

# Rising Risk of Heat Waves in Asia



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## ABOUT THIS ISSUE

In the past decade, many countries of Asia have been repeatedly struck by extreme heat and heat waves. Many scientists have attributed this trend of rising heat wave incidents to climate change. Extreme heat events are becoming more frequent and severe because as the world continues to warm due to human emissions of greenhouse gases from the burning of fossil fuels.

This issue of Southasiadisasters.net is titled "Rising Risk of Heat Waves in Asia". It highlights not only the incidences and impacts of heat waves in Asia but also all the scientific and governance innovations designed to mitigate their damage. While instances of heat waves are on the rise across the world, Asia in particular seems to be reeling under an intense heat wave. According to the meteorologist Etienne Kapikian, at least seven Asian countries have already set monthly high temperature records at the end of March 2018.

All this scientific and empirical evidence points to the inconvenient truth that the incidence and intensity of heat waves will increase across Asian countries in the coming years. Therefore, there is a need to address this rising risk or mitigate its adverse impacts. This issue of Southasiadisasters.net takes stock of the best practices in governance systems (heat wave action plans), early warning and health preparedness among others to mitigate the adverse impacts of heat waves in Asia. ■

- Kshitij Gupta



When a heat wave hits, our instinct is to stay indoors, under the fan or in the air-conditioning. However, millions of India's working poor do not have that choice. Street vendors, waste pickers, cart-pullers, and rickshaw drivers are among the many kinds of self-employed workers that earn their living on the street. For many, the day they do not work is the day they do not eat. Their work continues in blistering heat, under the scorching summer sun.

Heat waves put both their lives and their livelihoods at risk. Exhaustion and dehydration affect both the body and the mind, causing headaches, dizziness, or nausea as well as confusion, irritability or delirium. Produce vendors are particularly vulnerable to the heat. Fruit and vegetables are perishable so every day is an anxiety-ridden race against the clock. To make matters worse, when city temperatures rise, customers are sparse and their earnings, like their produce, is at risk. In addressing the public health and poverty crises brought on by heat waves, cities must consider the following:

### 1. Investing in Urban Trees

The value of trees extends far beyond aesthetics; trees are vital to the public health of a city. During the summer, trees cool both the ground and the air. Trees with wide canopies provide a large shaded area where the sun's rays cannot hit the ground directly, thereby reducing the amount of heat the ground absorbs. Trees also transpire water as they grow, releasing vapor

and cooling the surrounding air. In addition to regulating temperatures, trees also filter air pollution and absorb atmospheric carbon dioxide.

### 2. Protecting Open Spaces

Temperatures are higher in urban areas, as compared to rural areas, because of what is known as the heat island effect. As buildings and roads replace vegetation and open land, the sun beats down on rooftops, roads and pavements. Impermeable surfaces like steel, concrete and asphalt trap and release heat—all contributing to the heat wave. Vegetative cover and permeable surfaces such as soil can mitigate the heat island effect. Green roofs, city parks, waterbodies, and backyard gardens provide space that shield against the sun's rays.

### 3. Supporting Vernacular Architecture

Street-based workers employ diverse strategies to withstand the sweltering heat. Many chaiwalas and vendors construct makeshift awnings by attaching old sarees or wet jute cloth to lampposts and trees. For produce vendors, shade not only protects against heat stroke and exhaustion but also extends the life of their fruits and vegetables, thereby protecting their take-home earnings. Vernacular architecture of this kind can protect both health and business, ultimately saving lives. Cities have an opportunity to support its citizens in their efforts to make the built environment livable to those who use it. ■

- Maya Potter,

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# Top Three Achievements of India to become "Weather Ready and Climate Smart"

Weather and climate information is vital to public well-being and safety, food security, water resources and health. During the past many decades, high impact weather events have taken many lives and inflicted huge damages causing enormous economic hardship. Global warming and climate change cause an increase in the frequency and intensity of such extreme events. Frequency of heavy rainfall events and severe heat waves has increased over India during the last 3 decades. Early warning systems and disaster risk reduction measures are therefore important for boosting the community resilience. Climate services on the other hand can inform decisions on both climate change mitigation and adaptation.

The Ministry of Earth Sciences has the mandate to provide accurate and timely services for all events from now-casting (next few hours) to sub-seasonal and seasonal weather and longer-term climate predictions to all users. Ministry over the past 10 years has been building up required infrastructure and capability for improving the services. This include a) strengthening of observational network (over land, sea and air); b) installing the state-of-the-art weather and climate prediction systems based on coupled models; c) acquiring faster computing resources; and d) investing in human resources development. Ministry has the computing capacity of about 8.0 petaflop, which is the best in the country and fourth best among the weather prediction centers in the world. The dramatic reduction in the lives lost due to high impact weather events in the last few years has been largely attributed to the significant increase in accuracy of weather

forecasts and warnings and improved coordination with disaster management authorities.

## The Major Three Achievements Made by the Ministry on Weather and Climate Services are given below:

### 1. Agrometeorological Services

Farmers make use of weather forecasts and warnings for planning the operations like sowing, irrigation, application of fertilizer and pesticide, harvest and protection of crops from weather disasters. The Ministry in collaboration with the Indian Council of Agricultural Research (ICAR) provides the Agromet Advisory Services (AAS) for the benefit of farmers. This includes 5-day weather forecasts issued on every Tuesday and Friday. The services carried out at 130 agromet zones (cluster of 4-6 districts) now have been successfully extended to the district level and operated across 608 districts of the country. Currently, about 22.4 million farmers are receiving

crop specific agrometeorological advisories in vernacular languages. The third party assessment by the National Council of Applied Economic Research (NCAER) on the agromet services provided by the ministry concluded that the annual economic benefit for the farmers cultivating 4 principal crops (Wheat, Rice, Sugarcane and Cotton) was Rs 42,000 Crore in 2015. IMD is now planning to provide these services extended to block level through 660 district Agromet field units being set up at ICAR Krishi Vigyan Kendras by 2019. These improved services with additional climate and soil information for rain-fed agriculture and irrigated agriculture of the country are expected to benefit farmers substantially and contribute to the Government initiative on doubling the income of farmers.

### 2. Early Warning Systems for High Impact Weather Events

The quality of weather services by the Ministry has shown



<http://citiscopes.org/story/2017/lessons-and-challenges-indian-cities-step-planning-heat-waves>

appreciable improvements during the past 4 years. There have been noticeable improvements achieved in skills of forecasts for high impact weather events like heavy rainfall and tropical cyclones. This is evident with reference to recent tropical cyclones, Phailin, Hudhud and Vardah and heavy rainfall events in Uttarakhand, Jammu and Kashmir and Chennai. For the recent cyclone, Vardah, which had caused severe damages in the city of Chennai and neighborhood, accurate predictions were provided almost 3 days in advance, helping to save thousands of lives. **The loss of lives during the last 4 years due to tropical cyclones has reduced to less than hundred as compared to the thousands during the previous decade.** The track forecast error during 2014-17 has been 89, 142, 207 km against 125, 202, 268 km

during 2007-13 for 24, 48 and 72 hrs lead period respectively. The period during 2014-17 registered a decrease in track forecast error by 29, 30, and 23% as compared to 2007-13 for 24, 48 and 72 hours lead period respectively.

