-resistant materials to improve living conditions, matched with trees and plants in all open areas.
- **Promoting cool roofs and reflective paints** to reduce indoor temperatures, in addition to planting trees in the compound around the home.
- **Encouraging energy-efficient housing** with proper ventilation and insulation.

By implementing these solutions, Indian cities can start to create affordable and climate-resilient housing.

3. Ensuring Affordable and Sustainable Cooling

A major concern in Miami's study is the rising cost of air conditioning, which makes cooling unaffordable for low-income families. Indian cities, where air conditioning ownership remains low, can take proactive measures by:

- **Providing subsidies for sustainable cooling solutions** that are nature-based in economically weaker communities.
- **Encouraging passive cooling techniques** like shaded windows, rooftop gardens, tree-planted streets, and cross-ventilation to reduce dependency on air conditioning.
- **Expanding access to energy-efficient cooling technologies** such as solar-powered fans and evaporative coolers, in addition to landscaping with trees and vegetation on available surfaces.

Extreme heat adaptation at Ahmedabad.
Photo: AIDMI.

Affordable and sustainable cooling strategies can prevent extreme indoor heat exposure while keeping electricity costs manageable. The aim should be to reduce dependence on electricity for cooling.

4. Strengthening Energy Policies and Infrastructure

The Miami study emphasises the need for better energy policies to support vulnerable communities. Indian cities can implement similar measures, such as:

- **Offering tiered electricity pricing** to make energy affordable for low-income households. The poor pay less for basic supplies for cooling. First fan free, as a small business in Ahmedabad told AIDMI team.
- **Upgrading energy infrastructure** to ensure a stable electricity supply during peak summer months. Find ways to turn extreme heat into additional electricity.
- **Expanding renewable energy adoption** to reduce dependence on fossil-fuel-based power grids.

A well-structured energy policy can reduce both financial and heat burdens on urban residents, especially the low-income.

5. Investing in Community-Based Heat Resilience Programmes

Community engagement played a significant role in Miami's research, helping authorities understand localised heat risks. Indian cities can benefit from:

- **Launching heat awareness campaigns** to educate residents on heatwave preparedness. Focus should be on solutions and not the impact of extreme heat.
- **Creating neighbourhood cooling centres** in schools, libraries, and community halls. New structures are not needed. The reuse, repair, and revival of existing structures often save time and money.
- **Encouraging public-private partnerships** to implement large-scale urban cooling projects. Large scale does not always mean a single corporate project. Large scale also means small, local, community or small business-initiated urban cooling projects.

Community-driven approaches ensure that heat resilience efforts address real-world challenges effectively. Network such community initiatives to multiply impact.

Conclusion: Indian cities can learn valuable and urgent lessons from the Miami study by integrating heat-resilient housing, affordable cooling, sustainable energy policies, and community engagement into their urban planning. By proactively addressing residential heat and energy burdens, they can create safer, cooler, and more sustainable living environments for millions of urban residents by the summer of 2025. ■

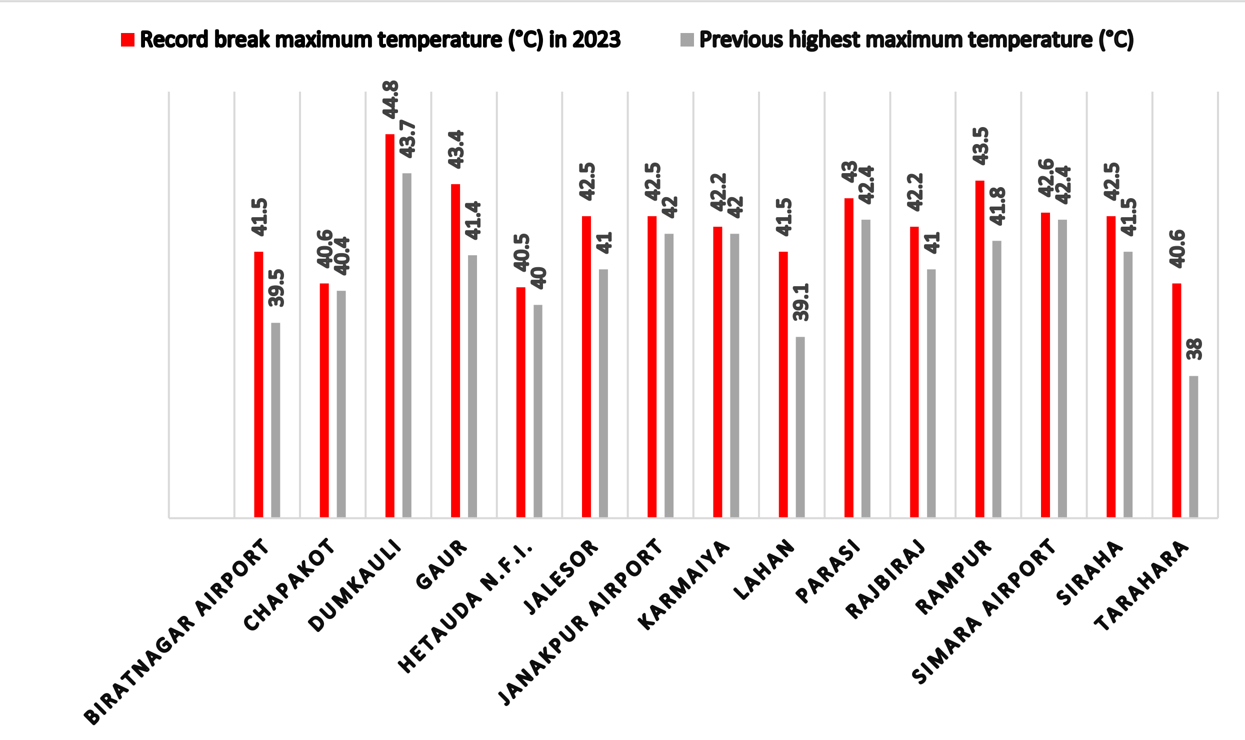
EXTREME HEAT PREPAREDNESS

Strengthening Community Resilience: A Heatwave Early Warning and Early Action System for Nepal Amidst Urban Heat Islands

*By **Dharam Raj Uprety,** Thematic Lead: Climate and Resilience, Practical Action, Nepal*

Nepal, increasingly vulnerable to climate change's intensifying effects, confronts a significant, often overlooked threat: heatwaves. Despite being categorised as moderately at-risk, ranking 69th in vulnerability (Germanwatch 2025), the nation faces complex challenges from multiple hazards. This danger is particularly acute in its rapidly expanding urban areas, where the Urban Heat Island (UHI) effect significantly elevates temperatures, creating hazardous pockets of extreme heat that threaten public health and well-being. The escalating frequency and intensity of global heat events, coupled with observed warming trends within Nepal, underscore the urgency of developing robust heatwave mitigation strategies. As illustrated in the figure above, major cities in the Terai plains experienced unprecedented record-breaking heatwaves in 2023. The stark contrast between the red bars, representing the 2023 temperatures, and the green bars, indicating previous record highs, highlights the alarming acceleration of heat stress in the region. The Urban Heat Island (UHI) effect, caused by factors like dense land surfaces, reduced vegetation, and human-generated heat, intensifies heatwave risks in Nepal's cities. This phenomenon renders urban populations particularly susceptible to heat stress, dehydration, and heatstroke. While some municipalities are implementing valuable greening and urban forestry initiatives (e.g., in Dhangadhi, Butwal, Chitwan, and Hetauda) to mitigate heat stress, these efforts require significant scaling up and enhanced community participation in their protection and management to achieve meaningful impact.

