



Environment (PART-2)

Current Affairs

Compilation

Jan 2025 - Dec 2025

UPSC Prelims 2026

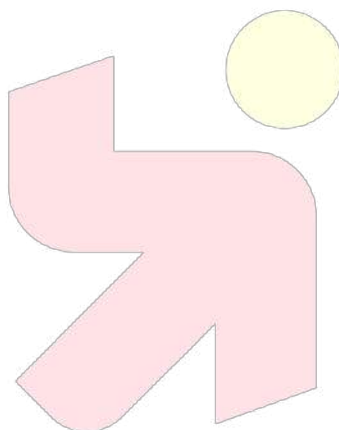


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1. Climate Change

COP30 Summit

Context:

- 30th Conference of the Parties (COP30) **under the UNFCCC in Belém, Brazil, has concluded with the adoption of the 'Belém Political Package'.**
- **Theme:** Known as the '**COP of Truth**' or the '**Implementation COP**,'
- It seeks to move beyond symbolic commitments towards real, measurable climate action across six thematic areas ("Axes").
- It marked the **first-ever COP held in Amazon region.**
- **COP29, held in Baku, Azerbaijan,** concluded with **Baku Climate Unity Pact** and several significant agreements.
- 28th Conference of the Parties (COP28) **of the UNFCCC, was held in Dubai, UAE.**

UNCED or Earth Summit 1992, Rio De Janeiro Brazil

- The **United Nations Conference on Environment and Development (UNCED)** is popularly known as **Earth Summit 1992**. It raised public awareness of the need to integrate environment & (sustainable) development.
- Climate change, desertification and biodiversity loss are heavily interlinked and pose existential challenges to humanity. In response to these challenges, governments founded **three sister "Rio Conventions"** at the 1992 Earth Summit in Rio de Janeiro, Brazil.

These are:

- The United Nations Framework Convention on Climate Change (UNFCCC, also known as UN Climate Change)
- The Convention on Biological Diversity (CBD, also known as UN Biodiversity)
- The United Nations Convention to Combat Desertification (UNCCD)

United Nations Framework Convention on Climate Change (UNFCCC)

- It is an international environment treaty
- UNFCCC is an international environmental treaty that came into existence under the aegis of the UN.
- It was negotiated in 1992 in New York City and was signed in 1992 at the Rio Earth Summit (UNCED).
- Opened for signature in 1992
- Came into force from 1994
- **Secretariat is located in Bonn, Germany**
- Ratifiers: 198 (197 countries + EU)
- The convention is legally non-binding, but makes provisions for meeting called 'protocols' where negotiating countries can set legally binding limits.

Key Outcomes of COP30

- **Belém Political Package:** The outcome document **reflected the mutirão ("coming together") spirit**, emphasising collective effort and stronger multilateral climate action.
 - **Belém Political Package lacked a clear, time-bound roadmap for "transitioning away" from fossil fuels.**
 - Key commitments on fossil-fuel and deforestation were moved to voluntary, non-binding roadmaps outside the formal UNFCCC framework.
- **Belém Action Mechanism (BAM):** A new Just Transition Mechanism was adopted to support a fair and equitable global transition to a green economy for workers and communities.
- **GGA Indicators:** Countries endorsed a **voluntary framework of 60 indicators** across seven thematic and four-dimensional targets to track progress **under the Global Goal on Adaptation (GGA).**

- **Indigenous Rights:** The **Belém Political Package** reaffirmed the need to uphold Indigenous Peoples' rights, including land rights and traditional knowledge, in climate action.
- **Climate Disinformation Acknowledgement:** It formally acknowledged the harmful impact of climate disinformation and called for information integrity in science-based policymaking.
- **Tropical Forests Forever Facility (TFFF):** A **Brazil-led blended-finance** mechanism offering long-term **performance-based payments** to tropical forest countries for conservation efforts.
- **Global Ethical Stocktake (GES):** Complements the technical Global Stocktake by examining the moral and ethical dimensions of climate action and required behavioural changes.
- **FINI Initiative:** Fostering Investible National Implementation (FINI) platform aims to make National Adaptation Plans more investible and unlock USD 1 trillion in adaptation pipelines by 2028.

Paris Agreement (COP 21)

- The Paris Agreement was adopted by 185 nations in December 2015.
- India had **signed** the agreement in New York in April 2016.
- So far, 191 countries have signed the agreement.
- It officially entered into force after 55 parties to the convention accounting for at least 55% of total GHG (greenhouse gas) emissions ratified it
- India was 62nd country to ratify it.
- Paris Agreement gives thrust to the global actions to address climate change and pertains to post-2020 climate actions. In the pre-2020 period, developed countries are to act as per Kyoto Protocol and some developing countries have taken voluntary pledges.
- **In 2017**, the US announced that it would cease all participation in the 2015 Paris Agreement. In accordance with Article 28 of the Paris Agreement, it remained a signatory till November 2020.

Outcomes of Paris Climate talks

- Commitment to reduce emissions to limit rise of temperature well beyond 2 degree and trying for 1.5 degree
- **Five-year review mechanism** to check progress on nationally declared goals (INDCs)-In Warsaw Cop 19 – First time Discussed
- Funding to the tunes of additional 1 million USD per year in GCF up till 2020, further establishing a mechanism.
- The agreement also includes a provision **requiring developed countries to send \$100 billion annually to their developing counterparts** beginning in **2020**.
- The agreement gives countries considerable leeway in determining how to cut their emissions but mandates that they report transparently on those efforts.
- Every five years nations will be required to assess their progress towards meeting their climate commitments and submit new plans to strengthen them.
- Some elements in the agreement are binding-like reporting requirements.

Shared responsibilities:

- Unlike previous agreements which put all the responsibility for reducing emissions on rich countries, in the Paris Agreement, all 196 signatories agreed that every country must take action, while acknowledging that richer countries should start immediately and cut emissions more steeply, while poorer countries' contributions will depend on their individual situations.

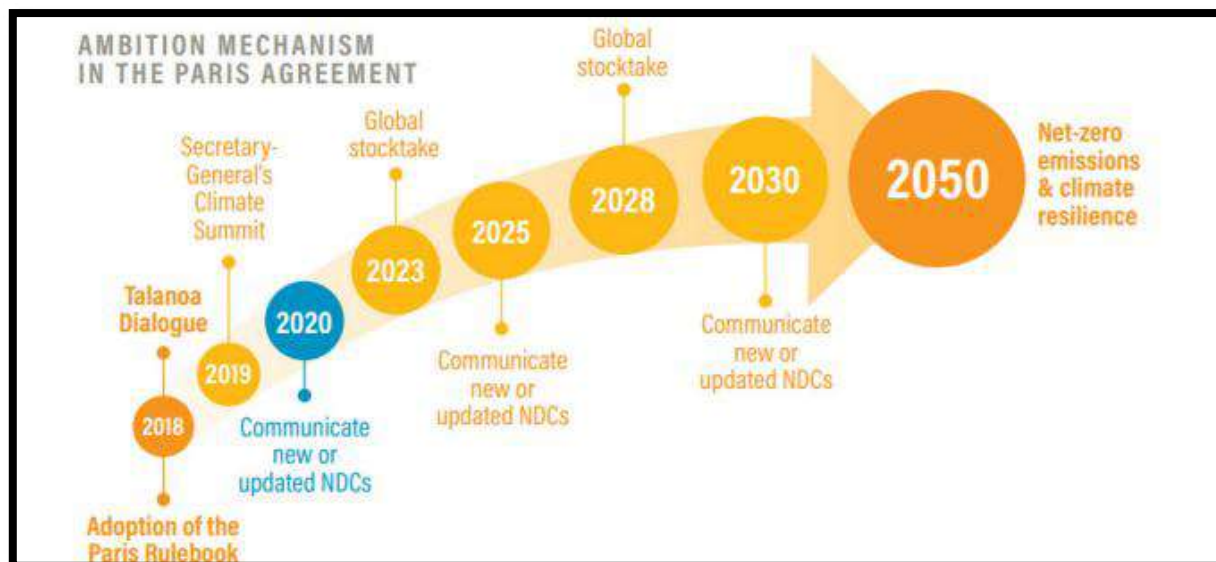
A "ratchet mechanism":

- This is the technical term for the agreement to submit new pledges by 2020.
- It's the most important victory within the agreement, as many large developing nations, like India and Indonesia, were reluctant to agree to a system that would **pressure** them to up their ambition within the next decade.

- The ratchet mechanism requires **countries to return to the table in 2020 and spell out their plans for 2025 to 2030**. This creates the opportunity for the world to potentially put itself on a course to stay below 2 C.

Paris Rulebook

- The 2018 Paris Rulebook governs how the world community of 191 countries must pledge emissions reduction targets under the Paris Agreement and report on their progress.
- It also contains provisions for rich countries to provide climate action finance to developing countries
- Article 6.2 regulates** bilateral and mini-multilateral markets by setting up conditions under which carbon credits can be used to achieve a country's nationally determined contributions, or NDCs.



ARISE Programme

- At UNFCCC COP30 Climate Summit, **Germany and Spain pledged \$100 million to support** Accelerating Resilience Investments and Innovations for Sustainable Economies (ARISE) Programme.
- Objective:** To help developing countries integrate resilience into economic planning, strengthen adaptive capacity, and mobilise climate finance.
- Implementing Body:** Climate Investment Funds (CIF), a \$13 billion multilateral financing mechanism housed within the World Bank.

Integrated Forum on Climate Change and Trade

- Launched at UN COP30** to address rising **climate linked trade frictions and create a dialogue platform**.
- Permanent, politically backed but non-negotiating** platform for climate-trade discussions.
- Purpose:** Align trade policies, climate goals, & development priorities while preventing fragmentation.
- Initial consultations in Geneva, linking it with the WTO-centred multilateral trading system.

Green Credits Programme (GCP)

- GCP was **launched by the Ministry of Environment, Forest and Climate Change (MoEFCC)**.
- It is an initiative within the GoI's broader Lifestyle for Environment (LiFE) Movement.
- It is an effort to create a market-based incentive for various environment-positive actions, not just for carbon emission reductions.
- It incentivises **voluntary environmental actions of individuals, communities, and private industries**.
- It will allow an individual or entity to earn Green Credit and trade it on a dedicated exchange.

This programme will cover eight types of activities:

- Tree plantation
- Water management
- Sustainable agriculture
- Waste management
- Air pollution reduction
- Mangrove conservation and restoration
- **Ecomark**
- Sustainable building and infrastructure
- In its initial phase, the GCP will focus on two key activities: water conservation and afforestation.
- The Indian Council of Forestry Research and Education shall administer GCP.

Eco mark

- Ecomark (or Eco Label) is a voluntary labelling of consumer products meeting Indian environmental criteria and quality standards.
- GoI launched the Eco Mark Scheme in 1991.
- The Ecomark Scheme is **administered by the Central Pollution Control Board (CPCB) in partnership with the Bureau of Indian Standards (BIS)** (the national body for standards and certification).

NDCs

Context: -

- Importance of **Nationally Determined Contributions** (NDCs) in Global climate talks.
- India **announced at COP30 in Belém that it will submit its updated Nationally Determined Contribution (NDC) for 2035 and the first Biennial Transparency Report (BTR) by December 2025.**
- Countries are required to submit their 1st BTRs in 2024 & their 3rd round of NDCs (for 2031-2035) in 2025.

Biennial Update Report (BUR-4)

- India has **submitted its Biennial Update Report (BUR-4) to the UNFCCC**, detailing its greenhouse gas (GHG) emissions inventory and climate action efforts.
- The Biennial Update Report (BUR) is a **submission by developing countries** under the UNFCCC, detailing their **climate action progress, GHG emissions inventory** and mitigation strategies.
- **Mandatory report that every Party to the Paris Agreement must submit every two years detailing national climate actions.**
- Least Developed Countries and Small Island Developing States (SIDS) are exempt from the biennial requirement and may submit BTRs at their discretion.
- Part of Enhanced Transparency Framework (ETF) and replaces the earlier Biennial Reports (BRs) and Biennial Update Reports (BURs) under the UNFCCC framework.

What are NDCs?

- NDC is a **non-binding climate action plan to cut emissions** and adapt to climate impacts. It describes a country's national policies or decisions toward reaching net-zero emissions.
- They represent short- to medium-term plans and are **required to be updated every five years** with increasingly higher ambition based on each country's capabilities and capacities.
- **Article 4 of the Paris Agreement requires Parties** to prepare, communicate, and maintain successive NDCs and adopt domestic measures to achieve them.
- New and progressively ambitious NDCs must be submitted every 5 years, **in sync with Global Stocktake cycle.**

- **Pledges made within an NDC are considered voluntary**, with countries facing no legal penalty if they fail to meet their goals. However, they are **obligated under the Paris Agreement to monitor progress and report on any failures**.
- Some countries like Britain and Chile have incorporated their NDCs into national law, making their climate commitments legally binding at the national level.
- They can help identify if the world is on track with its climate goals. More than 170 countries met the last NDC deadline ahead of COP26 in early 2021.

INDIA'S CLIMATE TARGETS: EXISTING AND NEW

Target (for 2030)	Existing: First NDC (2015)	New: Updated NDC (2022)	Progress
Emission intensity reduction	33-35 per cent from 2005 levels	45 per cent from 2005 levels	24 per cent reduction achieved in 2016 itself. Estimated to have reached 30 per cent
Share of non-fossil fuels in installed electricity capacity	40 per cent	50 per cent	41.5 per cent achieved by the end of June this year
Carbon sink	Creation of 2.5 to 3 billion tonnes of additional sink through afforestation	Same as earlier	Not clear.

About-

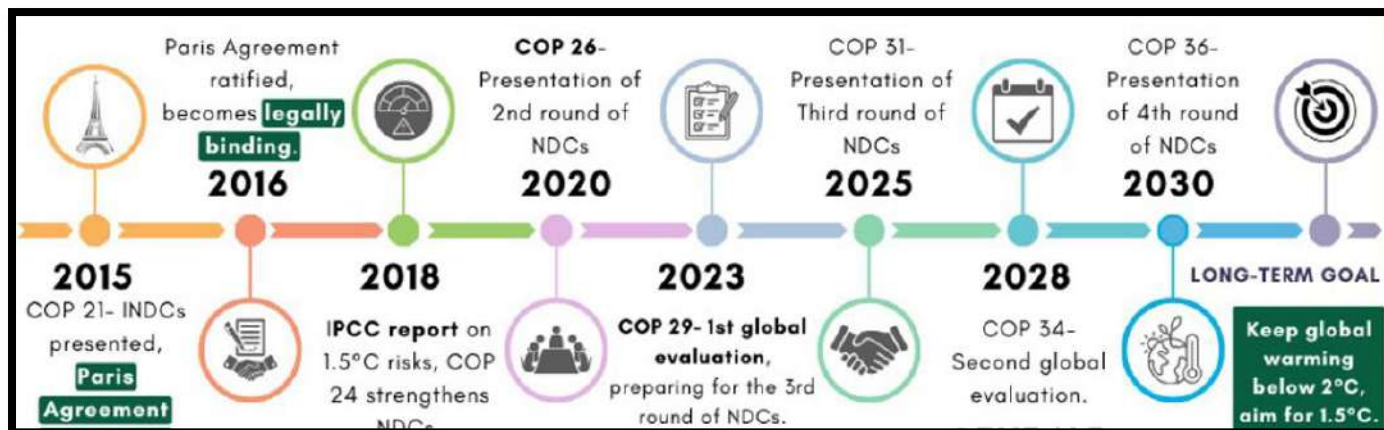
- This update to India's existing NDC is a step forward toward our long-term goal of reaching **net zero by 2070**
- Recently Union Cabinet approved India's updated Nationally Determined Contributions (NDCs)
- In its updated NDC (2022), **India elevated the targets for the first two commitments, having already surpassed the previous goals** eight years ahead of schedule.
- Paris Agreement (COP 21) requires every country to set self-determined climate targets or NDCs
- As per the Paris Agreement's provisions, countries must 'update' their pledges every five years to make higher commitments to greenhouse gas (GHG) emissions reductions.
- India submitted its first NDCs to UNFCCC in 2015.
- Recently Glasgow Climate Pact (CoP 26) requested to strengthen the targets by the end of 2022.
- India has updated its NDCs while considering the principle of common but differentiated responsibilities and respective capabilities (CBDR-RC).
- The 2015 NDC comprised **eight goals** which included three quantitative targets related to emission intensity, fossil fuels and carbon sink and the rest were qualitative targets

Updated INDC

- To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation, including through a mass movement for 'LIFE'- 'Lifestyle for Environment' as a key to combating climate change [UPDATED].
- To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.
- To reduce Emissions Intensity of **its GDP by 45 percent by 2030, from 2005 level [UPDATED]**.
- To achieve **about 50% cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030**, with the help of transfer of technology and low-cost international finance including from Green Climate Fund (GCF) [UPDATED].
- To create an additional carbon sink of 2.5 to 3 billion tonnes of CO₂ equivalent through additional forest and tree cover by 2030.
- To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management.
- To mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap.
- To build capacities, create domestic framework and international architecture for quick diffusion of cutting-edge climate technology in India and for joint collaborative R&D for such future technologies

The Maastricht Principles: A Framework for Future Generations' Rights

- The **Maastricht Principles on the Human Rights of Future Generations** provide a clear framework:
- Affirm that human rights extend to all members of the human family, including future generations.
- Emphasise the continuum of human generations.
- Stress the need to interpret rights in light of humanity's relationship with nature and scientific understanding.
- Outline obligations to protect future generations against risks posed by public and private actors.
- Advocate for meaningful representation of future generations in decision-making processes.



