VISIONIAS
INSPIRING INNOVATION

ENVIRONMENT

Classroom Study Material 2023

(August 2022- May 2023)

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ENVIRONMENT

Table of Contents

Previous Year Questions

A reference sheet of syllabus-wise segregated previous year questions from 2013-2022 (for the Environment Section) has been provided. In conjunction with the document, it will help in understanding the demand of the exam and developing a thought process for writing good answers.

A NOTE FOR THE STUDENTS

Dear Students,

- Understanding current affairs can add depth to your perception of intricate issues and help you form nuanced perspectives, especially in the context of the Mains examination.
- In light of this, Mains 365 documents attempt to simplify your study process by including features that assist in creating answers, reviewing content, and retaining information.

Here are the key features we have integrated in the document:

A Topic at Glance:
This offers a comprehensive view of the topic, seamlessly connecting current and static aspects while providing necessary data and facts.

Enhanced Infographics:
These are designed to effectively revise as well as to be readily used in your answers, making your responses more engaging and informative.

Data Banks:
To help you identify and revise the crucial datasets of topics, we have designed and integrated data banks in the articles.

Appendix:
We have added an appendix of key data and facts at the end of each document, aiming to facilitate quick revision.

Weekly Focus Document List:
A QR code linked list of relevant weekly focus documents has been added at the end of each document, ensuring a smoother journey while approaching these topics.

Previous years questions:
To facilitate efficient revision, a QR code linked syllabus-wise segregated list of previous years' questions is added.

We sincerely hope Mains 365 documents will guide you effectively in your preparation and aid you in scoring better in your Mains examination.

"Learn everything you can, anytime you can, from anyone you can. There will always come a time when you will be grateful you did."

All the best! Team VisionIAS

1. CLIMATE CHANGE

1.1. CLIMATE CHANGE AND AGREEMENTS

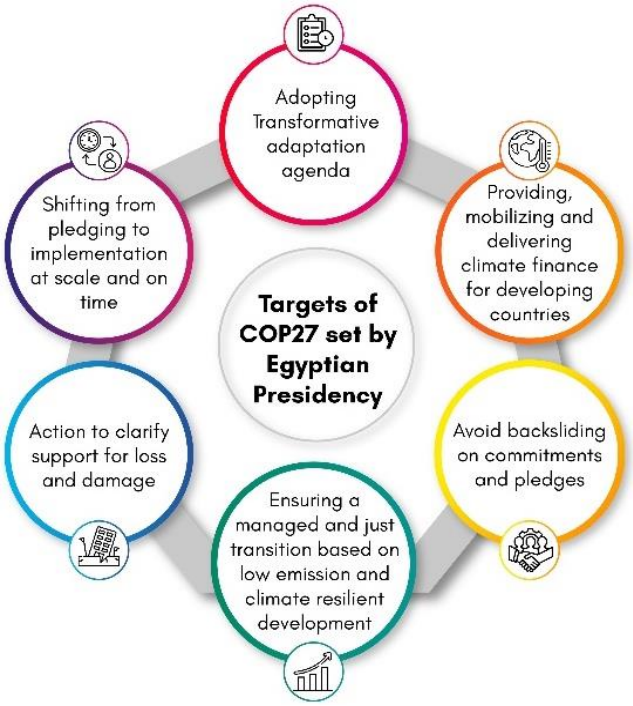
1.1.1. 27TH CONFERENCE OF THE PARTIES (COP 27)

Why in news?

The 27th Conference of the Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC) was **held at Sharm El-Sheikh, Egypt.**

About COP27

- COP27 holds significance as it **aims to build on previous successes, including the Glasgow Climate Pact of COP26** and pave the way for higher ambition on mitigation, adaptation and climate finance, with focus on loss and damage.
- The conference concluded with release of **Sharm el-Sheikh Implementation Plan.**



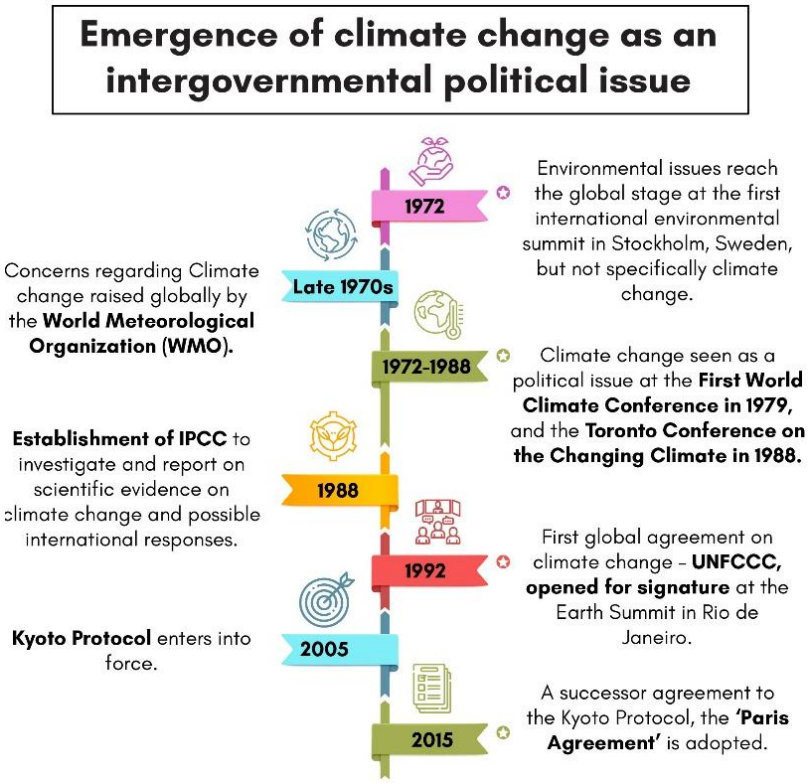
Key outcomes of the COP27

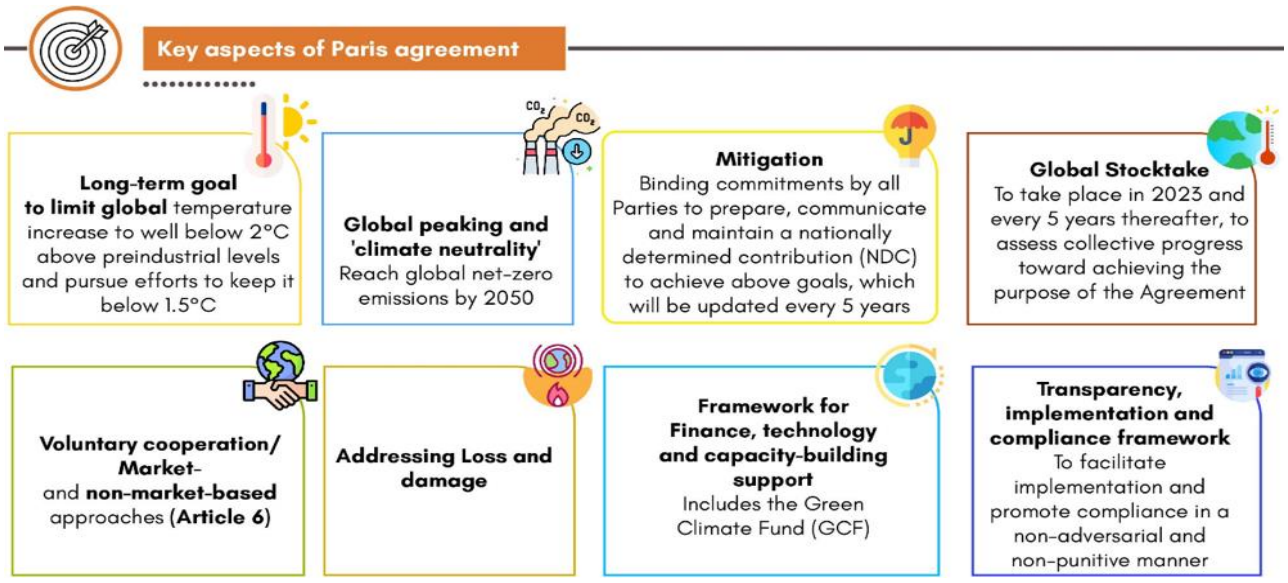
Areas of discussion	Important Decisions and Developments
Climate targets	• Countries requested to **revisit and strengthen their 2030 climate targets by the end of 2023,** as necessary to align with the Paris Agreement.
Mitigation	• **Finalised the details of Mitigation work programme** to urgently scale up mitigation ambition and implementation in this decade.
Adaptation	• **Development of a framework for the global goal on adaptation** to be undertaken through a structured approach under the **Glasgow–Sharm el-Sheikh work programme in 2023 at COP28.** • **New pledges, totaling more than USD 230 million,** were made to the Adaptation Fund.
Finance	• **Sharm el-Sheikh dialogue launched on Article 2.1c** of the Paris Agreement, which says "financial flows" should be aligned with global temperature targets.
Loss and damage	• **New funding arrangements established** for assisting developing countries that are particularly vulnerable to the adverse effects of climate change, in responding to loss and damage. o **A transitional committee** set up to make recommendations for the operationalization of the new funding arrangements at COP28. • **Institutional arrangements made for operationalization of the Santiago network.** The host of the secretariat of the network will be selected by 2023.
Energy	• Parties called upon to transition towards **low-emission energy systems** and accelerate efforts towards the **phasedown of unabated coal power** and **phase-out of inefficient fossil fuel subsidies.**
Financial system reform	• For transformation of the financial system and its structures, **multilateral development banks and international financial institutions have been encouraged to reform their operational model, channels and instruments** to address the global climate emergency.
Just transition	• **A work programme on just transition was launched,** including annual "high-level ministerial round tables", with the first taking place at COP28 next year.
Agriculture	• **Koronivia Joint Work for Agriculture (KJWA) given another four-year lease** by establishment of the four-year Sharm el-Sheikh joint work on implementation of climate action on agriculture and food security. o KJWA is a **landmark decision** under UNFCCC that **recognizes unique potential of agriculture in tackling climate change.** o It a**ddresses six interrelated topics on** soils, nutrient use, water, livestock, methods for assessing adaptation, and socio-economic and food security dimensions of **climate change across agricultural sectors.**

