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News: Heat waves as notified disasters

- India's recent heat wave crisis has resurfaced the debate about adding heat waves to the list of notified disasters covered by the Disaster Management (DM) Act of 2005 instead of only a natural disaster.

Notified Disasters

- In India, the Disaster Management Act, 2005, defines a disaster as a "catastrophe, mishap, calamity or grave occurrence" arising from natural or man-made causes those results in substantial loss of life, destruction of property, or damage to the environment.
- Currently 13 disasters are classified as Notified Disaster namely: Cyclone, drought, earthquake, fire, flood, tsunami, hailstorm, landslide, avalanche, cloud burst, pest attack and frost, cold wave and Covid – 19.
- Presently the notified list of disasters eligible for National Disaster Response Fund/State Disaster Response Fund (SDRF) assistance.
- Being designated a notified disaster makes the affected region eligible for financial aid from the 2 funds set up under the DM Act, the National Disaster

Response Fund (NDRF) at the national level and the State Disaster Response Fund (SDRF) at the state.

- The SDRF is primarily used for immediate relief to victims of notified disasters.
- The NDRF supplements the SDRF in cases of severe disasters where funds are insufficient.

National Disaster Management Authority (NDMA)

- The National Disaster Management Authority (NDMA) is the apex statutory body for disaster management under Ministry of Home Affairs in India.
- The NDMA was formally constituted on 27th September 2006, in accordance with the Disaster Management Act, 2005 with Prime Minister as its Chairperson and nine other members, and one such member to be designated as Vice-Chairperson.
- Its primary purpose is to coordinate response to natural or man-made disasters and for capacity-building in disaster resiliency and crisis response. It is also the apex body to lay down policies, plans and guidelines for Disaster Management to ensure timely and effective response to disasters.
- It aims to build a safer and disaster resilient India by a holistic, proactive, technology driven and sustainable development strategy that involves all stakeholders and fosters a culture of prevention, preparedness and mitigation.

- NDMA recently developed **National Migrant Information System**.
- NDMA along with **Board (Ministry of Earth Sciences- MoES)** under the Chairmanship of Director, members drawn from MoES, Ministry of Home Affairs (MHA), INCOIS, Odisha State Disaster Management Authority (OSDMA) and Andaman & Nicobar Islands Directorate of Disaster Management (DDM) implements the **International Oceanographic Commission** launched **Tsunami Ready Community Program**.
- Disaster Management Volunteers (Aapda Mitras) Scheme, a **Central Sector Scheme** has been implementing by National Disaster Management Authority (NDMA) since May 2016.

National Disaster Response Fund (NDRF)

- National Calamity Contingency Fund (NCCF) was renamed as National Disaster Response Fund (NDRF) with the **enactment of the Disaster Management Act in 2005**.
- It is defined in **Section 46 of the Disaster Management Act, 2005 (DM Act)**.
- It is placed in the "**Public Account**" of Government of India under "**Reserve funds not bearing interest**".

- It is managed by the Central Government for meeting the expenses for emergency response, relief and rehabilitation due to any threatening disaster situation or disaster.
- It supplements the State Disaster Response Fund (SDRF) in case of a disaster of severe nature, provided adequate funds are not available in the SDRF.
- The Centre contributes 75% of the SDRF allocation for general category States and Union Territories, and 90% for special category States/UTs (northeast States, Sikkim, Uttarakhand, Himachal Pradesh, and Jammu & Kashmir).
- NDRF is financed through the levy of a cess on certain items, chargeable to excise and customs duty, and approved annually through the Finance Bill.
- Currently, a National Calamity Contingent Duty (NCCD) is levied to finance the NDRF and additional budgetary support is provided as and when necessary.
- NCCD is levied in the case of goods specified in the Seventh Schedule (goods manufactured or produced).
- Department of Agriculture and Cooperation under the Ministry of Agriculture and Farmer Welfare monitors relief activities for calamities associated with drought, hailstorms, pest attacks and cold wave/ frost while rest of the natural calamities are monitored by the Ministry of Home Affairs (MHA).
- Comptroller and Auditor General (CAG) audits the accounts of NDRF.