Humboldt Glacier

Context (WION):

- **Venezuela becomes the first** nation to lose all of its glaciers.

About: -

- By 2011, five of Venezuela's glaciers had vanished, leaving only the Humboldt glacier, also known as La Corona, struggling for survival in the Sierra Nevada National Park.
- Recently, the **International Cryosphere Climate Initiative (ICCI)**, held that the South American nation's only remaining glacier - the **Humboldt in the Andes** - had become "too small to be classed as a glacier" and has been classified into ice field.
- While there is no global standard for the minimum size a body of ice must be to qualify as a glacier, the US Geological Survey says a commonly accepted guideline is around 10 hectares.
- An interconnected series of ice caps and glaciers is called an ice field.



International Cryosphere Climate Initiative:

- It was **formed in 2009 following COP-15 in the Copenhagen meeting**.
- It is a **network of senior policy experts** and researchers working with governments and organizations to create, shape and implement initiatives designed to preserve as much of the Earth's cryosphere as possible.

- Its work focuses on three major areas of the cryosphere: the Arctic, the Antarctic and high mountain regions.

Environmental Performance Index (EPI), 2024

- Recently, EPI 2024 has been published by Yale Center for Environmental Law & Policy.
- Using 58 performance indicators across 11 issue categories, EPI ranks 180 countries on climate change performance, environmental health, and ecosystem vitality.
- Estonia tops the list.
- **India has been ranked 176.**
- In 2022, **India surpassed China as the world's largest emitter of anthropogenic SO₂.**

EU's Nature Restoration Plan (NRP)

- European Union approves NRP, first of its kind.
- It is a continent-wide and comprehensive law that forms part of the EU's European Green Deal (aims for net zero emissions of greenhouse gases by 2050).
- Aim: **Contains binding restoration targets for long-term recovery of nature in EU's land and sea areas.**
- It seeks to recover at least 20% of the EU's land and sea areas by 2030, and all ecosystems in need of restoration by 2050.

Teal Carbon

Context: -

- India's first 'teal carbon' study undertaken at Keoladeo National Park (KNP).

About: -

- Refers to **carbon stored in non-tidal freshwater wetlands, encompassing carbon sequestered in vegetation, microbial biomass, and dissolved and particulate organic matter.**

Other types of carbon: -

- Purple: Carbon captured through the air or industrial emissions.
- Green: Carbon stored in terrestrial plants.
- Black: Carbon released through the burning of fossil fuels.
- Red: Carbon released through biological particles on snow and ice that reduce albedo.
- Grey: Carbon released through industrial emissions.

Yala Glacier

- Yala Glacier in **Nepal was declared 'dead' after losing 66% of its area since the 1970s**, marking a significant loss in the **Hindu Kush Himalayan (HKH) cryosphere.**
- Precedents of **Symbolic** glacier funerals: Okjokull Glacier (Iceland, 2019), Pizol Glacier (Switzerland, 2019), Clark Glacier (USA, 2020) and Ayoloco Glacier (Mexico, 2021).
- **Location:** Situated in the **Langtang Valley**, central Nepal.
- Expected to disappear completely by the 2040s.
- Only the **Himalayan glacier** is listed in the **Global Glacier Casualty List (GGCL) launched** in 2024.

Global Glacier Casualty List (GGCL)

- **Initiated in 2024 by Rice University**, University of Iceland, Iceland Glaciological Society, World Glacier Monitoring Service (WGMS) & UNESCO to emphasise urgency of glacier preservation & high light their role in storing 70% of global freshwater.

Examples of Listed Glaciers:

- Pico Humboldt Glacier (Venezuela): vanished in 2024.
- Sarenne Glacier (France): disappeared in 2023.
- Dagu Glacier (China): "critically endangered", expected to vanish by 2030.

NOTE: - UN has declared 2025 as the International Year of Glaciers' Preservation.



Declining Snow

- ICIMOD's report flags the **3rd consecutive below-normal snow year in the Hindu Kush Himalaya (HKH)**.
- **Snow Persistence refers to** the fraction of time snow remains on the ground during the snow season (Nov-Mar).
- **Melting snow contributes 23%** of the annual runoff to 12 major river basins in the HKH.

Hindu Kush Himalaya

- The HKH mountains **extend around 3,500 km** over eight countries (Afghanistan, Bangladesh, Bhutan, China, India, Nepal, Myanmar, and Pakistan).
- These mountains are **also called the "water towers of Asia"** because they are the origins of 10 crucial river systems on the continent (Amu Darya, Indus, Ganga, Brahmaputra, Irrawaddy, Salween, Mekong, Yangtze, Yellow River, and Tarim).
- These river basins provide water to **almost one fourth of the world's population**.
- These river basins are a significant **freshwater** source for people in the HKH region.



ICIMOD (International Centre for Integrated Mountain Development)

- **Intergovernmental** organisation founded in 1983.
- **Headquarters: Kathmandu** serves 8 HKH countries.
- Conducts: regional scientific research, pilots field solutions, and informs mountain development and climate adaptation policy.

Carbon Capture, Utilisation, and Storage

Context (PIB):

- GoI launched the **first national R&D Roadmap for Carbon Capture, Utilisation, and Storage (CCUS)** to support its Net Zero goals.
- **NITI Aayog** holds a **workshop** on the "Legal & Regulatory Frameworks & Technical Considerations for CCUS in collaboration with US Government."

About: -

- Carbon Capture Utilization and Storage involve the capture of CO₂ generally from large point sources like power generation or industrial facilities that use either fossil fuels or biomass as fuel.
- It involves the transport of the captured CO₂ to sites, either for utilization in different applications or injection into geological formations or depleted oil & gas fields for permanent storage and trapping of the CO₂.



Benefits: -

- It offers a unique set of tools for decarbonizing hard-to-abate industries (steel, cement, chemicals).
- It enables a cleaner coal gasification economy by utilizing India's vast coal reserves.
- It supports the hydrogen economy by enabling blue hydrogen production.
- It can remove CO₂ from the air to balance emissions that are unavoidable or technically difficult to abate.

Roadmap:

- Focuses to deploy Carbon Capture, Utilisation & Storage (CCUS) at scale, especially in sectors with few clean-energy options, like coal power, cement, petro chemicals, oil, gas, and fertilisers.
- Developed by: Department of Science & Technology (DST), Ministry of Science & Technology.**
- Funding:** Proposes utilising the ₹1 lakh crore RDI Scheme and encourages the use of captured CO₂ for value-added products.
- It encourages **Public-Private Partnership** to establish CCUS test beds in industrial facilities.
- It recommends CCUS clusters where multiple industrial units capture CO₂ and utilise shared transportation and storage networks to reduce costs.

United Nations Environment Programme (UNEP)

- 7th Session of the **United Nations Environment Assembly (UNEA-7)** was held in **Nairobi, Kenya**.

About: -

- UNEA serves as the governing body of UNEP.
- It is an **UN agency**.
- It coordinates UN's environmental activities, assisting developing countries in implementing environmentally sound policies and practices.
- It was **founded because** of the **UN Conference on the Human Environment (Stockholm Conference) in 1972**
- HQ: Nairobi, Kenya**
- UNEP has also been active in funding and implementing environment related development projects.
- UNEP has aided in the formulation of guidelines and treaties on issues such as the international trade in potentially harmful chemicals, transboundary air pollution, and contamination of international waterways.
- UNEP is also one of several Implementing Agencies for the Global Environment Facility (GEF) and the Multilateral Fund for the Implementation of the Montreal Protocol

Major Reports:

- 1) Emission Gap Report
- 2) Adaptation Gap Report
- 3) Production Gap report
- 4) Global Environment Outlook
- 5) Global Chemical outlook
- 6) Frontiers
- 7) Invest into Healthy Planet

Major Campaigns:

- 1) Beat Pollution
- 2) UN75
- 3) World Environment Day
- 4) Wild for Life

United Nations Environment Assembly

- **Established in 2012 at Rio+20 as the world's highest environmental** decision-making body with universal membership of all 193 United Nations (UN) member states.
- Serves as the **governing body of UNEP**, approving its Programme of Work and Budget, and setting global environmental mandates and priorities.
- Meets **biennially** in Nairobi, Kenya.
- Its **resolutions are non-binding** but influence global environmental governance, norms, and cooperation.
- The **UNEA Bureau, elected for a two-year term**, consists of a President and eight Vice-Presidents and is responsible for organising and coordinating the Assembly's sessions

National Authority for Carbon Market

- **Ministry of Environment, Forest and Climate Change (MoEFCC)** has set up a National Designated Authority (NDA) to implement carbon markets under **Article 6 of the Paris Agreement**.
- It is a **21-member body** headed by the Environment Secretary.

Article 6 of Paris Agreement

- It allows countries to trade emissions to meet their Nationally Determined Contributions (NDCs).
- Provides framework for carbon markets and emissions trading

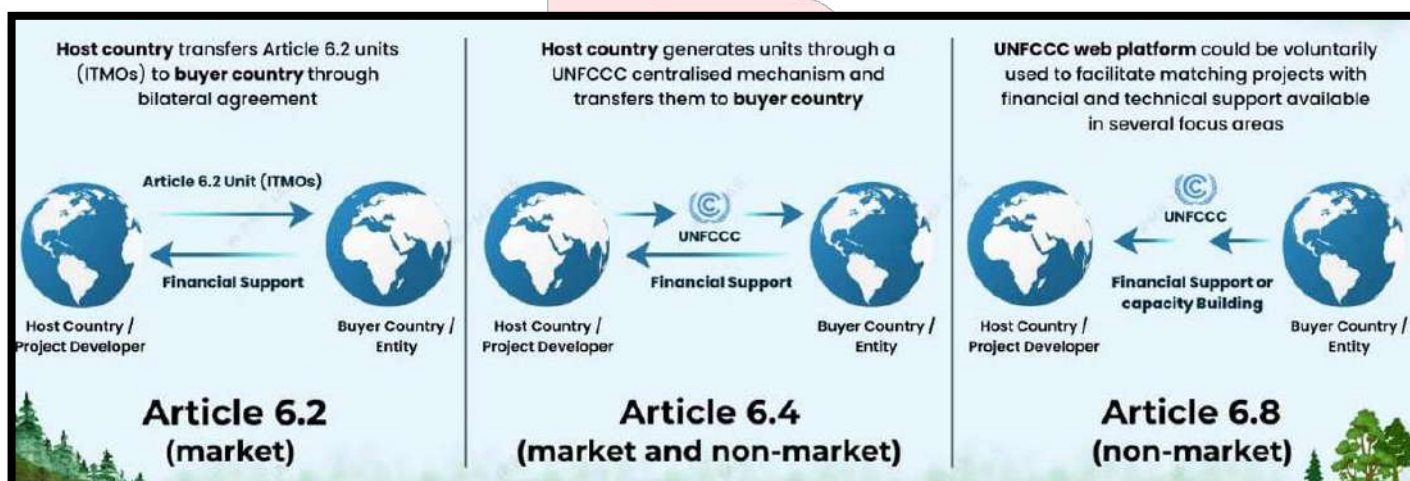
Carbon Trading**Context: -**

- Rules for carbon trading under Article 6 of the Paris Agreement were **finalized after a decade of negotiations**.

Article 6 of the Paris Agreement: -

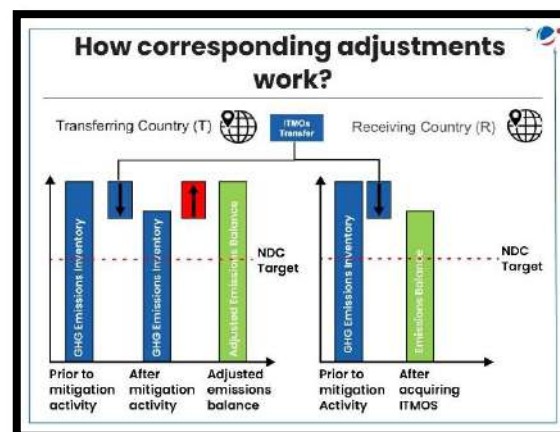
- It details a set of tools and mechanisms of carbon market, that allows countries to **voluntarily cooperate to achieve their Nationally Determined Contribution (NDC)**.
- It has 3 main mechanisms: 2 Market-based and 1 non-market based.

Mechanisms under Article 6		
Market based approaches		Non-Market based approach
Article 6.2	Article 6.4	Article 6.8
✓ Decentralized approach that allows for bilateral cooperation between countries ✓ Involves international trading of International Transferred Mitigation outcomes (ITMOs) (emissions reductions that result from mitigation actions) ✓ Corresponding adjustment in NDCs are made on trade of ITMOs.	✓ Centralized approach under UNFCCC for transfer of ITMOs termed as Paris Agreement Crediting Mechanism (PACM). ✓ Establishes a global carbon market. ✓ Uses Baseline-and-crediting mechanism similar to Clean Development Mechanism (CDM) of Kyoto Protocol which uses cap-and-trade system.	✓ Introduces non-market approaches to promote mitigation and adaptation through finance, technology transfer, capacity building etc. ✓ No trading of emission reductions is involved. ✓ Involves more than one participating Party.



About Corresponding adjustment (Article 6.2)

- These are changes made in a countries' emissions levels to reflect the transfer (export) or acquisition (import) of ITMOs.
- They are made for 3 different cases based on different types of targets and measures in NDCs:
- GHG metrics: E.g., economy-wide annual levels of GHG emissions
- Non-GHG metrics: E.g., installed capacity of renewable energy in MW
- Policies and measures within a country's NDCs



About Carbon Market

- Carbon markets are trading systems where entities buy carbon credits to offset their greenhouse gas emissions by supporting projects that reduce or remove emissions.

- One tradable carbon credit generally equals one metric tonne of carbon dioxide or the equivalent amount of a different greenhouse gas reduced, sequestered or avoided.

Difference between Carbon trading of Kyoto Protocol and Paris Agreement		
Aspect	Kyoto Protocol	Paris Agreement (Article 6)
Scope of Participation	Limited to developed countries (Annex I) with project hosting by developing countries.	Inclusive of all countries.
Adaptation Funding	Share of proceeds from CDM projects directed to the Adaptation Fund.	5% of proceeds from Article 6.4 transactions allocated to the Global Adaptation Fund.
Market Scope	Focused on project-based mechanisms like- Clean Development Mechanism (CDM): Projects in developing countries. Joint Implementation (JI): Projects in other developed countries.	Combines market-based and non-market-based approaches.
Legacy Credits	Allowed use of older credits from inactive projects, causing oversupply concerns.	Restricts legacy credit use; only post-2013 credits.

Carbon Trading Mechanisms in India

Carbon Credits Trading Scheme (CCTS), 2023:

- Introduced through amendments in the Energy Conservation (Amendment) Act, 2022, it establishes Indian Carbon Market under two mechanisms:

Compliance mechanism:

- Mandatory program for the energy-intensive industries where Government will set GHG emission intensity targets.
- Initially includes 9 sectors like Fertiliser, Iron & Steel, Pulp & Paper, Petrochemicals, Petroleum refinery, etc.

Offset mechanism:

- A voluntary project-based mechanism for entities not covered under compliance mechanism.

Green Credit Program:

- A **market-based voluntary** mechanism for trading of Green Credits to incentivise environment positive actions by different stakeholders, **established under the Environment (Protection) Act, 1986.**
- Eligible Activities include Tree plantations, Sustainable agriculture practices, etc.

Other Instruments:

Perform, Achieve and Trade (PAT) Scheme:

- Mandates large energy-intensive industries to reduce their specific energy consumption.
- Industries that exceed their targets earn energy saving certificates (ESCs), which can be traded with those who fall short.
- It will be transitioned gradually to the compliance mechanism under CCTS.

Renewable Energy Certificates (REC) Scheme:

- A market-based instrument to promote renewable energy and facilitate compliance of renewable purchase obligations (RPO).
- Value of REC is equivalent to 1MWh of electricity.

Geoengineering Projects

- Study has raised serious concerns over five polar geoengineering concepts aimed at mitigating climate change.

Methods:

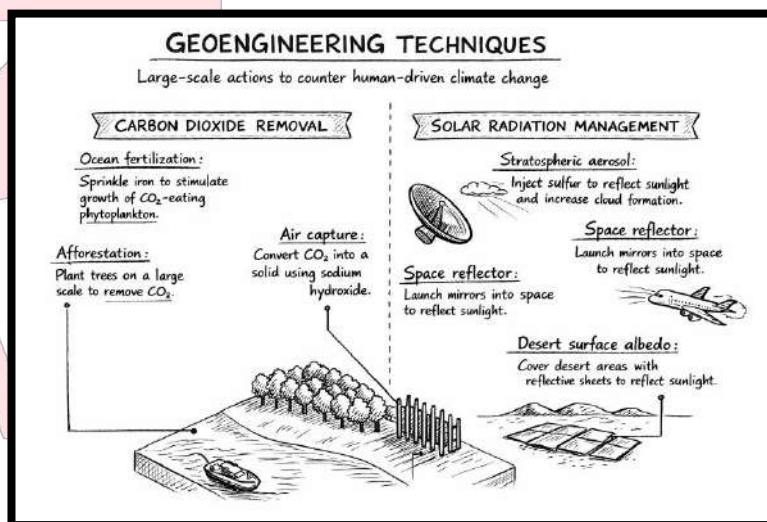
- **Stratospheric Aerosol Injection (SAI):** Releasing reflective aerosols like sulphur dioxide to cool the atmosphere.
- **Sea Curtains/Walls:** Large buoyant structures blocking warm water inflows to ice sheets.
- **Sea Ice Management:** Using glass microbeads to increase ice reflectivity.
- **Basal Water Removal:** Extracting subglacial water to slow glacier flow.
- **Ocean Fertilisation:** Adding nutrients (iron) to stimulate phytoplankton and absorb CO₂.