### 3. Climate Services

Climate services are very useful for various sectors like agriculture, water resources, disaster management, health etc. Ministry has been providing various climate service products to various user agencies. The National Climate Centre at Pune has been now recognized as the Regional Climate Centre by the World Meteorological Organisation (WMO) for providing regional climate services to south Asian countries. The center is now issuing monthly climate bulletins providing details of climate anomalies over the region, status of El Nino and La

Nina and climate prediction products.

Ministry has the mandate of doing research on basics of climate change. A State-of-the-art Earth System Model (ESM) has been developed by the scientists at the Centre for Climate Change Research (CCCR), Indian Institute of Tropical Meteorology (IITM) Pune. This model will be further used to develop future regional climate change scenarios at 25 km resolution and conduct climate impact assessment studies. The ESM will be the first climate model from India to contribute to the forthcoming sixth IPCC climate change assessment process. The center will come out with a detailed climate change assessment report for India by early 2019. ■

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## HEAT WAVES AND HEALTH

# Public Health Impact of Heat Waves in Indian Cities

Globally, the effect and burden due to climate change is distributed unequally and often unpredictably. Urban cities, due to their economic and social advancement, face a high risk due to the variability and unpredictability of changing climate. Anthropogenic activities have increased the global average temperature by more than half since 1950's<sup>1</sup> and it is predicted that global mean temperature will rise by 5.5°C by the end of this century.<sup>2</sup> The city will witness increased frequency and intensity of heat wave- a period of sustained high temperature. According to IMD, a heat wave condition is announced when maximum temperature remains to be at 45°C.<sup>3</sup> Episodes of extreme temperature, such as heat waves

were experienced in Orissa in 1998 which caused 2048 deaths and in Ahmedabad and Andhra Pradesh in 2015 which killed 1,334 and 2500 people respectively.<sup>4</sup> Similar bolts of heat waves were also witnessed in Chicago in 1996 in Europe in 2003.<sup>5,6</sup>

Increased rate of hospitalization is seen due heat related morbidity and mortality. Direct effects includes like dehydration, exhaustion, fainting, heat cramps, heat stroke and indirect effects like cardio-respiratory illness. Vulnerability to heat increases with age, disability and existing illness, type of occupation like daily wage labor, transportation, etc., socio economic status.<sup>7,8,9</sup>

During dry spells, urban areas generally experience 10°C rise in

night as compared to the adjoining areas or rural areas due to 'Urban Heat Island' effect; an effect caused by trapping of heat by the materials such as buildings, pavements during the day time and releasing the same at the night time.<sup>10,11</sup> The intensity of the effect is directly proportional to city size, population, unplanned urbanization, vehicular movement and industrial growth and indirectly proportional to the green cover and open land mass. A study by McMichael et al. in 2008 in Delhi along with other international cities, said that for every 1°C rise in temperature above 29°C, there is 3.94% increase in mortality.<sup>12</sup>

The impact of heat related health outcomes in cities are inter sectoral. Incidences of vector borne diseases

will rise due to congestion and high temperature promoting breeding and maturation of pathogen.<sup>13</sup> Water scarcity and food insecurity will be common with increasing temperature which will further push up the levels of under nutrition and other micronutrient related deficiencies. Greenhouse Gases (GHGs) like carbon dioxide, nitrous oxide, etc. released due to high demand of mobility and industrialization acts, heat trapping agent; further causing air pollution and increasing the city temperature. The public health system is already resource strapped to deal with existing health issues, the adversities caused by extreme temperature further adds the burden.

By 2050, urbanization is expected to increase the urban dwellers by 6 million. Establishing effective early warning signals with trans-regional co-operation, setting up effective health surveillance systems, restoring natural resources can mitigate impending extreme events and also factor in an adaptation consciousness.<sup>14,15</sup>

In conclusion, India will have to evolve a multi-dimensional domain expert co-ordination to ensure that global policy frameworks trickle down to the last mile and ensure life and livelihoods are protected from heat waves.

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# Heat Wave Action Planning in Cities: A View from Gujarat



Photo: AIDMI.

Street vendor selling seasonal summer vegetables.

## Introduction

Heat Wave is a period of abnormally high temperatures, more than the normal maximum temperature that occurs during the summer season in the North-Western parts of India. Heat Waves typically occur between March and June, and in some rare cases even extend till July. The extreme temperatures and resultant atmospheric conditions adversely affect people living in these regions as they cause physiological stress, sometimes resulting in death.

## Reasons

A heat wave is declared when the temperature rises by 5-6°C than average maximum temperature, or

actual maximum temperature remains 45°C or more irrespective of normal maximum temperature. Higher daily peak temperatures and longer, more intense heat waves are becoming increasingly frequent globally due to climate change. India too is feeling the impact of climate change in terms of increased instances of heat waves which are getting intense in nature with each passing year, and have a devastating impact on human health thereby increasing the number of heat wave casualties.

## Impacts

The health impacts of Heat Waves typically involve dehydration, heat cramps, heat exhaustion and/or heat stroke. Fatigue, weakness, dizziness,

headache, nausea, vomiting, muscle cramps and sweating are observed in even healthy persons. Heat Stroke is considered when body temperatures reaches to 40°C i.e. 104°F or more along with delirium, seizures or coma. This is a potentially fatal condition.

Heat waves could have other dire effects including disastrous crop failures, deaths from hyperthermia, widespread power outages due to increased use of air conditioning, wildfires (often when a heat wave is combined with a drought), other fires as power transformers explode under the heat and humidity, damage to infrastructure (roads, highways and water lines), etc.

## Gujarat – Ahmedabad situation

One of the major reasons for "Heat Island" effect in urban areas in India is the rapid and unplanned development of built-up space in major cities. For example, in Ahmedabad city in last 20 years between 1996-2016, built-up areas has increased by 132%, whereas tree cover has reduced from 24% to 7%, which is the main reason of increasing heat impacts in high temperature days of summer months. Also there is sharp decrease in water bodies in and around city. The same situation is prevailing in other major cities of Gujarat and India. Another important thing is land use change for increasing heat impacts in cities. In Ahmedabad 7% of land was built up in 1990 which has increased to 16.34% in 2010 and by 2024 it is expected to be 38% of land under building. Along with built up areas, size and intensity of road network is increasing day by day. BRTS has taken space in major roads of the city, which has impacted on road sides, sideways or footpath, which have been asphalted to increase the size of roads and to accommodate more vehicles. Trees nearby the main roads are cut or chopped to expand the infrastructure work and improve the traffic situations. Footpaths have been paved along the road sided, in and around the residential and commercial complexes, parking, etc. which has reduced the space for green cover and chance for water percolation in monsoon season. All these cumulative impacts are important reasons behind the heating up of urban areas more as compared to other parts of the State. The phenomenal growth of population from 2 million to 7 million is impacting the availability of per capita natural resources of Ahmedabad city as well. As per the State Government's forest data, in 2011 trees density has reduced to 11 tree / 100 persons, and in present 2018 scenario if study is conducted again it would have reduced further.

The same type of situation is found in other major Indian cities like Bhopal, Hyderabad, Bangalore, Nagpur, Bhubaneshwar, Bengaluru, etc.

## Responses

Government at different levels is constantly promoting new and innovative ways to control the environmental conditions within the city, but population increase, migration from rural to urban and rapid urbanisation are anthropogenic reasons of change in environmental conditions of the city. Over and above these reasons the impact of global warming is pressing further ecological stress over the city areas.

