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Climate Vulnerability Index

Delhi-based Environmental think tank Council on Energy, Environment and Water (CEEW) has carried a first-of-its-kind district-level Climate Vulnerability Index (CVI).

- This district-level Climate Vulnerability Index has analysed 640 districts in India to **assess their vulnerability to extreme weather events** such as cyclones, floods, heatwaves, droughts, etc.
- The Climate Vulnerability Index maps,
    1. Exposure (i.e., whether the district is prone to extreme weather events),
    2. Sensitivity (the likelihood of an impact on the district by the weather event), and
    3. Adaptive capacity (what the response or coping mechanism of the district is).
- It helps map critical vulnerabilities and plan strategies to enhance resilience and adapt by climate-proofing communities, economies and infrastructure.
- Instead of looking at climate extremes in isolation, the study looks at the combined **risk of hydro-met disasters** (floods, cyclones and droughts), and their impact.
    - The study does not take into consideration other natural disasters such as earthquakes.
- While assessing the preparedness of a state or district, the Index takes into account certain indicators like,
    1. Availability of critical infrastructure like cyclone and flood shelters,
    2. Government mechanisms in place including updating of disaster management plans, mitigation strategies, standard operating procedures before, during and after an extreme weather event.

According to Germanwatch's Global Climate Risk Index 2021, India is the 7th most vulnerable country with respect to climate extremes.

Extreme weather events have been increasing in the country such as supercyclone Amphan in the Bay of Bengal, which is now the strongest cyclone to be recorded in the country.

Findings of Climate Vulnerability Index

- The CVI has ranked 20 states out of which Assam and Andhra Pradesh are the most vulnerable to extreme weather events, and Kerala, Tripura and West Bengal are the least vulnerable.
    - The study points out that the difference in the vulnerability of states ranked is marginal, making all states vulnerable.
- The reason why Kerala and West Bengal have performed better is because they have stepped up their climate action plans & preparedness to handle an extreme weather event.
- While 27 Indian states and UTs are vulnerable to extreme climate events, 463 districts out of 640 are vulnerable to extreme weather events.

India's Most Climate Vulnerable Districts	State
Dhemaji and Nagaon	Assam
Khammam	Telangana
Gajapati	Odisha
Vizianagaram	Andhra Pradesh
Sangli	Maharashtra
Chennai	Tamil Nadu

- 17 of 20 Indians (More than 80%) live in districts vulnerable to climate risks, out of which every 5 Indians live in extremely vulnerable areas.
- More than 45% of these districts have undergone unsustainable landscape and infrastructure changes.
- 183 hotspot districts are highly vulnerable to more than one extreme climate events.
- 60% of Indian districts have medium to low adaptive capacity in handing extreme weather events.

States	Vulnerability
North-eastern states	More vulnerable to floods
Southern and central states	Most vulnerable to extreme droughts
59% of the total districts in the eastern states	Highly vulnerable to extreme cyclones
41% of the total districts in the western states	

- **Impacts** - Apart from the intensity and frequency of extreme weather events which have increased in the country, the report finds that "**land disruptions**'' have increased the impact of these events.
- Land disruptions primarily point to anthropogenic activity resulting in the disappearance of forests, wetlands, mangroves and other habitats.
    - These ecosystems have traditionally acted as natural buffers against such extreme weather, reducing the impact.
    - With their disappearance, the impact of the weather events have increased and are being felt more across the country.

Recommendations

- Develop a high-resolution **Climate Risk Atlas** (CRA) to map critical vulnerabilities at the district level and better identify, assess, and project chronic and acute risks.
- Establish a centralised **climate-risk commission** to coordinate the environmental de-risking mission.
- Undertake **climate-sensitivity-led landscape restoration** focused on rehabilitating, restoring, and reintegrating natural ecosystems as part of the developmental process.
- Integrate climate risk profiling with infrastructure planning to increase adaptive capacity.
- Provide for **climate risk-interlinked adaptation financing** by creating innovative CVI-based financing instruments that integrate climate risks for an effective risk transfer mechanism.

Increasing Population of Peafowls

An unusual incident in Kerala - a person died after he was hit by a peafowl (pavocristatus) while

driving a bike - has turned the spotlight on the increasing population of peafowls in the state.