Several urban municipalities are taking proactive steps to mitigate heatwave impacts. For instance, Nepalgunj Sub-metropolitan City has developed a Heat Action Plan focused on seasonal risk reduction and long-term urban planning. Building on this momentum, the Climate Resilience Measurement for



Source: Department of Hydrology and Meteorology, Government of Nepal, 2024.

Communities (CRMC) is being implemented in 13 local governments, including key urban centres like Dhangadhi, Bhimdatta, and Tikapur. Evolving from the Zurich Climate Resilience Alliance's successful Flood Resilience Measurement for Communities (FRMC), the CRMC now addresses multiple climate hazards, including heat stress and wildfires, to accelerate adaptation efforts. This data-driven process, supported by a web-based tool and mobile app, enables communities to assess their resilience, identify and implement targeted interventions, and track progress through subsequent measurements.

Given the escalating impact of heat stress in Nepal's urban centres, the development of a timely and actionable early warning system is crucial. Leveraging the proven success of Nepal's flood early warning systems, a robust, community-centred, end-to-end Heatwave Early Warning and Early Action System (HEWEAS) must be established. This system should feature tailored risk communication that addresses the specific needs of each community range from Terai to hill and mountain regions of Nepal. It requires a comprehensive ecosystem that integrates robust risk knowledge, advanced monitoring and prediction, effective communication strategies, and proactive preparedness measures, all coupled with enhanced community capacity at the local level.

Developing robust, community-centred Heat Early Warning and Early Action Systems (HEWEAS), alongside strengthened Local Emergency Operation Centre (EOC) response and inter-agency coordination as mandated by Nepal's Disaster Risk Reduction and Management Act 2017, presents both challenges and significant opportunities. Crucially, Nepal can capitalise on global initiatives like Early Warning for All, implement the National Disaster Risk Reduction and Management Authority's (NDRRMA) Strategic Action Plan for Early Warning Systems, embrace technological advancements in weather modelling and communication, leverage increasing public awareness, and build upon the nation's inherent community resilience.

In conclusion, strengthening the capacity of Nepal's disaster risk reduction (DRR) institutions to combat the escalating threat of heatwaves, especially within its rapidly warming urban centres, demands a paradigm shift which includes prioritising robust, community-driven HEWEAS, significantly enhancing the capacity of EOCs, and empowering local communities to take proactive measures. ■

COOLING INVESTMENTS

Urban Heat Adaptation: Areas for Investments and Funding

*By **Owen Gow,** Deputy Director, Extreme Heat Initiative, Atlantic Council's Climate Resilience Center, Washington, DC*

Despite the escalating impacts of climate change, including longer, more frequent and severe heatwaves, only a fraction of total climate change-related financial flows go toward climate adaptation. Recent estimates suggest spending on climate adaptation comprises only 5% of total climate finance, and the adaptation gap remains as high as USD$359 billion. Investment specific to extreme heat, the deadliest climate hazard, is yet to be quantified but is likely a small proportion of adaptation finance.

Numbers on a balance sheet fail to capture the human lives affected by investment decisions. The reality is that additional dollars spent on adaptation could help a tired worker sleep comfortably in their home at night, or alert a family ahead of a life-threatening heatwave. And the good news is that opportunities exist for both improving human health outcomes and making economies more resilient in a warming world.

The first priority should be saving lives and reducing chronic illnesses among communities most likely to suffer the worst consequences of heatwaves. Local governments and philanthropies should act swiftly to invest in protective measures like community-level cooling infrastructure and heat early warning systems.

Next, governments and industry must incorporate heat-related considerations into large-scale public infrastructure projects to ensure that they are reliable and cost-effective over the mid- to long-term. How might rail lines buckle under the temperatures predicted 10 years from now? How can shade canopies and building design specifications deliver public spaces that are both walkable and improve business continuity during hot days?

Insurance markets are struggling to adapt to the ever-increasing levels of risk posed by climate change. The way forward is supplementing widespread heat preparedness measures with risk transfer tools such as parametric heat insurance. This accounts for worst-case scenarios by providing a quick post-event payout to assist with recovery, and in the coming years, might pay out ahead of heatwaves.

Finally, national governments should direct research funds toward the research and design of new heat adaptation technologies. From hyper-efficient air conditioners and wearable tech like "cooling patches" to the technologies that are yet to be imagined, societies will increasingly turn toward advancements in science to bridge the gap between the magnitude of heatwave exposure and the limits of human physiology to maintain not just safety, but thermal comfort.

> *Governments must act with foresight – investing now in equitable, scalable solutions to avoid escalating economic and human costs of extreme heat.*

Governments may be loathe to prioritise heat adaptation against the constellation of other risks and expenses managed by the state. But the reality is that heat is already costing us. Reduced labour productivity, increased healthcare costs, and infrastructure damage are just a few examples of how people and economies are absorbing these costs into their daily lives. In some cases, the prices of heat-adaptive products are becoming competitive with the status quo alternative. The mid- to long-term savings from lower temperatures may become just an added bonus.

In order to mobilise economy-wide changes in infrastructure, preparedness, and resilience, private finance will need to be mobilised toward heat adaptation. As seen in the case of the Inflation Reduction Act in the United States, accelerating the domestic solar market, governments can play a decisive role in expanding markets for new or underutilised technologies. The question today is whether governments will have the foresight to act now, before the next heatwave strikes. ■

Heat Action Platform, Atlantic Council's Climate Resilience Center.

Urban Heat Adaptation in Bangladesh

*By **Md. Abul Kalam Azad,** Senior Environmental & Social Safeguard Specialist, Dhaka, Bangladesh*

The urban heat adaptation is urgent in Bangladesh due to the country's increasing vulnerability to heatwaves and the associated health, economic, and social impacts. Bangladesh faces rising temperatures, elongated summers, and more unpredictable monsoon seasons, exacerbated by urbanisation and the urban heat island effect. This necessitates immediate action to protect vulnerable populations, including children, the elderly, and marginalised communities, from heat-related illnesses.