Technology transfer and deployment	• **First joint work programme of the Technology Executive Committee** and the **Climate Technology Centre and Network**, set up for 2023–2027, which will facilitate the transformational change needed to achieve the goals of the Convention and the Paris Agreement.
Other	• For the first time, a COP cover decision mentioned **food, rivers, nature-based solutions, tipping points and the right to a healthy environment.**
Initiatives launched	• **Agriculture and food:** International Drought Resilience Alliance (IDRA), Initiative on Nutrition and Climate Change (I-CAN), Agricultural Innovation Mission for Climate (AIM4C) • **Finance:** Sustainable Debt Coalition Initiative, Global Shield against Climate Risk • **Forest and Land:** Mangrove Alliance for Climate (MAC), Forest and Climate Leaders' Partnership (FCLP) • **Urban transformation:** Low Carbon Transport for Urban Sustainability (LOTUS) initiative, Sustainable Urban Resilience for the next Generation (SURGe) initiative

Ongoing Debates and issues (post COP27 in Sharm El-Sheikh, Egypt)

- **No commitments to phase out all fossil fuels.**
- **Lack of stringent mitigation targets** such as global emissions to peak as soon as possible and by 2025.
- **Finance related issues:** Inadequate climate finance; Unequal access of climate finance for Developing nations; Unclear definition of "climate finance"; shortage of Grants-based finance; global climate finances skewed towards mitigation activities etc.
- **Full rules of procedure for Article 6.2,** relating to Market Mechanism for carbon trading**, remain unresolved.**
- **Prevalence of Greenwashing** (the practice of misleading general public into believing that companies, sovereigns or civic administrators are doing more for the environment than they actually are).
- **Concerns related to Fossil fuel lobbying.**
- **NDCs for 2030 remain totally inadequate** to fulfil the 1.5° pathway.





Way Forward

- **Enhancing mitigation targets** through rapid, deep and sustained reductions in global GHG of 43% by 2030 relative to the 2019 level.
- **Gradual phase out of all fossil fuels.**
- **Scaling climate finance** through contribution from developed nations, proactive involvement of private sector, multilateral finance institutions**.**
- **Promote Just Energy Transition Partnerships (JETPs)** to finance the energy transitions of emerging economies.
- **Establishing clear source and commitments for funding loss and damage through dialogue**.
- **Adopting clear definitions for climate finance** reflecting the principle of common but differentiated responsibilities (CBDR).
- **Setting standards to quantify and measure emission reductions** to reduce instances of greenwashing.

Related Development: Breakthrough Agenda sets priorities

- Signatories to Breakthrough Agenda have mapped out **Priority Actions**, to be delivered by COP28 climate summit, to help make clean technologies cheaper and cleaner.
- Breakthrough Agenda was launched at COP26 by a coalition of about 45 world leaders (India is also a signatory).
- **Objective**: To provide a framework for countries, businesses and civil society to strengthen their actions in key emitting sectors. Priority Actions aim to speed up **decarbonisation under five key sectors of power, road transport, steel, hydrogen and agriculture**.
- These priority actions are being supported by various initiatives including:
  - **Climate Investment Funds**: largest multilateral climate fund focused on transformational climate innovation in 72 middle- and low-income countries (including India).
  - **Mission Possible Partnership,** an alliance of leading climate organizations.

1.1.2. INDIA AND COP27

Why in news?

India raised several concerns regarding climate equity during the COP27.

India and climate change negotiations

- **Interests**: **Early and ambitious global climate action** with enough 'policy space' and 'carbon space' for domestic development.
- **Position:**
  - **Continued support to international negotiations** under UNFCCC and awareness about its responsibilities.
  - Belief in foundational principles of **equity, and common but differentiated responsibilities and respective capabilities (CBDR/RC).**
- **Role in shaping Negotiations: Leads as a role model, represents interests of developing nations** and provides alternate channels to fight Climate Change.
- **Initiatives launched by India during COP27:** In Our LiFEtime campaign; LeadIT (Leadership for Industry Transition) Summit 2022 etc.

Concerns raised by India in COP 27

- **Gap in operationalizing the principles of equity and climate justice** and **CBDR-RC.**
- **Developing countries** should be provided with a **greater share of the remaining carbon budget.**
- **Just transition to cleaner sources of energy** should give due consideration to developmental needs of developing countries.
- Practices, such as **Carbon Border Adjustment Mechanism,** could result in market distortion and aggravate the trust deficit amongst Parties.
- **Extending the scope of mitigation to agriculture under Koronivia Joint Work on Agriculture (KJWA)** will burden small farmers.
- **Selective singling out of sources of emissions such as coal**.
  - Global oil and gas emissions are 25% higher than coal emissions.
- **Unclear definition of climate finance.**
- **Shortage of climate finance,** India needs tens of trillions of dollars by 2050 to achieve net-zero status by 2070.

Way Forward

- **Enhanced mitigation efforts from Developed countries.**
- **Just transition for developing countries requires low-carbon development** and independence in their choice of energy mix, and in achieving the SDGs.
- Need for a **united solidarity response by developing countries.**
- **Long-term goal of phasing down all fossil fuels**.
- **Defining and implementing Article 2.1(c)** (making finance flows consistent) for the developing countries.
- **Scaling up climate finance** by delivering on the promise of $100bn under Green Climate Fund and setting up a target of $1tn climate finance per year.

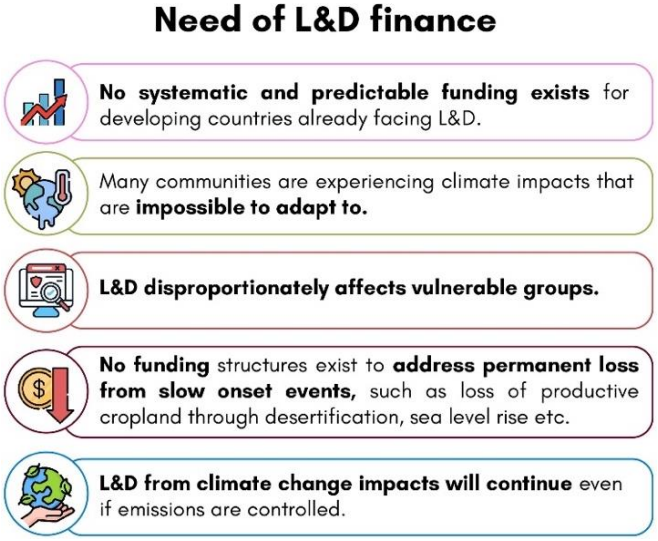
1.1.3. LOSS AND DAMAGE

Why in news?