What is Geo-Engineering?

- Geoengineering refers to large-scale, deliberate climate interventions, mainly categorized as **Carbon Dioxide Removal (CDR)** and **Solar Radiation Management (SRM)**.

Stratospheric Aerosol Injection (SAI)

- Solar geoengineering technique to combat global warming by artificially cooling the Earth's surface.
- Involves **deliberate injection of reflective aerosols, such as sulphur dioxide (SO₂), into the stratosphere**, where they reflect a portion of incoming solar radiation back into space.
- It **mimics the natural cooling effect observed after major volcanic eruptions**, offering a short-term strategy to offset rising temperatures caused by greenhouse gas emissions.
- **Challenges Associated:** May disrupt monsoon patterns, hydrological cycles, delay ozone recovery (increasing UV and acid rain), and mask global warming, reducing urgency for emission cuts.
- Aerosols, tiny, suspended particles, whether natural (like volcanic ash) or anthropogenic (like industrial soot), can alter the Earth's radiation balance.



Enhanced Rock Weathering (ERW)

- It seeks to **accelerate the natural process of capturing and storing carbon dioxide** (carbon sequestration) by enhancing the geological process of weathering by spreading finely ground, fast-weathering rocks, such as basalt, over farmland, thereby increasing the surface area for chemical reactions and enhancing carbon removal.
- Its effectiveness depends on variables such as rock type and size, the level of moisture and heat in the climate, soil type, and land management practices.

- **Benefits:** Crushed rock increases alkalinity, enhancing nutrient availability & crop growth. Even if the rock doesn't capture CO₂ directly, it can neutralise acidic runoff.
- **Brazil delivered the world's first verified ERW** carbon removal credits earlier this year.

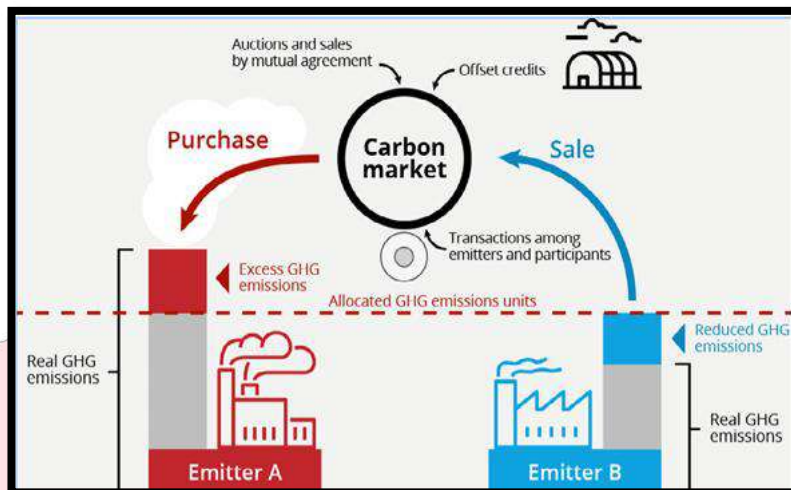
Surat Emission Trading Scheme

Context: -

- Gujarat's Surat ETS has **demonstrated the effectiveness** of market-based pollution control in particulate matter (PM) pollution from 2019 to 2021.

About: -

- **Initiated in 2019 in Surat, Gujarat, the ETS is the world's first trading market for particulate matter (PM) emissions** by means of the Cap-and-Trade Mechanism (used in Carbon Trading).
- Based on market-linked 'cap and trade' mechanism.
- Trading: Industries trade permits on a platform developed by NeML (National Commodities and Derivatives Exchange e-Markets).



Terms in News

Ocean darkening

- Ocean darkening is **shrinking of the photic (sunlit) zone**; about 21% of global oceans darkened (2003–2022), especially in Arctic, Antarctic and Gulf Stream regions.
- **Caused by:** Fertiliser-driven algal blooms, higher sediment runoff, climate-driven shifts in plankton, rising sea temperatures, and altered ocean currents.
- Photic zone is the **sunlit upper layer of the ocean**, extending up to 200 meters, to support photosynthesis. It acts as the base for nearly 90% of the world's marine life.
- **Impacts:** Lowers phytoplankton productivity, weakens CO₂ uptake, disrupts feeding, migration & reproduction of marine species, threatening marine food webs.

2. Environmental Degradation

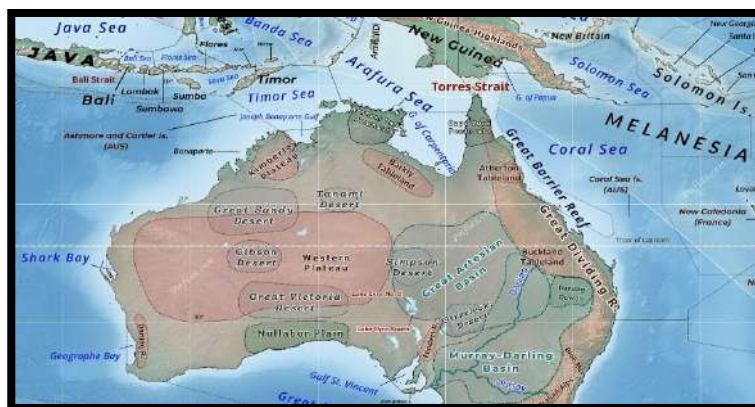
Great Barrier Reef Warming

Context: -

- Water temperatures in and around the Great Barrier Reef, Australia, is the warmest in the past 400 years (Nature Journal).

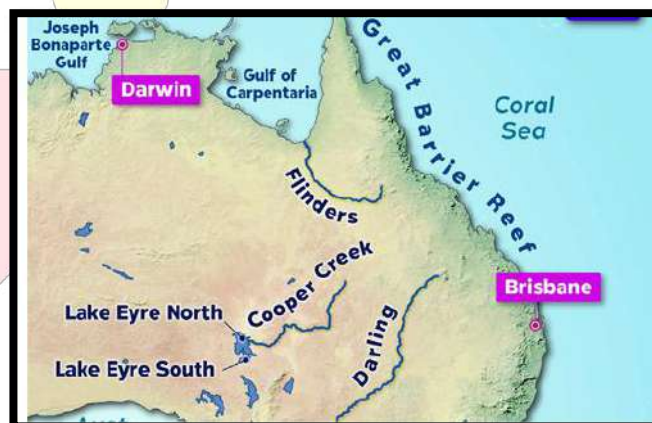
About: -

- Record-high temperatures had **created mass coral bleaching in 2016, 2017, 2020, 2022 and 2024.**
- It **projects a loss of 70%-90% coral reefs even with** the signing of Paris Agreement and future coral reefs might be different with less diversity in coral species.



Great Barrier Reef

- World's largest coral reef ecosystem located** in the Coral Sea off Queensland, Australia.
- It is the **world's largest collection of coral reefs & comprises of some 2,500 individual reefs and 900 islands.** It is **designated as a UNESCO World Heritage site in 1981.**
- Located in the Coral Sea, off the northeastern coast of Australia,** it extends in a **north-south direction, roughly parallel to the mainland and south of the Torres Strait.**



World's first cryo-born baby corals

- World's first cryo-born baby corals have been **successfully settled on the Great Barrier Reef.**
- Scientists successfully used **cryopreserved coral sperm to fertilise fresh eggs** and produced lab grown "cryo-born" coral babies.

Algal Blooms

Context (DTE):

- A study warns that **climate change is increasing algal bloom risks in the Thames River despite a 40-year decline** in phosphorus levels.

Thames River: -

- Length: Longest river in England, **second longest in the UK after the Severn.**
- Drains into the **North Sea.**

Note: Cyanobacterial Bloom

- Lake Victoria is experiencing harmful cyanobacterial blooms.**



- **Signatory nations can decide** whether to allow or ban the importation of chemicals listed in the treaty

Iprodione and Terbufos

- Iprodione, a fungicide used on vines, fruits, trees and vegetables, has been classified as carcinogenic and toxic for reproduction.
- Terbufos is a soil insecticide used commonly on sorghum, maize, beet and potatoes.
- It has also been found to pose risk to aquatic organisms due to its toxicity.
- Both the pesticides, which are used in agriculture, are known for their harmful impacts on human health and the environment.
- In India, the use of these chemicals was permitted by the 2015 Anupam Verma committee report.
- India is among the largest exporters of Terbufos

UV-328 and Other POPs

- At 15th Conference of the Parties (COP15) to Stockholm Convention in Geneva, parties decide to grant use of UV-328 in the aerospace and defence sector.

About:

- Used **since the 1970s in paints and plastics, adhesives, sealants**, cosmetics, sunscreens, and food contact materials as a UV absorber to prevent degradation and discolouration under sunlight.
- Classified as a persistent organic pollutant (POP) due to its persistence, bioaccumulation, long-range environmental transport, and toxicity. Can damage the liver and endocrine system.

Addition to Annex A of Stockholm Convention

- **Chlorpyrifos:** Neurotoxic insecticide linked to developmental harm in children.
- **Long-chain perfluoro carboxylic acids (LC-PFCAs):** Highly persistent “forever chemicals” used in cookware. Associated with cancer and environmental persistence.
- **Medium-chain chlorinated paraffins (MCCPs):** Industrial chemicals used to make plastic flexible and durable. Harmful to liver, kidneys, and thyroid.

Stockholm Convention on Persistent Organic Pollutants

- It is an International Environmental Treaty
- It is a **UN Treaty**
- It is a **legally binding instrument**
- Open for signature in 2001 in Stockholm
- Became effective in 2004
- It aims to **eliminate or restrict the production and use of persistent organic pollutants**
- **India is a party to this treaty**
- US is not a party to this treaty

Annexures under the convention:

- **Annex A:** Chemicals listed here are to be eliminated (e.g., aldrin, dieldrin, UV-328, etc.).
- **Annex B:** Chemicals subject to restriction (e.g., DDT —limited use for malaria control).
- **Annex C:** Unintended by-products to be reduced or eliminated (e.g., dioxins, furans)

Why regulate POPs?

POPs are chemical substances that:

- Persist in the environment
- Bio-accumulate through the food web
- Pose a risk of causing adverse effects to human health and the environment

Important POP restricted-

- Intergovernmental Forum on Chemical Safety (IFCS) and the International Programme for Chemical Safety (IPCS) prepared a list, **known as the Dirty Dozen :**
- **Eight organochlorine pesticides:** aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex and toxaphene;
- **Two industrial chemicals:** hexachlorobenzene (HCB) and the polychlorinated biphenyl (PCB) group; and
- Two groups of industrial by-products: dioxins and furans.

Basel Convention

- Formally called: The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal
- It is an international treaty
- It is a UN Treaty
- **Open for signature in 1989**
- Effective from 1992
- **It is a legally binding instrument**
- Signatories: 53
- Parties: 183
- It **does not address** the **movement of radioactive waste.**
- India is a member
- United States has signed the Convention but has not ratified it.
- Its objective was to stop dumping of hazardous waste from developed countries in developing nations.

Basel Convention is an international treaty that was designed to:

- Reduce the movements of hazardous waste between nations.
- Prevent the transfer of hazardous waste from developed to less developed countries (LDCs).
- Basel Convention focuses on **merely regulating the trade in hazardous waste & not in its complete ban.**
- It **does not prohibit waste exports** to any location except Antarctica but merely requires a notification and consent system known as "prior informed consent" or PIC.

IMP

- In 2012, the Secretariats of the Basel and Stockholm conventions, as well as the UNEP-part of the Rotterdam Convention Secretariat, **merged to a single Secretariat with a matrix structure serving the three conventions.**
- The three conventions now hold back-to-back Conferences of the Parties as part of their joint synergies decisions.

Black Plastic

- Over 90% of food delivery containers in major Indian cities are made of black plastic.
- Manufactured **using recycled electronic waste (e waste) like old computers**, TVs, and appliances.
- Contains **harmful substances such as Brominated flame** and heavy metals like lead, cadmium, mercury, antimony, nickel, and chromium.

Global Plastic Action Partnership

- **Seven new countries** — Angola, Bangladesh, Gabon, Guatemala, Kenya, Senegal, and Tanzania — have joined Global Plastic Action Partnership.
- **Launched in 2018 during World Economic Forum's** Sustainable Development Impact Summit.

- Acts as the **plastics pillar of the Platform for Accelerating the Circular Economy** and the Friends of Ocean Action.
- **Objective:** To stop plastic waste leakage and foster a shift toward sustainable materials.
- **Members: 25 (incl. India).**
- Helps countries in developing National Action Roadmaps and Investment Mobilization for waste management.

Report on Land Drying

Context: -

- The **U.N. Convention to Combat Desertification (UNCCD) report "The Global Threat of Drying Lands"** has highlighted an increase in global aridification, with over 77% of Earth's land becoming drier in the last 30 years.

Key Findings of the Report

- **The Scale of Global Drying:** During the three decades leading up to 2020, global drylands expanded by approximately 4.3 million square kilometres, an area nearly a third larger than India. These drylands cover more than 40% of the Earth's total land area.
- **Population Implications:** The number of people living in drylands doubled to 2.3 billion over the past 30 years. Asia and Africa host about half of the world's dryland inhabitants.
- **High-Risk Areas:** High greenhouse gas emission scenarios predict dryland expansion in regions such as the US, Venezuela, Brazil, Argentina, Mediterranean region, Black Sea coast, southern Africa, & Australia.

COP 16:

- **16th Conference of the Parties (COP16) to the United Nations Convention to Combat Desertification (UNCCD) concluded in Riyadh, Saudi Arabia**, with nearly 200 countries committing to prioritise land restoration and drought resilience.

About: -

- It was also the first time a UNCCD COP was held in the Middle East and North Africa (MENA) region.
- **Theme: - Our Land. Our Future**

Key Outcomes of COP16: -

- **Global Drought Framework:** Nations advanced efforts toward a global drought framework, aiming for completion at COP17 in Mongolia 2026.
- **Great Green Wall (GGW) Initiative:** The African-led GGW initiative secured Euros 11 million from Italy for Sahel landscape restoration and Euros 3.6 million from Austria to enhance coordination across 22 African countries.
- **Indigenous Peoples and Local Communities:** Caucuses for Indigenous Peoples and Local Communities were formed to ensure their perspectives and challenges are represented.
- **The Sacred Lands Declaration, presented** at the Indigenous Peoples Forum, greater involvement in global land and drought governance.

COP 15:

- COP-15 of the UNCCD was **conducted recently at Abidjan, Côte d'Ivoire**.
- At COP-15, India reaffirmed its commitment to restoring 26 million ha of degraded land by 2030.

Major Outcomes of COP-15

- COP-15 theme- Land. Life. Legacy: From scarcity to prosperity.

- “Drought in Numbers, 2022” was released at the COP-15 & a global pledge was taken to boost drought resilience & invest in land restoration for future prosperity.
- Target to **Restore one billion hectares of degraded land between now & 2030**
- Future-proof land use against the impacts of climate change.
- Regional initiatives were launched in support of the Africa-led Great Green Wall at COP-15.
- Abidjan Call issued by the Heads of State & Government to boost long-term environmental sustainability.
- Abidjan Declaration on achieving gender equality for successful land restoration
- COP-15 “Land, Life & Legacy” Declaration, as a response to the findings of the UNCCD’s flagship report, Global Land Outlook 2 (second edition of the Global Land Outlook).

United Nations Convention to Combat Desertification (UNCCD)

- UNCCD, along with the Convention on Biological Diversity and the UNFCCC, emerged from the 1992 Rio de Janeiro Earth Summit.
- It is a UN convention
- Opened for sign in 1994 in Paris
- Became effective from 1996 (Canada withdrew. First to do so)
- **HQ: Bonn, Germany**
- It is the **only internationally legally binding framework** set up to address the problem of desertification
- UNCCD aims to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, **particularly in Africa**
- India ratified the UNCCD Convention in 1996
- The Convention requires countries to draw **up their national action programmes (NAP) using a bottom-up approach** — from the local community up — to restore degraded lands.
- The Global Mechanism (GM) was established under UNCCD to assist countries in the mobilization of financial resources to implement the Convention

Recent COP under UNCCD

- COP 13 – 2017 - Ordos City (China)
- COP 14 – 2019 - New Delhi (India)
- COP-15 – 2022 - Abidjan (Côte d’Ivoire)
- Future meetings of the biennial Conference of the Parties to the UNCCD & its subsidiary bodies will be held in Saudi Arabia (COP16 in 2024) & Mongolia (COP17 in 2026).

Note: Decade 2021-2030 is declared as the **UN Decade on Ecosystem Restoration/or improving environmental conditions** and enhancing human communities.

Q. What is/are the importance/importances of the ‘United Nations Convention to Combat Desertification’ ? (2016)

- 1) It aims to promote effective action through innovative national programmes and supportive international partnerships.
- 2) It has a special/particular focus on South Asia and North Africa regions, and its Secretariat facilitates the allocation of major portion of financial resources to these regions.
- 3) It is committed to bottom-up approach, encouraging the participation of local people in combating the desertification.

Select the correct answer using the code given below:

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only

(d) 1, 2 and 3

14th Session of COP-14 of UNCCD

- India had for the first time hosted the 14th session of the Conference of Parties (COP-14) of the United Nations Convention to Combat Desertification (UNCCD) at Greater Noida in 2019.
- The **theme** of the Conference was '**Restore land, Sustain future**'.
- During the conference, the Delhi Declaration was issued. The declaration called for better access over land and emphasised gender-sensitive transformative projects.