The city administration of Ahmedabad (AMC - Ahmedabad Municipal Corporation) has developed the heat action plan, which has given very encouraging results in extreme heat scenarios. Other cities have followed Ahmedabad model in controlling similar situations in city level heat wave management. Indian Institute of Public Health - Gandhinagar (IIPHG) and NRDC have been instrumental in development and implementation of heat action plan in Ahmedabad. AMC has also developed mobile based application for dissemination of early warning of air quality as well as heat wave information. AMC is also providing free saplings of trees to citizen on their door step with help of social media and mobile application. However, despite several government initiatives public participation and capacity building of the common citizens can still be vastly improved.

The Ahmedabad Heat Action plan serves to focus attention on those individuals who are most at risk during heat waves, including slum communities, outdoor workers, elderly and children. The Plan also focuses on individuals and

organizations, such as Urban Health Centres (UHCs) and link workers, who frequently work with at-risk populations and can provide early diagnosis of heat-related illnesses and preliminary treatment.

## Community Engagement

In fighting with such extreme heat situation the role of individuals, community groups, and the media is central. Individuals can take specific preventative steps to protect themselves, their families, and their communities from harmful heat waves including learning about early signs of heat exhaustion, limiting heavy work during extreme heat, drinking water, staying out of the sun; wearing light clothing, checking on neighbours, and informing their fellow community members about how to keep cool and protect themselves from heat. The media is vital in spreading the word about the harm heat poses to health, and protecting people against dangerous heat waves. The media plays an essential awareness-building role by sharing news about health threats, and increased public protection by running ads and providing local resources information.

## Conclusion

At the same time the civic authority and the health department are also participating actively to reduce the immediate casualties, which has reduced the human loss during heat waves. Ahmedabad heat action plan is considered to be a very successful adaptation initiative in heat related disasters not only in India but across the world. However, to mitigate such situation citizens and authorities will have to focus on greening the city through vertical gardens, green belts, terrace gardens and such options to reduce the further concretization of our cities. ■

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## Research Issues on Heat Waves in India



After the mid-1990s, heat waves have been a big killer in India with the most recent report from CSE declaring it as the second biggest killer among all natural calamities. During heat waves, the deadly combination of heat and humidity causes hyperthermia and accordingly, some of the coastal or near coastal states like Odisha, Andhra Pradesh, Telengana, Gujarat, etc. have been bearing the brunt of the heat waves impacts. Odisha and Gujarat have activated Heat Health Action Plans to adapt to this extreme situation and other state governments are making elaborate plans on similar lines to control the situation in their regions. Review of Heat Action Plans makes it clear that government actions are tuned towards minimizing the human health impacts only through reduced exposure or providing medical facilities in case somebody suffers heat stress. The question comes whether this initiative is enough? By now, the state of Odisha has been doing such adaptive activities for more than 10 years and the question comes whether the Government of

Odisha has been able to fully control the heat wave mortalities in the state? Though mortalities have come down in spite of increasing heat wave days, large number of deaths are still occurring.

Studies of informal sector poor urban workers show such people are taking the risk of working under scorching sun during heat wave days due to economic compulsions, even though they are fully aware of the dos and don'ts during heat waves as advised by the state government. This may explain the situation of why people are still dying in the state in spite of so many years of awareness generation and heat action plan. In-depth studies need to be initiated to explore why deaths are still occurring and what extra work needs to be done? Is there a need for economic incentives like differential wage rate as people can work only for less number of hours or for electricity subsidy as electricity use is essential to adapt to heat and subsidy can reduce the burden on people? These issues need to be examined carefully to bring out

policy options for poor people who have little resources with them to adapt to such extremes on their own. At the moment, Heat Action Plans are formulated on the line of such activities in developed countries and they need to be more orientated to the realities of a poor economy.

Heat waves impose multiple impacts on the society other than the health impacts. Agriculture, livestock, poultry, and fishery are some of the other sectors facing high impacts and there is an urgent need for systematic assessment of these impacts to design policy interventions for these sectors. Heat waves are not declared as a natural calamity in India and heat wave losses are not covered by any type of insurances whereas cold waves are. Other than health effects, losses from heat waves are invisible and attrition is difficult. Unless studies are done and economic losses are carefully measured, arguing for insurance cover will be difficult.

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# Heat Wave As A New Norm in Vietnam

Vietnam has usually experienced temperature variation between 21°C to 28°C during the dry summer season.<sup>1</sup> However, last year, the northern parts of Vietnam experienced temperature in excess of 40°C, with a peak of 42.5°C recorded in central Hanoi, nearly breaking the city's 1926 record of 42.8°C.<sup>2</sup>

This extreme heat affected not only Vietnam but several regions in countries such as the USA, Western Europe and North Africa, all located in the Northern Hemisphere. Climate researchers now call 'simultaneous heat waves are the new normal', attributing the increasing heat wave severity and frequency to climate change.<sup>3</sup>

Vietnam's long line of coastal areas, degradation of environmental amenities, and rapid urbanisation

have exacerbated the effect of heat waves. According to a UNDP paper<sup>4</sup>, while Vietnam has experienced an increase in mean annual temperature of 0.4°C since 1960 the expected increase is 0.8°C-2.7°C by 2060. Additionally, instances of heat waves observed in Vietnam is rising nationwide, especially in the central regions.<sup>5</sup>

Records from Viet Nam National Hospital of Pediatrics in Ha Noi in 2007 show the hospital has been treating about 1,500-1,700 children per day, 30 per cent of whom are hospitalised with illnesses relating to the hot weather<sup>6</sup>. Power outages because of increasing demand and degradation of underground water sources have aggravated not only direct health consequences, but also led to a reduction of production in those sectors, particularly the

agricultural sector, where workers operate in extreme heat conditions, under direct sunlight or in poorly ventilated workplaces.

Well-off citizens use air-conditioners, avoid going outside under the sun or go to the water park to cool-off. Authorities asked the relevant supplying company to take all possible measures such as mobilise additional water container trucks, speed up the construction of electricity plants to supply adequate levels of fresh tap water and ensure no power cuts, especially on days of extreme heat. '*Ensuring that no households are without water is the most urgent tasks*' – said Minister Dung. For outdoor workers, or those in poorly ventilated and constructed buildings, who have little bargaining power, the chances are slim.

Research from COHED (The Center for Community Health and Development), Vietnam suggest that knowledge and awareness of precautions for dealing with heat stress remains low.<sup>7</sup> Additionally, current labour laws do not provide adequate protection for workers. The risk of heat stress is exacerbated by a lack of health insurance and social protection.

While authorities are beginning to recognize that heat waves present a worsening health challenge, they have not yet acknowledged these as 'disaster' events, because possibly the impacts of these episodes are not visibly as destructive as other 'traditional' disasters in Vietnam such as flood or storm. The strategy to tackle heat waves, and build a resilient community, thus, remains limited to already affected areas such



Construction site workers in Da Nang stop to drink water and keep hydrated.

as Delta Mekong Rivers and the central regions, but not yet expanded to cities and urban areas.