The **Transitional Committee on operationalization of Loss and damage fund**, established in **COP27,** held its 1st meeting in Luxor, Egypt in 2023.

About Loss and Damage (L&D)

- Refers to the **negative consequences** that arise from **unavoidable risks of climate change.**
  - Also **includes non-economic losses** such as incalculable toll of losing family members, disappearance of cultures and ways of living etc.
- L&D emerged in climate negotiations when **Warsaw International Mechanism for Loss and Damage** was established at the COP19 in 2013.



Constraints in mobilizing L&D finance

- **Disagreements regarding source of funds:**
  - **Developed countries** like the USA want L&D finance to flow through **existing financial instruments**, and do not support creation of a new facility.
  - Developing countries like India argue for providing support—financial, technical, capacity-building—based on **historical emissions.**
- **Current funding** is inadequate to address the full scale and scope of the problem.
- **Formal mechanism** for funding not been finalized yet.

Way Forward

- **Emphasizing on finalization** of the all the key issues such as operationalizing of funding.
- **Transfer of funds in a transparent way**.
- **Independent authority** to audit for the usage of the fund.
- **International collaboration to address disagreements**.
- **Alternative financial mechanisms** like insurance cover, private sector finance etc. **to supplement financing.**

1.1.4. 50 YEARS OF STOCKHOLM CONFERENCE

Why in news?

Recently, **Stockholm+50 meeting** was held at Stockholm, Sweden to commemorate the 50 years since the **1972 United Nations Conference on the Human Environment (also known as the Stockholm Conference),** which made the environment a pressing global issue for the first time.

Stockholm+50 Recommendations for actionable agenda

- **Placing human well-being at the center** of a healthy planet and prosperity for all.
- **Recognizing and implementing the right to a clean,** healthy and sustainable environment.
- **Adopting system wide changes** in our current economic system.
- **Accelerate transformations** of high impact sectors.
- **Help developing countries** tackle environmental challenges by providing access and support for digital and technological solutions.

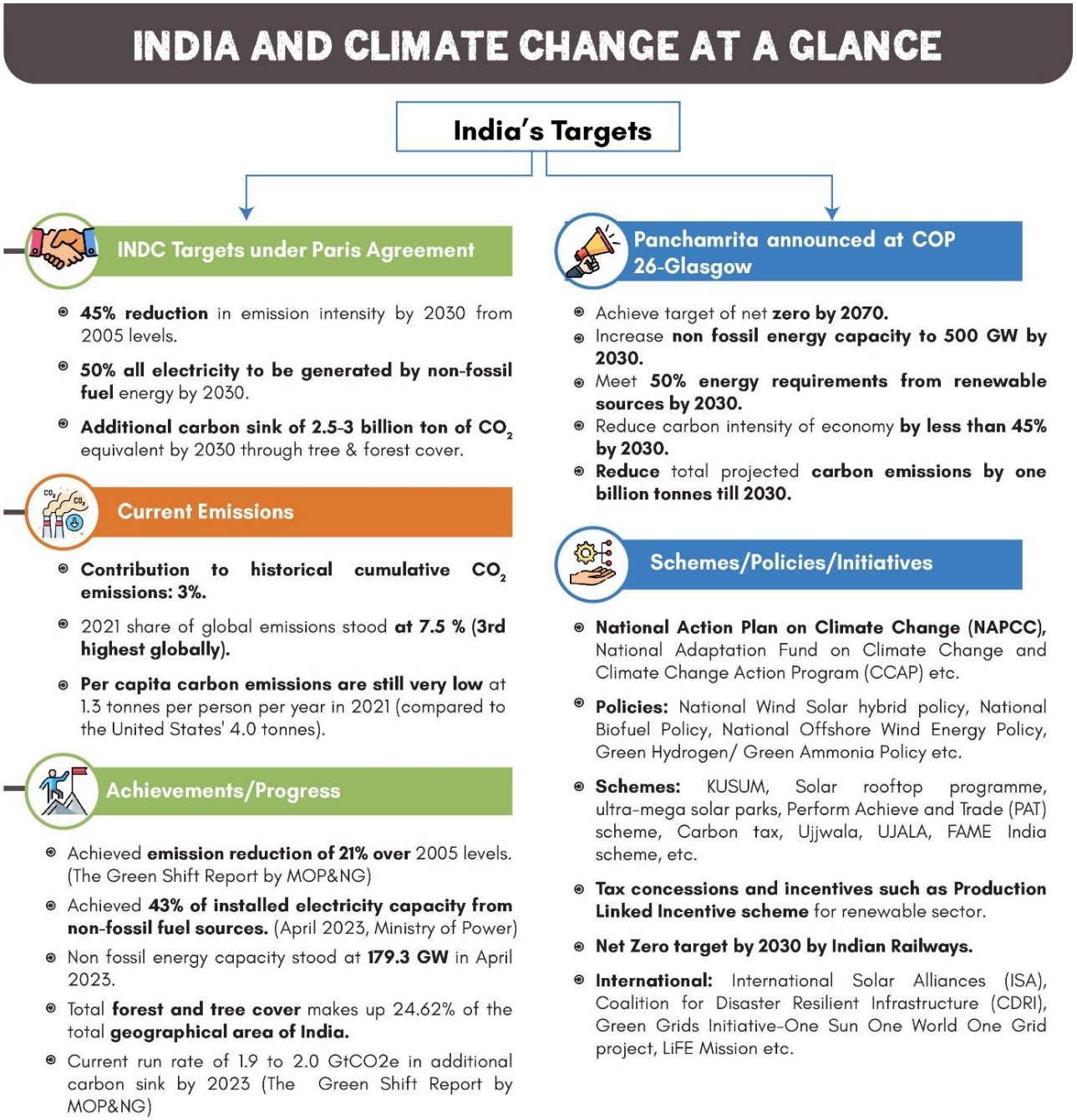
About Stockholm conference

- **UN's first major conference on international environmental issues,** and marked a turning point in the development of international environmental politics.
- **Organized in 1972** to coordinate global efforts to promote sustainability and safeguard the natural environment with the **theme 'Only One Earth'**.
  - **122 countries adopted the Stockholm Declaration** on to **26 principles and an action plan.**
- **The three dimensions of this conference were:**
  - **Countries agreeing not to harm each other's environment** or the areas beyond national jurisdiction;
  - Action plan to **study the threat to Earth's environment;** and
  - **Establishment of an international body called the UN Environment Programme (UNEP)** to bring in cooperation among countries.

Outcome & success of Stockholm Conference

- **Established UNEP** and made **multilateral governance of planetary concerns mainstream.**
- Led to **more than 500 multilateral environmental agreements** (MEAs) **being adopted in the last 50 years** such as- Vienna Conventions, CITES, Stockholm convention, Rotterdam convention, Bonn Convention, Convention for the Prevention of Pollution from Ships (MARPOL) etc.
- **Beginning of the contemporary "environmental era":** Most of the conventions related to planetary crises like the **UNFCCC, the Convention to Combat Desertification (UNCCD), and the Convention on Biological Diversity (CBD) etc. originated in the Stockholm Declaration.**
- **Led to identification of a theme of sustainable development** in the 1992 UN Conference on Environment and Development – **the Earth Summit – in Rio de Janeiro**.
- **Established key Principles like Precautionary principle** (in Vienna Convention) and **Polluter-pays principle (PPP).**
- Opened the door to **broader participation in sustainable development arena,** by welcoming non-governmental organizations (NGOs), Indigenous Peoples, scientific community, and the private sector etc.
- **Start of Environmental diplomacy** and **establishment of national environmental ministries**: In India, Ministry of environment and forest was set up in 1985.

1.2. INDIA AND CLIMATE ACTION



1.2.1. INDIA'S UPDATED NDC'S

Why in news?

India recently **submitted its Updated Nationally Determined Contributions (NDCs)** to the United Nations Framework Convention on Climate Change (UNFCCC).