Peace Forest Initiative

- Peace Forest is an initiative of South Korea launched in 2019 during the 14th Conference of the Parties to the UNCCD in New Delhi, India.
- Aim: To promote cooperation between countries to rehabilitate degraded land and forest in fragile and post-conflict locations while promoting peace and confidence.

Drought Toolbox:

- It was launched during the 14th Conference of the Parties to the UNCCD in New Delhi, India.
- It is a one-stop-shop for all actions on drought.
- It is a sort of knowledge bank which contains tools that strengthen the ability of countries to anticipate and prepare for drought effectively and mitigate their impacts
- As well as tools that enable communities to anticipate and find the land management tools that help them to build resilience to drought.

Land Degradation Neutrality (LDN) initiative

- The concept of LND emerged from the UN Conference on Sustainable Development (Rio+20) in 2012.
- LDN has been **defined as** a state whereby the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remains stable or increases within specified temporal and spatial scales and ecosystems.
- Target 15.3 of the Sustainable Development Goals(SDG) aims to achieve Land Degradation Neutrality (LDN) worldwide by 2030.
- The United Nations Convention to Combat Desertification (UNCCD) adopted LDN as the principal target of the Convention at COP12 in October 2015.
- **New Delhi Declaration**: 190+ countries agreed to achieve 'land degradation neutrality' by 2030 and vowed to ensure that the efforts in this direction do not affect land rights of forest dwellers and women.
- **India's LND Targets**: India will restore **26 million hectares of degraded land by 2030; earlier the target was 21 mha.**

Global Land Outlook (GLO)

- Strategic communications platform and associated publications of the UNCCD secretariat that demonstrates the central importance of land quality to human well-being.

Global Land Outlook-2

- Recently **released by UNCCD**

Bonn Challenge:

- Launched **by the Government of Germany and IUCN in 2011**, it is a global goal to bring 150 million hectares of degraded and deforested landscapes into restoration by 2020 and 350 million hectares by 2030.
- At the UNFCCC 2015 in Paris, India joined the voluntary Bonn Challenge pledge to bring into restoration 13 million hectares of degraded and deforested land by the year 2020, and additional 8 million hectares by 2030. (It was later increased to 13 mha)

Biodiversity Leakage

- Refers to a situation where conservation or environmental policies **aimed at protecting biodiversity in one area unintentionally led to the loss of biodiversity in another region.**
- E.g. If a protected area is established in one region, industries might move their operations to nearby unprotected areas, leading to habitat destruction there.

Grey Rhino Event

- Recent report identified Wayanad's landslide (2024) as a "grey rhino" disaster.
- A 'grey rhino event' is a highly probable, high-impact crisis that is clearly foreseen yet deliberately ignored by policymakers.
- E.g., 2008 Global Financial Crisis, 2023 sinking of Joshimath, 2018 Kerala floods, etc.
- **This term distinguishes predictable disasters from 'black swan' events**, which are exceptionally rare and unpredictable with severe impact.
- E.g., 2004 Indian Ocean Tsunami, COVID-19 pandemic, 9/11 terrorist attacks in 2001 etc.

Tropical Forest Forever Facility

- India announced its decision to join the **Tropical Forest Forever Facility (TFFF) as an 'Observer'** at COP30 in Belém, Brazil.

About: -

- TFFF is a **global finance mechanism launched by Brazil at COP30** to ensure predictable, long-term funding for tropical forest conservation. It covers about 1.2 billion hectares of eligible forests across more than 70 developing countries.
- **Objective:** Provides **performance-based financial support to Tropical Forest Countries (TFCs)** for conserving and restoring tropical and subtropical moist broadleaf forest (TSMBF).
- **Founding members include** Brazil, Colombia, Ghana, the Democratic Republic of Congo, Indonesia, and Malaysia.
- Fundraising: It aims to **mobilise \$25 billion from member countries and attract up to \$100 billion from private investors.**
- **Mechanism:** Money is pooled into the Tropical Forest Investment Fund (TFIF) and invested in clean, fixed-income assets. The investment returns are used to finance annual conservation payments.
- Structure: It operates as an umbrella facility with two complementary parts coordinated by a Secretariat:
- **Tropical Forest Investment Fund (TFIF):** Mobilises and manages resources for forest finance.
- **Tropical Forest Forever Facility:** Oversees reward rules, eligibility, monitoring, and disbursement
- **Institutional Host:** World Bank (WB) acts as interim trustee and host of the TFFF Secretariat.
- **Payment Structure:** Countries receive \$4 per hectare annually for maintaining forest cover. Deductions are made for deforestation and forest fires.
- Indigenous Support: **At least 20% of total funds are earmarked for Indigenous Peoples and Local Communities (IPLCs) engaged** in forest protection.
- **Verification:** A satellite-based monitoring system tracks canopy cover, deforestation and degradation.
- The TFFF complements the objectives of the UNFCCC, CBD, and UNCCD but operates independently of their financial frameworks.

3. Legislations & Initiatives

Traditional Knowledge

Context (DTE | PIB):

- The **Treaty on Intellectual Property (IP), Genetic Resources (GR) and Associated Traditional Knowledge (ATK)** was adopted at the World Intellectual Property Organization (WIPO) meeting in 2024 in Geneva.

About: -

- The treaty was adopted by consensus among more than 150 countries (including India).
- The **non-legally binding treaty** will enter force after 15 parties ratify it.
- Members:** Any member states of WIPO may become party to this treaty
- This is the **27th treaty under WIPO and the first in the last ten years.**
- Negotiations for the Treaty began at WIPO in 2001, initiated in 1999 with a proposal by Colombia.
- It is the **first WIPO treaty with provisions specifically for Indigenous Peoples and Local Communities.**

Key provisions of the Treaty-

Mandatory Patent Disclosure Requirements (PDRs)-

- Mandatory disclosure of Country of Origin:** For any claimed invention involving genetic resources, the applicants must disclose the country of origin or source of the genetic resources.
- Disclosure about IPLC:** In case the patent is based on traditional knowledge, the applicant would also have to disclose the Indigenous Peoples or local community that provided it.
- Mandatory legal, administrative, and/or policy Framework** at national level: To remedy failure to provide PDRs.
- Establishment of information systems:** Such as databases of GRs and associated TK, in consultation with Indigenous Peoples and local communities, and other stakeholders.
- Financial assistance for facilitating participation** of developing countries or countries in transition to a market economy.
- Not applicable on patents filed prior to entry** into force of this treaty.
- Administrative tasks to be performed by International Bureau of WIPO.

Treaty aims to-

- Enhance the efficacy, transparency and quality of the patent system.
- Prevent patents from being granted erroneously for inventions that are not novel.
- Treaty **acknowledged the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)** and its commitments.

UNDRIP: -

- Adopted by the **United Nations General Assembly** in 2007, addressing the human rights of indigenous peoples such as right to maintain, control, protect and develop their TK.
- It is **legally non-binding resolution.**



- **India** supported the resolution.

Concerns raised-

- The final text still does not address the problem of the **biopiracy** of genetic resources and associated traditional knowledge using patents.
- Non-disclosure of traditional knowledge sources in a patent application is **not grounds for revocation**.
- Lack of on-ground implementation can also be a challenge, as **is the case of the Nagoya Protocol** under the Convention on Biological Diversity.

Traditional knowledge (TK):

- Knowledge system held by indigenous communities, often relating to their natural environment like Agriculture, scientific, ecological and medicinal knowledge.
- It helps in biodiversity Conservation.
- 80% of the world's population depends on traditional medicine for its primary health care (WHO).

Key Characteristics of TK

- Preserved and transmitted from generation to generation
- Not static, rather evolves communities respond to new challenges
- Collective/individual in nature

Genetic Resources (GRs):

- Resources that are contained in medicinal plants, agricultural crops, and animal breeds.
- While GRs themselves cannot be directly protected as intellectual property, **inventions developed using them can be protected** through a patent.

Traditional Knowledge Digital Library (TKDL)

- TKDL, first of its kind globally, is a database of Indian traditional knowledge established in 2001, **by Council of Scientific and Industrial Research (CSIR) and Ministry of AYUSH**.
- It contains information related to Ayurveda, Unani, Siddha, Sowa Rigpa, and Yoga in five international languages (English, German, French, Japanese and Spanish).
- It seeks to prevent misappropriation of country's traditional medicinal knowledge through patenting worldwide.

Global Centre on Traditional Medicines

- Traditional medicine is often contrasted with Evidence based medicine.
- The 2018 Declaration of Astana on primary health care acknowledges the need to include traditional medicine knowledge and technologies in the delivery of primary health care.
- **In 2023, India signed a five-year agreement to assist WHO's Traditional, Complementary and Integrative Medicine (TCI) unit.**
- **Global Centre on Traditional Medicines in Jamnagar, Gujarat, established by the WHO,** is the first and largest traditional medicine outpost in any developing country.

The Protection of Plant Varieties and Farmer's Rights Act, 2001:

- Protects farmers' and breeders' rights to plant varieties, acknowledging their roles in conservation and improvement.

Biological Diversity Act, 2002:

- Fair and equitable sharing of the benefits arising out of the use of biological resources and knowledge

Forest Rights Act 2006:

- Provides for Community rights over forest resources and traditional practices.

Heatwave

Context: -

- Recently, over 37 cities in the northern and central regions experienced temperatures exceeding 45°C, posing severe risks to millions of vulnerable people

About: -

- Heatwaves are a period of unusually high temperatures as compared to what is normally expected over a region.
- Therefore, the temperatures at which Heatwaves are declared differ from place to place based on the temperature, and climatology of that region.

Factors contributing to Heatwave:

- Anti-cyclone conditions
- Hot dry air
- Cloudless sky
- Absence of moisture in upper atmosphere

Causes of Heat Waves: -

- Heatwaves are caused due to shifting of Jet Streams (Rossby Waves; cause Heat Domes), hot local winds like loo (affects Gangetic Plains Region), and anthropogenic causes like global warming.
- Urbanisation aggravates heat waves in the form of Urban Heat Islands.

Criterion for Declaring Heatwave-

- Heatwave is considered if the maximum temperature of a station reaches at least 40°C or more for Plains and at least 30°C or more for Hilly regions.

Based on Departure from Normal-

- Heat Wave: Departure from normal is 4.5°C to 6.4°C.
- Severe Heat Wave: Departure from normal is >6.4°C.

Based on Actual Maximum Temperature-

- Heat Wave: When actual maximum temperature $\geq 45^\circ\text{C}$.
- Severe Heat Wave: When actual maximum temperature $\geq 47^\circ\text{C}$.

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

Criteria for Heatwave for Coastal Conditions-

- When the maximum temperature departure is 4.5°C or more from normal, a Heatwave may be described, provided the actual maximum temperature is 37°C or more.

Effects of Heatwave-

- Sunstroke** (results in body temperature $>40^\circ\text{C}$) and vital organ failure: In 2015, 2,300 people died in India due to heat waves. A record heatwave in July 2021 killed 500 people in western Canada.
- Reduced human output**: This happens due to adverse effects on mental health (the body works best in a narrow range of body temperature — 36-37.5°C).

Initiatives taken to mitigate heat waves: -

National Guidelines on Heat Wave Management:

- **Developed by NDMA** to guide states and other stake holders on heat wave management.

Action taken by IMD-

- **Early Warning System and inter agency co-ordination:** IMD Communicate Heatwave alerts/warnings promptly.
- **Heat Action Plans:** Started by **IMD in collaboration with NDMA** and local health departments in around 23 states that are prone to heat waves.
- **Rescheduling Working hours:** Centre has issued advisory to states to reschedule the working hours for workers and labourers across sectors to save them from health hazards.

IMD colour-coded warnings for Heatwave-

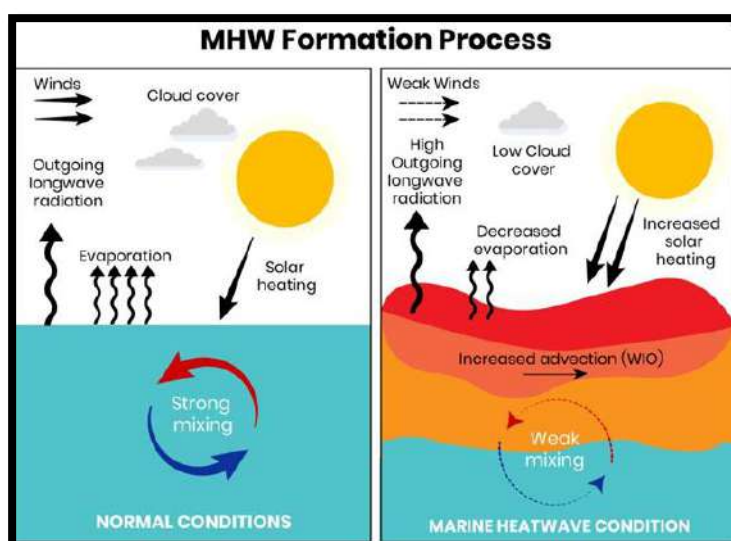
Colour Code	Alert	Warning	Impact	Suggested Actions
Green (No action)	Normal Day	Maximum temperatures are near normal	Comfortable temperature. No cautionary action required.	Nil
Yellow Alert (Be updated)	Heat Alert	Heat wave conditions at isolated pockets persists on 2 days	Moderate temperature. Heat is tolerable for general public but moderate health concern for vulnerable people e.g. infants, elderly, people with chronic diseases	(a) Avoid heat exposure. (b) Wear lightweight, light-coloured, loose, cotton clothes. (c) Cover your head: Use a cloth, hat or umbrella
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.	(b) Avoid heat exposure— keep cool. Avoid dehydration. (b) Drink sufficient water- even if not thirsty. (c) Use ORS, homemade drinks like lassi, torani (rice water), lemon water, buttermilk, etc. to keep yourself hydrated

Marine Heatwaves (MHW):

- It is defined when seawater temperatures exceed a seasonally-varying threshold (usually the 90th percentile) for at least 5 consecutive days.
- MHWs have increased by up to four-fold in the tropical Indian Ocean, aided by rapid warming in the Indian Ocean and strong El Niños.

Heatwave is not notified disaster in India:

- States have **put the demand of including heatwaves as a notified disaster** before the last three Finance Commissions.



However, the Finance Commissions have not entirely been convinced.

- As per the 15th Finance Commission, the existing list of notified disasters “covers the needs of the states to a large extent” and did not find merit in the request to include heatwaves.
- It, however, endorsed an enabling provision created by the preceding Commission that allowed states to utilise a part of the SDRF money, i.e., up to 10%, for “local disasters” such as lightning or heatwaves, which states could notify on their own.
- Using this new enabling provision, at least four states, Haryana, Uttar Pradesh, Odisha, and Kerala, have added heatwaves as local disasters.
- The government has to provide monetary compensation, i.e., Rs 4 lakh, for every life lost because of a disaster that is in the notified list.

Heat action plan: -

- Odisha first developed a Heat Action Plan in 1999 following more than 2,000 Heat Wave deaths in 1998.
- Followed by this, the first city level Action Plan was developed by Ahmedabad in 2013 following severe Heat Wave in 2010.
- The National Disaster Management Authority and IMD are reported to be working with 23 States to develop HAPs.
- There is no centralised database on HAPs, but at least 23 HAPs exist at the State and city level, with a few States, such as Odisha and Maharashtra, laying out district-level HAPs.

India Meteorological Department (IMD)

- It was established in 1875.
- It is an agency of the Ministry of Earth Sciences of the Government of India.
- It is the principal agency responsible for meteorological observations, weather forecasting and seismology.
- IMD is also one of the six Regional Specialized Meteorological Centres of the World Meteorological Organization.

Nor 'Westers

Context: -

- India is working to develop its first research testbed to study Nor 'westers.

About: -

- Aim to study thunderstorms from the formation stage, growth, and propagation over eastern parts of the country covering a large area adjoining West Bengal, Odisha, and Jharkhand.
- Control centre will be at Chandbali in Odisha's Bhadrak district (near Bhubaneswar).
- Agencies involved are India Meteorological Department (IMD), Indian Institute of Tropical Meteorology (IITM), Pune, and the National Centre for Medium-Range Weather Forecasting (NCMRWF), Delhi, will jointly develop and use this facility.

What are Nor 'westers?

- Nor'westers are called so because they are thunderstorms that travel from the northwest to southeast.
- They are local winds that affect the east and northeast regions of India every summer.
- They cause thunderstorms in the region.
- In Bengal, it is locally known as “Kalbaishaki” meaning, calamity in the month of Baisakh (the first month in the Bengal calendar). Whereas, in Assam, they are known as “Bardoli Chheerha”.
- **Negative influence:** They are notorious in nature and lead to destructive tornadoes, causing uprooting of trees and loss of property.

- **Positive influence:** However, they are extremely helpful for pre-kharif crops like jute, tea, paddy, and a large number of vegetables and fruits. Also, a sudden drop in temperature gives relief after unbearable mid-day heat.

Other Local Winds: -

Other Local winds and their socio-economic influence		
Name	Description	Influence
Loo	They are hot, dry winds blowing throughout the daytime in north and western India during the month of May and June . They are developed due to formation of the Monsoon Low Pressure Trough in northern India.	• Negative influence: These winds cause loss of life due to dehydration. • Positive influence: It facilitates the process of separating the chaff from the grain. There is also decline in number of insect-borne disease like malaria due to decrease in mosquito population.
Aandhi	Also known as ' Kali Aandhi ', they are strong dust storms observed over north-western and Central India before monsoon .	They can cause destruction of life and property as well as add to the pollution of cities like Delhi .
Mango showers	They are pre-monsoon local rain-carrying winds which cause early showers along coastal Karnataka and Kerala .	They aid in early ripening of Mangoes , thus locally called Mango showers.
Blossom showers	They are pre-monsoon showers in late-summer in Kerala and adjacent areas.	They aid in blossoming of coffee flowers , having high commercial importance for the state.
Elephanta	They are strong southerly and south westerly winds blowing along the Malabar coast of India post-monsoon in the months of September and October .	They mark the end of southwest monsoon .