State Disaster Response Fund (SDRF)

- State Disaster Response Fund (SDRF) has been constituted under Section 48 (1) (a) of the Disaster Management Act, 2005.
- It was constituted based on the recommendations of the 13th Finance Commission.
- It is the primary fund available with the State governments for responses to notified disasters to meet expenditure for providing immediate relief.
- It is audited by the Comptroller and Auditor General of India (CAG) every year.
- The Centre contributes 75% of the SDRF allocation for general category States and Union Territories and 90% for special category States and Union Territories (northeastern States, Sikkim, Uttarakhand, Himachal Pradesh, Jammu and Kashmir).
- The annual Central contribution is released in two equal installments as per the recommendation of the Finance Commission.
- Disasters covered under SDRF include (known as notified disasters) Cyclone, drought, earthquake, fire, flood, tsunami, hailstorm, landslide, avalanche, cloudburst, pest attack, frost, cold waves and Covid – 19.

- A State Government may use up to 10% of the funds available under the SDRF for providing immediate relief to the victims of natural disasters that they consider to be ‘disasters’ within the local context in the State and which are not included in the notified list of disasters of the Ministry of Home Affairs.

Heat Waves

- A 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.

The Indian Meteorological Department (IMD) has given the following criteria for Heat Waves:

- Heat Wave need not be considered till the maximum temperature of a station reaches at least 40°C for Plains and at least 30°C for Hilly regions.

- When the normal maximum temperature of a station is less than or equal to **40°C** Heat Wave Departure from normal is 5°C to 6°C Severe Heat Wave Departure from normal is **7°C or more**.
- When the **normal maximum temperature of a station is more than 40°C** Heat Wave Departure from normal is 4°C to 5°C Severe Heat Wave Departure from normal is 6°C or more.
- When the **actual maximum temperature remains 45°C or more irrespective of normal maximum temperature, heat waves should be declared**.
- Higher daily peak temperatures and longer, more intense heat waves are becoming increasingly frequent globally due to climate change.

Health Impacts of Heat Waves

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

The signs and symptoms are as follows:

- **Heat Cramps: Edema (swelling) and Syncope (Fainting) generally accompanied by fever** below 39°C or 102°F.
- **Heat Exhaustion:** Fatigue, weakness, dizziness, headache, nausea, vomiting, muscle cramps and sweating.

- Heat Stroke: **Body temperatures of 40°C / 104°F** or more along with delirium, seizures or coma.
- This is a potential fatal condition.

Heat Domes

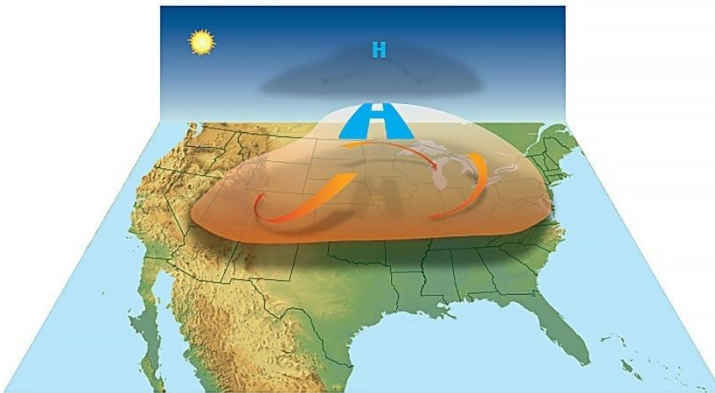
- High-pressure circulation **traps hot ocean air like a lid** or a cap **trapping heat at the surface and favouring the formation of a heat wave.**
- **Higher daily peak temperatures and longer, more intense heat waves** are becoming increasingly frequent globally due to climate change.

Effects of Extreme Heat

- According to the World Health Organization (WHO), extreme heat can exacerbate **pre-existing health conditions, including respiratory diseases, heart conditions and kidney disorders.**
- The immediate effects on the human body are **heat cramps, dehydration and even potentially fatal heat strokes.**
- It can also have **a severe impact on agriculture and forests.**
- It either causes vegetables to wilt and die or **encourage the spread of plant**

diseases.