More on the news

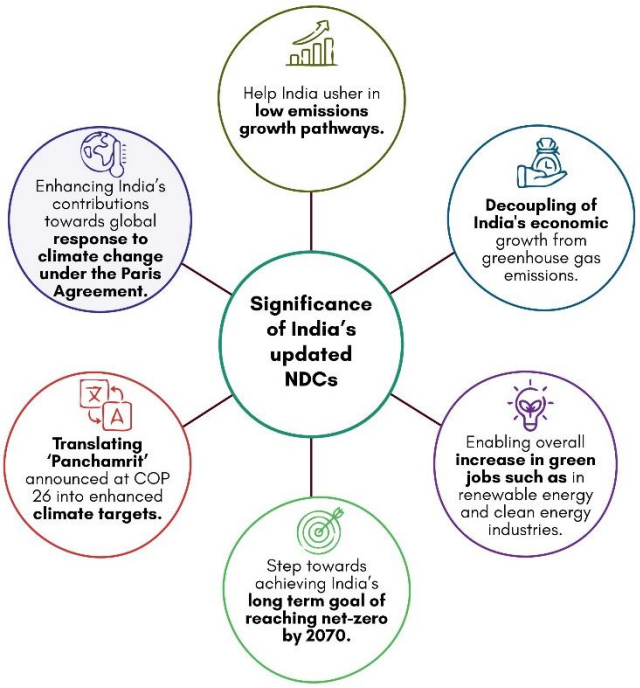
- Updated NDCs are manifestations of the Paris Agreement's **'ratcheting mechanism'** (wherein countries must revise their pledges to be more ambitious every five years).
  - They are **submitted every five years to the UNFCCC secretariat.**

About India's NDCs

- India submitted its **first NDC to UNFCCC in 2015.**

- The 2015 NDC comprised eight goals; 3 of which have quantitative targets upto 2030 with respect to **reduction of emissions intensity, increasing the share of non-fossil fuels in installed electricity capacity** and **creation of additional carbon sink** through additional forest and tree cover.

- **India's updated NDCs:**
  - It represents the framework for India's transition to cleaner energy for the **period 2021-2030.**
  - The new NDCs have **updated 2 of the 3 quantitative targets of 2015 NDCs** related to emissions intensity and share of non-fossil fuels in installed electricity capacity.



Challenges in achieving climate targets

- **Pace of decommissioning coal-based plants does not match** the pace of rise of renewable energy.
- **Constraints in increasing share of renewable energy:** Intermittent supply, high dependence on import for components, high cost of storage, grid connectivity etc.
- **Dilution of panchamrita commitments in NDCs.**
- **Financial constraints** (climate finance of $1 trillion needed by developed countries).
- **Lack of sector specific mitigation obligation** or action.
- **Issues in implementation of the climate missions** like inter-ministerial coordination; lack of technical expertise and project clearance delays etc.

Way Forward

- **Provision of new and additional financial resources** as well as transfer of technology by developed countries under UNFCCC and the Paris Agreement.
- **Gradually phasing out coal** by early retirement of the existing coal capacity and reduction of the coal project pipeline.

INDIA'S NATIONALLY DETERMINED CONTRIBUTION (NDC)

Quantitative Targets

	Targets for 2030	Previous NDC, 2015	Updated NDC, 2022	Progress
1	**Reduce the emissions intensity of its GDP**	By **33 to 35% by 2030** from 2005 level.	By **45% by 2030** from 2005 level.	Estimated **reduction of 21%** over 2005 levels (The Green Shift Report by MOP&NG)
2	**Cumulative electric power installed capacity from non-fossil fuel-based energy resources** with the help of transfer of technology and low-cost international finance including from Green Climate Fund (GCF).	About **40%**	About **50%**	**43% achieved.** (April 2023, Ministry of Power)
3	**Create an additional carbon sink** through additional forest and tree cover	**2.5 to 3 billion tonnes of Co2 equivalent**	**Same as earlier**	**Current rate of 1.9-2.0 GtCO2 in additional carbon sink by 2030**

Qualitative Targets

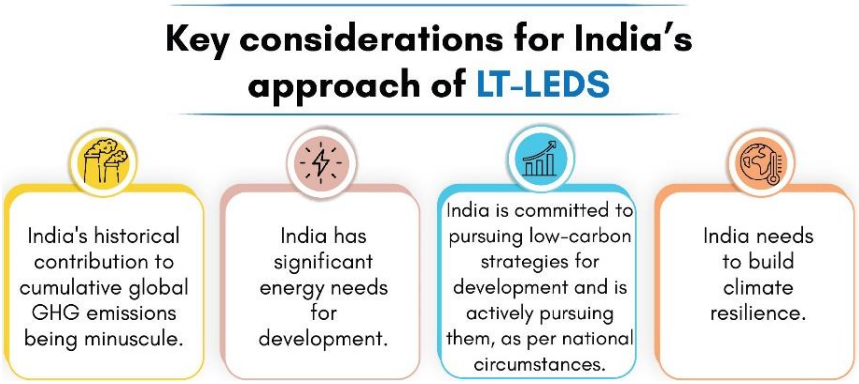
	Previous NDC, 2015	Updated NDC, 2022
4	Put forward and further propagate a **healthy and sustainable way of living** based on traditions and values of conservation and moderation.	Put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation, including through a mass movement for **'LIFE'- 'Lifestyle for Environment'** as a key to combating climate change.
5	**Adopt a climate friendly and a cleaner path** than the one followed hitherto by others at corresponding level of economic development.	**Same as earlier**
6	**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.	**Same as earlier**
7	**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.	**Same as earlier**
8	**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.	**Same as earlier**

- **Developing a mitigation strategy** for net zero goals.
- **Need of net negative emission commitments from developed nations** to vacate the carbon space in 2050 for developing countries.
- **Focusing on energy intensive sectors** for emission reduction.

1.2.2. INDIA'S LONG-TERM LOW EMISSION DEVELOPMENT STRATEGY (LT-LEDS)

Why in news?

India has submitted its **Long-Term Low Emission Development Strategy (LT-LEDS)** to the United Nations Framework Convention on Climate Change (UNFCCC) recently.



About India's Long-Term Low Emission Development Strategy (LT-LEDS)

- Lays out the steps to achieve net zero by 2070 and rests **on 7 key transitions to low-carbon development pathways.**
- Parties to the UNFCCC agreed to formulate and communicate long-term low greenhouse gas emission development strategies (LT-LEDS) under **Article 4.19 of the Paris Agreement.**
- It is informed by the **vision of LiFE, Lifestyle for the Environmen**t.

India's Long-Term Low Emission Development Strategy (LT-LEDS)	
Elements	**Current Targets and Policies**
Low carbon development of electricity systems consistent with development	• **NDC Target: 50% of non-fossil capacity by 2030.** • A **three-fold rise in nuclear installed capacity by 2032.** • Renewable Purchase Obligations; Green energy corridors etc.
Integrated, efficient, inclusive low-carbon transport system	• **20% ethanol blending in petrol by 2025.** • **Indian Railways to become net-zero by 2030.** • Leapfrogging directly to Bharat Stage VI emissions, PM Gati Shakti etc.
Adaptation in urban design, energy and material-efficiency in buildings, and sustainable urbanisation	• National Urban Policy Framework (NUPF), Eco-Niwas Samhita, India Cooling Action Plan, National Mission on Sustainable Habitat etc. • **Plastic Waste Management (Amendment) Rules,** 2021.
Economy-wide decoupling of growth from emissions and development of an efficient, innovative low-emission industrial system	• **National Missions for Enhanced Energy Efficiency, Standards and Labelling Scheme**, and the **Energy Efficiency Financing Platform.** • **National Policy on Bio-Fuels, National Green Hydrogen Mission etc.**
CO_2 removal and related engineering solutions	• R&D and building human and infrastructure capacity to evolve technologies and methodologies like **Carbon Capture Utilisation and Storage (CCUS).**
Enhancing Forest and vegetation cover consistent with socio-economic and ecological considerations	• **NDC target**: Create an **additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent by 2030.** • Voluntary commitment: **To restore 26 million ha degraded land by 2030.** • National Mission for a Green India, National Afforestation Programme, Nagar Van Yojana, **National REDD+ Strategy 2018** etc.
Economic and financial aspects of low-carbon development	• **Business Responsibility and Sustainability Report (BRSR) by SEBI;** Inclusion of Renewable energy projects under **Priority Sector Lending (PSL); Sustainable Finance Group established by RBI** etc.

