



HEATWAVES - GS III MAINS

Q. Adaptation to heat waves can be effective to minimize the negative impacts by developing a comprehensive action plan. Elucidate (15 marks, 250 words)

News: *Heat waves will intensify, milder ones are also deadly, scientist makes pitch to NDMA*

What's in the news?

- While the most extreme heat waves have the greatest short-term impact on mortality, it is the mildest ones that kill most over time because they are more common, according to a study conducted in India.

Key takeaways:

- As heat waves are projected to become more common as the Earth's climate warms, the health risks of temporarily elevated temperatures must be investigated further, the researchers said.

Heat Waves:

- Heat waves are expected to become more intense, longer, and more frequent over the Indian subcontinent.
- According to the IMD, a region has a heat wave if its **ambient temperature deviates by at least 4.5-6.4° C from the long-term average. There is also a heat wave if the maximum temperature crosses 45° C (or 37° C at a hill-station).**

Dangers of Heat Waves:

- Spring (March-April) in 2022 in India was already a sign of things to come - the heat wave 'season' started early, was more intense than the long-term average, and had more waves.
- The 2022 heat wave season was also unusual because the **heat waves extended much further south into peninsular India because of the north-south pressure pattern set up by the La Niña**, a world-affecting weather phenomenon in which a band of cool water spreads east-west across the equatorial Pacific Ocean.
- The last three years have been La Niña years, which has served as a precursor to 2023 likely being an **El Niño year**. (The El Niño is a complementary phenomenon in which warmer water spreads west-east across the equatorial Pacific Ocean.)

Origin of Heat Waves:

1. In spring, India typically has **air flowing in from the west-northwest**. In the context of climate change, the **Middle East is warming faster** than other regions in latitudes similarly close to the equator, and serves as a source of the warm air that blows into India.



- Likewise, air flowing in from the northwest rolls in over the **mountains of Afghanistan and Pakistan**, so some of the compression also happens on the leeward side of these mountains, entering India with a bristling warmth.
- The air flowing over the oceans is expected to bring cooler air, since land warms faster than the oceans (because the heat capacity of land is much lower). However, the **Arabian Sea is warming faster than most other ocean regions**.
- The **strong upper atmospheric westerly winds that come in from the Atlantic Ocean** over to India during spring control the near-surface winds. Any time winds flow from the west to the east, the winds are blowing faster than the planet itself, which is also rotating from west to east. The energy to run past the earth near the surface, against the surface friction, can only come from above. This descending air compresses and warms up to generate some heat waves.
- Finally, the **lapse rate** – the rate at which temperatures cool from the surface to the upper atmosphere is **declining under global warming**. In other words, global warming tends to warm the upper atmosphere faster than the air near the surface. This in turn means that the sinking air is warmer due to global warming, and thus produces heat waves as it sinks and compresses.
- The area covered by these heat waves is also influenced by the **background pressure patterns set up by El Niño and La Niña events**, and of late it has been expanding.

Impacts of Heat waves:

1. Killing people:

- Heat waves are one of the **extreme weather events (EWE)**. In 50 years (1971-2019) EWE killed 1,41,308 people. Of this, 17,362 people were killed due to heat waves - a little over 12 percent of the total deaths recorded, the study said.
- It is estimated to have led to at least 90 deaths across India and Pakistan.
- It also triggered an **extreme Glacial Lake outburst flood in Northern Pakistan**.
- The maximum heat wave deaths were in Andhra Pradesh, Telangana and Odisha, it added.

2. Social impacts:

- Extreme heat can lead to **heat-related illness and death**, particularly in elderly populations, the **poor, outdoor workers, and urban areas**.
- Heat waves exacerbate the **urban heat island effects**, amplifying temperatures in built environments, and resulting in poorer air quality due to the creation of ozone that negatively impacts health.
- Heat-related **mortality is expected to be higher in cities**, particularly those characterized by high population density, inequalities, limited access to health care, high pollution levels and fewer green spaces.