As Vietnam is a signatory of the UN Framework Convention on Climate Change, the Kyoto Protocol, and the Paris Agreement on Climate Change, Vietnam clearly needs a holistic and comprehensive approach to analyse and tackle the cross-sectoral problems and consequences. Applying adaptive measures to enhance capacity of residents, increasing awareness among employers and laborers, integrating city planning in addressing disasters, and enhancing collaborations between different departments are suggestive solutions that Vietnam can consider in tackling this new type of

'disaster'. Experiences learning and sharing with countries which face similar situations and have built rich experiences in the field such as India, Australia, etc. can encourage adopting best available practices. ■

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#### HEAT WAVES IN PHILIPPINES

## Heating Island Paradise: Philippine Temperature Rises

While the Philippines welcomes as many as at least 20 typhoons every year- some of them very destructive-it is also a well-known fact that the dry months (March-May) with less than average rainfall can be extremely hot. Months and days in some distinct locations (e.g., Tuguegarao City in northern Luzon and Cabanatuan City in central Luzon, but also in Pres. Rodrigo Duterte's Davao) could heat up to more than 40 degrees Celsius, effectively forbidding agricultural activities, causing some deaths, and forcing people to head for beaches, malls or anywhere the shade can minimize so-called "heat index". March-when the temperature begins to climb--is also the month when most fires occur, razing down communities with houses made from light materials. Only the onset

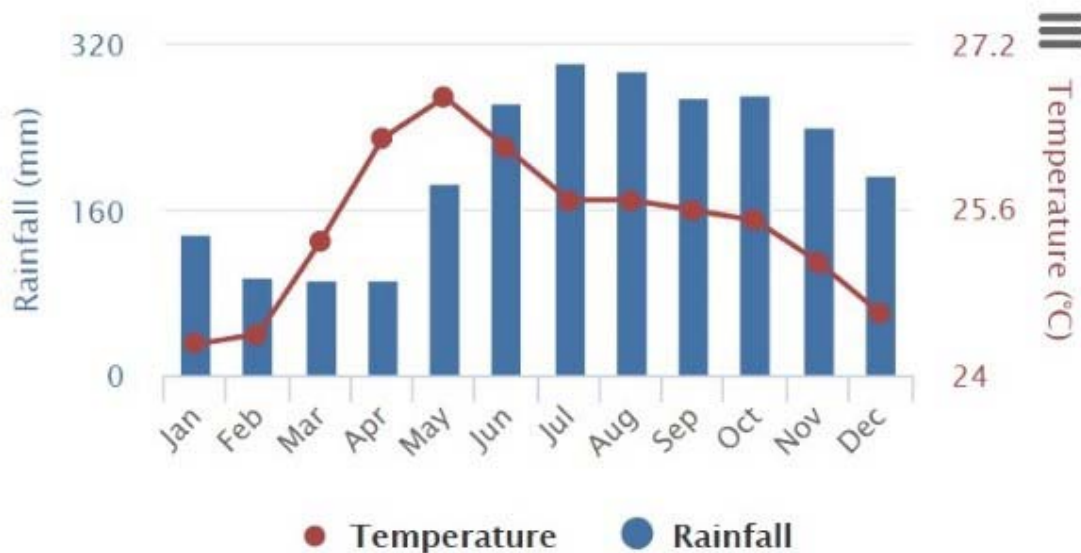


*This file photo shows informal settlers' homes (foreground) dwarfed by highrise buildings in the background near the port of Manila.*

of the rainy season from the southwest monsoon—sometime in June—will ease the drought spell.

The Philippines, together with a few other countries, "will face more than 300 potentially lethal heat wave days

## Average Monthly Temperature and Rainfall for Philippines from 1901-2015



Source: World Bank Climate Change Knowledge Portal, 2018.

each year under the business-as-usual emissions trajectory, known as RCP 8.5.<sup>1</sup> As this has happened, car and cab aircons overheat, water reservoirs dry up, farm irrigation stops, rice yield drops prompting massive importation. This is tied to the El Niño phenomenon that delays the rainy season and also cuts it short.

Studies indicate that this is all due to climate change as countries, even signatories to promises to bring down temperature rise by miniscule degrees Celsius, succumb to increasingly longer heat wave durations. Luzon and Mindanao have been identified as having more than 200 and 300 heat wave days, respectively, and so-called "deadly heat conditions" will be around up to the year 2050. However, in 2013, the state weather agency called Philippine Atmospheric, Geophysical and Astronomical

Services Administration (PAGASA) declined to call 35 degree Celsius temperature conditions back then as heat wave. As "easterlies, warm, humid winds" blew from the Pacific and heated the eastern section of the archipelago, PAGASA also projected "isolated rain showers and thunderstorms" seemingly to assuage public fears of worse weather.

Not so much—or in spite of—the temperature, it is the "heat index" which could really be very dangerous specially to people with heart conditions when it rises to 51 degrees Celsius as it did in Nueva Ecija province on 9th April 2018. In mid-April 2016, for consecutive days, this province experienced over 50 degrees Celsius heat index, and recurred in May the following year, with dire consequence on water buffalo production therein. Tuguegarao shares Nueva Ecija's great weather misfortune.

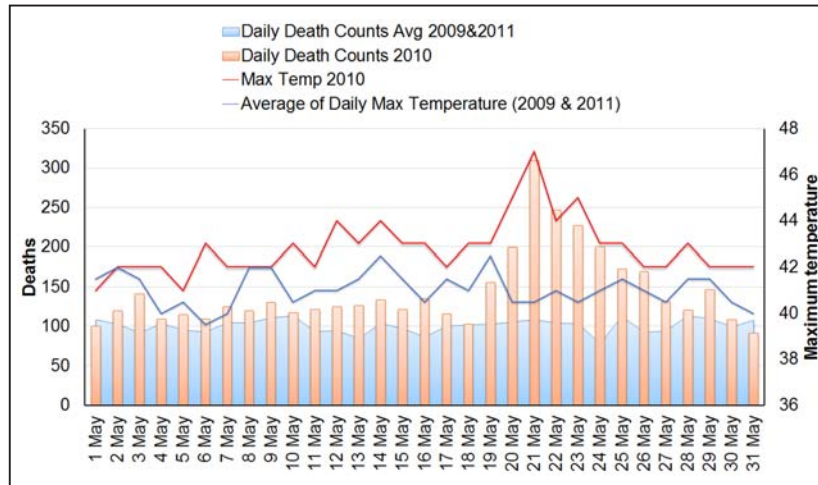
Other countries have plans to deal with heat waves. India's disaster management agency has some, so does the US. The Philippines can use studies like this which shows effects of temperature rather than heat waves across sexes and age groups, but it may be too technical to be useful at all for specific interventions. The country works mainly with addressing climate change-related commitments and actions and with releasing manuals for disaster risk reduction education.

In more direct ways, people themselves try to address the heat index and heat wave concerns, suggesting what to do, and at least one UN agency focuses on the most vulnerable. Somehow, "Lucifer" heat waves have to be met head on. ■

- Rolando Talampas, Asian Center,  
University of the Philippine Diliman,  
Quezon City, Philippines

1 <https://www.rappler.com/science-nature/environment/173433-study-global-warming-cap-heatwaves>

# Heat Wave Action Plan – Ahmedabad



Temperature and all-cause mortality correlation during the 2010 heat wave in Ahmedabad as compared to 2009 and 2011.

South Asia has been identified as one of the most vulnerable regions in the world exposed to the impacts of climate change. The current heat wave is one such manifestation of the adverse impacts of climate change on the region. Heat waves are not categorized as disasters yet. However, the increasing incidence of heat waves and their impacts on human health, agriculture and livelihoods has compelled governments to take note of this rising threat.