1.2.3. DECARBONISATION OF INDIAN ECONOMY

Why in News?

The **Energy Transition Advisory Committee (ETAC)**, formed under the direction of the Ministry of Petroleum & Natural Gas (MoP&NG), has compiled a report **'The Green Shift: The Low Carbon Transition of India's Oil & Gas Sector'**.

About Decarbonization

- Term for **removal or reduction of carbon dioxide or GHG** output into the atmosphere.
- Involves two aspects- **reducing GHG emissions** and **absorbing carbon from atmosphere.**
- **Need for Decarbonization**
  - **Combating Global Warming:** Earth is expected to be **2.7-3.5°C warmer** than pre-industrial temperature levels by the end of this century.
  - **Managing Climate Change risk:** India ranked **7th in the world's most affected countries** by climate change in 2019.
  - **Achieving Net Zero commitments amidst an increase in energy demand.**

Challenges in Decarbonization

- High dependence on **conventional fuel (contributes about 60%).**
- **Technological limitations** in important fields like low-carbon technology, CCUS etc.
- **Lack of policy measures and monitoring standards for tracking decarbonization of** different sectors**.**
- **Funding challenges: Shortage of green finance, higher perceived risk of green investments** and **lack of bankable pipeline projects for investors**.
- **Limited availability of domestic resources** like reserves of rare earth elements (critical for EVs).
- **Infrastructure challenges** in shifting to low carbon economy. E.g., shifting to electrical vehicles would require expansion of charging infrastructure, switching to renewable energy need development of energy storage systems etc.
- **Skill gap in labour force,** as shift towards a low-carbon economy will lead to job transitions, particularly in industries heavily reliant on fossil fuels**.**
- **Limited International collaboration and cooperation**.

Way Forward

Social & Economic Changes needed for Effective Decabonization

Catalyzing effective capital reallocation and new financing structures

Capital Reallocation

Scaling up climate finance:
- $3.5 trillion increase in spending on low-emissions assets vs today

Develop new financial instruments:
- SPVs for setting up low emission assets
- Long-term purchase agreements

Pricing externalities to rebalance incentives:
- **Policies** to encourage capital spending in emission reduction projects
- Funding the repurposing or **decommissioning of redundant assets**

Managing demand shifts and near-team unit cost increases

Demand shift Management

Building transparency around climate risks and opportunities:
- **Climate stress** test for factoring risks in investment

Identifying measures to manage cost increases
- Distribute the impact of cost increase **across value chain**

Incentives for making low emission tech cost competitive:
- **Lift demand** for low emission tech to achieve economies of scale

Establishing compensating mechanisms to address **socio-economics** impact

Compensation Mechanism

Supporting economic development and diversification:
- Expediting the timeline for **$100 Bn climate support fund**

Reskilling and redeployment of workers:
- **Retaining workers** for right skills needed in a low-carbon economy

Instituting support for displaced workers:
- Options for aiding displaced workers eg. **income-support measures** and subsidies

Institutional setup and changes recommended for Indian Economy's decarbonization

- **Creating an administrative Setup at the Ministry level** around **energy-providing Ministries** consisting of MoPNG, Ministry of New and Renewable Energy (MNRE), and Ministry of Power and Coal Ministry at the core.
- **Tasking Bureau of Energy Efficiency (BEE) with validating and consolidating all data related to the energy transition.**
- **NITI Aayog can provide modelling expertise** and make projections for the future, which are **essential for planning, monitoring, course correction** etc.
- **Creating an Expert Group on Energy Transition to provide inputs** comprising industry representatives from different sectors, both energy demand and supply.
- **Tie-up/ Liaison with international organizations** to constantly **scan and note the relevant developments taking place globally.**

1.2.3.1. SECTOR SPECIFIC DECARBONATIZATION IN INDIA

Power Sector

Share in India's Emissions (2019): 34 %

Schemes/ Initiatives/Policies

- **Renewable energy (RE) missions:** National Green hydrogen Mission, National Bioenergy Programme, etc.
- **Renewable Purchase Obligations (RPO).**
- **National Mission for Enhanced Energy Efficiency.**
- **Eased terms for open access to buy green energy.**
- **Green Term-ahead Market to provide enhanced avenues for sale of RE.**

Constraints

- **Technological limitations** in energy storage systems, high efficiency power transmission, carbon sequestration etc.
- **Import dependency for necessary equipment** such as solar panels, lithium ion batteries etc.
- **Intermittent nature of RE and low consumption.**

Way Forward

- **Reducing** per unit cost of renewable energy**.**
- **Invest in R&D for development of clean energy technologies.**
- **Creation of** domestic **capabilities across the entire clean energy value chain** through initiatives like PLI**.**

Transportation

Share in India's Emissions (2019): 9 %

Schemes/ Initiatives/Policies

- **FAME India.**
- **Sustainable Alternative Towards Affordable Transportation (SATAT).**
- **Implementation of Bharat Stage VI Emission Standards.**
- **Mission Electrification by the Railways.**
- Adoption of Bio-based **Sustainable Aviation Fuel (SAF).**
- Vehicle scrappage policy.

Constraints

- High cost involved in **deployment of new technologies and infrastructure.**
- **Hesitancy among consumers to adopt low carbon transportation** such as Electic vehicles due to high cost, safety concerns, etc.
- **Low adoption and penetration of sustainable public transportation.**
- **High emission from aviation sector.**

Way Forward

- Modal **shift towards public and less polluting modes of transport.**
- PPP models to build **compatible infrastructure.**
- **Setting targets for aviation secor,** e.g., India will start participating in **International Civil Aviation Organisation's (ICAO) Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) and Long-Term Aspirational Goals (LTAG)** from 2027.

Industry

Share in India's Emissions (2019): 28 %

Schemes/ Initiatives/Policies

- **Perform, Achieve, and Trade (PAT) scheme.**
- **National Solar Mission.**
- **Promotion of adoption of Low carbon technology (LCT) by industries (developed green steel).**

Constraints

- **Alternative sources of energy** are less reliable in comparison to fossil fuels.
- **Requires an adequate amount of funding for transition to low carbon technologies.**

Way Forward

- **Improve energy and resource efficiency,** with efforts to increase the use of **natural and bio-based materials.**
- **Promote fuel switching and electrification** in manufacturing as feasible and viable.

	• **Lack of research and Development.** • **Lack of monitoring** mechanisms. • High emissions from **linear economy.**	• **Enhance material efficiency** and recycling, strengthening the **circular economy.**
Agriculture	**Share in India's Emissions (2019): 18 %**	
Schemes/ Initiatives/Policies • **Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan Yojana.** • **Adoption of** practices like System of **Zero Budget Farming, Rice Intensification (SRI) etc.**	**Constraints** • **Dependence over** traditional fuel and technologies like diesel operated pumps. • **Requires adequate capital** for just transition (**Dominated by marginal farmers).** • **Poor waste management.**	**Way Forward** • **Financial support to marginal farmers.** • **Small clusters of renewable energy generation with the help of cooperatives.**
Buildings	**Share in India's Emissions (2019): 4.5 %**	
Schemes/ Initiatives/Policies • **Eco Niwas Samhita (energy conservation building code for residences)** • **Energy Conservation and Sustainable Building Code.** • **Green Rating for Integrated Habitat Assessment (GRIHA)** • **Building Energy Efficiency Labelling.** • **National Mission on Sustainable Habitat.**	**Constraints** • **Poor implementation of norms.** • Climate-responsive urban planning and building practices require **large investments in innovation and low-carbon technologies.** • **High cost of Retrofitting** current infrastructure.	**Way Forward** • Mainstreaming **adaptation measures** in the built environment and urban systems. • **Promote climate responsive** and resilient building design, construction, etc. • Use of **energy-efficient heating, ventilation, and air conditioning (HVAC) systems.**

