



Extreme Heat Waves and Mitigation

This editorial is based on [“Dealing with extreme heat”](#) which was published in The Hindu on 18/04/2023. It talks about a comprehensive overview of the problem of heat waves and suggests mitigation strategies for policymakers at various levels.

For Prelims: Criteria for Heat Waves, El Nino, Indian Meteorological Department

For Mains: Causes, Impact, Mitigation strategies of Heat Waves, Urban Heat Island

For last few years, heat wave during the summer season is increasingly affecting morbidity

and mortality in the country. Heat waves are a growing concern for disaster management in India, causing widespread health and environmental impact.

Extreme weather events have become more frequent globally, requiring communities to understand and cope with heat waves.

From the view of hazard mitigation, rising number of heat wave related deaths is expected to serve as danger signal and corroborate the need to develop innovative methods to control summer-time losses.

What is Heat Wave?

- Heat wave as a hazard causing disaster scenario, is little more than the physical phenomenon of high heat conditions and is **characterized as a complex of hydro-climatic risks** coupled with **social, occupational and public health risks**.
- **Definition:**
 - As such there is **no universal definition for heat wave**.
 - It is **generally defined as a prolonged period of excessive heat**.
- **Indian Meteorological Department (IMD) Criteria:**
 - Heat Wave **need not be considered till maximum temperature** of a station **reaches** at least **40°C for Plains** and at-least **30°C for Hilly regions**.
 - If the **normal maximum temperature** of a station is **less than or equal to 40°C**, then **an increase of 5°C to 6°C** from the normal temperature is considered to be heat wave condition.
 - Further, **an increase of 7°C or more** from the normal temperature is considered a **severe heat wave condition**.
 - If the **normal maximum temperature** of a station is **more than 40°C**, then an **increase of 4°C to 5°C** from the normal temperature is considered to be heat wave condition. Further, **an increase of 6°C or more is considered a severe heat wave condition**.
 - Additionally, if the **actual maximum temperature remains 45°C or more**

irrespective of normal maximum temperature, **a heat wave is declared.**

Heat wave Scenario	40°C	30°C
Maximum Temperature	Plains	Hills
Heat wave conditions prevail when...	Severe heat wave conditions prevail when....	
Normal maximum temperature	Normal maximum temperature	Normal maximum temperature
Deviation from normal	Deviation from normal	Deviation from normal
Above	Above	Above
40°C	40°C	40°C
4-5°C or more	6°C or more	6°C or more
At or below	At or below	At or below
40°C	40°C	40°C
5-6°C or more	7°C or more	7°C or more

To What Extent Heat Wave is the Problem?

- **Heat Stress:**
 - **350 million** Indians **exposed to strong heat stress** between **April and May 2022**
- **Temperature Trends:**
 - **Summer temperatures** have **risen by 0.5-0.9°C** across districts in Punjab, Haryana, Uttar Pradesh, Bihar, and Rajasthan **between 1990 and 2019.**
 - **54% of India's districts** have seen a similar **rise in winter temperatures.**
 - Maximum temperature is **expected to rise by 2-3.5°C** in **100 districts** and by **1.5-2°C** in around **455 districts between 2021 and 2050.**
- **Urban Heat Island Effect:**
 - Rising temperatures **lead to [urban heat island](#) effect** with temperatures **4-12°C higher than rural area.**
- **Climate change exacerbates local weather patterns,** leading to **weather variability and losses in agriculture.**

What are the Causes?

- **Sparse Pre-Monsoon Season Showers:**
 - **Less moisture** in many areas, **leaving large parts of India arid and dry.**
 - The **sudden end of pre-monsoon rain showers,** an uncommon trend in India, has **contributed to the heat waves.**
- **El Nino Effect:**
 - **El Nino** often **increases temperatures in Asia,** combined with the weather pattern to **create record high temperatures.**
 - **Trade winds** coming from South America normally blow westward towards Asia during **Southwest Monsoon** and warming of the Pacific Ocean results in weakening of these winds.
 - Therefore, **moisture and heat content get limited** and **results in reduction and uneven distribution of rainfall** across the Indian sub-continent.

What are the Impacts of Heat Waves?