Climate change is leading to an increase in average temperatures and increased possibilities of severe heat waves. Extreme heat can lead to dangerous, even deadly, health consequences, including heat stress and heatstroke. In addition to the heat, the citizens are exposed to poor air quality, which is a common problem this time of year. The city of Ahmedabad had a major heat wave in May 2010, there was large

rise in daily mortality in 2010 coinciding with the heat wave. This led to 1,344 additional deaths registered in the city during the month of May.<sup>1</sup>

The 2010 heat wave was a wakeup call that intergovernmental agency action, preparedness, and community outreach was needed to save lives. Rising to this challenge of climate change and increasing heat waves, the Ahmedabad Municipal Corporation (AMC) is working to prepare health systems and residents against dangerous heat waves. The first Heat Action Plan (HAP or Plan) was prepared in 2013 by the AMC with help from national and international academic experts and learning from global best practices on early warning systems and heat adaptation. Ahmedabad launched a first-of-its-kind Heat Action Plan, making it the first city in South Asia to create a comprehensive early warning system and preparedness

plan for extreme heat events fuelled by climate change. Each year the AMC and partners modify and prepare an updated Heat Action Plan.<sup>2</sup>

Therefore, the 2017 heat wave plan adopted comprehensive early warning system and preparedness plan for extreme heat events in Ahmedabad. The plan represented immediate and longer-term actions to increase preparedness, information-sharing, and response coordination to reduce the health impacts of extreme heat on vulnerable populations. The plan was inclusive of four key strategies:

- To build public awareness and community outreach:** Disseminating public messages on how to protect people against extreme heat through media outlets and informational materials such as pamphlets and advertisements on heat stress prevention.
- To utilize early warning system and inter agency coordination:** Alerting governmental agencies, the Met Centre, health officials and hospitals, emergency responders, local community groups, and media outlets of forecasted extreme temperatures through formal communication channels.
- To build capacity among health care professionals:** providing trainings focus on primary medical officers and other paramedical staff, and community health staff so they can effectively prevent and

1 <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0091831#abstract0>

2 <https://www.nrdc.org/sites/default/files/ahmedabad-heat-action-plan-2017.pdf>

manage heat-related cases so as to reduce mortality and morbidity.

**4. Promoting adaptive measures to reduce heat exposure:**

Increasing outreach and communication on prevention methods, access to potable drinking water and cooling spaces during extreme heat days. Collaboration with non-governmental organizations was also identified as a means to expand outreach and communication with the city's most at-risk communities.

The Ahmedabad model to counter heat wave effects has had an impressive start and the most positive impact has been on street vendors, casual labourers, construction workers, traffic police

and AMC staff and schoolchildren. The most vulnerable populations have been carefully identified through on-the-ground studies, focus groups, interviews, and workshops that considered factors affecting heat exposure, susceptibility to heat-related illness, and adaptive capacity. Hence, the Heat Action Plan is tailored to help the city's at-risk residents cope with rising heat. Ahmedabad's Heat Action Plan describes both immediate and longer-term actions to increase preparedness, information-sharing, and response coordination to reduce the health effects of heat on vulnerable populations. It includes, preventative training and awareness building for medical professionals and slum community outreach workers. Under the plan the heat-health protection trainings would

also be provided for school children, outdoor workers, and other vulnerable groups. The plan includes communications outreach, such as an early warning system that will immediately alert the public of impending heat waves, the distribution of multilingual pamphlets, and long-term awareness-building ad campaigns. Apart from this, there would be coordinated action by government agencies at the municipal, state, and national levels to ensure successful implementation of the preparedness plan and warning system. Impressed with the Ahmedabad model, civic bodies in Nagpur and Bhubaneswar have also launched a similar initiative.

Ahmedabad's efforts are unique in South Asia, as countries and international organizations have yet to establish comprehensive heat preparedness plans in the region. In recent years, the World Health Organization (WHO) has included among its goals the strengthening of health systems to cope with the health threats posed by climate change. Among seven nations hosting WHO pilot projects related to climate change and health, China has an early heat warning system planned.<sup>3</sup>

The initiative can further be moulded in a more effective way by involving community based mitigation and responsive measures to the impacts of heat wave. This action plan can further be used as a reflection to construct or design the heat wave cope up strategies in other cities and states of India. It is therefore necessary because the incidents of heat waves are on a rise which undoubtedly effects the most vulnerable sections of the society.

**- Sushma Modi,**

SOAS, University of London, and  
AIDMI



Photo: AIDMI.

Selling water bottle on road side during hot summer afternoon's.

3 <https://www.ibef.org/archives/detail/bmV3cyYzNDEzOSYxMTM=>

# Role and Results of National Disaster Management Authority in Heat Wave Planning in India

Being the apex nodal agency of Disaster Management in India, the National Disaster Management Authority (NDMA) has played a pivotal role, in dealing with various disaster preparedness and response activities, including Heat Wave Planning in the country. The role and contribution of NDMA in the Heat Wave Planning can be understood, as per the following initiatives taken in recent past:

## NDMA Guidelines

Realizing the intensity of extreme heat events and also the number of recorded deaths in recent years, NDMA formulated Guidelines in 2016, for "Preparation of Action Plan – Prevention and Mitigation of Heat Wave" to address this pertinent issue in detail. The National Guidelines were reviewed and revised again in 2017 after the apex level national consultation. These Guidelines aim to facilitate the stakeholders in preparing Heat Wave Action Plan by providing insights into heat related illness and necessary mitigative and



Ramprasad is serving water in scorching heat of Delhi.

response actions to be undertaken. The Guidelines have specified roles and responsibilities of concerned Ministries/ agencies for managing heat wave at respective levels. This actually helped in reducing number of deaths from 2400 in 2015, to 1100 in 2016 and to 200 in 2017 reportable cases across India.



Rickshaw puller has only this option to survive in Capital.

## Social Media Campaign on Heat Wave

NDMA has been extensively running heat wave awareness campaign on social media. NDMA's Beat The Heat India campaign is being widely used and publicized by various stakeholders. Further it has also come out with the basic awareness stuff about heat wave on website by throwing light on Do's & Don'ts, tips for treatment, emergency kits, resources and other allied information, with the objective to spread alertness for communities. Besides this, short audio and video spots are also used for greater public awareness. The campaign has reached to masses with a message.

## Pushing States to embed Heat Wave in SDMPs

In the last four years, NDMA has reviewed all States and UTs DM Plans. And while reviewing, the NDMA has encouraged the States and UTs to cover Heat wave in their State DM Plans. On the same lines, the States have started addressing the heat wave. Andhra Pradesh SDMP is a good example of heat wave coverage.

## Encourage States for Heat Action Plans

The current focus of NDMA is to encourage all the heat wave affected States and Cities to come out with their own heat wave action plans. And in this regard, NDMA has prepared specific checklist for States to develop Heat Action Plans. As of now, 11 States and 17 Cities have prepared the Heat Action Plans (HAPs). Now the State Governments are taking respective prevention, preparedness and mitigation measures to beat the heat.

### Periodic Reviews with States and Departments

NDMA has organized periodic monitoring and review meetings at regular intervals with all concerned States, Central Ministries/ Departments relating to Heat Waves. The academic institutions and selected INGOs, UN agencies were also involved in these consultations (organized in Telangana, 2017 and in Andhra Pradesh, 2018). The best practices were also shared. Further NDMA is taking stock of the progress with

concerned States at regular intervals through video conferencing as well. It is expected that such initiatives will really set the tone for better preparedness, towards addressing the heat wave and allied risks in the country.