- It **causes wildfires** which lead to forest cover reduction and death of fauna.
- It affects infrastructure too by **straining power grids and causing blackouts**. It can ground planes, melt roads and cause the inside of **vehicles to overheat** to dangerous levels.
- Recently, **Death Valley (USA) registered a temperature** of 54.4°C which, once verified, could be the highest temperature in more than a century.
- The temperature has been termed as preliminary and not final as it awaits verification.



Marine Heatwaves

- Marine heatwaves are periods of extremely high temperatures in the ocean.
- These events are linked to coral bleaching, seagrass destruction, and loss of kelp forests, affecting the fisheries sector adversely.
- Study showed that 85% of the corals in the Gulf of Mannar near the Tamil Nadu coast got bleached after the marine heatwave in May 2020.
- The most common drivers of marine heatwaves include ocean currents which can build up areas of warm water and air-sea heat flux, or warming through the ocean surface from the atmosphere.
- Winds can enhance or suppress the warming in a marine heatwave, and climate models like El Niño can change the likelihood of events occurring in certain regions.

Impact of Marine Heatwaves

Affect Ecosystem Structure

- Marine heat waves affect ecosystem structure, by supporting certain species and suppressing others.

- It has been **associated with the mass mortality of marine invertebrates**, and may force species to change behaviour in a way that puts wildlife at increased risk of harm.

Change Habitat Ranges of Certain Species

- Marine heatwaves can **change the habitat ranges of certain species**, such as the spiny sea urchin off southeastern Australia which has been expanding southward into Tasmania at the expense of kelp forests which it feeds upon.

Economic Losses

- Marine heatwaves can **cause economic losses through impacts on fisheries** and aquaculture.

Affect Biodiversity

- Biodiversity can be drastically affected by marine heatwaves.
- In **2016, marine heatwaves across northern Australia led to severe bleaching of the Great Barrier Reef.**

Increase the Risk of Deoxygenation and Acidification

- Often they occur alongside other stressors such as **ocean acidification, deoxygenation, and overfishing**.
- In such cases, MHWs not only further damage habitats, but also **increase the risk of deoxygenation and acidification**.

Urban Heat Islands

- Urban heat island may be defined **as the local and temporary phenomenon in which certain pockets within a city are experiencing higher heat load than its surrounding area**.
- This rise **of heat basically happens due to buildings and houses of cities made up of concrete where the heat is trapped and not able to dissipate easily**.
- Urban heat island is basically **induced due to trapped heat between establishments made up of concrete**.
- The **temperature variation can range between 3 to 5 degrees Celsius**.

Reasons behind cities being hotter than Rural Areas

- It has been observed that **greener localities experienced lower temperatures than non-green localities**.

- Green vegetation like plants, trees and forests are prominent factors to regulate the incidences of the urban heat islands.
- Rural areas are blessed with more green cover in the form of plantations, farmlands, forests, and trees than urban areas.
- Transpiration is the phenomena which the plants carry to regulate the temperature.
- Lack of green trees and shrubs in urban areas is the basic cause of Urban Heat Island in urban areas.
- Frequent construction of High rise structures, roads, parking spaces, pavements, and public transportation transit lines have accelerated the incidences of urban heat islands.
- It occurs by black or any dark colored material.
- Buildings in cities are often made of glass, bricks, cement, and concrete. All of them are dark-colored materials, which attract and absorb more heat.

Causes of Urban Heat Island

- **Manifold increase in construction activities:** For building simple urban dwellings to complex infrastructures, carbon absorbing material like asphalt and concrete is needed for the expansion of cities. They trap huge amounts of heat which increases the mean surface temperatures of urban areas.

- **Dark surfaces:** Many buildings found in urban areas have dark surfaces, thereby decreasing albedo and increased absorption of heat.
- **Air conditioning:** Buildings with dark surfaces heat up more rapidly and require more cooling from air conditioning, which requires more energy from power plants, which causes more pollution. Also, air conditioners exchange heat with atmospheric air, causing further local heating. Thus, there is a cascade effect that contributes to the expansion of urban heat islands.
- **Urban Architecture:** Tall buildings, and often accompanying narrow streets, hinder the circulation of air, reduce the wind speed, and thus reduce any natural cooling effects. This is called the Urban Canyon Effect.
- **Need for mass transportation system:** Transportation systems and the unimpeded use of fossil fuels also add warmth to urban areas.
- **Lack of Trees and green areas** which impedes evaporation and transpiration, shade and removal of carbon dioxide, all the processes that help to cool the surrounding air.

