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3 Heat Wave - Causes, Consequences and its Mitigation

India is well-known for being extremely vulnerable to the effects of climate change. The country has been experiencing an increasing trend of heat waves in recent years. Due to a severe heat wave that has affected most of the country, the harvest prospects for several crops, particularly wheat, have been reduced this year. The government had previously expected wheat production of 111.32 million tonnes, but due to a strong heat wave in mid-March, it reduced the prediction to 105 million tonnes in May. The recent heat wave in India is having repercussions around the world in terms of food supplies, as the country has pushed to limit wheat exports. The early-summer heat wave serves as a wake-up call for all agencies and policymakers to take the required precautions in terms of prevention, readiness, and community outreach in order to preserve the lives of the general public, livestock, and wild animals.

INTRODUCTION

During the pre-monsoon (April to June) summer season, a heat wave is defined as a period of abnormally temperatures that are higher than the normal maximum temperature. The increasing influence of climate change has resulted in a substantial increase in the number of heat waves. An abnormally strong heat wave is endangering millions of people across the country as summer approaches. The heat wave is often known as a "silent killer" because it moves slowly yet causes large-scale mortality among humans and animals. Heat waves are most common in India between March and June, with a few exceptions in July. Heat waves are common in Northern India, particularly in the Gangetic belt.

Across weather records dating back to 1901 in northwest and central India, the IMD (India Meteorological Department) declared April 2022

as the hottest month in terms of day temperatures. The IMD issued a yellow notice in April 2022 for severe and frequent heat waves across Delhi, MP, Rajasthan, and Odisha. So far in 2021, India had an unusually dry year, with north India experiencing a heat wave and a delayed monsoon till early July. April was the warmest month on record, breaking a 122-year-old record. In the current situation, effective response is critical for preserving people's lives and health, as well as developing plans for future risk mitigation and heat wave management.

CRITERIA FOR DECLARING HEAT WAVE

1. The World Meteorological Organization defines heat wave as five or more consecutive days during which the daily maximum temperature surpasses the average maximum temperature by 5°C (9°F) or more.
2. Criteria set by the IMD for declaring heat waves are: When the highest temperature of a station reaches at least 40°C for Plains, 37°C for Coastal stations, and at least 30°C for Hilly regions, it is termed a heat wave.

- a) On the basis of a deviation from the normal.
 - i. Heat Wave: Departure from normal is 4.5°C to 6.4°C.
 - ii. Severe Heat Wave: Departure from normal is >6.4°C.
- b) Based on Actual Maximum Temperature (for plains only).
 - i. Heat Wave: When actual maximum temperature $\geq 45^\circ\text{C}$.
 - ii. Severe Heat Wave: When actual maximum temperature $\geq 47^\circ\text{C}$.

CAUSES FOR INTENSE HEAT WAVE IN INDIA

There are primarily two phenomena for arriving intense early summer heat wave in India.

1. Climate Change
2. La Nina

CLIMATE CHANGE

Climate Change occurs because of greenhouse gas emissions, heat waves are 30 times more likely to occur now than they were in 1750. Human activities have warmed the world at a rate never seen before,

according to the Intergovernmental Panel on Climate Change (IPCC) study. In comparison to the pre-industrial period of 1850-1900, the global surface temperature has increased by 1.09 degrees Celsius. Heat waves are becoming longer, more extreme, and more frequent as a result of climate change. The number of heat wave days in India grew from 413 in 1981-1990 to 600 from 2011 to 2020, according to the IMD. The frequency of heat wave days has risen dramatically as a result of climate change's rising influence.