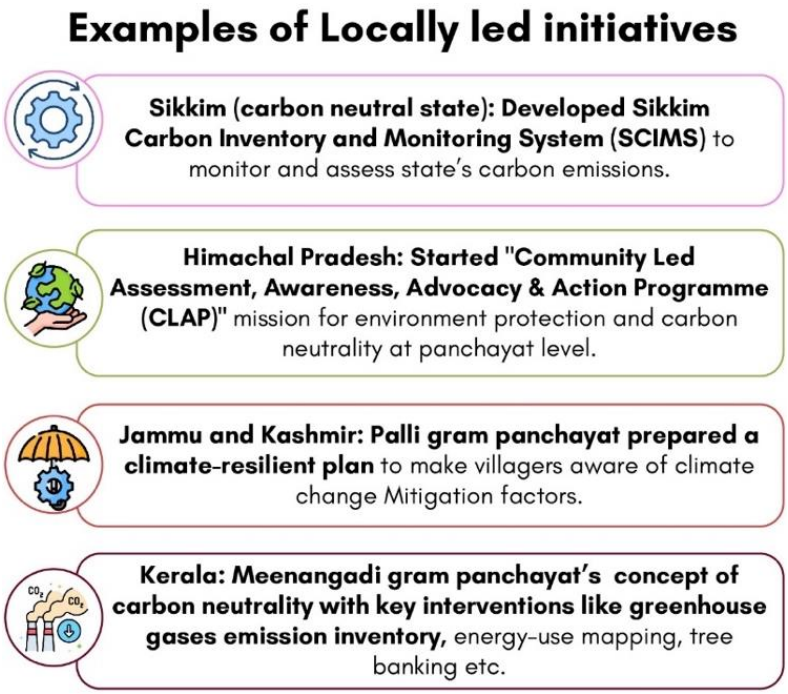
1.2.4. DECENTRALIZATION OF CLIMATE ACTION IN INDIA

Why in News?

Idea has been mooted to set up **India's Intranational COP (IndiaCOP),** a forum similar to GST council, to generate national consensus on India's climate goals and means to achieve them.

More on News

- IndiaCOP can promote spirit of **cooperative and competitive federalism** with each state/UT committing bolder actions towards net zero.
  - Net zero refers to a state in which **GHGs going into atmosphere are balanced by removal out of atmosphere.**



Significance of Decentralization of climate action in India

- Though a project is conceived, financed, and implemented by central agencies, **site-specific mobilisation of resources requires active cooperation of states/UTs.**
  - Constitutional provisions, legislations of Parliament, etc. enable **states/UTs/Local level governments to have an influence on matters like land, electricity, pollution control etc.**

- **Local communities lack effective voice** in prioritizing, decision-making, and implementing the climate actions that most affect them.
- Can **innovate customised approaches for adoption of climate goals** in line with socioeconomic and cultural sensitivities of region.
- Building local resilience will help to **anticipate climate risks and hazards, absorb shocks**, and reshape and transform development pathways in longer term.
- **Proximity to community** makes Local governments most accessible authority when disaster strikes.
- Can **coordinate effective responses** and ensure **people's participation.**

Challenges faced by state/UTs/Local Governments in climate action

- **Shortage of climate finance** that is easily accessible at the local level.
- **Limited scientific knowledge about climate modelling** and technical and institutional capacity to **build concrete strategies** to guide decision making.
- **Finances and resources are focused more on primary things** such as healthcare, governance etc.
- Lack of **cooperation** between different layers of government.
- Climate Change has not been declared as a **major emergency** or concern.

Efforts promoting decentralization

- **National Platform for Disaster Risk Reduction (NPDRR):** A multi-stakeholder platform constituted by Government of India.
- **Local participation** by engaging **'Yuvak Mandals'** and **'Sakhi Mandals'** at village and neighborhood levels.
- Prime Minister's **10-Point Agenda** (refer image) emphasizes for building local capacities and initiatives.

PRIME MINISTER'S 10-POINT AGENDA

Sl No.	Agenda Point
1	All development sectors must imbibe the principles of disaster risk management
2	Risk coverage must include all, starting from poor households to SMEs to multi-national corporations to nation states
3	Women's leadership and greater involvement should be central to disaster risk management
4	Invest in risk mapping globally to improve global understanding of Nature and disaster risks
5	Leverage technology to enhance the efficiency of disaster risk management efforts
6	Develop a network of universities to work on disaster-related issues
7	Utilise the opportunities provided by social media and mobile technologies for disaster risk reduction
8	Build on local capacity and initiative to enhance disaster risk reduction
9	Make use of every opportunity to learn from disasters and, to achieve that, there must be studies on the lessons after every disaster
10	Bring about greater cohesion in international response to disasters

Way Forward

- **Combining spontaneous** (based on indigenous knowledge) **and planned** (based on scientific thought) **adaption strategies.**
- **Enabling access to international funds** and support.
- **Capacity building** in terms of human resources, skills, knowledge, planning capabilities **of individuals and communities.**
- **Fast-track implementation of climate related actions** as part of development planning at sub-national level.
- **Clarity about the responsibilities of governments** at different levels**.**
- **Develop reliable downscaled climate models** to predict district and block-specific climate impacts.

1.3. CLIMATE JUSTICE

Why in news?

Climate justice as the concept featured in sessions of two top global institutions — the **United Nations General Assembly and the European Court of Human Rights (ECHR).**

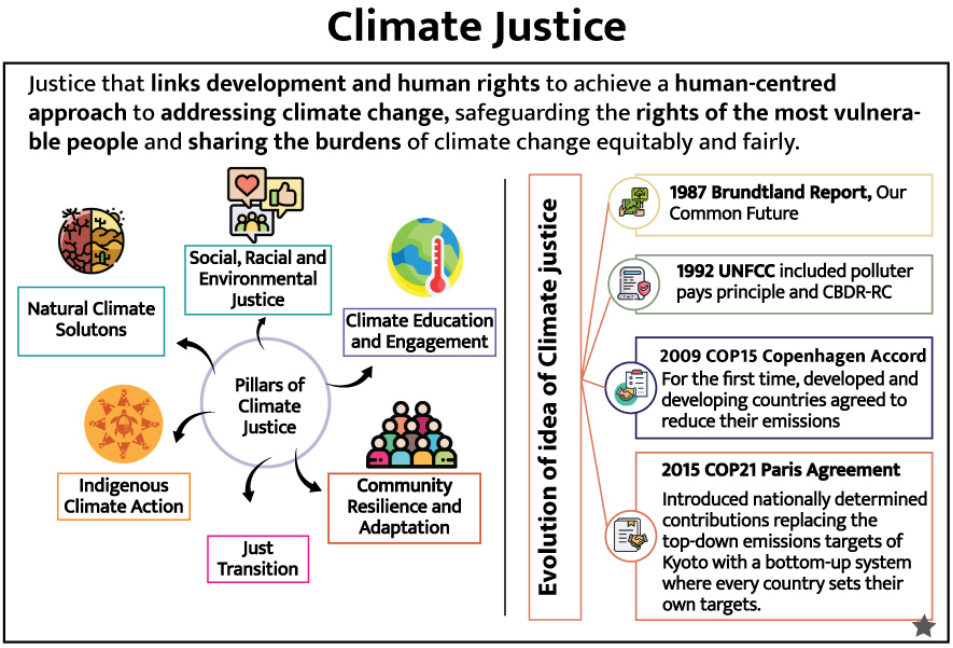
Significance of climate justice

- **Acknowledges the social dimensions of climate change which** affects people of **different classes, races, genders, geographies, and generations unequally.**

- **Highlights concerns of vulnerable countries and communities,** e.g., countries in the global south and communities such as women, elderly etc.
- **Shares the burdens of climate change** by helping vulnerable countries and people who are often unable and ill-equipped to respond.
- **Recognise local solutions** such as **indigenous practices** to address the climate crisis.
- **Promotes culture of 'Polluters Pays Principle'.**
- **Recognises gender equity in Climate Justice.**

Challenges in ensuring climate justice

- **Gradual Dilution of Common but Differentiated Responsibilities (CBDR)** by developed countries.
- Vulnerable communities lack the **technical** and **institutional capacity** to develop and implement climate policies and programs.
- Lack of access to **accurate information** about climate change and its impacts.



- **Climate action of major developed countries is incompatible** with the goals of the Paris Agreement.
- **Globalization and Neoliberalism** can perpetuate **inequality**.