- Studies have shown that the peafowl population has been on the rise in the state since the 1980s.
- Peafowls are a threat to paddy farmers in Kerala; they destroy its seeds and cause man-animal conflict.
- The species are currently habituated more in central Kerala, followed by southeast and northwest parts of the state.
- At least 19% of the states' area is suitable habitat for this species; this may increase by 40-50% by 2050.
- **The growing population of peafowls signals climate change**:
    - They are known to grow and thrive in dry conditions.
    - They are well adapted to living in forest edges and cultivated areas.
- As humans have encroached the foothills of the Western Ghats in Kerala to cultivate crops and construct buildings, it has resulted in the loss of vegetation and has altered the Western Ghats.
- **Agriculture expansion and deforestation** have caused other species to 'invade the human territory'.
- In the end, it is important to establish strategies and controlling methods to manage the peafowl population.

Fabricated Guar gum-Chitosan Film

Indian scientists have developed an environmentally friendly, non-toxic, biodegradable polymer using guar gum and chitosan.

> Both guar gum and chitosan are polysaccharides extracted from guar beans and shells of crab and shrimps.

- Due to the low mechanical properties, high water-solubility, and low barrier properties of the polysaccharides, these biopolymers are not preferred.
- The fabricated guar gum-chitosan composite film will help in overcoming these challenges of polysaccharide.
- This film is a **cross-linked polysaccharide** without using any plasticizer with the help of a method called the **solution casting method** (a simple technique to make polymer films).
- The fabricated film can potentially be used in **packaging applications,** due to its,
    1. **High water stability** - Fabricated film does not dissolve in water even after 240 hours,
    2. **Higher mechanical strength** compared to general biopolymer (Biopolymer are known to possess poor strength),
    3. **High water repellence** or hydrophobic nature due to its high contact angle of 92.8º. It had low water vapor permeability when compared with the film made only from chitosan.
    4. Excellent resistance to harsh environmental conditions.

Zeolite Oxygen Concentrators

IISc has transferred the technology of making oxygen concentrators using Zeolite to over 20 companies.

Zeolites

- Zeolites are hydrated aluminosilicate minerals made from interlinked tetrahedra of alumina (AlO_4) and silica (SiO_4).
- They are **microporous**, 3-D meshes of silica and alumina.
- In nature, they occur where **volcanic outflows have met water**.
- **Properties -** Zeolites are very stable solids that resist the kinds of environmental conditions that challenge many other materials.
- They have high melting points (over 1000°C), and they don't burn.
- They resist high pressures, don't dissolve in water or other inorganic solvents, and don't oxidize in the air.
- **Forms of Zeolite** - The most commonly mined forms include chabazite, clinoptilolite, and mordenite.
- Synthetic zeolites have been designed for specific purposes, the best known of which are,
    1. Zeolite A (commonly used as a laundry detergent),
    2. Zeolites X and Y (Faujasites used for catalytic cracking), and
    3. Petroleum catalyst ZSM-5 (a branded name for pentasil-zeolite).
- **Uses** - They are commonly used as commercial adsorbents and catalysts.
- They are used as water softeners and water filters. They are found in everyday laundry and dishwasher detergents.
- Synthetic zeolites have proven to be a big and low-cost boon.

Oxygen Concentrators

- Oxygen concentrators are the biomedical device that has entered our lexicon during the pandemic.
- It has brought down the scale of oxygen purification from industrial-size plants to the volumes needed for a single person.
- At the heart of this technology are synthetic zeolites with nanometer-size pores that are rigid.
- Beads of **Zeolite 13X** are packed into 2 cylindrical columns in an oxygen concentrator.
- **Working** - Zeolite performs the chemistry of separating oxygen from nitrogen in the air. Being highly porous, zeolite beads have a surface area of about 500 square meters per gram.
- At high pressures in the column, nitrogen is in a chemically tight embrace with the Zeolite.
- Interaction between the negatively charged zeolite and the asymmetric nucleus (quadrupole moment) of nitrogen causes it to be preferentially adsorbed on the surface of the zeolite.
- **Result** - Oxygen remains free, and is thus enriched. Once nitrogen is under arrest with hydrogen, 90%-plus oxygen flows out of the column.
- After this, lowering the pressure in the column releases the nitrogen, which is flushed out, and the cycle is repeated with fresh air.

Causes of Heavy Rain and Landslides in Kerala

After two years, intense rain, flash floods, mudslides and landslides were reported in most districts located between central and southern Kerala.

- The intense rain was mainly due to the **low pressure system** developed in the east-central Arabian Sea.
- This system moved closer to Kerala coast and triggered severe weather.
- This year, the southwest monsoon withdrawal has been significantly delayed. But the rainfall is mostly caused by the localised phenomenon triggered due to the low pressure system**.**

Reference

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