LA NINA

The second most important cause of heat waves is the persistence of a north-south low-pressure pattern that formed over India during the winter when the La Nina phenomenon was active in the equatorial Pacific Ocean, which began around October 2020 and formed for the second year in a row in the winter of 2021. La Nina is an oceanic phenomena that

Colour Code	Alert	Warning	Impact
Green (Noaction)	Normal Day	Maximum temperatures are near normal.	Comfortable temperature. No cautionary action required.
Yellow Alert (Be updated)	Heat Alert	Heat wave conditions at isolated pockets persists on 2 days	Moderate temperature. Heat is tolerable for general public but moderate health concern for vulnerable people e.g. infants, elderly, people with chronic diseases
Orange Alert (Be prepared)	Severe Heat Alert for the day	(i) Severe heat wave conditions persists for 2 days (ii) Through not severe, but heat wave persists for 4 days or more	High temperature. Increased likelihood of heat illness symptoms in people who are either exposed to sun for a prolonged period or doing heavy work. High health concern for vulnerable people e.g. infants, elderly, people with chronic diseases.
Red Alert (Take Action)	Extreme Heat Alert for the day	(i) Severe heat wave persists for more than 2 days. (ii) Total number of heat/severe heat wave days exceeding 6 days.	Very high likelihood of developing heat illness and heat stroke in all ages.

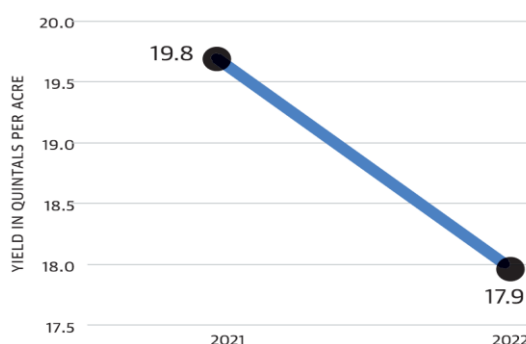
Impact Based Color Coded Alert and Warning for Heat Wave Issued by IMD

transports warm water from the western Americas to eastern Asia, affecting the jet stream in the process. The subtropical westerly jet stream, which is currently blowing across India, is a band of intense winds that blow around the world at various latitudes. However, the subtropical westerly jet stream that blows over the northern portion of India has acquired a ridge or crest. Because of the tremendous pressure of the jet stream, hot air over land was boxed in from all sides, resulting in the construction of a 'heat dome'.

IMPACT OF HEAT WAVE

1. AGRICULTURE

The world's food supply is being impacted by India's heat wave. The hot wave is wreaking havoc on the wheat-growing regions of Punjab and Uttar Pradesh. Punjab has seen a drop in wheat production of at least 13.5 percent in the current rabi season compared to the previous year due to a sudden heat wave in March. The average wheat production per acre in the previous 2021 season was 19.8 quintals/acre, down to 17.9 quintals/acre this season. The abrupt heat wave in March, when the crop was mature, caused the crop to suddenly dry up, and this was a major role in the production drop. The yield dropped in each of the state's 23 districts. With a 30 percent drop in yield, Fatehgarh Sahib was the hardest hit, followed by Patiala (23%), and Nawanshahr (12%). (22 percent). Other districts in the state that suffered losses of 20% or more include Sangrur and Ropar, which both suffered losses of 21%. Mohali (16%), Moga (15%), Jalandhar and Ludhiana (14%), Bathinda, Ferozepur, and Fazilka (11%), Hoshiarpur and Kapurthala (13%), and Faridkot and Mansa (10%) were among the districts that suffered losses of 10% or more.



Source: Punjab Mandi Board, MOSPI, IMD Chandigarh, Punjab Agriculture Department

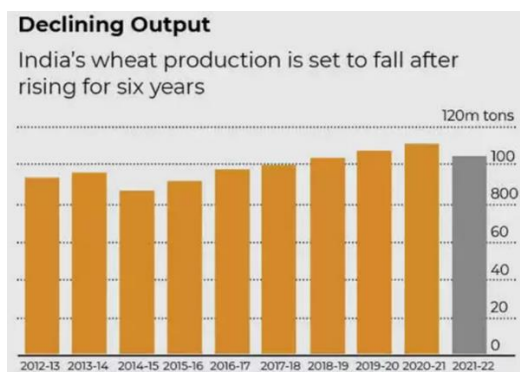
The unexpectedly intense warmth in March had an impact on production, causing dramatic rises in wheat spot prices. In the fiscal year that ended in March, wheat exports reached 8.7 million tonnes, with the government expecting record production levels of 122 million tonnes in 2022. This year, the government predicted a crop of 111.32 million tonnes in February, the sixth consecutive record crop, but it decreased the projection to 105 million tonnes in May owing to crop damage caused by a severe heat wave in mid-March. Due to severe heat waves that have devastated crops, India is considering restricting wheat exports in order to secure food security in the country. This has prompted the government to prioritise domestic consumption above supplying the grain to the rest of the globe.