Initiatives in India

- **Protecting rights of Indigenous community**: Panchayats (Extension to Scheduled Areas) Act, 1996 (PESA); Forest Rights Act 2006 etc.
- **Sustainable Agriculture**: National Innovations in Climate Resilient Agriculture etc.
- **Commitment to climate actions**: Goal of net zero by 2070 etc.
- **Accessible Renewable Energy**: One Sun One World One Grid (OSOWOG), International Solar Alliance etc.

Ways to achieve climate justice

- **Global acceleration of environmental rule of law** to protect and fulfil the right to a **clean and healthy environment** (sustainable development).
- **Strong national legal frameworks** for **equitable** and **sustainable management** of natural resources.
- **Accessible justice and human rights institutions** for vulnerable, excluded and marginalized people and communities (participation in decision-making).
- **Gender equality and Community Actions** where women and indigenous people can act as powerful **agents of change** and **climate justice** advocates.
- **Secure equitable distribution of funds** to ensure that the **Global South** has access to opportunities to participate on equal footing towards true climate justice.

1.3.1. CARBON INEQUALITY

CARBON INEQUALITY AT A GLANCE

Phenomena of the **highly unequal distribution of carbon emissions** throughout the world.

Current Situation

- World's richest people emit **unsustainable amounts of carbon** and unlike ordinary people, **50% to 70% percent of their emissions result from their investments (Oxfam report).**
- The bottom **50% of households contribute 12% of the global total GHG emissions,** whereas the top 1% emit contribute 17% of the total (Emission gap report 2022).

Types of inequalities

- **Carbon Inequality Between Nations:** A small number of developed countries are responsible for substantially higher share of the CO_2 emitted globally.
- **Carbon Inequality within Nations:** Carbon emissions of higher income groups are significantly higher.

Significance of addressing Climate Inequality

- **Accounts for historical responsibilities.**
- **Standard climate measures lead to social and economic inequity.**
- **Designing effective and targeted climate policies.**
- **Making productive use of public investment etc.**

Way Forward

- **Proper tracking** of individual emissions within countries.
- **Policy instruments targeting investments** in polluting and fossil activities.
- **Scaling up public investments in low-carbon energy** production infrastructures, transport and energy efficiency etc.
- **Significant resources** should be invested in **production and collection of climate inequality statistics** in all countries.
- **Windfall taxes on excess profits** in polluting industriescould help to fund low-carbon investment.
- **Developing countries** also need to **reform their domestic tax systems to redistribute more** from the wealthy.

1.4. CLIMATE CHANGE IMPACTS

1.4.1. IMPACT ON WOMEN

IMPACTS AT A GLANCE: WOMEN

UN figures estimate that **80% of people displaced by climate change are women.**

DISPROPORTIONATE IMPACTS OF CLIMATE CHANGE

- More dependent on **livelihood threatened** by climate change.
- **Poor access to finance** to cover weather-related losses, **adaptation technologies, education** etc.
- **Limited mobility and Heightened vulnerability and exposure** to climate change related extreme weather events due to **societal norms**.
- **Lack of gender sensitive disaster planning.**
- **Heightened burden of household responsibilities.**
- **Increased violence against women** due to strain over limited resources etc.

ROLE IN CLIMATE ACTION

- **Ensuring climate justice** by including the needs, perspectives, and ideas of women in climate action.
- **Utilising women's traditional knowledge and experience** related to natural resource management in climate action strategies.
- **Ensuring sustainable agriculture and food security** with the help of large women agricultural labour force.
- **Women act as first responders in community responses to natural disasters and contribute to post recovery needs** of their families.
- **Advancing climate investments** through grassroots women's organizations.

WAY FORWARD

Integrate gender perspectives into mitigation and adaptation actions by making Climate Action Policies:

- **Gender-aware**- including local women in their research.
- **Gender-sensitive**- accounting for gender in the project design.
- **Gender-responsive**- positively impacting local women.
- **Gender-transformative**- contributing to a more equal society.

1.4.2. IMPACT ON CHILDREN

IMPACTS AT A GLANCE: CHILDREN

CURRENT SITUATION

- Estimated 1 in 7 children globally are exposed to at least 5 **major climate and environmental hazards.**
- **In 2020, nearly 10 million children were displaced** due to weather-related events.
- **India** is among four South Asian countries **where children are at extremely high risk of the impacts of the climate crisis.**

DISPROPORTIONATE IMPACTS OF CLIMATE CHANGE

- Children are physically, **physiologically and emotionally more vulnerable** than adults to climate and environmental shocks.
- **Issues related to Children displaced by climate change:**
  - **Greater risk of maltreatment** in the form of abuse, trafficking, exploitation etc.
  - **More likely to lose access to essential** services, such as health, nutrition, education etc. and social protections against child labour, child marriage etc.
- **Climate policies often does not address the specific risks** that children face because of climate change.
- **Any deprivation as a result of climate and environmental degradation at a young age can result in a lifetime of lost opportunity.**

INTERNATIONAL INITIATIVES

- UNICEF, the International Organization for Migration (IOM), Georgetown University, and the United Nations University recently launched **Guiding Principles for Children on the Move in the Context of Climate Change.**
- **Children's Climate Risk Index' (CCRI)** introduced by UNICEF which provides the first comprehensive view of children's exposure and vulnerability to the impacts of climate change.

WAY FORWARD

- **Adopting a rights-based approach to empower and protect children based on international conventions** like the Convention on the Rights of the Child.
- **Understand children's vulnerability** through ground level assessments.
- **Provide appropriate guidance to children in exercising their rights** through-
  - **Imparting awareness** through climate education and developing greens skills.
  - **Encouraging their participation** in national, regional and international level decision-making.
- **Investing heavily in adaptation and resilience of social services** based on a careful assessment of children's exposure and vulnerability to climate change.

1.4.3. IMPACT ON HUMAN CAPITAL

IMPACTS AT A GLANCE: HUMAN CAPITAL

Impacts

- **Adversely impacts socio-economic development** by interrupting schooling, health services, and leading to forced displacement.
- **Health impacts** like malnutrition, respiratory diseases, injuries, heart related illness etc.
- Adverse impact on **physical and mental well-being.**
- **Destruction of livelihoods** in climate impacted sectors like agriculture and tourism.
- **Traps vulnerable population into poverty** and increases the financial pressure.
- Climate mitigation and adaptation efforts like transition to clean energy can **create skill gap and cause job losses.**
- **May lead to conflicts,** civil war-like situations.

Constraints in tackling impacts

- **No specific parameter to assess climate change impacts on human capital** across the globe.
- **Marginalized sections** such as indigenous people, children etc. **face greater impacts but are least protected.**
- **Social protection systems** are not prepared to adapt to climate change.
- Adaptation and mitigation are at a slow pace due to the **slow transition of new technologies and capital.**
- Financial limitations of developing nations to overcome socio-economic impact of **climate induced loss and damage.**

Way forward

- **Updating education policies** to encourage behavior change, empower people, and reskill and upskill workers for **low-carbon economy and Climate resilient development.**
- Assessing **workforce vulnerabilities and promoting adaptive social protection** services.
- **Investments** in the **rehabilitation and equipping** of essential services such as health care facilities.
- **Developing financial mechanisms to assist marginalized sections** in adapting to climate change and participating in energy transition.

1.4.4. ARCTIC REGION

IMPACTS AT A GLANCE: ARCTIC

Significance of Arctic

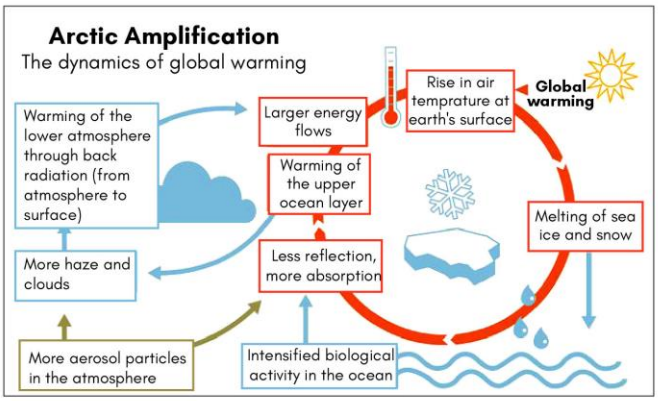
- An area of **geo-political, geo-economic and geo-ecological interest.**
  - Climate change causing melting of ice, **making region more accessible for economic exploitation** (oil & gas reserves, metals and minerals).
  - Possibilities to **open Northern Sea Route as a new trade route.**
- Helps circulate **world's ocean currents.**
  - Characterized as **world's climate change "barometer".**

India and Arctic

- Since 2007, **India has an Arctic research programme** with several expeditions undertaken till date.
- Unveiled its first **Arctic policy.**
- India is **one of the Observers in the Arctic Council.**

Impact of climate change

- **Arctic Amplification:** Arctic is heating up **more than 2 times** as fast as rest of world.
- **Melting sea ice:** 2022 **sea ice extent is well below long-term average.** It is also **impacting albedo of region,** thereby inducing the melting.
- **Changing chemistry of western region of the Arctic Ocean:** Acidity levels increasing three to four times faster than ocean waters elsewhere.