Elaboration:

- Rising Temperatures and Heatwaves: Bangladesh is experiencing a trend of increasing average temperatures and more frequent and intense heatwaves.
- Urban Heat Island Effect: Urban areas, particularly in Dhaka, are experiencing higher temperatures than surrounding rural areas due to the urban heat island effect.
- Health Impacts: Heatwaves lead to increased mortality rates, especially in urban areas, and contribute to heat-related illnesses like heatstroke, dehydration, and respiratory problems.
- Economic Losses: Heatwaves cause significant economic losses due to reduced labour productivity, agricultural damages, and increased healthcare costs.
- Vulnerable Populations: Children, the elderly, and marginalised communities are disproportionately affected by heatwaves due to factors like limited access to cooling and healthcare.
- Need for Adaptation: Adaptation strategies are crucial to minimise the impacts of heatwaves on human health, economic productivity, and social well-being.
- Potential Adaptation Measures: These include improving urban green spaces, promoting climate-smart agriculture, implementing early warning systems, and strengthening public health infrastructure.

Key Considerations:

- Climate Change: The increasing frequency and intensity of heatwaves are linked to climate change, making urban heat adaptation a vital component of climate resilience.
- Urban Planning: Urban planning should prioritise climate-resilient design to minimise the urban heat island effect and enhance the ability of cities to cope with heatwaves.
- Social Equity: Adaptation measures should be designed to protect vulnerable populations and ensure that the benefits of adaptation are shared equitably.
- Capacity Building: Strengthening institutional capacity and community awareness are crucial for the effective implementation of urban heat adaptation strategies.

Conclusion: In summary, heatwaves in Bangladesh have a profound impact on health, the economy, and daily life. Addressing these challenges requires both immediate responses and long-term strategies to enhance resilience and adaptation to increasing temperatures.

Strategies in response of Heatwaves: In response to heatwaves in Bangladesh, several strategies can be implemented to mitigate their impacts and enhance resilience.

Early Warning Systems: Establishing robust early warning systems that utilise weather forecasting and climate modelling to anticipate heatwave events in advance. This allows authorities to issue timely alerts and advisories to the public, enabling them to take preventive measures.

Heat Health Action Plans: Developing comprehensive heat health action plans that outline protocols for healthcare professionals, emergency responders, and community organisations to address heat-related health risks. These plans should include guidelines for identifying vulnerable populations, providing medical care, and establishing cooling centres during heatwave events. Public Awareness Campaigns: Launching extensive public awareness campaigns to educate citizens about the dangers of heatwaves and promote adaptive behaviours. This may involve disseminating information through various media channels, organising community workshops, and engaging with local leaders to raise awareness about heatwave preparedness.

Urban Planning and Green Infrastructure: Incorporating heat resilience into urban planning and infrastructure development initiatives. This includes implementing green spaces, increasing tree cover, and adopting cool roof technologies to mitigate the urban heat island effect and reduce temperatures in densely populated areas.

Community Engagement and Capacity Building: Empowering communities to take proactive measures against heatwaves through capacity building and community engagement initiatives. This may involve training local volunteers in heatwave response and first aid, establishing community-based monitoring systems, and fostering social cohesion to support vulnerable individuals during heatwave events.

Climate Adaptation and Resilience: Integrating heatwave resilience into broader climate adaptation and resilience strategies at the national and local levels. This includes incorporating heat risk assessments into disaster risk management plans, enhancing infrastructure resilience to extreme heat, and mainstreaming heat adaptation considerations into development policies and programmes. By implementing these strategies in a coordinated manner, Bangladesh can enhance its capacity to respond to heatwaves and minimise the adverse impacts on public health, infrastructure, and livelihoods. ■

DATA-DRIVEN HEAT PLANNING

Leveraging Historical Disaster Data to Enhance Anticipatory Action and Crisis Responses on Extreme Heat in India

*By **Akash Yadav**, AIDMI, India*

Extreme heat is getting worse across India. It is becoming more intense, more frequent, and reaching new areas. With climate change, its impact is only increasing. One of the most important tools we have to respond to this challenge is our own history. By studying past heatwaves and disaster data, both governments and communities can plan ahead. This helps protect people's health, reduce financial losses, and prevent damage to essential services and infrastructure.

1. Understanding Historical Disaster Data

Historical disaster data includes past records of heatwaves, temperature trends, mortality rates, and socio-economic impacts. Sources of such qualitative and quantitative data include:

- **Community surveys and case studies** highlighting vulnerable populations such as women, outdoor workers, displaced communities, small business, and minorities, and their local coping strategies.
- **Meteorological records** from the India Meteorological Department (IMD).
- **Health reports** documenting heat-related illnesses and deaths.
- **Economic and agricultural data** showing crop failures and farm labour productivity losses.

Studying this data helps pinpoint high-risk areas, vulnerable populations, and how well previous public and private interventions have worked. In March 2025, a multi-disciplinary team from Harvard, along with extreme heat experts from leading climate institutes, highlighted the importance of such data during a dialogue with small businesses affected by heat in Ahmedabad.

2. Enhancing Early Warning Systems

Historical data improves early warning systems by enabling more accurate predictions. Key strategies include:

- **Issuing timely alerts** to the most affected population through SMS, social media, and local news channels.
- **Developing heatwave forecasting models** using temperature trends and previous heatwave patterns.
- **Implementing colour-coded warning systems** to indicate heat severity levels.

Predictive analytics can support both governments and communities in taking timely, proactive steps before heatwaves become a threat to lives and livelihoods. At the Colombo Dialogue on Disaster Risk Reduction in September 2024, convened by Duryog Nivaran, participants from multiple agencies emphasised the need to shift from early warning systems to anticipatory action for extreme heat, using historical data and past experiences as a guide.

3. Strengthening Public Health Preparedness

Data-driven insights enable targeted health interventions, such as:

- **Allocating medical resources** such as cooling centres, hydration stations, and emergency response teams in addition to "ready-for-action" ambulances and clinics.
- **Identifying high-risk areas** where heat-related illnesses have been frequent or severe.
- **Training public and private healthcare workers** on heat-related illness management, cure, and prevention.

By leveraging past health records, authorities can ensure better medical preparedness with a focus on public health in addition to occupational health hazards and reduce mortality rates.

4. Protecting Livelihoods and Agriculture

Extreme heat affects farmers, outdoor workers, and industries. Historical climate data helps:

- **Develop heat-resilient cropping patterns** based on past drought and heatwave impacts.
- **Schedule work shifts** for labourers during cooler hours.
- **Promote water conservation techniques** such as drip irrigation and rainwater harvesting.

By incorporating data on past agricultural losses into policy planning, authorities can better support rural communities in adapting to extreme heat. At the Extreme Heat and Climate Resilience workshop in Guwahati 2025, the Honourable Revenue Minister of Assam highlighted the growing need for collaboration between state authorities and key stakeholders to protect livelihoods and agriculture from the impacts of extreme heat, using historical data as a foundation.