2. HEAT-RELATED ILLNESSES AND MORTALITY

Heat stroke and heat exhaustion are more likely when temperatures are extremely hot or humid. When humidity levels are excessively high, the human body's ability to cool itself through perspiration is compromised, resulting in overheating and physiological harm. As the body's ability to regulate heat deteriorates with age, older persons and people with chronic illnesses including heart disease, lung disease, and diabetes are more prone to heatstroke.

3. RISK OF WILDFIRES

Droughts and wildfires can be exacerbated by heat waves, which can have detrimental consequences for agriculture. Wildfires are fuel by the heat domes, which destroy a large amount of land each year. Over 1,00,000 forest fires were reported in Uttarakhand, Chhattisgarh, Rajasthan, Madhya



Source- Indian Agriculture minister

Pradesh, Odisha, Karnataka, and Tamil Nadu in just the first three months of this year. From April 1 to 10, there were 313 forest fires in Uttarakhand, destroying a total of 374.79 hectares.

4. URBAN HEAT ISLAND

It occurs when city experience much warmer temperatures than nearby rural areas. Temperatures in metropolitan areas are 1 to 7° Fahrenheit higher than in rural areas. The effect is greatest during the day, but the delayed release of heat from infrastructure can keep cities much hotter than the surrounding areas overnight. People, ecosystems, and the economy are all at risk as a result of rising temperatures across the country.

MITIGATION OF HEAT WAVE

To combat the negative effects of heat waves, an immediate mitigation and adaptation plan is required. The National Disaster Management Authority has released a detailed guideline for developing major national initiatives to mitigate the impact of heat waves in 2016.

- **Early warning system and inter-agency coordination** - The nodal agency, as well as other assistance agencies, must send temperature forecasts and heat advisories via bulk text messages to mobile phones.
- **Medical up-gradation and administrative measures** - In hospitals, heat treatment wings must be established, and an advise on how to avoid heat exposure and other heat-related injuries must be distributed to schools and offices.
- **Public Awareness and community outreach** - Through electronic and print media, social media, and IEC materials, public awareness is vital in reducing the possible effect of extreme heat-wave scenarios.
- **Collaboration with NGOs and civil society organizations** - To combat heat wave conditions, improved water distribution systems, temporary shelters in public spaces, and other innovative methods must be employed.
- **Assessing the impact** - Feedback for reviewing and revising the heat wave disaster risk reduction plan should become a regular element of government efforts, as this can aid in the preparation of early preventative strategies in response to changing circumstances.

ADVISORY TO COMBAT THE EFFECT OF HEAT WAVE

- Always Stay hydrated and stay indoor as much as possible
- Worker should avoid direct sunlight and should stay under shaded area.
- Avoiding high intake of protein-based food and stale food.
- Wearing light clothing rather than dark, thick, or constrictive apparel.
- When the outside temperature is high, we should avoid engaging in activities which have high physically demand.
- Avoid cooking during peak hours.
- Avoid drinking beverages like tea, alcohol, coffee and aerated drinks as it will dehydrate our body faster.
- Drinking of ORS or lemon water is recommended.

CONCLUSION

With climate change, concern about increasing duration, intensity and frequency of heat waves it is indeed a wake-up call that climate change is impacting weather pattern globally. Multiple collaborations worldwide are needed to enhanced mitigation strategies that could provide the greatest opportunity to improve global public health and prevention efforts that are both sustainable and effective at the local level.