### Issue of Advisory to the State and UTs

NDMA also timely issues the advisories, precautions, Do's and Don'ts to the States and UTs, especially related to heat waves. However, primarily IMD informs about the same via MHA, further

NDMA ensures that information and alerts (**RED** - Extreme Heat Alert, **ORANGE** - Severe Heat Alert, **YELLOW** - Heat Alert, etc.) reaching to the States, by verifying with State Emergency Operations Centers.

NDMA has functioned more of a facilitator rather than being as an authority, extending its support to other stakeholders as partner and resource provider, to create an enabling environment in order to deal with heat wave in country. ■

- AIDMI Team

## HEATWAVES AND PUBLIC HEALTH

# Impact of Heat Wave on Vulnerable Citizens in Indian Cities

### Introduction

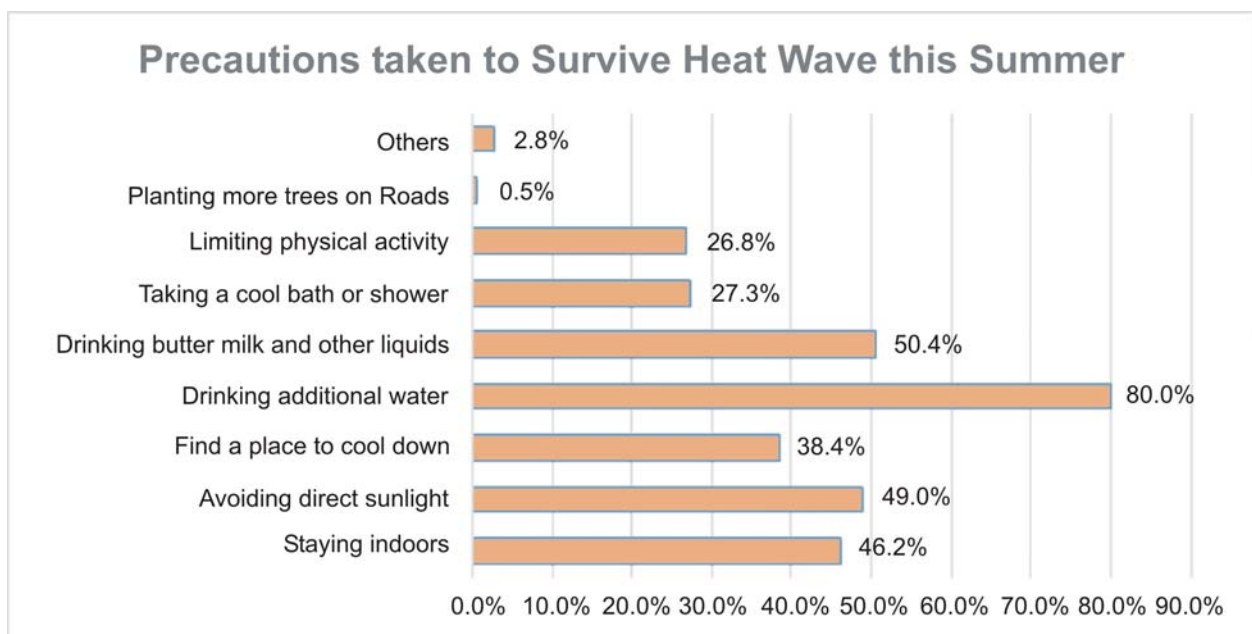
Climate change is leading to an increase in average temperatures and increased possibilities of severe heat waves. Higher daily peak temperatures and longer, more intense heat waves are becoming increasingly frequent globally due to climate change. Extreme heat can lead to dangerous, even deadly,

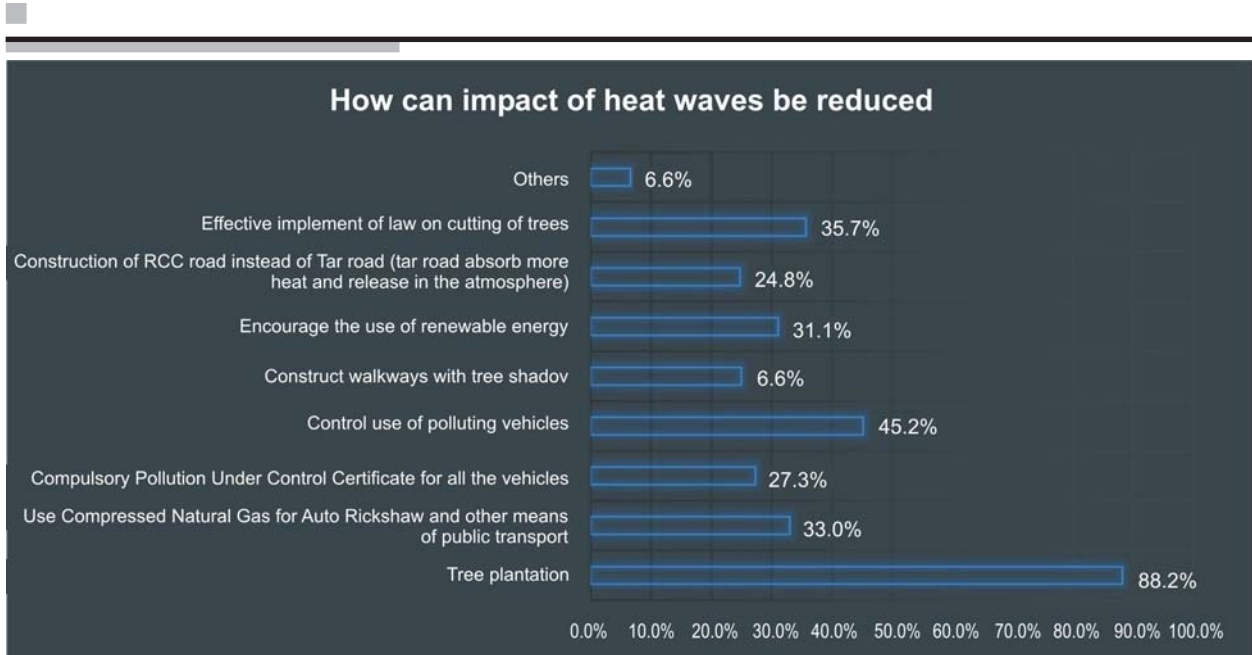
health consequences, including heat stress and heatstroke. A Heat Wave is a period of abnormally high temperatures, more than the normal maximum temperature that occurs especially during the summer season in India. Heat Waves typically occur between March and June, and in some rare cases even extend till July. Extreme heat events already have a

significant impact in India. The impact of heat wave has been more adverse to the vulnerable groups of street vendors who are directly exposed to sun.

### Methodology

A Survey with reference to heat wave in 10 cities namely, Ahmedabad, Bhubaneswar, Bhub,





Mumbai, Machilipatnam, Vijayawada, Rajkot, Guwahati, Puri, and Chatrapur around India was conducted through survey forms with concerned community individuals randomly as well as municipal officials. The survey consisted 10 questions on impacts of heat wave, prevention measures on heat wave and early warning systems on heat waves in different cities of India etc.

**Limitations**

While conducting the survey, it was difficult for the team to approach the respondents with the term heat wave, as not all of them were aware about it. Many explanations were given on heat wave to guide the respondents to fill up the forms.