Solution to the Urban Heat Islands

- **Increase Area under Green Cover:** Plantation and effort to increase the area under green cover are the primary requirement to cut heat load within urban areas.

- **Passive Cooling to Reduce Urban Heat Islands:** Passive cooling technology, a widely-used strategy to create naturally ventilated buildings, can be a vital alternative to address the urban heat island for residential and commercial buildings.
- The IPCC report cites ancient Indian building designs that have used this technology, which could be adapted to modern facilities in the context of global warming.
- Other methods of heat mitigation include using appropriate construction materials.
- Roof and terraces should be painted in white or light colors to reflect heat and reduce the absorption.
- Terrace plantation and kitchen gardening should be promoted.

Reasons for not listing Heat waves as notified disaster

- **Finance Commission Reluctance:** The Finance Commissions have not been entirely convinced about including heatwaves as a notified disaster.
- The 15th Finance Commission allows states to utilise up to 10% of SDRF funds for "local disasters" such as lightning or heatwaves, which states can notify on their own.

- **Huge Financial Implications:** The government has to provide monetary compensation (Rs 4 lakh) for every life lost due to a notified disaster. This could be a huge burden given the large number of heat-related deaths.
- **Estimating Deaths:** In most cases, heat itself does not claim lives directly. Most people die due to other pre-existing conditions made worse by extreme heat, making it difficult to ascertain the exact cause.
- **Potential Exhaustion of Disaster Funds:** The financial allocations to SDRF and NDRF, though substantial, may become insufficient if heatwaves and other local disasters like lightning are added to the notified list.

News: Reusable Launch Vehicle

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RLV LEX – 03 Mission / Pushpak

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- During the RLV LEX-03 mission, the **Pushpak vehicle** was released from an **Indian Air Force Chinook helicopter** at an altitude of 4.5 km.
- From this point, the **winged vehicle** autonomously executed **cross-range correction manoeuvres** approached the runway and performed a **precise horizontal landing** at the runway centerline.
- The **high-speed landing**, exceeding 320 km/h, was successfully slowed to around 100 km/h using the vehicle's **brake parachute** and **landing gear brakes**.

Technologies and Capabilities Demonstrated

- **Precise Landing:** LEX-03 **used multisensor fusion** to guide the vehicle for a **controlled landing**.
- **Autonomous Flight:** The Pushpak vehicle **demonstrated its ability to land itself**, including **correcting its course** during descent.
- **Reusable Design:** The **mission reused key parts** from a previous flight, **highlighting the cost-saving potential** of RLVs.

Significance

- This **mission simulated the approach and landing interface**, as well as the **high-speed landing conditions**, for a vehicle returning from space.

- It validated ISRO's advanced guidance algorithm for longitudinal and lateral error corrections, which is essential for future Orbital Re-entry Missions.
- By testing key technologies like autonomous landing and reusable parts, it paves the way for a fully reusable launch vehicle. This could cut launch costs and make space missions more efficient.

Reusable Launch Vehicles

- Reusable launch vehicles (RLVs) are rockets that can be used multiple times for space missions, unlike traditional expendable rockets where each stage is discarded after use.

Different from Multi-Stage Rocket

- In a typical multi-stage rocket, the first stage is jettisoned (discarded to lighten the load) after its fuel is consumed, while the remaining stages continue to propel the payload into orbit.
- RLVs recover and reuse the first stage. After detaching from the upper stages, the first stage uses engines or parachutes to descend and land back on Earth.
- It can then be refurbished for future launches, significantly reducing costs.

Space Agencies currently using RLVs.

- **SpaceX (USA):** Falcon 9, with over 220 launches, 178 landings, and 155 re-flights as of May 2023.
- **Blue Origin (USA):** New Shepard performs suborbital flights and lands vertically.
- **JAXA (Japan) and ESA (Europe):** Researching reusable launch systems to reduce space access costs.
- **ISRO (India):** Developed the Reusable Launch Vehicle-Technology Demonstration (RLV-TD) and conducted a successful landing.