- **Health Impacts:**

- Heat rash:
 - Also **known as sunburn** phenomenon with **pinkish skin** resulting in burning of skin and pain sensation.
- **Heat syncope:**
 - Giddiness, vertigo **headache and sudden onset drowsiness/unconsciousness.**
- **Heat Cramps:**
 - **Edema (swelling) and Syncope (Fainting)** are generally accompanied by **fevers below 39°C i.e., 102°F.**
- **Heat Exhaustion:**
 - Fatigue, weakness, dizziness, headache, nausea, vomiting, muscle cramps and sweating.
- **Heat Stroke:**
 - Body temperatures of 40°C i.e., 104°F or more along with delirium, seizures or coma. This is a potentially fatal condition.
- **Impact on Labor and Productivity:**
 - Heat exposure **leads to a loss of 162 hours per year** for laborers doing heavy work, impacting productivity.
 - About **50% of India's workforce** is estimated to be **exposed to heat during their working hours**, including marginal **farmers**, construction **workers**, and street **vendors.**
- **Impact on Agriculture Sector:** Crop **yields suffer** when **temperatures exceed** the ideal range.
 - Farmers in Haryana, Punjab and Uttar Pradesh have reported losses in their wheat crop in the past rabi season.
 - **Livestock** is also **vulnerable** to heatwaves.
- **Food Insecurity:**
 - The concurrence of heat and **drought events** are causing **crop production losses and tree mortality.**
 - The risks to health and food production will be made more severe from the sudden food production losses exacerbated by heat-induced labour productivity losses.
 - These interacting impacts will **increase food prices, reduce household incomes**, and lead to **malnutrition and climate-related deaths**, especially in tropical regions.
- **Impact on Energy Demand:**
 - Average Daily peak demand rises due to increased heat.

What Should be Mitigating Strategies?

- **Urban Greening:**
 - **Greener** and more **permeable urban surfaces** can help **reduce urban heat.**
 - Development plans for Tier 2 and Tier 3 cities can set up a mandate to increase the density and area of urban forests.
 - **Natural landscapes** in urban areas, such as **trees, parks, and vegetation**, can help in cooling.
- **Infrastructure:**
 - Greater usage of permeable materials in **civic infrastructure and residential construction can reduce** the urban heat island effect.
 - Encouraging **cleaner cooking fuels** such as **Biogas, Compressed Natural Gas, Liquefied Petroleum Gas** will reduce indoor air pollution and urban heat.
 - Improving **public transportation and reducing personal vehicle** usage can help in reducing extreme heat waves.
- **Waste Management:**
 - Reducing the size of **landfills, waste segregation, and solid waste** management at the source can reduce methane production and fires that exacerbate urban heat.
- **Policies and Guidelines:**
 - **Policies and guidelines on weather variability and urban heat management** are needed at various levels.
 - Expanding **wetlands and restoring ponds and lakes** may also help.
- **Building Design:**
 - Promoting the use of **green roofs and cool roofs** in buildings, increasing ventilation, and setting up green spaces.

- **Passive cooling techniques** such as natural ventilation, shading, and thermal insulation can significantly reduce indoor temperatures and energy consumption.
- **High-albedo roofs** and pavements in the buildings.
- **Renewable Energy:**
 - Promoting the use of renewable energy sources such as [solar](#) and [wind energy](#) for cooling and electricity needs.
- **Public Awareness:**
 - Educating the public about the risks of heatwaves, how to stay cool, and the importance of reducing carbon footprint.
- **Agricultural Adaptation:**
 - Supporting farmers with resilient farming practices that take into account the risks of heatwaves, [droughts](#), and water scarcity.
 - Crop diversification, Agroforestry, mulching, crop rotation, and cover cropping, drip irrigation and sprinkler systems can be helpful.
- **Disaster Management:**
 - Developing emergency response plans for heatwaves, including providing cool shelters and adequate medical facilities.
 - **In the short-term:**
 - It is essential to establish an effective early warning system that can provide timely and accurate information to people at risk.
 - This system should be integrated with public health services and local governments and should be able to mobilize resources quickly in response to a heat wave.
 - **In the long-term:**
 - Structural infrastructure measures are required to help Indians adapt to extreme heat.
- **Green Transport:**
 - Encouraging the use of public transport and bicycles to reduce vehicle emissions and traffic congestion.
 - **Bicycles**, [Electric Vehicles](#) etc. can be helpful.

What are Government Initiative Regarding Heat Waves?

- **National action Plan for Climate Change (NAPCC):**
 - There are 8 national missions forming the core of the [NAPCC](#) which represent multi-pronged, long term and integrated strategies for achieving key goals in climate change. These are-
 - National Solar Mission
 - National Mission for Enhanced Energy Efficiency
 - National Mission on Sustainable Habitat
 - National Water Mission
 - National Mission for Sustaining the Himalayan Ecosystem
 - National Mission for A Green India
 - National Mission for Sustainable Agriculture
 - National Mission on Strategic Knowledge for Climate Change
- **India Cooling Action Plan (ICAP):**
 - [ICAP](#) is a long-term vision to address the cooling requirement across sectors. Reducing cooling demand by 20-25% and refrigeration demand by 25-30% by the year 2037 are the goals of this plan.
- **NDMA Guidelines:**
 - In 2016, the [National Disaster Management Authority \(NDMA\)](#) issued comprehensive guidelines to prepare national level key strategies for mitigating the impact of heatwaves.

Drishti Mains Question

Discuss the impact of rising temperatures on India and suggest measures to mitigate the problem. (150 Marks).

UPSC Civil Services Examination Previous Year's Question (PYQs)

Mains

Q: Bring out the causes for the formation of heat islands in the urban habitat of the world.

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