**Key Findings**

Total 165 responses from community and 36 responses form officials were noted from different cities of different age group and profession. Considering the gender aspect 80.8% participation was noted by males and 19.1% from females. In the survey conducted to identify what population of the society is more exposed to ill health due to heat wave, 44.2% of the respondents considered children to be more

prone. Whereas, 28.5% constituted of elderly people and 22.3% of pregnant women susceptible to the impacts of heat wave.

The below two charts give an overall outline what can be done reduce the impacts of heat wave and simultaneously what precautions were taken by the individuals to survive the heat this summer.

The graph diagram-1 illustrates what precautions were taken by individuals this summer to beat the heat wave (in percentage). The respondents were asked to fill up more than one answer as per their satisfaction. 74.5% people followed to drink lots of water, 44.90% people avoided going in direct sunlight and 44.30% preferred staying indoors. Furthermore, 42.60% people opted to drinking butter milk and other liquid and 43.10% individuals initiated to find a place to cool down during the afternoons. Subsequently, as shown in the graph other precaution remained below 40%, but what is surprising is only 0.50% people chose the most effective measure that is planting more trees on roads.

The graph diagram-2 illustrates recommendations or steps to reduce

impact of heat wave in day to day life. The surveyed results point out that tree plantation (87.2%) is most necessary and efficient way to reduce impact of heat wave, furthermore, to control using polluting vehicle at 41.2%. Though, the respondents recommends to have effective law on cutting trees and Use of Compressed Natural Gas for Auto Rickshaw and other means of public transport at 35.7% and 37.5% respectively.

**Conclusion**

The survey was conducted as an exercise to evaluate the community knowledge on heat wave, its effects and precautions from heat wave. The analysis suggested that not all people are well aware about rise in heat and also its impacts. Whereas, precaution have not been community based rather individual compression to reduce vulnerabilities caused due to heat wave. There has been positive response on effectiveness of early warning mechanism as individuals are warned and advised cautiously. Furthermore, the respondents gave suggestions on how the early warning can diversify through different mediums. ■

- Vipul Nakum, AIDMI



# Impact of Heat Waves on Citizens

Heat wave events are becoming increasingly common in India. Globally, 2015 was the hottest year on record, beating the record set in 2014 and making it the fourth time this century that a new high temperature record was set. In 2015, heat waves in India killed more than 2,300 people, making it the 5<sup>th</sup> highest in world history in terms of number of casualties. Most of the deaths concentrated in Andhra Pradesh, Telangana, Punjab, Odisha and Bihar. In 2016, India again experienced a similar heat wave with the same deadly consequences.

Despite claiming many lives and making countless people ill, heat waves in India are not considered a calamity at the institutional level. In India's experience with heat waves, it is instructive to note that the majority of casualties resulting from the extreme heat are among the very poor, elderly, outdoor labourers and homeless, likely with pre-existing health problems and a lack of access to relief. As pointed out by UN's Intergovernmental Panel on Climate Change (IPCC), climate change will aggravate the frequency and severity of heat waves in the coming years. All these factors necessitate building the resilience of the poor, marginalized and low income communities in India to the adverse impacts of heat waves. Thus, India needs institutional level planning to combat the threat of heat waves.

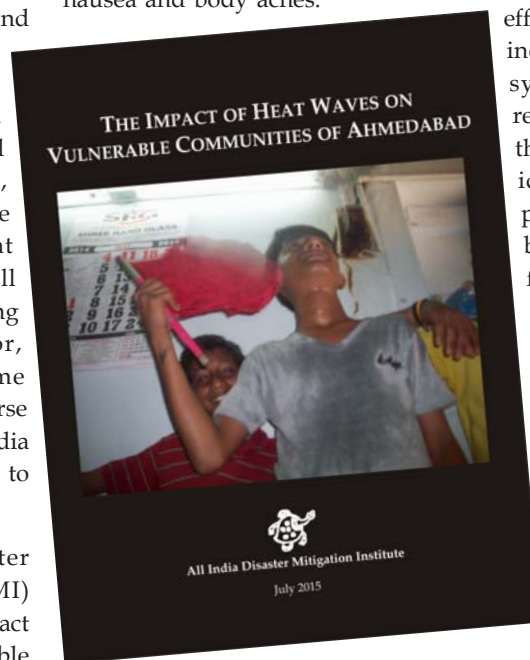
In 2015, the All India Disaster Mitigation Institute (AIDMI) conducted a study titled, 'The Impact of Heat Waves on the Vulnerable

Populations of Ahmedabad'. This study was conducted primarily with the participants who either stayed in the city's slums or worked on its streets. The study focused on how the extreme heat affect the elderly, children, pregnant women living in slums as well as cobblers, porters, auto drivers, construction site workers, kiosk operators and others who have to brave the vagaries of weather to earn a livelihood. All these people have to work in the extreme heat to make ends meet, often at the expense of their health. Most of the respondents reported reduced earnings as a result of this increased heat. Furthermore, the respondents also identified some of the health hazards associated with the extreme heat such as fever, fatigue, respiratory problems, losing consciousness, blurred vision, heat strokes, dehydration, experiencing nausea and body aches.

This study was primarily conducted in Ahmedabad to understand how well is the city's civic administration is equipped to handle the risks of extreme heat. The heat wave that struck the city of Ahmedabad in May 2010 resulted in 4,462 all cause mortalities. In 2013, the Ahmedabad Municipal Corporation (AMC) launched the city's first Heat Action Plan (HAP). Ever since, the casualties due to extreme heat have been considerably reduced.

In addition to the HAP of the Ahmedabad civic administration, AIDMI's research on the impact of extreme heat on the citizens of the city presented unique lessons. The first lesson was the importance of institutional efforts such as the heat action plan (HAP) launched by the AMC. These initiatives lend a greater degree of efficacy and sustainability to the mitigation and adaptation efforts. The second lesson was the indispensability of early warning systems in saving lives and reducing human distress. Perhaps the most important lesson was the idea that extreme heat impacts people from different backgrounds differently. While for the rich who have the option of cloistering themselves in air conditioned rooms, this extreme heat may be at best an inconvenience. The poor on the other hand have no such luxury, and often expose themselves to the extreme heat to earn a livelihood.

- Kshitij Gupta,  
AIDMI



1 How to Reduce Heat Wave Exposure among the Most Vulnerable, <https://blogs.scientificamerican.com/guest-blog/how-to-reduce-heat-wave-exposure-among-the-most-vulnerable/>

# India Heading for Worst Summer and Heat Wave Across Half the Country



Photo: ADMI.

Street vendors have to often brave out the extreme heat in order to make a living.

According to a scientist in Germany and Spain, heat waves are set to double in size by 2020 and continue to grow in coming decades, as heat trapping greenhouse gases warm the global climate. According to India's weather department, the country is heading for a worst summer average temperature from March to May across half of the country will rise by 1 degree Celsius.

According to Indian Meteorological Department (IMD), these months are expected to be particularly merciless in north India including Delhi, along with Haryana, Punjab and Rajasthan, which likely to see average temperatures soar over 1.5 degrees above normal.

The maximum rise, however, has been projected in the hill states of

Himachal Pradesh and Uttarakhand, where average temperatures could be a massive 2.3 degrees higher than usual. Both states are known for their hill stations where thousands of tourists throng to escape from the scorching sun in Northern and Western parts of the country.