Decline in Ozone-Depleting HCFCs

Context: -

- A recent study published in Nature Climate Change reports a significant decrease in atmospheric concentrations of hydrochlorofluorocarbons (HCFCs).

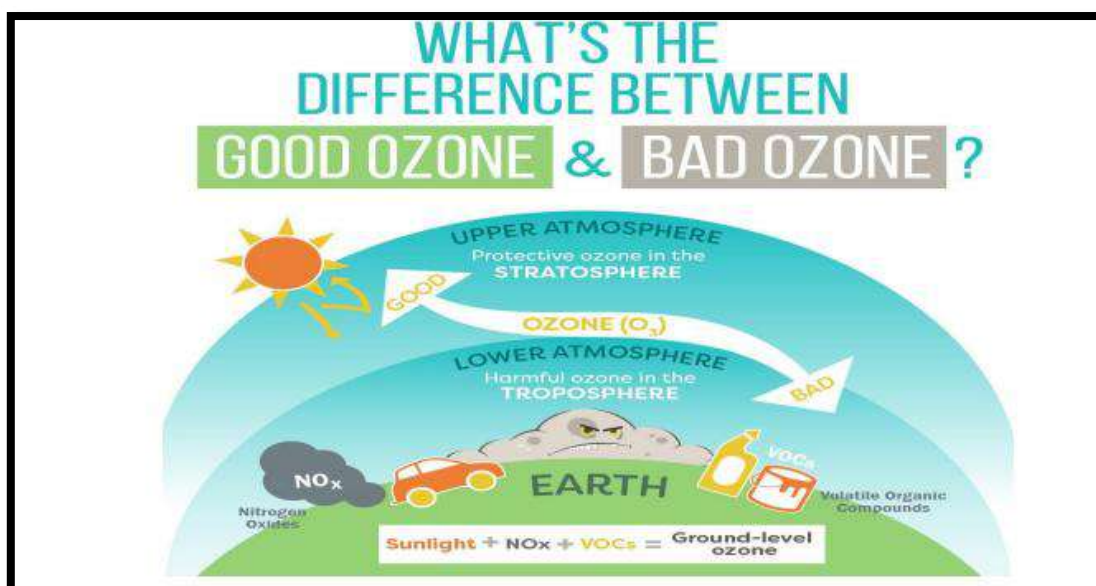
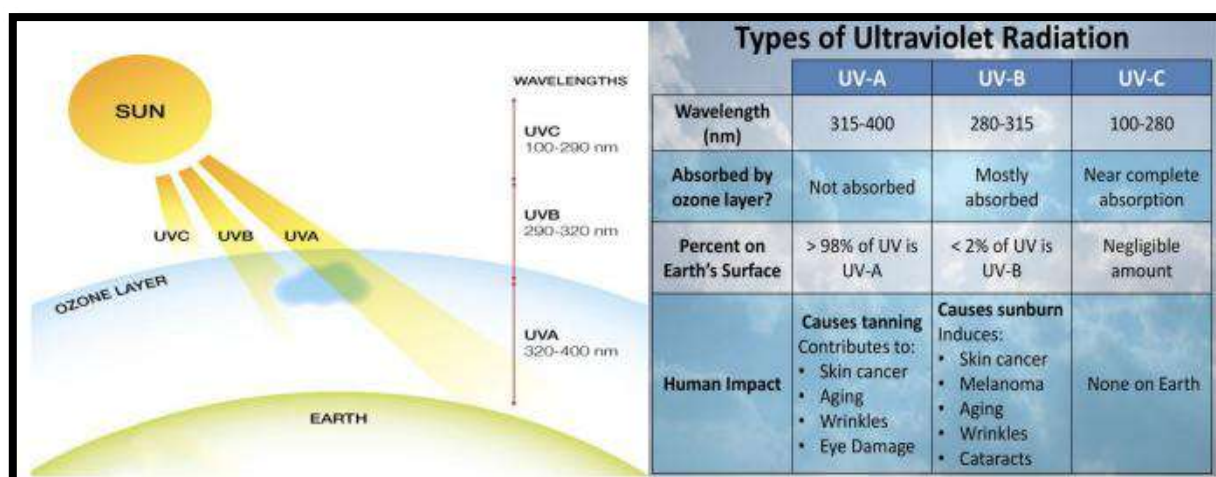
About: -

- HCFCs are potent ozone-depleting substances, and the decline was achieved five years earlier than targeted, attributed to the successful implementation of control measures.
- The **research credits the Montreal Protocol and its amendments** for the successful reduction in HCFC emissions and endorses multilateral commitments to combat ozone depletion and climate change.
- The study projects HCFCs will return to 1980 levels by 2082 for radiative forcing and 2087 for EECL.
- Hydrofluorocarbons (HFCs), which have largely replaced HCFCs, are now **also facing restrictions under the 2016 Kigali Amendment to the Montreal Protocol**.

What is Ozone Layer?

- A layer of Ozone gas in the **stratosphere** (between 15 and 50 km).
- Almost 90% of ozone is in the stratosphere.
- Ozone (O₃) is a molecule made up of three atoms of oxygen (O).
- It protects the Earth's surface from the Sun's harmful ultraviolet (UV) radiation. So, ozone is crucial for life on Earth.

- If the ozone layer weakens, increases the penetration of UV rays leading to sunburns, skin cancer, cataracts, reduced crop yields etc



Ozone Layer Depletion and Ozone Hole

- Ozone molecules are constantly formed and destroyed in the **stratosphere**.
- Without any intervention, the amount of ozone in the ozone layer should remain constant over time.
- But if more ozone molecules get destroyed than formed, then the earth's ozone layer gradually thins and it is called ozone layer depletion.
- Ozone hole is an area where ozone levels drop below the historical threshold of 220 Dobson Units (DU is the measure of ozone concentrations).
- Causes of ozone depletion can be natural and anthropogenic.

Causes of ozone layer depletion are: -

Anthropogenic Causes of Ozone Hole:

Ozone Depleting Substances (ODS):

- They release chlorine and bromine atoms on exposure to UV rays.
- The chlorine and bromine atoms come in contact with ozone and destroy the ozone molecules.
- Chlorofluorocarbons (CFCs) are the most abundant ozone-depleting substance.

- Nitrogenous Compounds such as NO₂, NO, and N₂O deplete the ozone layer.

ODS	Sources
Chlorofluorocarbons (CFCs)	Refrigerators, Air-conditioners, Solvents, Dry-cleaning agents, etc.
Halons	Fire-extinguishers
Carbon tetrachloride	Solvents & Fire extinguishers
Methyl chloroform	Aerosols & Adhesives
Hydrochlorofluorocarbons (HCFCs)	Air-conditioners, Solvents & Fire extinguishers

Natural Causes

- Certain natural processes such as **sunspots and stratospheric winds** also destroy ozone.
- During periods of increased solar activity, more UV radiation reaches the Earth, which can lead to ozone depletion in the stratosphere.
- **Volcanic eruptions** can release large amounts of sulphur dioxide (SO₂) and water vapour. These substances can reach the stratosphere and cause ozone depletion by forming sulphate aerosols.
- Strong stratospheric winds can create a vortex and prevent it from mixing with surrounding air.
- Ozone holes are created since ozone within the vortex is isolated and not replenished.

Unregulated Rocket Launches: they may result in much more depletion of the ozone than the CFCs do.

National & International Measures to Regulate Ozone Depleting Substances -

Vienna Convention for the Protection of the Ozone Layer

- The Vienna Convention for the Protection of the Ozone Layer (Vienna Convention) was agreed in 1985.
- It established global monitoring and reporting on ozone depletion.
- It also created a framework for the development of protocols for taking more binding action.

Montreal Protocol

- **Also called:** Montreal Protocol on Substances that Deplete the Ozone Layer
- It is a protocol to Vienna Convention for the Protection of Ozone Layer
- It is an international treaty
- It aims to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion.
- **Came into force in 1989**
- Ratifies: 197 (Universal treaty)
- **India became a party** to the Montreal Protocol on Substances that Deplete the Ozone Layer **in June 1992**
- Due to its widespread adoption and implementation, it has been hailed as an example of exceptional international co-operation
- **It is legally binding**
- As a result of the international agreement, the **ozone hole in Antarctica is slowly recovering**. Climate projections indicate that the ozone layer will return to 1980 levels between 2050 and 2070. so, it can be termed as a successful treaty.

What it does?

- The treaty is structured around several groups of halogenated hydrocarbons that have been shown to play a role in ozone depletion. All of these ozone depleting substances contain either chlorine or bromine (substances containing only fluorine do not harm the ozone layer).
- It aims at **phasing out:**
 - Chlorofluorocarbons

- Hydro chlorofluorocarbons
- Hydro Fluorocarbons are being considered to be included under it (HFCs do not harm Ozone but are harmful as a Greenhouse gas.)

Kigali Amendment to Montreal Protocol 2016

- In the 28th meeting of the Parties (2016) to the Montreal Protocol, negotiators from 197 nations have signed an agreement to amend the Montreal Protocol in Kigali (capital city of Rwanda).
- Kigali Amendment to the Montreal Protocol aims to phase out the use of potent greenhouse gases called hydrofluorocarbons, which are used widely in ACs.
- Unless substituted, ACs alone could cause 0.4 °C of additional warming by the end of the century.
- ACs greatly exacerbate Urban Heat Island effect making cities inhospitable, especially for the poor.
- The parties are expected to reduce the manufacture and use of Hydrofluorocarbons (HFCs) by roughly 80-85% from their respective baselines, till 2045.
- This phase down is expected to arrest the global average temperature rise up to 0.5 °C by 2100.
- It is a legally binding agreement between the signatory parties with non-compliance measures.
- It came into effect from 1st January 2019

DEAL TO CURB USE OF HFCs

WHY IT WAS NEEDED

- HFCs, climate-damaging refrigerants, are used in air-conditioning, refrigeration, foams and aerosols as replacement for many ozone-depleting substances (ODS)
- ODS are being phased out under the Montreal Protocol (MP) of 1987
- Phasing out ODS is important to protect the stratospheric ozone layer
- Stratospheric ozone layer filters out harmful ultraviolet radiation, which is associated with increased prevalence of skin cancer and cataracts
- HFC is not ODS, but its global warming potential is thousands of times that of carbon dioxide
- So, the global community wanted the use of HFCs also to be curbed under MP
- Agreement in Kigali is meant to amend the MP to bring the HFCs' phase-down within its ambit

197 Parties (196 countries plus EU) agreed to the deal in Kigali, Rwanda

WHAT IS AGREED

- Agreed to an amendment to include HFCs' phase-down under MP (Unlike Paris Agreement, MP is legally binding)
- It entered into force from Jan 1, 2019
- Creates three categories of countries with different schedules and timetables for reduction

- 1 Developed countries led by the US, Japan and West European nations.
- 2 Developing countries like China, South Africa, Brazil among others.
- 3 Developing countries like India, Iran, Iraq, Pakistan among others.

HFCs' PHASE DOWN SCHEDULES

Category	Baseline	Freezing	Max % reduction
1	2011-13	2019	85% by 2036
2	2020-22	2024	80% by 2045
3	2024-26	2028	85% by 2047

→ Freezing year is the year when use of HFCs will peak before being rapidly scaled down and finally phased out altogether

→ Baseline years are the years for which the average production/consumption quantity of HFCs is taken as the upper limit—so it serves as a level

Hydrofluorocarbons (HFCs)

- Hydrofluorocarbons (HFCs) are used since as an alternative to CFCs and HCFCs.
- HFCs do not contribute to ozone depletion.
- However, they are potent greenhouse gases with high global warming potential.

HFO Alternatives to HFCs

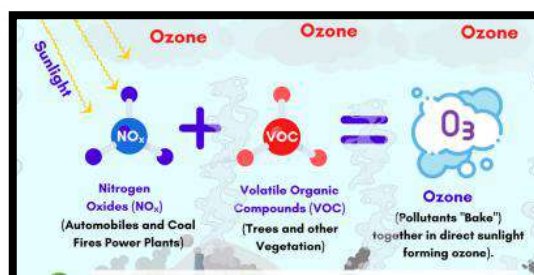
- HFO stands for hydrofluoro olefin.
- HFO refrigerants are composed of hydrogen, fluorine and carbon atoms, but contain at least one double bond between the carbon atom

Ozone Depleting Substances (ODS) Rules

- Rules are framed under the jurisdiction of Environment (Protection) Act.
- These Rules set the deadlines for phasing out of various ODSs, besides regulating production, trade import and export of ODSs and the product containing ODS.

Ozone Pollution

- Ozone (O₃) forms less than 0.00005% by volume of the atmosphere and is unevenly distributed.
- Ozone is formed naturally in the stratosphere (good ozone – formed due to the interaction between O₂ and UV light) and absorbs harmful ultraviolet rays of the sun.
- However, at the ground level (bad ozone), it is a pollutant (greenhouse gas) with highly toxic effects.



- **Ground level (tropospheric)** ozone is not emitted directly into the air.
- Some of it is transported from the **stratosphere**.
- The rest is formed when the pollutants like carbon monoxide, nitrogen dioxide and **volatile organic compounds** (VOC – oil & gas extraction) react in the presence of sunlight at the ground level and convert O₂ to O₃.
- Ozone is most likely to reach unhealthy levels on hot sunny days.
- It can also be transported long distances by wind, so even rural areas can experience high O₃ levels.

Impacts of Ozone Pollution

- Surface level Ozone causes damage to crops and forests.
- Irritation can occur in the respiratory system giving rise to coughs and an uncomfortable sensation in the chest.
- Ozone worsens bronchitis, emphysema, asthma, etc and increases the risk and susceptibility to pulmonary inflammation like Chronic Obstructive Pulmonary Disease (COPD).
- It may reduce lung function and make breathing difficult.

Gross Environment Product Index

Context: -

- **Uttarakhand** has become the first Indian state to launch a Gross Environment Product Index (GEPI).

About: -

- It assigns monetary values to its natural resources, including air, water, forest, and soil and **termed it as the Gross Environment Product**.
- It is a **component of Green GDP** and is considered as the product and service value that the ecosystem provides for human welfare and economic and social sustainable development, including provisioning, regulating and cultural ecosystem services.
- GEPI is a **novel method to evaluate ecological development caused by human interventions**.

Significance:

- Help assess the impact of anthropological pressure on our ecosystem and natural resources.
- Also calculates what we put back into the environment.
- Quantifies contributions of natural ecosystems to the economy and overall welfare.

EU Nature Restoration Law

Context: -

- Recently, the EU Nature Restoration Law came into force.

About: -

- EU's first continent-wide legislation for nature restoration.
- Aim: **Restore 20% of degraded ecosystems by 2030 and all by 2050**.
- Requires Member States to prepare National Restoration Plans by 1 September 2026.
- Prioritizes conservation of Natura 2000 network areas.
- Natura 2000 is a network of protected areas in EU.

Legally binding targets:

- Restore 30% of terrestrial, coastal, freshwater, drained peatlands, and marine ecosystems by 2030.
- Restore 25,000 km of rivers to free-flowing status.
- Plant three billion additional trees by 2030.

CDRI

Context: -

- On 5th Anniversary occasion, **CDRI announced a \$2.5 million fund under Urban Infrastructure Resilience Programme (UIRP)** to enhance climate resilience of cities in 30 low and middle-income countries including India.

About: -

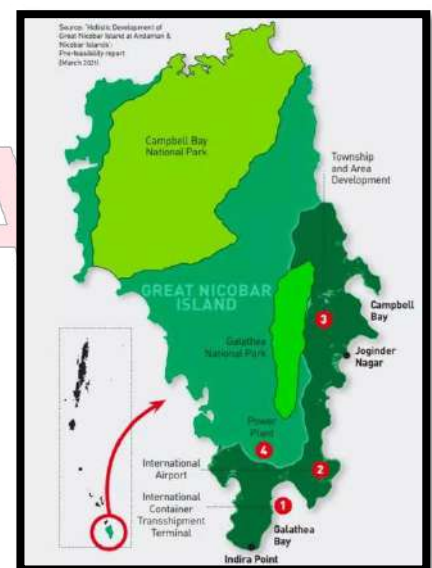
- It is a **multi-stakeholder global partnership** of national governments, UN agencies and programmes, multilateral development banks and financing mechanisms, private sector, and academic and knowledge institutions.
- Since its inception, **31 countries, 6 international organisations and 2 private sector organisations have joined CDRI as members.**
- It was **launched by India's PM at UN Climate Action Summit 2019.**
- It is the Government of **India's second major global initiative** after the International Solar Alliance, and it demonstrates India's leadership in climate change and disaster resilience issues.
- Purpose:** It aims to promote the resilience of new and existing infrastructure systems to climate and disaster risks, thereby ensuring sustainable development.
- Governing Council:** The Governing Council is the highest policy-making body of the CDRI. ***It is co-chaired by India and a representative of another nation, nominated by rotation every two years.***
- Funding:** A large share of the fund over the first five years has been invested by India. There are **no obligations on the part of members to make financial contributions to CDRI.** However, at any point, members of the CDRI may make voluntary contributions.
- Secretariat: New Delhi, India.**
- Recently, Union Cabinet approves **categorizing the Coalition for Disaster Resilient Infrastructure (CDRI) as an "International Organization".**
- Report: - Global Infrastructure Resilience**

Great Nicobar Project

- The Great Nicobar Project, with potential to **become a strategic connectivity hub**, is criticised for endangering indigenous rights, biodiversity, and legal safeguards.