5. Designing Climate-Resilient Infrastructure

Urban heat islands worsen extreme heat effects in cities. Historical temperature data helps in:

- **Expanding tree cover** in areas with high past temperature records to start with, and cover all open areas with trees and vegetation.
- **Designing heat-resistant public buildings** such as railway station or ward offices with reflective roofing and green spaces.
- **Improving water management systems** to prevent heat-induced droughts and water shortages and address the heat island effect.

Data-driven urban planning reduces the long-term impacts of heatwaves on infrastructure and public health.

6. Engaging Communities in Resilience Planning

Using historical disaster data to educate and engage affected communities strengthens local resilience. Strategies include:

- **Encouraging behavioural changes** such as increased hydration and avoiding outdoor activities during peak heat hours.
- **Heat awareness for action campaigns** based on past incidents and solutions.
- **Community-led heat action plans** using traditional knowledge and scientific data on solutions.

Local multiple participation ensures that interventions are practical, sustainable, and widely adopted.

Conclusion: Leveraging historical climate data enables proactive planning, better resource allocation, and improved crisis responses to extreme heat in India. By integrating past lessons into forecasting, health, infrastructure, and community strategies, India can build even better long-term resilience and reduce the devastating impacts of heatwaves to its citizens. ■

Urban Heat Adaptation: Agenda for Action in India

*By **Dr. Nipra Ajamani** and **Dr. Prasoon Singh,** The Energy and Resources Institute (TERI), India*

Urbanisation in India is significantly intensifying the impact of heatwaves. Indian cities are experiencing an early and intense heatwave summer, with temperatures soaring across multiple states. The India Meteorological Department (IMD) has issued warnings, predicting above-normal heatwave days from April to June 2025, highlighted in the current news articles[2]. Moreover, the IMD have forecasted the arrival of the extreme heat season of 2025. It included the red and yellow alerts in different states[3]. Also, the year 2024 had one of its hottest summers in 14 years, with 536 days of heatwaves across the country. In Churu, Rajasthan, the temperature hit 50.5°C, the highest of the season[4]. Studies recorded the four warmest years as 2016 (+0.71°C anomaly), 2009 (+0.55°C), 2017 (+0.54°C), and 2010 (+0.53°C)[5]. Heatwaves are expected to start earlier, persist longer, and occur more frequently, with urban heat island effects intensifying their severity, leading to an increase in heat-related deaths, heightened instances of heat stress, unbearable working conditions, and a broader spread of vector-borne diseases[6]. By 2050, it is projected that 24 urban centres in India will experience average summer temperatures exceeding 35°C, disproportionately affecting economically weaker sections of society[7]. These heat-related challenges have profound implications for health, mortality rates, and labour productivity.

Presently, heatwaves are declared based on specific criteria, such as deviations from normal and maximum temperatures sustained over two consecutive days. This method often overlooks crucial contextual factors, particularly how these thresholds intersect with socio-urban dynamics. As a result, reactive response mechanisms are activated only after a heatwave is officially declared, leaving already vulnerable populations exposed to significant risks stemming from heat sensitivity. The focus shall move towards the use of Technology & Innovation to enhance adaptation measures like Spatial data analysis using GIS and RS, AI based climate and weather monitoring, focus on smart urban cooling solutions, strengthen the more localised high precision in analysing the heat phenomenon both in terms of spatial and temporal using these advance tools and technologies available to have very localised data to target specific interventions at specific location and can't be generic in nature what is currently being practiced.

The issue of urban heat significantly impacts India's economy, labour productivity, and public health. An article by Climate Policy Initiative (CPI) highlighted that from 2001 to 2020, the country experienced an annual average loss of approximately 259 billion labour hours due to heat[8]. Also, the 2022 heatwave further intensified this crisis, with wheat yields declining by 15–20%, milk production dropping by 15%, and poultry farmers facing severe financial losses as chicken prices fell by 50% amid heat-induced urgencies. Additionally, the deterioration of perishable vegetables contributed to rising food inflation, imposing further economic strain on households.

To address such challenges, the National Disaster Management Authority issued guidelines (NDMA, 2020), urging state and municipal authorities to develop Heat Action Plans (HAPs). In response, the country has introduced multiple strategic policies and initiatives aimed at curbing greenhouse gas emissions and air pollutants. These include the National Action Plan on Climate Change (NAPCC), Nagar Van Scheme, Swachh Bharat Abhiyan, Smart Cities Mission, AMRUT and A Green India for All. Aligned with

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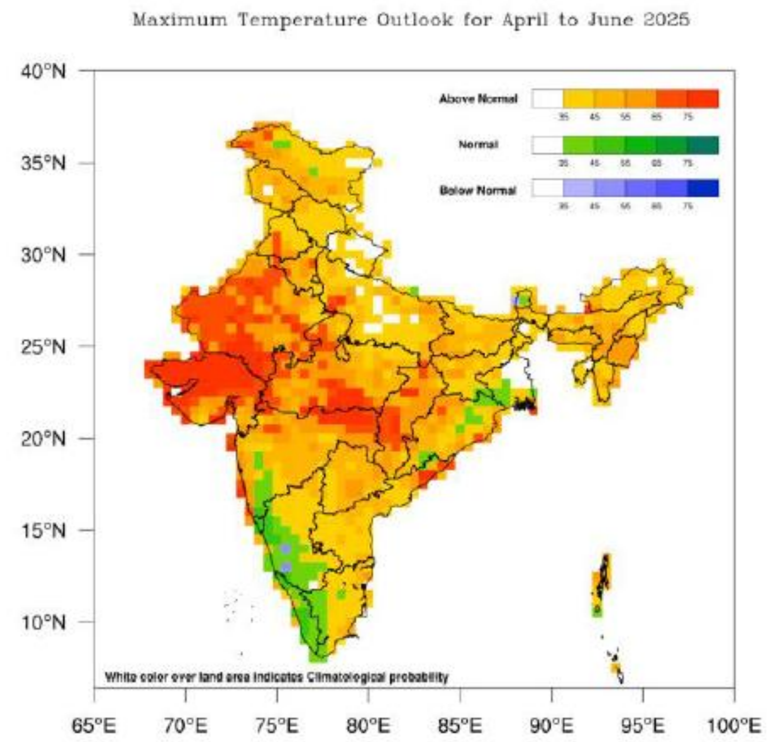
SDG 13, the Government of India has launched various policies to enhance adaptive capacity and resilience against rising heat risks. The National Disaster Management Authority (NDMA) has formulated a National Disaster Management Plan and Policy, establishing frameworks for mitigating heatwaves through early warnings, public awareness campaigns, and inter-agency coordination for emergency responses. A noteworthy development was the introduction of the Panchamrit agenda by the Indian Prime Minister at COP26, outlining five key climate targets: Achieving 500 MW of non-fossil energy capacity; Meeting 50% of energy needs from renewable sources; Reducing one billion tons of carbon emissions; Lowering the carbon-intensive economy by 45% by 2030; Attaining net-zero emissions by 2070[4].