The seasonal forecast, released by the IMD also notes that there is about 52% probability that maximum temperatures in the core heat wave zone during the period of March to May will touch their peak-pointing to a high likelihood of heat waves in the country. This zone includes Delhi, Punjab, Himachal Pradesh, Uttarakhand, Haryana, Rajasthan, Uttar Pradesh, Gujarat, Madhya Pradesh, Chhattisgarh, Bihar, Jharkhand, West Bengal, Odisha, Telangana, Marathwada, Vidarbha, Madhya

Maharashtra and coastal Andhra Pradesh.

It was also observed that extreme temperature is often underestimated and never reported as a disaster event, but records show that in the past decade heat waves were the second most deadly disaster event in India, after floods.<sup>1</sup>

As per the IMD forecast, regions where the temperature rise is likely to be moderate are south India and four northeastern states. The outlook shows that the seasonal average mean temperature in Tamil Nadu, south interior Karnataka, Rayalaseema and north-eastern states of Nagaland, Manipur, Mizoram and Tripura is likely to be less than 0.5 degrees Celsius above normal.

The forecast for the March-May period is prepared on the basis of prevailing initial conditions in February.

"In the absence of other large scale signals during the March-May period, the increased temperatures predicted in the forecast can be attributed to global warming," said D Sivananda Pai, head of IMD's long term forecasting division which made the forecast.

IMD are actually doing a very good job in forecasting heat waves and media is also doing a good job by reporting these forecasts. But still it was observed in the city or any other place in India, people do not stop themselves to go outside even after

<sup>1</sup> Heat action plans: Scaling up India's ambition to protect the climate-vulnerable, November 2017 available at [https://cdkn.org/wp-content/uploads/2017/11/CDKN\\_Heatwave-Guide\\_FINAL-WEB.pdf](https://cdkn.org/wp-content/uploads/2017/11/CDKN_Heatwave-Guide_FINAL-WEB.pdf)

these weather forecasts of extreme. For millions of the people, whose livelihood is depend on daily labour, street vendors, sales representatives, staying away from the killer heat is still not a choice. Apart from the petty vendors, senior citizen, office and school goers, motorists, and pedestrians bore the brunt of the sun and get affected by the increasing heat.

"We have suffered a lot from the heat. We could not sit inside, we could not work, people were falling sick. After some people painted my tin roof with white reflective paint. I felt so much better. The paint brought the temperature down by several degrees, and I have been able to sit in my home, do my work."

- Meenaben, Ahmedabad

A new analysis of mortality during heat waves shows that the death toll may rise by two and a half times over the next 50 years. Recently a pilot study was conducted by All India Disaster Mitigation Institution with small business owners in the Guwahati city, Assam where it was found that among the total respondents 64% were affected by the rise in temperature in Guwahati City. 49% of the respondents affected by heat waves had faced damage to their livelihood products of which 46% indicated that they had faced a reduction in sales, as appetite of customers reduced due to scorching heat which results in fewer sales of food items, and 5% indicated major health problems like fever, sun stroke and Stomach problem. The highest gross amount of loss and damage is Rs 60000 while the lowest amount of loss and damage suffered by the respondent is Rs 200 and the average is Rs 2974.

Another research was carried out by the All India Disaster Mitigation Institute (AIDMI) to analyse the adverse impacts that the heat wave of 2014 has had on the vulnerable communities of the city of

Ahmedabad in Gujarat, India. It was found that 38% of the respondents had an opinion that heat waves impacted their incomes. During the survey, it came out that of the total respondents 31% favoured newspaper alerts followed by local TV alerts (25%), mobile SMS alerts (21%), alerts directly through AMC officials' visit (16%) and others such as loudspeakers (7%) for emergency alert.

The frequent rise in temperature may affect the human health in the long term which may cause serious health problems, including severe dehydration, heat stroke and, in the worst cases, death. The heat threat may worsen in urban areas due to heat absorbent building materials, higher air pollution and a lack of vegetation. Moreover, extreme temperature may lessen the productivity if people remain too unhealthy or unwell or tired to work and this may direly impact the socioeconomic life of human beings. It was also observed in as few cities where schools, colleges and offices were remained close for one -two days due to extreme temperature. For instance, in 2015 taxi drivers

union in Kolkata decided to stay off the roads between 11 am and 4 pm.<sup>2</sup>

Heat waves across the country has reached an alarming level, its not only affected human, animals and the environment, even the roads are bearing the brunt of it. In another instance of Delhi from 2015, several roads got melted under the sweltering heat. This is making life even more miserable for the local people, who are facing trouble walking on it as their footwear is getting stuck to the roads.<sup>3</sup> Heat waves have directly impacting temperature sensitive sectors such as livestock and agriculture. The 2015 heat wave, killed 17 million chickens within a month.<sup>4</sup>

Followed by such type of incidents, the government is taking action to the risks posed by extreme heat. In this regard, the city of Ahmedabad is leading the way. Ahmedabad is the first city to launch Heat Action Plan in 2013 and later on revised it in 2016. The Plan creates immediate and longer-term actions to increase preparedness, information sharing, and response coordination to reduce the health impacts of extreme heat on vulnerable populations. Furthermore, Ahmedabad Municipal Corporation's contributions towards reducing the impact of heat waves are commendable. In 2017, AMC, introduced 'cool roofs' initiative, which aimed to reduce heat risk in vulnerable slum settlements. Gradually, cities are now conscious about having a specific action plan for heat waves. Although heat wave/increased temperature is still

2 India today 2015, Heat wave forces Kolkata's yellow taxis to take five-hour break Available at <https://www.indiatoday.in/monsoon/monsoon-bad-news/story/kolkata-yellow-taxi-to-stay-off-the-roads-for-five-hour-summ-254684-2015-05-26>

3 Janakiram Karthik, After Delhi, Now Silvassa Roads Are Melting Due To The Heat Wave, Making It Difficult To Walk, 2016, available at <https://www.scoopwhoop.com/WTH-Roads-In-Silvassa-Are-Melting-After-Heat-Wave-In-India-Reaches-Extreme-Levels/#.df9gkh87y>

4 Indian chicken prices surge to record as heat wave kills millions of birds , 2015, available at <https://www.reuters.com/article/india-heatwave-chicken/indian-chicken-prices-surge-to-record-as-heat-wave-kills-millions-of-birds-idUSL3N0YM0B920150601>



Photo: AIDMI.

Fruit vendors like Satwan Prasad often suffer losses as their fruit gets quickly spoiled in the extreme heat.

a very new concept in India. There is need for perfect blueprint which may work better for other cities and states too. Still India has a long way to go to deal with extreme heat through several experimentation, evaluation research and all with learning by doing and these activities may ensure and help the country to plan to tackle with heat waves as effectively as possible.

Moreover, there is a need to have heat adaptation measures as follows:

**Measures to deal with extreme heat:**

1. In order to lessen the extreme heat mortality, there should be a proper action plan on heat wave and implementation of the same as well, which may be done in coordination with government line departments

and this has been already implemented in Ahmedabad in 2013.

2. Subsidy on purchase of raw materials considering the loss of inventories suffered due to extreme heat.
3. Plantation of number of trees to reduce the ill impact of rising temperature.
4. Providing proper market shelter, drinking water and other basic infrastructure for micro business and other common people.
5. Building public awareness on extreme heat management strategies.
6. Use of media to communicate and alert the public about increasing temperature by line departments.
7. Recognizing increased temperature as a major concern and there should be proper preparedness plan to tackle increased temperature or extreme heat.
8. Strong policies to reduce air pollution and managing traffics. ■

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