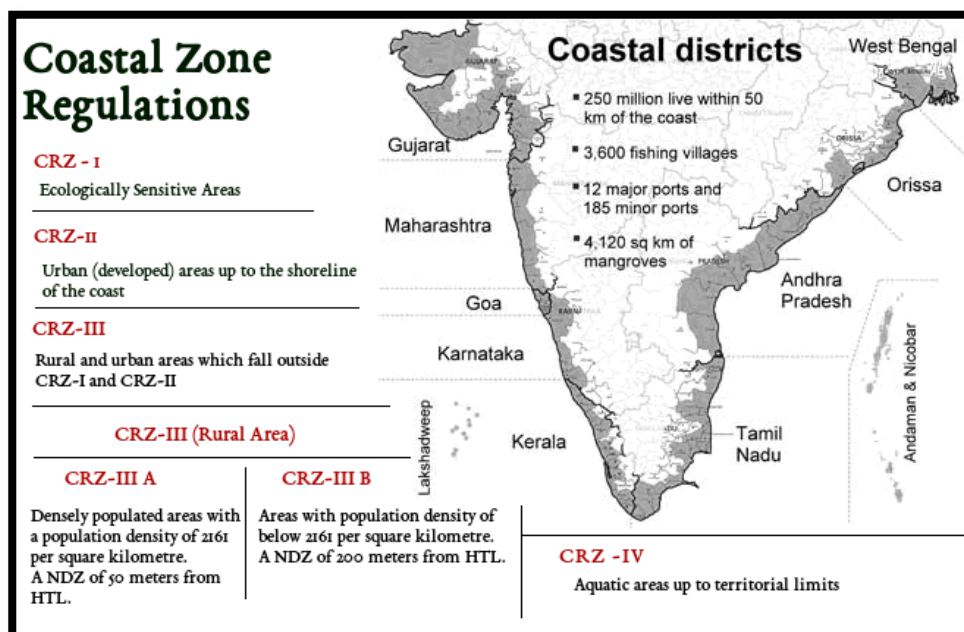
Under the project, a greenfield city has been proposed which includes four components:

- International Container Transshipment Terminal (ICTT) at Galathea Bay
- A greenfield international airport
- A gas and solar power plant
- A township
- Extent:** Spans 16,610 hectares, including 84 sq. km denotified Shompen & Nicobarese tribal reserves.
- Implementation:** Conceived by **NITI Aayog**, executed by ANIIDCO (Andaman and Nicobar Islands Integrated Development Corporation Limited) through a phased 30-year plan.
- The **Great Nicobar Island was declared a Biosphere Reserve in 1989 and included in UNESCO's Man and Biosphere Programme in 2013.**
- The project area is **part of Coastal Regulation Zones-IA and IB.**



Coastal Regulation Zones (CRZ)

- CRZ are coastal areas that are **regulated to protect the fragile ecosystems, biodiversity, and livelihoods of coastal communities.**
- The CRZ rules were first introduced in 1991 under the **Environmental Protection Act, 1986.**



Green India Mission

- Centre released a revised **roadmap for the National Mission for Green India, also known as the Green India Mission (GIM).** In addition to the core objective of GIM, the **revised mission** will focus on restoration in the Aravalli ranges, Western Ghats, Himalayas and mangroves.

About: -

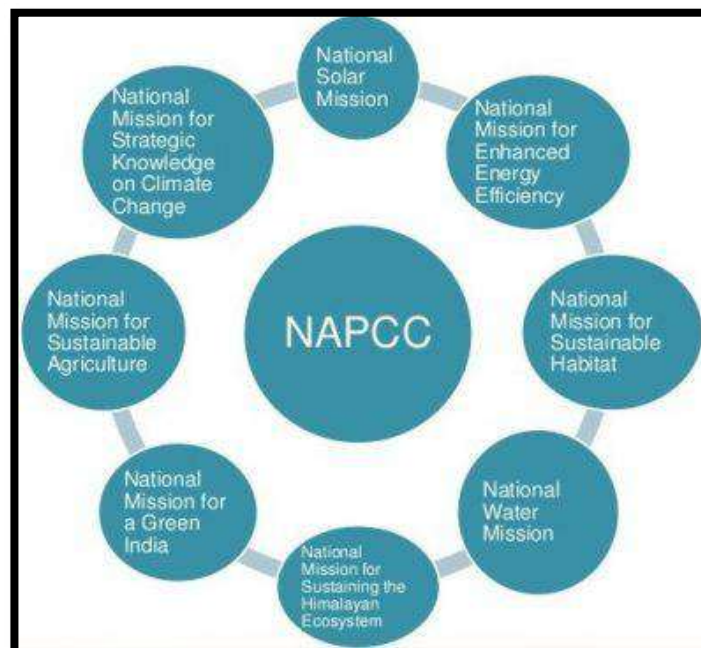
- Launched in 2014 as **one of the eight missions under India's National Action Plan on Climate Change (NAPCC).**
- Its core aim is to **combat climate change by increasing forest and tree cover**, as well as the ecological restoration of degraded ecosystems and forests.
- Nodal Ministry:** Ministry of Environment, Forest and Climate Change (MoEFCC).
- Objective: Increase forest and tree cover and enhance ecosystem services, while strengthening climate resilience.

Revised Roadmap:

- Time Period:** 10 years (2021-30) of revised roadmap.
- Creation of an **additional carbon sink of 2.5 to 3.0 billion tonnes of CO2 equivalent by 2030.**
- Funding:** Mission costs will be met **partly** from the budget under the ongoing Green India Mission scheme and balance from funds available under the National Fund of **Compensatory Afforestation Fund Management and Planning Authority (CAMPA).**
- Implementation:** Joint Forest Management Committees, with further management & coordination vested with Forest Development Agencies, State Forest Development Agencies & Mission Directorate.
- The Mission **would follow a 'Bottom-up' model** to strengthen the decentralized governance and management of its interventions.
- Encourages convergence** with CAMPA, MGNREGA, National Afforestation Programme.

CAMPA

- SC established CAMPA in 2002 as the **National Advisory Council** for monitoring, technical assistance and evaluation of compensatory afforestation activities and **administering Compensatory Afforestation Fund (CAF)**.
- CAMPA promotes afforestation and regeneration activities **to compensate for forest land diverted to non-forest uses**.
- **According to the Forest (Conservation) Act 1980, the project that wishes to divert the land must identify** land elsewhere to afforest and pay the land value for the afforestation exercise.



Compensatory Afforestation Fund

- The centre **passed the CAF Act in 2016, and the rules were notified in 2018**.
- The **National CAF under the Public Account of India** and the State CAF under the Public Account of each state were created.
- The CAF Act was enacted to manage the funds collected for compensatory afforestation, driven by the ad hoc CAMPA.
- **90% of the CAF money will be given to the states**, while the Centre will retain 10%.

The funds can be used for

- Treatment of catchment areas,
- Assisted natural generation,
- Forest management,
- Wildlife protection and management,
- Relocation of villages from protected areas,
- Managing human-wildlife conflicts,
- Training and awareness generation,
- Supply of wood-saving devices and allied activities.

Compensatory afforestation:

- Whenever Forest land is diverted for non-forest purposes such as mining or industry, the **user agency pays for planting forests over an equal area of non-forest land**, or when such land is unavailable, **twice** the area of degraded forest land.

Environment Audit Rules 2025

- MoEFCC introduced **Environment Audit Rules 2025** to address compliance gaps and enhance trust-based governance.

About: -

- **Objective:** To align with emerging instruments like the **Green Credit Program, Eco-mark Certification, and Extended Producer Responsibility**.

What is Environmental Audit (EA)?

- It differs from Environmental Impact Assessment, which is done before a project starts.

- EA is done to verify whether ongoing activities follow the approved Environmental Management Plan (EMP).
- In India, EA began in 1992 **under Environment (Protection) Rules, 1986**

Environment Audit Rules 2025:

- The rules **establish Environment Audit Designated Agency (Notified by MoEFCC)** for certification and registration of Environmental Auditors based on qualifications, experience, or a national examination.
- **Auditing:** Only Registered Environmental Auditors (REAs), who are randomly assigned projects for independence, can conduct audits, check compliance, and verify Green Credit obligations.
- Oversight: A **new MoEFCC Steering Committee over sees implementation** and addresses challenges.
- **Regulators:** CPCB, SPCBs, and MoEFCC regional offices continue inspections and monitoring support.

Environment Protection and Management of Contaminated Sites Rules, 2025

- MoEFCC notified Environment Protection (Management of Contaminated Sites) Rules, 2025.

About: -

- Codifies the identification, assessment, and clean-up of chemically contaminated sites **under the Environment (Protection) Act, 1986**.
- **Objective:** To provide a legal framework for identifying, assessing, and remediating chemically contaminated sites across India.

Tiered Assessment Process:

- **Conducted by State Pollution Control Board** or designated agency **within 90 days**.
- **Detailed Survey:** Completed within the next 90 days to assess contamination by hazardous chemicals as per Hazardous Waste Rules, 2016.
- **Polluter Pays Principle:** Clean-up is the polluter's responsibility; if defunct or unable to pay, the Centre and States will intervene.
- **Exclusions:** Radioactive contamination, mining waste, oil pollution at sea, or municipal solid waste from dumpsites.

EPR Framework for Non-Ferrous Metals

- MoEFCC notified Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2025, **introducing an Extended Producer Responsibility (EPR) Framework for nonferrous metals**, including aluminium, zinc, copper.
- **Applicability:** Producers, importers, recyclers, refurbishes, and bulk users handling notified non-ferrous metal products.

Greenhouse Gas Emissions Intensity (GEI)

- MoEFCC notified the **Greenhouse Gas Emission Intensity (GEI) Target Rules, 2025**, establishing India's **first legally binding framework** for industrial emission reductions.

About: -

- GEI refers to the **quantity of greenhouse gases (GHGs) emitted per unit of product output, such as per tonne of cement or aluminium, expressed in tonnes of CO₂ equivalent (tCO₂e)**, accounting for global warming potential of each GHG.
- **Includes** CO₂, CH₄, N₂O, O₃, water vapour and synthetic gases like CFCs and HCFCs.

GEI Target Rules, 2025

- The GEI Target Rules are a **set of legally binding mandates** for carbon-intensive industries to reduce greenhouse gas emissions per unit of output.
- Applicability: 282 industrial units across 4 sectors – Aluminium, Cement, Pulp and Paper, & Chlor-alkali.
- **Compliance Cycle:** First phase spans FY 2025-26 and 2026-27, with sector-specific targets based on the 2023-24 baseline.

Carbon Credit Trading Scheme, 2023

- It is an **initiative by the Ministry of Power** for implementation of carbon trading mechanism in India.
- Under this, carbon credit certificates are **issued by the Bureau of Energy Efficiency (BEE) to entities that surpass their emission reduction targets.**
- Launched by Ministry of Power **under Energy Conservation (Amendment) Act, 2022.**
- **Trading Platform: Grid Controller will maintain the registry.**
- **Central Electricity Regulatory Commission** will regulate trading & register power exchanges.
- The Ministry of Power notifies **obligated entities based on recommendations from the BEE.**
- **Emission intensity targets are set by the Ministry of Environment, Forest, and Climate Change,** based on recommendations from the Ministry of Power.
- Entities failing to meet their targets must purchase carbon credit certificates.
- The scheme is **overseen by a National Steering Committee chaired by the Power Secretary.**
- **Market Divided into-** Compliance segment and Voluntary segment.
- **Credit Mechanism:** Units meeting their reduction targets earn tradable carbon credits, while non-compliant units must buy credits or pay environmental compensation.
- The **environmental compensation is set at twice** the average trading price of carbon credits.
- **Institutional Oversight:** The Bureau of Energy Efficiency (BEE) issues credits, and the Central Pollution Control Board (CPCB) monitors compliance and enforces penalties within 90 days.

PAT vs. Emissions Trading

Aspect	PAT (Perform, Achieve, and Trade)	Emissions Trading (Cap and Trade)
Definition	A regulatory instrument to reduce specific energy consumption in energy-intensive industries , with a market-based mechanism for trading excess energy savings (The Bureau of Energy Efficiency).	A system where total emissions are capped, and entities can trade emission permits to encourage cost-effective pollution reduction.
Objective	Reduce energy consumption in energy-intensive industries through a market-based trading system for excess energy savings.	Set absolute emission caps to incentivize pollution reduction.
Focus	Relative energy efficiency: no cap on total energy used.	Absolute emission ceilings; no relative standards.
Mechanism	Firms meet energy efficiency standards; successful firms earn tradeable credits. Initiated in 2012 as part of the National Action Plan on Climate Change, by the Ministry of Power as a market-based mechanism to enhance energy efficiency.	Polluters are assigned emission limits; economic incentives drive reductions.

Dumpsite Remediation Accelerator Programme

- MoHUA launched Dumpsite Remediation Accelerator Programme (DRAP) under Swachh Bharat Mission–Urban (SBM-U 2.0) to fast-track the remediation of legacy waste dumpsites.
- The initiative aligns with the **government's 'Lakshya Zero Dumpsites' vision** and Viksit Bharat 2047, aiming for cleaner and more liveable Indian cities.
- Fast-tracked approach for scientific capping, biomining, and **bioremediation of waste to meet the 2026 deadline**

End-of-Life Vehicles Rules, 2025

Context:

- The Ministry of Environment, Forest and Climate Change (MoEF&CC) notified the Environment Protection (End-of-Life Vehicles) Rules, 2025 vide S.O. 98(E) dated 06th January, 2025 for environmentally sound management of end-of-life vehicles.
- **Link for reference:** [Press Release: Press Information Bureau](#)

About:

Statutory and Institutional Framework

- **Notification Date:** Notified by the **Ministry of Environment, Forest and Climate Change (MoEF&CC)** on January 6, 2025.
- **Effective Date:** The rules come into force on **April 1, 2025**.
- **Statutory Backing:** Issued under the **Environment (Protection) Act, 1986**.
- **Nodal Body:** The **Central Pollution Control Board (CPCB)** will manage a centralized online portal for registration and compliance.

Key Concept: Extended Producer Responsibility (EPR)

EPR means the responsibility of a vehicle manufacturer (Producer) for the environmentally sound scrapping of a vehicle after its useful life.

- **EPR Targets:** Producers have mandatory annual targets for scrapping vehicles based on their sales.
- **Calculation of Targets:** Targets are linked to vehicles introduced in the market **20 years ago** for non-transport (private) vehicles and **15 years ago** for transport (commercial) vehicles.
- **EPR Certificates:** Producers can meet their targets by purchasing "EPR Certificates" from **Registered Vehicle Scrapping Facilities (RVSFs)**. These certificates are valid for **5 years**.

What defines an "End-of-Life Vehicle" (ELV)?

A vehicle is classified as an ELV if:

1. It is declared **unfit** by an Automated Testing Station (ATS).
2. Its registration is **cancelled** under the Motor Vehicles Act, 1988.
3. It is **self-declared** as waste by the owner.
4. It is an abandoned/confiscated vehicle as per court orders.

Mandatory Timelines and Compliance:

- **Deposit Deadline:** Once a vehicle becomes an ELV, the owner or Bulk Consumer (entity owning >100 vehicles) must deposit it at an authorized collection center or RVSF within 180 days.
- **Registration:** Producers, RVSFs, and Bulk Consumers must register on the CPCB's centralized portal.
- **Exemptions:** These rules DO NOT apply to:
 - Agricultural machinery (Tractors, Harvesters, Power Tillers).
 - Waste batteries, tires, or e-waste (covered under separate specific rules).

Feature	Vehicle Scrappage Policy (MoRTH)	ELV Rules 2025 (MoEF&CC)
Focus	Fitness-based (Safety & Emissions).	Waste Management & Recycling (EPR).
Incentives	Road tax rebates, registration fee waivers.	Tradable EPR certificates for producers.
Enforcement	Voluntary for private owners (via high fees).	Mandatory for producers to meet targets.

Van Adhiniyam, 1980

- Forest Advisory Committee (FAC) of the Union Environment Ministry has recommended uniform penal provisions for violations of the Van (Sanrakshan Evam Samvardhan) Adhiniyam.

What Constitutes Violation?

- Use of **forest land for non-forestry purposes such as de-reservation**, lease, clear-felling, or construction **without prior central approval**.

Penal Compensatory Afforestation (CA):

- Refers to additional afforestation ordered beyond normal compensatory afforestation for restoring the forest ecosystem lost due to illegal use.

Penal NPV Concept:

- Introduced following SC directions (Aug 2017); allows up to 5× Net Present Value penalty for illegally diverted forest areas. NPV quantifies ecological services lost from deforestation.

Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980

- Earlier called Forest (Conservation) Act, 1980, it was enacted to regulate the diversion of forest land for non-forestry purposes.
- Mandates **prior approval of the Central Government** before any forest land is used for mining, industry, agriculture, or infrastructure.
- The Act provided that **any aggrieved person may file an appeal to the National Green Tribunal against the decision of the State Government or any authority**.
- Empowered the Central Government to **constitute the Forest Advisory Committee (FAC)** to advise the Government regarding forest conservation.

Van (Sanrakshan Evam Samvardhan) Amendment Rules

- MoEFCC notified Van (Sanrakshan Evam Samvardhan) **Amendment Rules 2025**, revising the Forest Conservation Rules 2023.