Probability forecast of Maximum Temperature for April to June 2025. Source: https://internal.imd.gov.in/section/nhac/dynamic/heat_outlook.pdf

Essentially, there is a need for integrating heat adaptation into urban planning to have the climate-responsive measures in city master planning to ensure capacity building, infrastructure support and financing for implementation. Increasing green spaces, urban forestry, etc., and mixed land use plans to overcome the concentrated impact of vehicular emissions and congestion and increasing shaded streets as much as possible shall be considered for LULC planning. The development of heat resilient buildings and infrastructures with technological innovations and the use of energy efficient solutions, energy efficient building, building materials and solutions such as permeable pavements to reduce heat absorption.

Apart from this, Nature-Based Solutions (NBS) can be a way forward. Other than urban afforestation, technologies such as green roofing, cool roofing and promoting blue-green infrastructure, pond and water body rejuvenation and protection to enhance cooling can be promoted for urban heat adaptation practices. Water sensitive urban design can be an agenda point in the articles as a solution for adaptation planning, such as a concept on landscape cooling through measures like the creation of artificial wetlands and the restoration of a natural drainage system.

At the local community level, it is essential to work with them closely. Equip them with knowledge and resources to combat heat stress through Public Awareness Campaigns, educating residents on heat stress management, EWS, establishing public shelters with shade and drinking water and use of IOT tools and technologies for dissemination.

With extreme heat becoming a defining feature of India's urban landscape, adaptation has shifted from being optional to an urgent necessity. The way forward lies in strategies that are long-term, context-specific, and inclusive, with a focus on protecting the most vulnerable populations. This involves redesigning urban spaces through climate-responsive planning, expanding green and blue infrastructure, and leveraging data-driven technologies for precise, targeted solutions. Equally important is fostering strong collaboration among governments, urban planners, civil society, researchers, and local communities. By adopting a comprehensive, people-centred approach to heat adaptation, India can not only safeguard its cities against soaring temperatures but also cultivate urban spaces that are healthier, more equitable, and resilient for future generations. ■

Urban Heat Island: Strategies for Mitigating the Effects in India

*By **Aniket Sawargaonkar,** M.Sc., Disaster Management, TISS, India*

India is increasingly grappling with extreme heat conditions, driven by rapid urbanisation and climate change. Cities like Delhi, Ahmedabad, Nagpur, and Hyderabad regularly record summer temperatures above 45°C. The Urban Heat Island (UHI) effect—where dense urban cores trap more heat than surrounding rural areas—exacerbates this crisis, making cities several degrees hotter and turning heatwaves into public health emergencies.

- Green and Blue Infrastructure (GBI) offers one of the most effective and sustainable strategies to combat this urban overheating. These nature-based solutions—such as urban forests, wetlands, green walls, and restored water bodies—cool cities through shade and evapotranspiration. A global meta-analysis of over 100 cities found that GBI can lower local temperatures by 2–5°C, with larger and denser features producing the most significant reductions.
- Botanical gardens and large urban parks were found to be ~5.0°C cooler than surrounding areas.
- Urban wetlands provided cooling effects of ~4.7–4.9°C, particularly strong in hot, dry regions.
- Street tree canopies and forested patches reduced nearby air temperatures by ~3.8°C on average.
- Adding just 5% more tree cover in a neighbourhood can reduce temperatures by 1°C.

These cooling impacts are not only environmental solutions but also life-saving interventions. For every 1°C rise in temperature, studies show a several-per-cent increase in heat-related mortality risk. Conversely, each degree of cooling can reduce the burden on healthcare systems and prevent heat-related illnesses such as dehydration, heatstroke, and respiratory stress.

In addition to public health, GBI contributes directly to urban resilience by reducing electricity consumption from air conditioning. Shade from trees alone can cut household cooling energy use by 20–30%, and cities like New York have recorded $27.8 million in annual energy savings due to tree-based cooling.

Cities like Ahmedabad have pioneered Heat Action Plans, but there is immense potential to scale up GBI integration across Indian cities, especially in informal settlements, low-income neighbourhoods, and heat-vulnerable zones. Wetlands in semi-arid cities, shaded transit corridors, and greened rooftops in dense housing blocks could serve as urban "heat buffers".

By investing in GBI, Indian cities can reduce heat stress, improve air quality, save lives, and build long-term resilience against the intensifying threats of climate change. Extreme heat may be inevitable, but its deadliest impacts are not.

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The Urgent Need for Urban Heat Adaptation in India

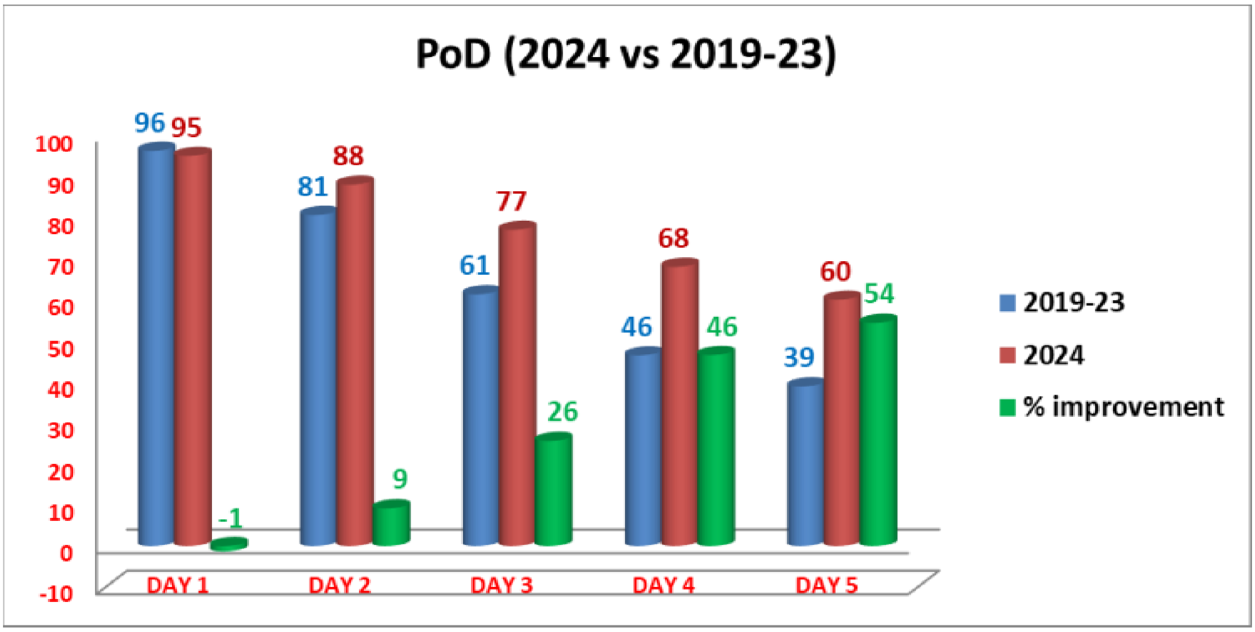
*By **Shyamji,** Master's in Disaster Management, Tata Institute of Social Sciences, Mumbai, India*