3. Economic impacts:

- **Economic losses:** Periods of extreme heat cost the global economy about \$16 trillion dollars between 1992 and 2013.
- **Reduced labor productivity:** Multiple areas of the economic sector experience reduced worker productivity during heatwaves, especially agriculture and construction. Globally, 2% of total working hours is projected to be lost every year, either because it is too hot to work or because workers have to work at a slow pace.
- **Impact on agriculture:** Lower agricultural yields, reduced labor productivity, heat stress will increase drought and exacerbate water scarcity for irrigation.
- **Impact on transportation:** Heat stress can negatively impact transport infrastructure, such as the softening of pavement, which can then be substantially damaged by vehicle circulation.
- **Indirect economic costs:** Heat related illness and mortalities, heatwaves may aggravate social inequalities (as the poor are more vulnerable to the impacts of heatwaves).
- **Poor countries are more vulnerable:** In the last 30 years, the richest countries have lost about 1.5 percent of their annual per capita GDPs dealing with heat waves, while the poorer countries have lost about 6.7 percent of their annual per capita GDPs.

4. Ecological impacts:

- Heat waves, without concomitant increases in precipitation, can lead to **water shortages and increased stress for plants**, particularly in arid regions.
- This has the effect of **reducing plant growth, the basis of energy production and the food chain**, with an overall drying-out of the landscape.
- For example, the 2003 European heat wave resulted in a 10% loss in glacier mass in Europe, which was five times more than the average annual loss.
- Over time, such **deep permafrost warming and thawing** could cause landslides and rockfalls, continuing the negative ecological impacts.

5. Health impacts:

- The health impacts of heat waves typically involve **dehydration, heat cramps, heat exhaustion and/or heat stroke**.
- Children, the elderly and those with pre-existing morbidities are particularly vulnerable.
- Vegetable vendors, cab drivers, construction workers, police personnel, roadside kiosk operators and mostly weaker sections of the society have to work in the extreme heat to make their ends meet and are extremely vulnerable to the adverse impacts of heatwaves such as dehydration, heat and sunstrokes.

Government Initiatives:

Heatwave Mitigation Strategy:

- The Ahmedabad Municipal Corporation (AMC) created the **first Heat Action Plan in 2013** as a result of the horrible mortality caused by the region's 2010 heatwave. There was no national strategy in place to handle heatwave situations prior to 2015.



- The **National Disaster Management Authority (NDMA)** released **thorough recommendations in 2016** to assist in the development of substantial national-level programs for reducing the effects of heatwaves.
- Although certain precautions have been made to prepare for and adapt to major weather-related shocks since they are challenging to implement, these efforts are insufficient to stop human fatalities from heatwaves.

Adaptation and Mitigation Efforts:

Adaptation to heat waves can be effective to minimize the negative impacts by developing a comprehensive action plan that includes early warnings, awareness raising and technology intervention.

1. Technological adaptations and Early Warning Systems:

- Strengthening heat resilience and early-warning capabilities may yield disproportionate economic benefits.
- Establishment of Early Warning System and Inter-Agency Coordination for prediction of heat waves and issuance of alert.
- IMD has the capability to predict the genesis, duration and intensity of heatwave events with reasonable accuracy upto four - five days in advance.

2. Contingent and temporary adaptations:

- Such as **converting public spaces into cooling centers**, deploying public evaporative cooling systems, and expanding emergency service availability.
- Improving the infrastructure setup like including **shadowed windows, insulated houses** etc.

3. Safety nets:

- Initiation of safety nets are required as a large segment of India's population is dependent on outdoor work.
- India must initiate safety nets which are a combination of **targeted transfers and insurance schemes** to improve the resilience of outdoor workers.
- Transfers are best linked to the beneficiaries own efforts to build resilience, for example, **adapting agricultural practices** to the uptick in heatwaves.
- Insurance schemes can help transfer some of the risks of severe heat faced by industrial, construction and agricultural workers to insurers.