Highlights of the Amendment:

- Linear Projects:** Centre empowered to define preparatory works post-Stage-I; Stage-I approval validity extended from 2 to 5 years; clearer distinction between in-principle and final approvals.
- Defence Projects:** Offline submissions are now allowed for defence, strategic, and national projects, replacing the previous mandatory online requirement.
- Critical Minerals:** Mining of minerals now requires compensatory afforestation and reduces the minimum land use duration from 20 to 10 years.
- Afforestation Land:** Compensatory afforestation land, earlier mandatorily notified as “protected forest” under the Indian Forest Act 1927, is now optional.
- Enforcement:** Forest officers are empowered to initiate legal action with stricter monitoring and compliance reporting.

AIM4NatuRe

- AIM4NatuRe was **launched on Earth Day 2025 with UK support**, to enhance ecosystem restoration monitoring under the Kunming-Montreal Global Biodiversity Framework (KMGBF).
- AIM4NatuRe (**Accelerating Innovative Monitoring for Nature Restoration**) is a Global Ecosystem Monitoring **Initiative led by Food & Agriculture Organization (FAO)**, as part of its expanded **AIM4Forests Programme**.
- Scope: Covers forests, agricultural lands, grasslands, marine zones and wetlands.
- Duration & Funding: 2025–2028, with US\$9 million funding.

Hong Kong International Convention

- Hong Kong International Convention on safe and environmentally **sound recycling of ships came into force in June 2025.**
- Hong Kong Treaty is a **global treaty under International Maritime Organisation (IMO).**
- Oversees global recycling of end-of-life ships to promote safety and environmental protection through standardized practices.
- Involves **cooperation between** IMO, International Labour Organisation, & Basel Convention for comprehensive regulation.
- **IMO Role:** Oversees the implementation of the convention globally.
- ILO Involvement: Contributes to worker safety standards.
- Basel Convention Link: Aligns with Basel Convention, which regulates the cross-border movement and disposal of hazardous waste.
- Objectives: Minimise workers' health hazards, regulate hazardous materials, such as asbestos and heavy metals, promote safe handling & waste disposal.
- **India is a party to the convention.**
- **Legally binding** to the parties.
- **Requirements:** Ships of 500 gross tonnage (GT) and above must maintain an Inventory of Hazardous Materials (IHM) and are only permitted to be recycled at authorized ship recycling facilities that comply with the convention.

Central Asian Mammal Initiative

- Central Asian Mammals Initiative (CAMI) **adopted its six-year work programme (2026-2032) at the 3rd Range States Meeting in Tashkent, Uzbekistan.**
- The plan spans 2026-2032 and sets conservation goals for 17 Central Asian migratory mammal species.
- Thirteen transboundary regions are designated as crucial for the movement and long-term survival.

About CAMI

- Operates **under the Convention on Migratory Species (CMS)** as a regional platform for conserving migratory mammals in Central Asia.
- **Launched in 2014 at COP11** to the CMS, held in Quito, Ecuador.
- **Objective:** To restore migratory mammal populations through coordinated policies and cross-border cooperation
- Species Coverage: Protects 17 species (up from 15), including the newly added Pallas's cat and Eurasian lynx.
- Key species include Snow Leopard, Saiga Antelope, Chiru, Argali, Bukhara Deer, Wild Camel, etc.

National Camel Sustainability Initiative

- **Ministry of Fisheries, Animal Husbandry and Dairying launched** National Camel Sustainability Initiative.

About: -

- **Multi-ministerial initiative involving the Department of Animal Husbandry & Dairying, the Ministries of Environment, Rural Development, and Tourism,** along with State governments, to conserve the camel population.
- It was **developed in consultation with the Food and Agriculture Organisation (FAO).**
- **Rationale:** India's camel population has declined by over 75% since 1977 (20th Livestock Census).
- **India hosts two types of camels** — single-humped (*Camelus dromedarius*) in Rajasthan and Gujarat, and double-humped (*Camelus bactrianus*) in Ladakh and Nubra Valley.
- Around **90% of India's camels live in Rajasthan and Gujarat** (20th Livestock Census).

Net-Zero Framework for Global Shipping

- **International Maritime Organisation (IMO)** approved the Net-Zero Framework for Global Shipping, the world's 1st ever global carbon tax imposed on the shipping industry.
- India and 62 other countries voted in favour of it.

Key Highlights:

- The policy will be **incorporated under Annex VI** (Prevention of Air Pollution from Ships) of the **International Convention for the Prevention of Pollution from Ships (MARPOL)**.
- **Objective:** Achieve net-zero GHG emissions from **international shipping by or around 2050**.
- **Global Fuel Standard:** Ships must progressively reduce their annual GHG fuel intensity (GFI).
- **GHG fuel intensity (GFI) means** the amount of greenhouse gases emitted per unit of energy consumed.
- **IMO Net-Zero Fund:** A dedicated fund will be established to collect emissions-based contributions, which will be used to support decarbonization efforts across the shipping industry.
- **Implementation Timeline:** Set to be formally adopted in October 2025.
- It will **come into effect in 2027, becoming mandatory for large ocean-going ships over 5,000 gross tonnages, accounting for 85% of international shipping's CO₂ emissions.**

MARPOL

- International **convention to prevent pollution from ships caused by operational or accidental causes.**
- **Adopted at IMO in 1973 and entered into force in 1983.** In 1997, a Protocol was adopted to amend the Convention, and a new Annex VI was added, which came into force in 2005.
- The technical requirements of **MARPOL** are included in 6 separate Annexes, each dealing with a different type of pollution.
- Periodic Amendments are made through the Marine Environment Protection Committee of IMO.

Matri Van Initiative

- **MoEFCC launched Matri Van initiative in Gurugram, Haryana, as part of 'Ek Ped Maa Ke Naam' program.**
- The Ek Ped Maa Ke Naam Programme was launched in 2024 by the MoEFCC to encourage citizens to plant trees in honour of their mothers, linking environmental action with memory.
- Matri Van is an **urban afforestation project to develop a 750-acre theme-based** urban forest in the Aravalli Hill area, along the Gurugram-Faridabad Road.
- **Objective:** To restore the Aravalli ecology, increase green cover & promote biodiversity in Delhi-NCR region.
- Implemented with **active participation from CSR firms, NGOs, MNCs, schools, and government bodies.**
- Focuses on replacing degraded shrubs with long-rotation native tree plantations to rejuvenate landscape.

India's 'Five-point call for Global Action'

- India **presented its 'Five-Point Call for Global Action' at the first Sagarmatha Sambaad in Kathmandu, Nepal.**
- The summit is named after Mt. Everest.
- **Theme:** "Climate Change, Mountains, and the Future of Humanity."

4. Pollution

Graded Response Action Plan (GRAP)

Context: -

- The Commission for Air Quality Management in NCR & Adjoining Areas, **Commission for Air Quality Management (CAQM)** has announced a **revision** in the existing Graded Response Action Plan (GRAP) to combat air pollution in the region.

About: -

- GRAP is an emergency response mechanism based on Delhi's Air Quality Index level.
- It brings together all stakeholders to respond to deteriorating air quality in Delhi-NCR.
- In pursuant to the Supreme Court's order of 2016 in the **matter of M. C. Mehta vs Union of India** regarding air quality in the National Capital Region of Delhi, a Graded Response Action Plan was prepared.
- Till 2020, the Supreme Court-appointed Environment Pollution (Prevention & Control) Authority (**EPCA**) used to order States to implement GRAP measures.
- The GRAP was notified under the Environment (Protection) Act of 1986 in January 2017 by the Ministry of Environment, Forest, and Climate Change.
- The EPCA was **dissolved and replaced by the Commission for Air Quality Management (CAQM) in 2020.**
- From 2021 onwards, the GRAP is being **implemented by the CAQM.**
- Since October 2022, GRAP has been enforced based on the AQI.
- AQI includes pollutants**-PM10, PM2.5, NO2, Ozone, SO2, CO, NH3 and lead (Pb).
- Older version of the GRAP was enforced based only on the concentration of M2.5 and PM10.

GRAP for the NCR has been classified under four different stages of adverse air quality in Delhi: -

Stages	Delhi AQI	Actions
Stage I - 'Poor' Air Quality	201-300	- Strictly enforce NGT / SC's order on over aged diesel / petrol vehicles and as per extant statutes. - Ensure hotels, restaurants and open eateries use only electricity / clean fuel gasbased appliances (Shifted from Stage-II to Stage I) New Additions: Citizen charter: Prefer hybrid vehicles or EVs to control vehicular pollution. - Do not drive/ply end of life/ 10/15 years old Diesel/Petrol vehicles.
Stage II - 'Very Poor' Air Quality	301-400	- Schedule for regulated operations of DG sets across all sectors in the NCR including Industrial, Commercial, Residential and Office establishments etc. New Additions: - Ensure focussed and targeted action on predominant sector(s) contributing to adverse air quality in all identified hotspots in NCR.
Stage III - 'Severe' Air Quality	401-450	NCR State Governments. / GNCTD Action: To impose strict restrictions on plying of BS III petrol and BS IV diesel LMVs (4 wheelers). New Additions: NCR State Governments. / GNCTD may take a decision on discontinuing physical classes in schools for children up to Class V.
Stage IV - 'Severe +' Air Quality	450+	New Additions: - Do not permit LCVs registered outside Delhi, other than EVs / CNG / BS-VI diesel, except those carrying essential commodities / providing essential services. - NCR State Governments/GNCTD may take a decision on discontinuing physical classes even for classes VI – IX, class XI and conduct lessons in an online mode.

CAQM:

- Commission for Air Quality Management in National Capital Region (NCR) and Adjoining Areas (CAQM) was **established by the CAQM Ordinance, 2020 and CAQM, Act 2021.** (Statutory Body)
- Act provides for the constitution of a Commission for better co-ordination, research, identification, and resolution of problems related to air quality in the National Capital Region (NCR) and adjoining areas.

- Adjoining areas have been defined as areas in the states of Haryana, Punjab, Rajasthan, and Uttar Pradesh adjoining the NCR where any source of pollution may cause adverse impact on air quality in the NCR.
- Powers of the Commission will also supersede that of any other body in matters of air pollution

National Air Quality Index

- Launched in 2014 with outline 'One Number – One Color -One Description' for the common man to judge the air quality within his vicinity.
- The **measurement of air quality is based on eight pollutants**, namely: Particulate Matter (PM10), Particulate Matter (PM2.5), Nitrogen Dioxide (NO₂), Sulphur Dioxide (SO₂), Carbon Monoxide (CO), Ozone (O₃), **Ammonia (NH₃), and Lead (Pb)**.
- AQI has six categories of air quality. These are: Good, Satisfactory, Moderately Polluted, Poor, Very Poor and Severe.
- It has been **developed by the CPCB in consultation with IIT-Kanpur** and an expert group comprising medical and air-quality professionals.



SAFAR

- SAFAR **stands for System of Air Quality and Weather Forecasting and Research**
- It is launched in greater metropolitan cities of India to provide location specific information on air quality in near real time
- It has been combined with the early warning system on weather parameters
- The ultimate objective of the project is to increase awareness among general public regarding the air quality in their city well in advance so that appropriate mitigation measures and systematic action can be taken up for betterment of air quality and related health issues.
- SAFAR was **introduced by the Ministry of Earth Sciences (MoES), developed indigenously by Indian Institute of Tropical Meteorology (IITM), Pune and operationalized by India Meteorological Department (IMD)**.
- **Pollutants monitored:** PM1, PM2.5, PM10, Ozone, CO, NO_x (NO, NO₂), SO₂, BC, Methane (CH₄), non-methane hydrocarbons (NMHC), VOC's, Benzene, Mercury.
- **Monitored Meteorological Parameters:** UV Radiation, Rainfall, Temperature, Humidity, Wind speed, Wind direction, solar radiation

Central Pollution Control Board

- CPCB of India is a **statutory organisation under the Ministry of Environment, Forest and Climate Change (MoEF&CC)**.
- It was **established in 1974 under the Water (Prevention and Control of pollution) Act, 1974**.
- CPCB is also entrusted with the powers and functions under the Air (Prevention and Control of Pollution) Act, 1981.
- It serves as a field formation and also provides technical services to the Ministry of Environment and Forests under the provisions of the Environment (Protection) Act, 1986.
- It Co-ordinates the activities of the State Pollution Control Boards by providing technical assistance and guidance and also resolves disputes among them.

Continuous ambient air quality monitoring system (CAAQMS)

- **Commissioned by Indian Army at its Eastern Command** Headquarters in Fort William Military Station, Kolkata, West Bengal.
- To monitor ambient air quality on real-time basis.

Recent Supreme Court decision:

- Pollution Control Boards can **impose environmental compensation for past damages and demand bank guarantees to prevent future harm.**
- PCBs can impose penalties under Section 33A of Water Act, 1974 and Section 31A of the Air Act, 1981.
- PCBs can't impose penalties in every contravention under the Acts but only when environmental harm has been caused by the erring entity.
- In **Indian Council for Enviro-Legal Action v. UoI, SC** held that according to **Polluter Pays principle**, responsibility for repairing the damage is that of offending industry.

PM2.5 Levels in India

- **Centre for Research on Energy and Clean Air (CREA)** released the "Beyond city limits: A satellite-based PM2.5 assessment" to measure pollution load across India's airsheds.

Findings:

- India's **annual PM-2.5 average is 55-60 $\mu\text{g}/\text{m}^3$** , with 60% of districts **exceeding NAAQS standards** (40 $\mu\text{g}/\text{m}^3$) and **none meeting WHO limits** (5 $\mu\text{g}/\text{m}^3$).
- Delhi remains India's most polluted state/UT with annual PM2.5 averaging 101 $\mu\text{g}/\text{m}^3$.
- Assam (11) and Delhi (11) contribute 22 of the 50 most polluted districts.
- Southern states have lower annual PM2.5 levels, with Puducherry recording the lowest at 25 $\mu\text{g}/\text{m}^3$.
- The Northeast region experiences high levels of PM2.5 year-round.

'Smog-Eating' Road Coatings

- Delhi govt conducted a **feasibility study on titanium dioxide (TiO_2)-based "smog-eating" coatings** for roads and public spaces. Titanium Dioxide (TiO_2)

About: -

- It is **low-cost, chemically stable, and compatible** with traditional construction materials such as concrete and asphalt.
- TiO_2 can **absorb UV light and trigger chemical reactions** that break down pollutants like NO_2 and volatile organic compounds.
- Research shows TiO_2 -based coatings can help in gaseous depollution and environmental cleaning.

National Clean Air Programme

- **Launched by MoEFCC in 2019 to improve air quality** in Million Plus Cities and non-attainment cities (unable to meet NAAQS for 5 years).
- **Targets:** To reduce Particulate Matter (PM2.5 & PM10) concentration by 20-30% by 2024 (base line is 2017). The target for PM10 has been revised to reduce by up to 40%.
- **City Action Plans (CAPs) have been prepared by all 131 cities and implemented by Urban Local Bodies.**
- Performance based financial support is provided by mobilising from various Central schemes
- Under NCAP, around 20,000 crores has been earmarked to these cities till FY 2025-26.

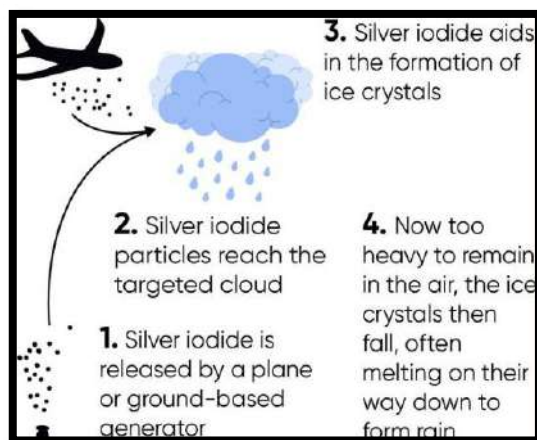
Cloud Seeding

Context:-

- Researchers discussed the possibility of using cloud seeding to tackle Delhi's air pollution.
- Delhi Government **conducted its first cloud-seeding flight trial**.

About

- Cloud seeding is a weather modification technology that artificially stimulates rainfall by spraying chemical substances into the air that serve as cloud condensation nuclei.
- The chemical substances used are silver iodides, potassium iodides, dry ice (solid carbon dioxide) or liquid propane.
- It works only when there are **enough pre-existing clouds** in the atmosphere



Applications of Cloud Seeding

- Increases rainfall: Cloud seeding helps in increasing rainfall quantity in case of inadequate rainfall.
- Boosts agriculture: It causes rain when needed which is important for agrarian economies. For e.g., **Karnataka's Project Varshadhari (2017)**.
- Regulates weather: It is used for controlling prevailing weather conditions (hail suppression, fog dispersal and cyclone modification). It helps in creating favourable microclimates.
- Controls air pollution: It is used to settle down toxic air pollutants through the rain.
- Controls water pollution: It helps in maintaining minimum summer flows of the rivers and lessens the impact of treated wastewater discharges from municipalities and industries.

Thermal Power Emissions in India

Context: -

- **MoEFCC extended the SO₂ emission compliance deadline by three years**, impacting 20 GW of thermal plants in high-density areas.
- MoEFCC has **exempted** most coal-fired power plants from installing Flue Gas Desulphurisation (FGD) systems, previously mandated in 2015.

What is FGD?

Purpose:

- FGD is a set of technologies used to remove sulphur dioxide (SO₂) from exhaust flue gases, primarily from fossil-fuel power plants and other sulphur dioxide-emitting processes.

Why it's important:

- SO₂ is a major contributor to acid rain and air pollution, so FGD helps mitigate these environmental problems.

How FGD Works:

Wet Scrubbers:

- The most common type of FGD uses a wet scrubber, where flue gases are brought into contact with a liquid or slurry absorbent, typically containing lime or limestone.
- Absorption: The SO₂ dissolves or reacts with the absorbent, becoming trapped in it.