Urban Heat and Urban heat island is a new phenomenon which is being observed in the urban settlements. It is observed when the core or centre of any urban settlement has higher temperature than the outer periphery of that urban settlement which is causing health risks in that area. The main reasons for this kind of phenomenon can be concretisation, development of industries and changing nature of land use in the urban areas. It is nothing but the heat generated from the human activities in the core region of urban areas. It is also because of cutting trees in the urban settlements in the name of development.

We need to tackle this problem soon because of this phenomenon the days of heatwaves in the urban settlements has been increasing year by year which is making the people of the area more exposed to different kind of health risks. It is also affecting the productivity of the residents. The events of extreme heat are being observed in the multiple urban settlements. Extreme heat can be seen as silent killer which can lead us to heat strokes, dehydration, organ failure, and death. This phenomenon is getting intensified because of the climate change. As In the given figure, We can see that there is a significant change in heatwave days in comparison to last five years.

Urban heat adaptation means to design urban settlements more heat resilient and equitable. To do this, it becomes mandatory to include green and blue infrastructure in the development plan of an urban settlement like trees, ponds, shaded water bodies, parks and green corridors. It is also necessary to have early warning systems and heat action plans for each urban settlement so we can easily reduce the negative impact of this phenomenon. A proper compensation policy should be introduced to help in the recovery process of the affected ones. In the adaptation part, we should more focus on the labours and street vendors because they are more exposed to the extreme heat phenomenon. If we will not focus on this issue now, it will become the deadliest disaster.

Conclusion: In the conclusion, I want to say that the government should develop a heatwave action plan which will have a proper compensation mechanism for the affected individuals like labourers and street vendors. The government should also run the awareness programmes in the heatwave prone regions and should prepare a guideline for the informal workers to let them know, what they are supposed to do in the extreme heat situation. ■



Source: https://internal.imd.gov.in/pages/heatwave_mausam.php

INCLUSIVE HEAT RESILIENCE

Urgently Integrating GESI Methodology into India's Urban Heat Action Plans

By AIDMI Team, India

As Indian cities grapple with increasingly severe heatwaves, the urgency to build robust Heat Action Plans (HAPs) has never been greater. In this context, a promising innovation is the integration of the Gender Equality and Social Inclusion (GESI) methodology into urban climate resilience planning. This approach not only enhances the effectiveness of HAPs but also ensures that the most vulnerable populations—women, the elderly, persons with disabilities, informal workers, small businesses, migrants, homeless and marginalised communities—are not left behind.

A woman managing her small business at a busy urban market amid rising temperatures, underscoring the urgent need for gender-sensitive and inclusive urban heat action plans that support small businesses. Photo: AIDMI.

The GESI methodology experimented by All India Disaster Mitigation Institute (AIDMI) in parts in its own work in Indian cities and reviewed for the SIDRRA project of Duryog Nivaran in South Asia, brings an inclusive lens to climate adaptation by recognising that extreme heat does not affect everyone equally. For instance, women working in open-air markets, construction labourers without access to shade, or elderly slum dwellers with no cooling options are at disproportionate risk. Traditional HAPs often fail to account for such social and economic vulnerabilities, limiting their impact and reach. GESI seeks to correct this by embedding equity into every stage of heat planning—from risk assessment and resource allocation to communication and relief strategies.

Several cities in India, including Ahmedabad, Pune, and Bhubaneswar, are now piloting GESI-informed HAPs in partnership with local governments, NGOs, and international agencies such as UNDP and the World Bank. These initiatives are grounded in community-level consultations and disaggregated data collection to identify vulnerable groups and map their specific heat-related risks. For example, in parts of Odisha, localised plans now include targeted early warning messages for women-headed households and provide cooling shelters accessible to persons with disabilities.

GESI-based HAPs also prioritise participatory governance, ensuring that women and marginalised groups, such as migrants, have a voice in the design and implementation of city-wide heat mitigation measures. Additionally, they recommend micro-level interventions—like shaded workspaces for street vendors, mobile water units in high-density informal settlements, and gender-segregated cooling centres—to address real-world barriers faced by underserved populations.

The broader implication of applying GESI to urban heat planning is transformative. It redefines resilience not as a uniform standard, but as a differentiated, people-centred process that acknowledges intersectional vulnerability. As climate change accelerates, India's urban policymakers must embrace such inclusive frameworks to ensure that adaptation is equitable, sustainable, and just.

If successful, India's GESI-informed heat resilience strategies could urgently become a blueprint for other climate-vulnerable nations, positioning inclusion not as a peripheral concern but as a core design principle in the age of planetary heat. ■

Heatwave in Mali: Impact on Elderly Mortality in Bamako

*By **Hippolyte Traoré**, Public Health Researcher, National Institute of Public Health (NIPH), Mali*[9]

Introduction

In Mali, the months of March, April and May each year are periods of high heat. The aim of the study was to describe the evolution of deaths among the elderly (aged 60 and over) in Bamako during heatwaves from 2013 to 2016.

Methods

This was a cross-sectional, descriptive study of people over 60 years of age who died and were registered by the Bamako Central Office for the Registration of Deaths and the Issuance of Burial Permits. Temperature data from "Mali-Météo" were used.

Results

Of a total of 11913 deaths recorded, 56% were male. Older people were the most numerous (46.1%), followed by 15-49 year-olds (32.8%).