4. Climate mitigation:

- **Promotion of better agricultural practices** which are not water-intensive, and to support **afforestation** that has a salutary effect on warming along with climate resilient crops.
- **Climate mitigation or decarbonisation of economies** on the part especially of the big emitters, such as the United States, the European Union, China, and India remains an imperative.



- Reversing climate change is predicated on leading emitters, including India, moving away from carbon-emitting fossil fuels, and replacing them with **cleaner, renewable fuels**.

5. Reduce Urban Heat Island:

- **Urban greenery** such as street trees, urban forests and green roofs can help cool urban areas.
- There is a need to shift to a more **energy-efficient pathway** which could lead to a substantial reduction in expected CO₂ levels by means of sustainable transportation.
- India's affordable housing program for the poor, the **Pradhan Mantri Awas Yojana (PMAY)**, can adopt such changes on scale to reduce heat island effects by provisions of affordable floor space.

6. Community Readiness Level:

- After floods, heatwaves are the natural calamity that kills the most people in India.
- The state and district governments could create a **regional heatwave action plan** by categorizing heat waves as a natural catastrophe.
- This will raise public awareness and encourage the development of robust, public safety, early warning, and infrastructure.
- **Capacity building and training programme for health care professionals** at different levels to recognize and respond to heat wave related illnesses.
- **Collaboration with non-government organizations (NGOs) and civil society** to provide support in distress situations.

7. Data-driven Governance:

- It's also essential to establish a **district-level database** with information on the age, gender, and occupation of those who have perished in heatwaves.
- Reviewing labour laws and other regulations taking climatic conditions into account.

8. Replace Dark Roofs:

- Dark roofs, roadways, and parking lots absorb and hold heat, which is a major factor in why cities are so much hotter than rural places.
- The atmosphere will dramatically cool as a result of one of the long-term options, which is to replace the dark surfaces with lighter, more reflecting materials.

9. Cooling Action Plan:

- Using passive cooling technology to design **naturally ventilated structures** for both residential and commercial buildings may be a crucial alternative to lessen the urban heat island effect. This technique has reportedly been included in conventional Indian architectural designs in regard to global warming, per the IPCC's AR6 report.
- In this scenario, it is imperative for India to **deploy alternative and innovative energy efficient technologies for keeping spaces cool**.
- **Adopting climate-responsive cooling techniques** as a norm in both private and government-funded constructions can reduce the impact of heat waves.



- It also proposed enacting a **policy for district cooling** which could lead to the consumption of 20-30% less power than the most efficient conventional cooling solutions. District cooling technologies generate chilled water in a central plant which is then distributed to multiple buildings via underground insulated pipes. This brings down the cost for providing cooling to individual buildings. Apart from this, guidelines for implementation of local and city-wide urban cooling measures such as cool-roofs should also be considered.

10. Innovative technologies:

- To minimise rising food and pharmaceutical wastage during transport due to higher temperatures, the report recommends fixing gaps in **cold chain distribution networks**.
- Investing in pre-cooling and refrigerated transport can help decrease food loss by about 76% and reduce carbon emissions by 16%.
- Improvements in servicing, maintenance and disposal of equipment that uses hydrochlorofluorocarbons, alongside a shift to alternative options with a lower global warming footprint, are also recommended.

11. Recognition of Heat Waves as a Natural Disaster:

- Recognising heat waves as a major disaster is long due. India still has a long way to go in building public awareness, particularly on how individuals and local communities can take care of themselves.
- Declaring heat waves as a natural disaster would help the **state and district administration prepare a heatwave action plan at the regional level**.

In alignment with the Paris Agreement, the study calls for global warming to be limited to 1.5°C to avoid substantial heat-related mortality in the future. Reducing the health impacts of extreme heat is an urgent priority and should include immediate changes to infrastructure, urban environment, and individual behaviour to prevent heat-related deaths.