- **Byproducts:** The process produces byproducts like gypsum, which can be used in construction materials.

Dry Scrubbers:

- Another type of FGD uses a dry absorbent, like pulverized lime or limestone, which is injected into the flue gas duct.
- **Dry and wet FGD systems use limestone to remove SO₂**, producing **gypsum** as a reusable by-product.

Rationale behind the decision

- Ambient SO₂ levels in India range between 10–20 µg/m³, well below the national standard of 80 µg/m³.
- Indian **coal is naturally low in sulphur**.
- Sulphates have a **“beneficial side-effect”**: They **may suppress global warming** by reflecting solar radiation and offsetting the warming effect of greenhouse gas emissions.

Flue gas

- Flue gas is the **exhaust emitted from burning fossil fuels** in thermal power plants & industrial processes.
- It **contains a mixture of gases**, including carbon dioxide (CO₂), carbon monoxide (CO), water vapour, nitrogen oxides (NO_x), sulphur dioxide (SO₂), particulate matter (PM), and other trace pollutants.

Sulphur Dioxide Emissions

- India was **largest SO₂ emitter in 2022**, contributing **over 20% of anthropogenic** emissions.
- **Sources:** Coal-fired power plants, heavy industries, & minor natural sources.
- **Regulations:** Governed under Air (Prevention and Control of Pollution) Act, 1981.
- Out of 537 coal-based power plants in India, **only 39 have installed FGD units**.

Phthalates

- A recent study has linked **daily exposure to phthalates specifically di-2-ethylhexyl phthalate (DEHP)** to deaths globally from heart disease in 2018.
- **India** recorded the highest number of these deaths (103,587), followed by China and Indonesia.

About: -

- Phthalates, **also referred to as plasticizers**, are chemicals commonly used **to make plastics flexible and durable**.
- Phthalates are **colourless, odourless, oily liquids**, also referred to as **plasticisers**.
- they are often **referred to as “everywhere chemicals”**, they are widely present in everyday items such as:
- **Plastic Products:** PVC pipes, vinyl flooring, garden hoses, medical tubing, rain- and stain-resistant materials, children’s toys etc.
- **Personal Care Products:** Shampoos, soaps, hairsprays, perfumes, and cosmetics (to extend fragrance longevity) etc.
- They **do not permanently bind to plastic surfaces** to which they are applied.
- They **can break down into microscopic particles** that enter the human body through ingestion, inhalation, or skin contact.

Health Impacts:

- Studies have **linked them to obesity, fertility issues, cancer, hormonal imbalances, increased risk of asthma** and allergies in children etc.
- It can **trigger inflammation in the arteries**, increasing the risk of heart attacks and strokes over time.
- It can **disrupt** endocrine system.

Global Conference on Air Pollution and Health

- **2nd WHO Global Conference** on Air Pollution and Health was held in Catrugen, Columbia.
- It was co-organized by WHO and Columbia and other UN Agencies like UNEP, WMO etc.
- **Objectives:** Accelerating action for clean air, clean energy access and climate change mitigation.

Fluoride Contamination

- Excess **fluoride in groundwater** (up to 8.2 mg/l) is causing widespread dental and skeletal fluorosis.

About Fluoride

- Fluoride is a **naturally occurring mineral found in soil**, water, plants, and living organisms
- It offers **dental health benefits in trace amounts**, but **excessive intake** results in fluorosis.
- **Safe Limits:** WHO prescribes 1.5 mg/L; Bureau of Indian Standards (BIS) sets 1.0 mg/L as desirable and 1.5 mg/L as the maximum permissible limit in drinking water.
- **Source of Contamination:** Groundwater leaching from fluoride-bearing minerals such as fluor spar, cryolite, fluorapatite and granite.

Health Impacts of Fluoride Contamination:

- **Dental Fluorosis:** Occurs in children < 8 years; causes enamel changes — white streaks to brown stains and pitting depending on severity.
- **Skeletal Fluorosis:** Long-term exposure causes bone and joint deformities, pain, stiffness and may lead to permanent disability. Government Measures •
- **National Programme for Prevention and Control of Fluorosis operates under the National Health Mission (NHM)** to prevent and manage fluorosis.
- **DE fluoridation Technology: Nalgonda Technique** (adding aluminium salts, lime, and bleaching powder) and Activated Alumina filters (an adsorbent) are used to remove excess fluoride from water.

Temperature Rise in India

Context: -

- The North, Central, & NE India are experiencing record-breaking high temperatures.

About: -

- Delhi recorded a maximum temperature of 52.9°C, the highest on record in the capital.
- However, the IMD suggested this might be due to a sensor error or local factors, as it was an outlier.

Factors Behind the Severe Temperature Rise-

Rise of Greenhouse Gas (GHG) Emissions

- The rise in temperatures is primarily due to increased emission of heat-trapping GHGs from human activities like burning fossil fuels, leading to global warming.
- Since the Industrial Revolution, these emissions have made the **Earth at least 1.1°C warmer than the 1850-1900 average**.
- The Indian subcontinent has seen a 0.7°C rise in annual mean temperatures since 1900.

Greenhouse Gas	Sources (% contribution to Global Warming)	Average Lifetime in the Atmosphere	Possible Added Heat Over a 100-Year Period
Carbon Dioxide	• Human sources (100%): Mostly the burning of fossil fuels (such as coal, oil, and natural gas), deforestation/land-use change,	Hundreds to thousands of years (about 25%)	CO ₂ is used as the reference point for other GHGs, so its possible added

	and wildfires/biomass (plant material) burning • Natural sources (0%)	lasts effectively forever)	warming (or global warming potential, GWP) is 1 .
Methane	• Human sources (60%): Leaks from fossil fuel production and transportation, landfills, livestock digestion and manure, rice farming, natural gas, wildfires/biomass burning • Natural sources (40%)	About a decade	1 metric ton can trap about 30 times the heat of 1 metric ton of CO ₂ .
Nitrous Oxide	• Human sources (40%): Production and use of organic and commercial fertiliser, burning of fossil fuels and vegetation • Natural sources (60%)	About 110 years	1 metric ton can trap about 273 times the heat of 1 metric ton of CO ₂ .
Chlorofluorocarbons (CFCs, namely CFC-11, CFC-12, CFC-113)	• Human sources (100%): Refrigerants; solvents (a substance that dissolves others); spray-can propellants • Natural sources (0%)	52 to 93 years	1 metric ton can trap thousands to tens of thousands of times the heat of 1 metric ton of carbon dioxide

U.N. International Methane Emissions Observatory Report

Context: -

- The U.N. International Methane Emissions Observatory (IMEO) report examines challenges in addressing methane leaks and explores the steps required to meet global methane reduction targets.

About: -

- **UN IMEO is a key initiative under the United Nations Environment Programme (UNEP)** aimed at providing reliable and actionable data to reduce methane emissions.

Global Methane Pledge: GMCCA Forum

Context:-

- Global Methane, Climate and Clean Air (GMCCA) Forum held in **Washington, DC, USA** to discuss opportunities to protect the climate and improve air quality with a special focus on methane by adhering to the Global Methane Pledge.

What is the Agenda of the Forum?

- Forum is a ***joint event sponsored by the Global Methane Initiative (GMI) and the UNEP-convened Climate and Clean Air Coalition (CCAC).***
- High-level plenary sessions will be held on global efforts to reduce methane and other short-lived climate pollutants.

Global Methane Initiative

- Global Methane Initiative (GMI) is a **voluntary government** and an informal international partnership with members from 45 country participants nations, **including the United States and Canada**.
- The meeting was established with the goal of reducing anthropogenic methane emissions globally through a partnership between the developed and developing countries having economies in transition.
- **India has been a member of the forum since its inception in 2004 and** has been taken up as Vice-Chairman of the Steering Leadership for the first time along with the United States.
- National governments are urged to join GMI as Partner Countries, while other non-state organizations may join GMI's extensive Project Network.

Global Methane Pledge

- The Global Methane Pledge was launched at COP (Conference of Parties) 26 in November 2021 to catalyse action to reduce methane emissions.
- It was led by the United States and the European Union.
- It has 111 country participants who together are responsible for 45% of global human-caused methane emissions.
- **India, which is not a part of the Global Methane Pledge**, is among the top five methane emitters globally. Most emissions can be traced back to agriculture.
- By joining the Pledge, countries commit to work together in order to collectively reduce methane emissions by at least 30% below 2020 levels by 2030.

Climate and Clean Air Coalition (CCAC)

- Climate and Clean Air Coalition is a voluntary partnership of governments, intergovernmental organizations, businesses, scientific institutions and civil society organizations.
- Aim: The coalition aims to protect the climate and improve air quality through actions to reduce short-lived climate pollutants.
- **India is a member of the coalition.**

Methane Alert and Response System (MARS)

- It was launched at COP27 by UNEP's International Methane Emissions Observatory (IMEO).
- It is the first-ever global system that uses satellite data to monitor major emission events and notify governments and companies who can address them.
- It works in partnership with the Climate and Clean Air Coalition (CCAC) and the International Energy Agency (IEA).
- It brings together four critical components to drive transparency and enable emission reductions:
 - Detection of large sources of human-caused methane emissions.
 - Notification of relevant countries and companies about these detected emissions.
 - Response from notified stakeholders to address the emissions.
 - Tracking progress of actions taken to reduce emissions and collaboration to prevent future methane.

Lowering Organic Waste Methane Initiative (LOW-Methane)

- It is a coalition of international partners launched at COP 28.
- **Objective:** To deliver at least 1 million metric tons of annual waste sector methane reductions well before 2030 and to unlock over \$10 billion in public and private investment.
- It will support action across the waste value chain, from reducing food loss and waste to diverting and treating organics in the waste stream to cutting emissions from disposal sites, in line with waste management hierarchies.

International Methane Emissions Observatory (IMEO)

- Launched by UNEP to provide open, and actionable data to reduce methane emissions.

Methane

- Methane is a gas that is found in small quantities in Earth's atmosphere.
- Methane is the simplest hydrocarbon, consisting of one carbon atom and four hydrogen atoms (CH₄).
- Methane is **powerful greenhouse gas**. It is **flammable**, and is used as a fuel worldwide.
- **Methane is produced by** the breakdown or decay of organic material and can be introduced into the atmosphere by **either natural processes** – such as the decay of plant material in wetlands, the seepage of gas from underground deposits or the digestion of food by cattle – or **human activities** – such as oil and gas production, rice farming or waste management.
- While methane has a much shorter lifetime than carbon dioxide (CO₂), it is much more efficient at trapping radiation.
- Per unit of mass, methane has a warming effect about 80 times more potent than CO₂ over 20 years.
- Methane has been responsible for 30% of total warming since the Industrial Revolution and is the **second largest contributor to global warming after carbon dioxide (CO₂)**.
- **Incomplete burning of both living and dead organic matter results in methane emission.**

Human Sources of Methane Emissions

- Globally, 50-65% of total CH₄ emissions come from human activities.
- More than 50% of global methane emissions stem from human activities in 3 sectors:
 - Agriculture (40%) 2. Fossil Fuels (35%) 3. Waste (20%)
- **According to UNEP, human-caused methane emissions must be reduced by 45% by 2030.**
- It has recommended different targets and areas for different countries. For India, it has recommended emission reduction in the waste sector (by improving sewage disposal).

IMP Point: -

- Human source > Natural Source
- Natural Source - Wetlands > Termites > Oceans > Methane Hydrates
- Human Source - Agriculture > Fossil Fuels > Waste

Global Nitrogen Threat

- **United Nations' Global Nitrous Oxide Assessment warns** that **nitrous oxide (N₂O)** emissions are increasing rapidly, demanding urgent mitigation.

About: -

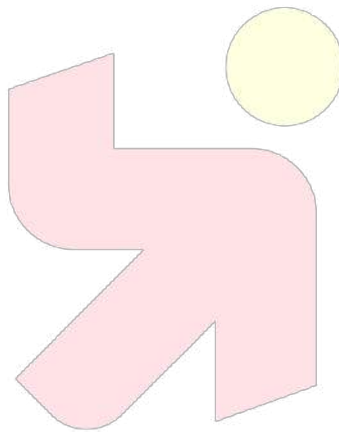
- Nitrogen is a **colourless, odourless, non-metallic gas forming 78% of Earth's atmosphere**
- It is essential for DNA (ATCG bases), proteins, ATP (adenosine triphosphate), nerve transmission, & immune function.
- Critical for plant growth, enabling synthesis of chlorophyll and proteins; cycled through ecosystems via Nitrogen Cycle.
- **Lightning naturally fixes nitrogen by converting it into nitric acid, enriching soils.**
- Industrial use includes the Haber-Bosch process (ammonia for fertilisers & explosives) and saltpetre (KNO₃) extraction for gunpowder, explosives (TNT, nitro-glycerine), and fertilisers.

Concerns Associated with Nitrogen: -

- Excess nitrogen runoff leads to **eutrophication**, causing algal blooms and dead zones.
- Respiratory conditions like methemoglobinemia or "**blue baby syndrome**."
- NO₂ **reduces crop productivity by hindering photosynthesis** (disrupts carbon uptake), causing oxidative cell damage, forming ground-level ozone and acid rain (NO₂ combines with water vapour to form nitric acid), and blocking sunlight through particulate matter, resulting in major yield losses.
- **Nitrogen Oxide (NO) and Nitrogen Dioxide (NO₂) contribute to global cooling and should not be confused with Nitrous Oxide (N₂O), which is a greenhouse gas and has many uses as an oxidiser.**

Revive Our Ocean Initiative

- Revive Our Ocean initiative was **launched by the international NGO Dynamic Planet.**
- Aims to scale up effective, community-led marine protected areas (MPAs) through local action.
- Plans to launch a microfinance program to help communities get loans and grants to start or expand their own protected areas.
- **Initial focus on seven countries:** UK, Portugal, Greece, Turkey, Philippines, Indonesia, and Mexico.
- Created a network called the Revive Our Ocean Collective, that brings together local leaders & groups.



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5. Key terminologies in News

Nexus Assessment

Context:

- The research paper released by The Intergovernmental SciencePolicy Platform on Biodiversity and Ecosystem Services (ipbes), has published two reports “**Nexus Assessment**”, and “**Transformative Change Assessment**”.

About:

Nexus Assessment:

- The “Nexus Assessment” report provides **more than 70 ways to deal with biodiversity**, water, food, health and climate change together.
- The report also examines future challenges—assessing 186 different scenarios from 52 separate studies, which project interactions between three or more of the nexus elements, mostly covering the periods up to 2050 and 2100.
- The assessment gives 71 response options currently available to manage biodiversity, water, food, health and climate change. The report states this response options are not “an exhaustive list”, but “a menu of options that can be applied in different contexts”.

Transformative Change Assessment:

- The “Transformative Change Assessment” report focuses on the underlying drivers of biodiversity loss and the system-wide changes needed to conserve and restore

Carbon Intensity

Context:

- Carbon intensity measures the amount of carbon dioxide (CO₂) emitted per unit of output in a specific sector or economy. It helps track progress in reducing emissions while accounting for economic growth or production levels.
- Link for reference:** [What is carbon intensity? - The Hindu](#)

About:

- For example, the carbon intensity of the steel sector can be measured as the number of tonnes produced per tonne of CO₂ emitted.
- National Carbon Intensity:** A country's carbon intensity is measured by dividing Gross domestic product (GDP) growth per capita by CO₂ emissions.
- Carbon intensity plays a crucial role in assessing climate commitments under the Paris Agreement (2015) and reducing Emissions Intensity of its **GDP by 45% by 2030, from 2005 level**.
- Carbon intensity supports sustainable economic growth while lowering environmental impact.

Stratospheric Aerosol Injection

Context:

- Lowering carbon emissions can delay, if not avert, catastrophic climate change, improve air quality and minimise environmental pollution. In fact, every tonne of emissions avoided today will translate to fewer shocks tomorrow, buying earth the sort of stability some are currently looking for with geoengineering.
- Link for reference:** [Polar geoengineering projects could cause severe harm, scientists say - The Hindu](#)

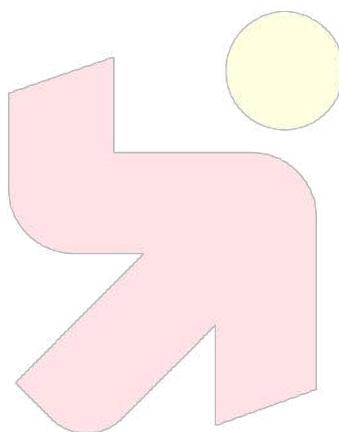
About:

- Stratospheric Aerosol Injection (SAI) – It involves injecting aerosols (tiny particles) into Earth's stratosphere.
- These aerosols then reflect a portion of incoming sunlight back into space, thereby reducing the amount of solar radiation reaching the Earth's surface and leading to a cooling effect.

- **Low-Altitude SAI:** Traditionally, SAI envisioned injections at very high altitudes (above 20 km).
- However, the new study investigates the feasibility of spraying particles at lower heights (e.g., 13 km).

Aerosols

- They are tiny solid or liquid particles suspended in air or a gas.
- Aerosols can be natural, such as fog or gas from volcanic eruptions, or artificial, such as smoke from burning fossil fuels.
- Aerosol particles are either emitted directly into the atmosphere (primary aerosols) or produced in the atmosphere from precursor gases (secondary aerosols).
- Aerosol particles are tiny, but numerous, and often comprise a number of inorganic and organic substances.
- True aerosol particles range in diameter from a few milli micrometres to about 1 micrometre (equal to 10^{-4} cm).



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