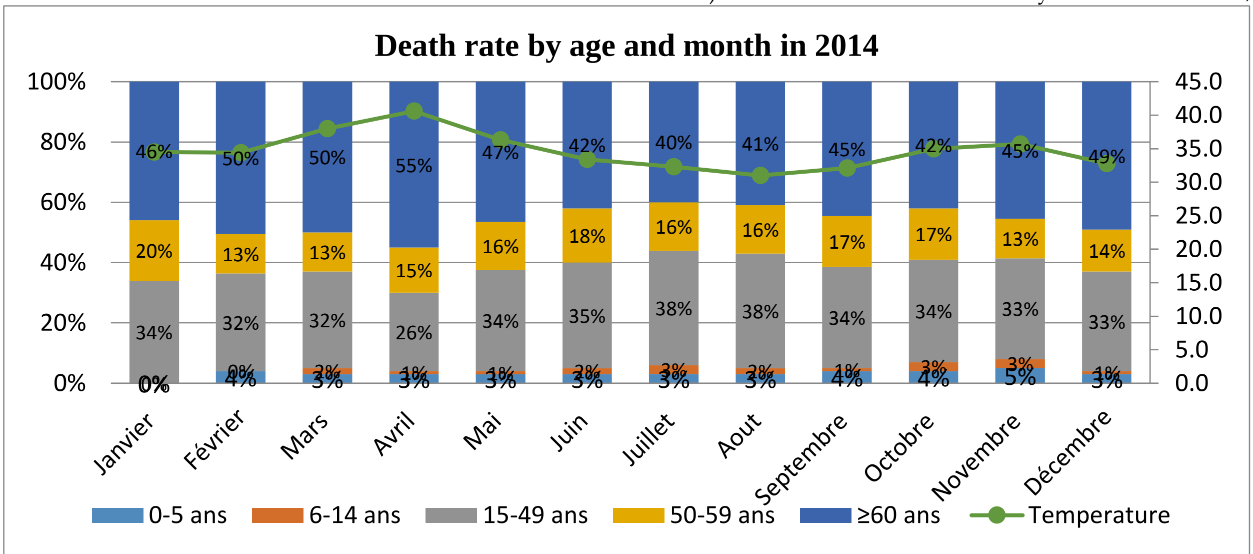
1. Age-specific death rates by temperature per month in 2013: In 2013, the average maximum (40.6°C) and minimum (25.9°C) extreme temperatures were observed in order of importance in March, April and May. The highest death rate (45%) was among the elderly, compared with other age groups.

2. Age-specific death rates by temperature per month in 2014: Analysis of the above graph shows that the average extreme temperatures in 2014 (maximum 40.6°C and minimum 25.5°C) were observed in order of importance in April, March and May. The highest death rate (55%) was among the elderly, compared with other age groups.

3. Death rates by age and temperature by month in 2015: In 2015, extreme temperatures (maximum 39.9°C and minimum 25.6°C) were observed in order of importance in April, March and May. The highest death rate (51%) was among the elderly, compared with other age groups.

4. Death rates by age and temperature by month in 2016: In 2016, extreme temperatures (maximum 40.9°C and minimum 26.6°C) were observed in order of importance in April, March and May, with a high death rate (57%) among the elderly compared with rates for other age groups.

5. Impact of the heatwave on the vulnerability of the elderly: The diagnoses of death were mostly poorly stated or non-existent in the registers, due to poor record-keeping. The diagnoses recorded were hypertension, cardio-respiratory problems, diabetes and death on arrival. Vulnerability to the heatwave,



Graph: Deaths by age and temperature by month in 2014.

[9] Bakary Diarra, University of Sciences; Niakalé Diawara, Bintou Fomba, Aly Landouré, and Mamadou Souncalo TRAORE, NIPH.

combined with the above-mentioned pathologies, is thought to be at the root of the high death rates (excess mortality) among the elderly. The study noted peaks in elderly deaths not attributable to the heatwave, which occurred in January-February (cold season with winds), June (beginning of rainy period), October-November (end of rainy season), when temperatures vary between 34°C-35°C, mainly caused by respiratory diseases and malaria.

Conclusion

In view of these results, health authorities need to computerise death registers, adopt preventive measures such as informing the elderly in nursing homes and mobilising additional resources for their holistic care. As part of the "One Health" platform, meteorological services must regularly communicate their timely data to sentinel sites and emergency services in other sectors, through the creation of an early warning network at central and decentralised levels. ■

HEAT ACTION PLAN

Heatwave Action Plan - Adaptation and Mitigation

*By **Dr. Shashi Ram,** Construction, Technology & Management Specialisation), Former Assistant Professor, Department of Civil Engineering, National Institute of Technology, Warangal, Telangana, India*

There has been a significant amount of research work available in the literature, but very less amount of literature references I have found which address the effect of climate change on the health of homo-sapiens and its race. And therefore, it is a demand of the time to approach this global issue with an interdisciplinary thought process.

This article will be streamlined towards physiological and psychological paradigms of turning out to be new epidemiological paradigms of heat stress for better comprehension of heatwave effects on health. Humans have a limited capacity to tolerate heat. As well as, acclimation capability is also limited for the human race under excessive thermal conditions.

The heat bearing capacity of the human race cannot be increased. therefore, the only option we are left with is to address this increment in the average temperature during summers, which is due to the global temperature rise. One of the major contributing factors in global temperature rise is concrete jungles and the urban heat island effect due to the denser concrete jungles in the cities. This has aggravated the budding disaster heatwave impact on human race health. There are various ways by which heatwave affects human health, i.e., psychological effects, heatwave illness, and its epidemiological effects on mortality.

Before, heatwave affects human health in a severe manner and can lead to heatwave illness or fatality of homo-sapiens, it has psychological effects on human race, of which whole human race suffers during the summer season. These psychological effects are fatigue and tiredness which is the result of excessive heat. When subjected to excessive heat, it becomes uncomfortable to live in for a human. Comfortable temperature is subjective and varies from human to human but the comfortable range of temperature which is taken as benchmark is 18-27/28 °C. so, when the temperature range increases than the set benchmark, it becomes uncomfortable for the human race and results in human body perspiration apart from an increase of body temperature. Which in return results into discomfort and psychologically affects the work efficiency and productivity of day-to-day life and at work. This psychological effect each human being suffers during heatwaves and excessive temperatures during summer. When human race is subjected to such excessive heat and temperature without requisite precaution and protection, then it results in severe effects on human race health in form of heatwave illness and its epidemiological effects which means it can cause death as well.

To bring resilience from heatwaves, the following framework is put forth. The framework is bifurcated into two sections to have a more streamlined approach.

The Solution Can Be Bifurcated into Two Strategies

A. Short-term Strategy

A. Reinforcing Health Awareness: Reinforcing health awareness is the need of the hour and of prime importance. As I have described in the above section, human heat bearing capacity cannot be increased. Educating our population to be alert with adequate protective equipment before going out and taking extra precautions while leaving the house will be required. Therefore, Awareness programmes will be required to have a heatwave understanding its repercussions and precautions at the grassroots level will be required. Apart from the digital mode of awareness programmes. Therefore, an early warning system will be the first step to strengthen our heatwave adaptive capacity.

