



HEATWAVES - ENVIRONMENT PRELIMS AND GS III MAINS

Q. Heatwaves are among the most dangerous natural weather hazards. What measures should be taken to mitigate the impacts of heatwaves? Discuss (15 marks, 250 words)

News: *What are heat waves?*

What's in the news?

- India is facing its hottest summer. Eastern India suffered its hottest April since temperature recording began in 1901.
- Very unusually, Kerala recorded two heat-related deaths in April.
- The Indian Meteorological Department (IMD) predicted the number of heatwave days in May will be 5-8 days above normal in some regions.

Heat Waves:

- A heatwave 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.
- Heatwaves 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.

IMD Criteria for Declaring Heatwaves in India:

- A heatwave is declared when the maximum temperature of a station reaches **at least 40°C or more for plains, 37°C or more for coastal stations, and at least 30°C or more for hilly regions.**

Based on departure from normal temperatures, the following criteria are used to declare a heatwave:

- **Heatwave** - Departure from normal is 4.5°C to 6.4°C.
- **Severe Heatwave** - Departure from normal is 6.4°C.

Based on the actual maximum temperature in **plains**, the following criteria is considered:

- **Heatwave** - When the actual maximum temperature $\geq 45^\circ\text{C}$.
- **Severe Heatwave** - When actual maximum temperature $\geq 47^\circ\text{C}$.

If the above criteria met **at least in 2 stations** in a Meteorological sub-division for **at least two consecutive days** and it was declared on the second day.

Causes of Heatwaves:



Heatwave conditions are regionally defined and can vary substantially at sub-national scales due to influences from geography, topography, atmosphere, and other conditions. Here are some causes that are driving the frequent heatwaves.

1. Climate Change:

- Climate change is causing a rise in global temperatures. As the planet heats up, it leads to more extreme weather events, such as heatwaves.

2. El Niño:

- According to Mrutyunjay Mohapatra, director general of the IMD, the years that begin in an El Niño state, experience extreme temperatures, harsh, multiple and extended heatwave spells, and lack of pre-monsoon rainfall.

3. Heat Dome:

- A heat dome occurs when an area of high-pressure stays over a region for days and weeks. It traps warm air, just like a lid on a pot, for an extended period.
- The longer that air remains trapped, the more the sun works to heat the air, producing warmer conditions with every passing day.
- Heat domes, if they last for a long period, may cause deadly heatwaves.

4. Anticyclone:

- An anticyclone, also known as a high-pressure system, is essentially an area of high pressure in which the air goes downwards towards the Earth's surface.
- As the air sinks, its molecules get compressed, which increases the pressure, making it warmer. This causes dry and hot weather.
- The winds remain calm and gentle during an anticyclone, and there is almost no formation of clouds because here the air sinks rather than rises.

Favourable Conditions for Heatwaves:

According to IMD the favorable conditions for Heatwaves are:

- Transportation / Prevalence of hot dry air over a region (There should be a region of warm dry air and appropriate flow pattern for transporting hot air over the region).
- Absence of moisture in the upper atmosphere (As the presence of moisture restricts the temperature rise).
- The sky should be practically cloudless (To allow maximum insulation over the region).
- Large amplitude anti-cyclonic flow over the area.

Areas in India Prone to Heatwaves:

- The **Core Heatwave Zone (CHZ)** spanning central, north, and peninsular India between **Gujarat and West Bengal** is prone to heatwave conditions every year, during the summer season March to June and occasionally in July.



- **Rajasthan, Punjab, Haryana**, Chandigarh, Delhi, West Madhya Pradesh, Uttar Pradesh, Chhattisgarh, Odisha, Vidarbha in Maharashtra, parts of Gangetic West Bengal, coastal Andhra Pradesh, and Telangana are the most heatwave-prone states or regions.

Impacts of Heatwaves:

Heatwaves are among the most dangerous natural weather hazards. Intense heatwaves can have serious environmental, health, social, and economic consequences.

1. Impact on Environment:

- According to WMO, multiple risks interact with heatwaves such as droughts, fire weather, flash flooding and air pollution which have compounding impacts for people and nature.
- Hot extremes including heatwaves have intensified in cities, where they have also worsened air pollution events and limited functioning of key infrastructure.
- It can also increase the risk of wildfires.

2. Impact on Health:

- The impact of heatwaves on human health is significant. Heat-related illnesses, such as heat exhaustion and heatstroke, are becoming more common, particularly among vulnerable groups such as the elderly, children, and outdoor workers.
- In addition, heatwaves can exacerbate existing health problems, such as respiratory and cardiovascular diseases.

3. Impact on Agriculture:

- Heatwaves can have a significant impact on agriculture, potentially compromising food security and farmer incomes.
- Heatwaves can cause crops to wilt and die, leading to reduced yields or even total crop failure.
- Heatwaves can also create ideal conditions for pests and insects to thrive. This can lead to increased damage to crops and the need for more pesticides, which can be costly for farmers.
- High temperatures can lead to increased evaporation of water from soil, reducing soil moisture levels and making it more difficult for crops to grow.

4. Impact on Livestock Health:

- Heat stress can be a major issue for livestock, resulting in lower milk production, lower fertility rates, and even death in severe circumstances.

5. Water Scarcity:

- Heatwaves can exacerbate existing water scarcity issues by causing water sources to dry up faster and increasing demand for irrigation.

6. Impact on the Energy Sector:



- Heatwaves can have significant impacts on the energy sector, causing grid stability issues, increased expenses, and power outages.
- Heatwaves can lead to increased demand for electricity, transmission and distribution issues, and reduced power generation due to inefficient power plants, particularly those that rely on water for cooling.

Mitigation Measures:

1. Comprehensive Response Plan:

- The effective way to mitigate the negative impacts of a heatwave is to develop a comprehensive response plan that integrates individual initiatives, institutional technology, and ecosystem-based responses.

2. Improving the Built Environment:

- We need to improve the built environment to make it more heat-resistant.
- This can be done by increasing the green cover in cities and improving building insulation and ventilation systems.
- Implementing these strategies can lessen the urban heat island effect, which occurs when cities are significantly hotter than surrounding areas.

3. Increase Public Awareness:

- People need to be educated about the impact of rising temperatures on their health, the environment, and the economy. This can be done through public campaigns, schools, and the media.

4. Increase the use of Renewable Energy:

- India has already made significant progress in this area. The country registered the highest year-on-year growth in renewable energy, of nearly 10 percent, in 2022.
- The government could incentivise individuals and businesses to invest in renewable energy, such as solar panels.
- This would help reduce the impact of rising temperatures, create new jobs, and stimulate economic growth.

5. Investment in Infrastructure:

- Investing in infrastructure that can cope with extreme temperatures is essential.
- This could include the construction of roads and buildings that are designed to withstand high temperatures, as well as the development of more efficient cooling systems that use less energy.