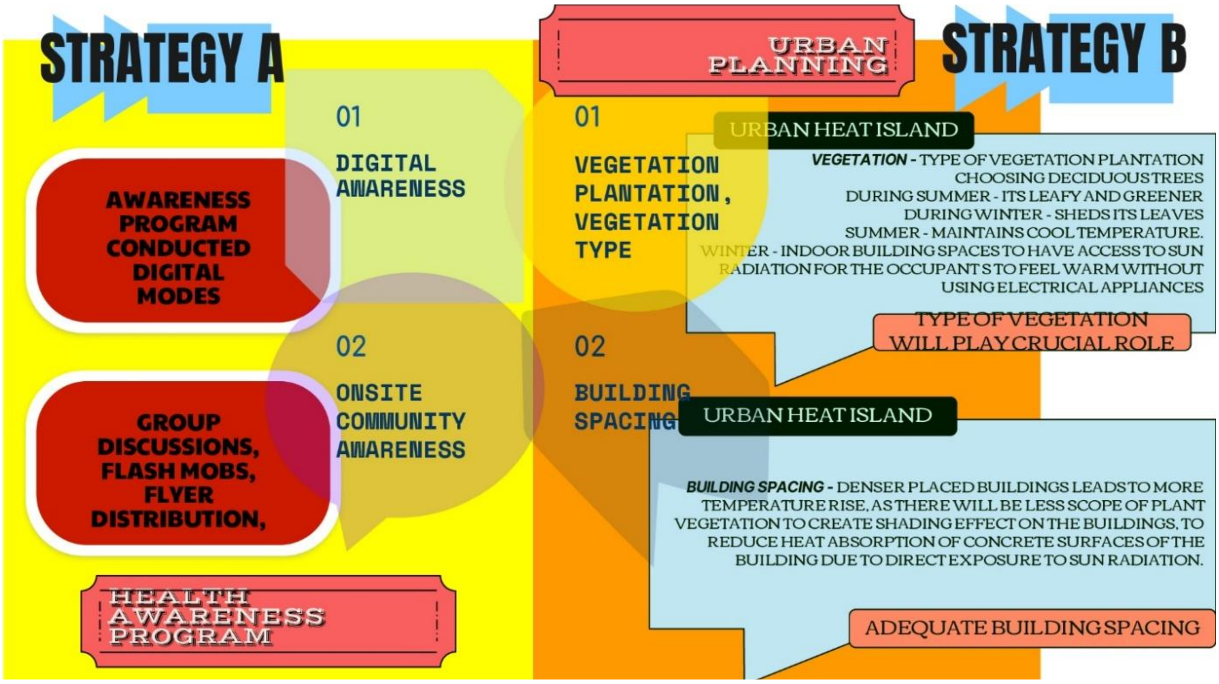
B. Long Term Strategy

A. Urban Planning: building design, green infrastructure, landscaping, even spacing of buildings to keep them evenly distributed within the area and not to cluster the buildings in one place, which adds up in the increment of heat island effect, which increases the temperature of the area and eventually for a region. Also, evenly distributed buildings with significant spacing among them open the opportunity for denser vegetation around the buildings. The strategies to reduce urban heat island effect are important because the urban heat island effect acts as a catalyst in the epidemic we call it heatwave now a days.

i. While tree plantation is one of an important part is the selection of tree. To have a holistic approach to tree plantation will govern the climate zones. As there may be a bias that excessive tree plantation around a building may be worrisome for the occupants during the wintertime. As, trees around the building will hinder the sunlight access inside the room spaces and might increase the cost of heating appliances to warm the indoor spaces. These alternative heating systems within the room spaces might include the use of burning charcoals or wood for fire within building premises during winter times. Which in turn increases the pollutants in the air, which is also one more problem that metropolitan cities are facing during winter times, that is, smog and particulate matter. For that, the tree plantation strategy will be governed by the above factor of sunlight access during winter times as well. For that, the choice of deciduous trees will play an important role in addressing this issue. Deciduous plants shed their leaves during the winter times and will be greener during summer times. So choosing such trees will be crucial and advantageous for addressing heatwaves and urban heat islands.

ii. The two solutions which should be in the centre of any urban planning is the building spacing to keep the building staggered to keep the balance of the concrete jungle and the vegetation even. and the second solution will be the choice of deciduous trees to keep the winter months bearable and pleasant.

A foolproof urban planning policy, which will be comprehensive on its own, will be a key guide here to bring the temperature of our country down as well as to meet the global set target of not letting the global temperature rise above 1.5°c. Only then will we be able to save our country, our planet Earth, from the heatwave, which is one more repercussion of climate change. ■



Strategic Outlook for Heatwave Action Plan - Adaptation and Mitigation Strategies.

URBAN HEAT ADAPTATION

Urgency of Urban Heat Adaptation in South Asia: Lessons from Bangladesh

*By **Michael Slingsby,** Urban Poverty and Climate Change Adviser, South and South East Asia*

Most of Bangladesh falls within the warm humid climate zone. Dhaka and Chattogram are severely affected by urban heat islands and are significantly hotter than the surrounding rural areas. This is due to dense urban infrastructure, a lack of green spaces, and increased heat-trapping materials, resulting in an increase in temperature of up to 3°C in Dhaka. Bangladesh is also affected by cyclones originating in the Bay of Bengal. Climate change-related stresses, including increased temperatures and the length of periods of high temperature. For example, in 2021, there were 49 days with a temperature of over 35°C and in 2024, 65 days. Mean annual temperatures are projected to increase by 1.8°C by the 2060s.

Climate impacts those living in houses constructed of temporary materials such as corrugated iron sheets, particularly children, women, the elderly, and people with disabilities who spend most of their time at home. It also affects those working in exposed situations such as farmers, construction workers and those selling food on the streets. They are negatively affected by a reduction in productivity, loss of working hours and fewer customers during the hottest hours, resulting in a loss of income.

The numbers of those who die as a result of being exposed to high temperatures are difficult to assess, as many also have chronic or severe illnesses, especially heart and kidney diseases. Excessive heat may have a contributory effect on death.

Cooling measures at Karail slum in Bangladesh.

Relative humidity is a factor often ignored, and about 50 years ago, Koenigsberger and others wrote a book, "Manual of Tropical Housing and Building", which defined "comfort zones" integrating relative humidity and air temperature. Increases in relative humidity reduce the body's natural ability to keep cool and increase the possibility of heat stroke. This book also includes sections on the design of shading devices.

There are a number of design and heat reduction methods which can reduce the internal temperatures in buildings. Koenigsberger's book describes the process of heat flow through building materials. A reinforced concrete roof will allow much of the external heat on the roof to pass through the roof, usually at about 2 am, when the occupants hope to sleep in comfort. A ceiling fan will add to the problem by sucking the hot air from the ceiling into the room below. Low-cost apartments often reduce ceiling height to reduce costs, leaving little space between the ceiling fan and the roof, exacerbating the problem.

Painting the roof with reflective white paint can reduce internal temperatures by up to 5°C. See an example from BRAC University's work in the Karail slum in Dhaka

Building orientation is also important. The smallest side of the building should face west, with the bathroom and toilets on this side. The design of shading devices to minimise the exposure of windows and doors to the sun to remain and to remain in the shade is important. ■

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