Impact of declining Arctic Sea ice cover

- **Adevrse impact on regional and global weather** due to interference with ocean circulation.
- **Ice albedo feedback** causing further melting of ice.
- **Boom in phytoplankton-driven** production of organic matter in oceans.
- **Life-threatening problems for the diverse population** of sea creatures **(especially organisms like oysters and corals).**

Way forward

- **Minimum Intervention in Arctic ecosystem** for resources exploitation.
- Sustainable tourism.
- Promoting **global cooperation in implementing international commitments such as Paris Climate deal.**

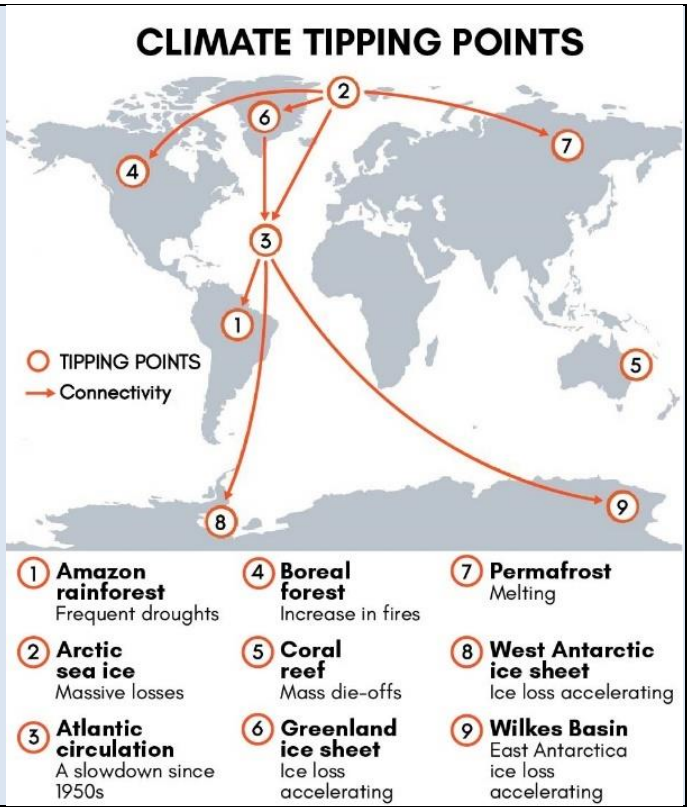
Related concepts:

Zombie Ice

- Zombie or doomed ice is ice that is **still attached to thicker areas of ice**, but is no longer getting fed by those larger glaciers because parent glaciers are getting less replenishing snow.
- Without replenishment, zombie ice is melting from climate change and will **inevitably raise seas.**

Tipping points

- Artic sea ice is one of the tipping points.
- Tipping points are thresholds where a tiny change could push a system into a **completely new state.**
- There are 9 "tipping points" where a **changing climate could push parts of the Earth system into abrupt or irreversible change** (refer image).



1.4.5. EXTREME WEATHER EVENTS

IMPACTS AT A GLANCE: EXTREME WEATHER EVENTS

Extreme weather

- Includes **unexpected, unusual, unpredictable severe or unseasonal weather; weather at the extremes of the historical distribution**—the range that has been seen in the past.
- **Vary from place to place in an absolute sense.**
- **Human induced climate change has likely increased the frequency and intensity of extreme events** since pre-industrial times, including heatwaves, extreme precipitation events, marine heatwaves, etc. (Sixth Assessment Report (AR6) IPCC).
- **Various examples of recent extreme weather events include:** Heatwaves and Forest Fire in USA (2022), Heatwaves in India and Pakistan (2022), Bushfire in Australia (2019-20) etc.

Status in India

- **More than 80 % of India's population** lives in districts highly vulnerable to extreme hydro-met disasters (Environment and Water's Climate Vulnerability Index).
- **The southern zone of India is the most vulnerable.**
- **2022 witnessed highest number of human casualties** in India due to extreme weather events in 3 years. **(Annual Statement on Climate of India – 2022)**

Impacts of extreme weather events

- **Heightened risk of irreversible loss of ecosystems and biodiversity.**
- **Positive feedback to climate change.**
- **Negative environmental effects** such as droughts, desertification, flooding and coastal erosion etc.
- **Reduced food and water security.**
- **Protracted, prolonged & repeated displacement.**
- **Impact on physical and mental health and livelihoods.**
- **Economic losses, damage to Infrastructure etc.**

Constraints in tackling

- **Lack of preparedness:** 1/3rd of the world's people are still not covered by early warning systems.
- **Commitment gap:** Current global commitments would lead to global warming in the range of 1.8 to 2.4 °C.
- **Difficult to predict due to uncertainty and complexity of extreme events.**
- **Unequal impact,** both at national and intra-national level, based on socioeconomic, demographic, and health-related differences and other factors.
- **Lack of funding to deal with consequences.**

Steps taken in India to tackle extreme weather events

- **Council on Energy, Environment and Water carried a first-of-its-kind district-level climate vulnerability assessment** to map regions vulnerable to extreme climate.
- **Guidelines and action plans for extreme events** by National Disaster Management Authority.
- **Early warning systems for floods and cyclones.**
- **Enhancement of Intended Nationally determined contributions.**

Way Forward

- **Enhancing climate commitments.**
- **Integrating extreme weather risk management and adaptation** into all social, economic, and environmental policy domains.
- **Early warning and response systems** like Heat Health Action Plans.
- Strengthening risk communication between decision makers and local citizens.
- **Bridging financing gaps through innovative risk financing instruments** like micro-insurance, insurance, reinsurance, etc.
- **Climate-proofing of infrastructure** and enhancing institutional capacity building and ecosystem-based responses.

** For comprehensive coverage and in-depth analysis of specific disasters, please refer to the Disaster Management section.*

1.4.6. SEA LEVEL RISE

IMPACTS AT A GLANCE: SEA LEVEL RISE

Present Status

- **Sea levels rose 4.5 mm a year** on average between 2013 & 2022, the highest ever.
- India, China, Bangladesh, and Netherlands face **the highest threat** of sea-level rise globally.

Causes of Sea level rise

- **Global warming**
- **Melting of Ice sheets, glaciers and caps.**
- **Changes in net storage of terrestrial freshwater** such as groundwater/river extraction etc.
- **Sinking of land in coastal regions.**
- **Natural factors** such as tectonic movements and changes in ocean currents.

Steps taken by India to tackle Sea level rise

- **Integrated Coastal Zone Management project (ICZMP), Coastal Regulation Zone (CRZ) Notification, 2019:** to **conserve and protect coastal stretches** etc. for coastal management.
- **Airborne Lidar Terrain Mapping (ALTM) elevation data** launched by **INCOIS.**
- **Indian Tsunami Early Warning System (EWS).**
- **Coastal Management Information System (CMIS).**
- NDMA has issued several **disaster specific guidelines** for managing extreme weather-related disasters etc.

Concerns related to Sea Level Rise

- **Environmental impacts** like increased intensity of **storm surges, loss of habitat, Impacts on coastal ecosystems etc..**
- **Economic impacts like threat to coastal infrastructure.** Saltwater **intrusion in groundwater supplies,** etc.
- **Social Impacts** like largescale displacement of people in coastal areas.
- **Potential Maritime disputes** due to change in the baselines from which most maritime zones (defined under United Nation Convention on Law of Seas (UNCLOS)) are measured.

Way Forward

- **Protect (reduce the likelihood of the hazard): Build/maintain hard defences,** Beach nourishment, dune restoration etc.
- **Accommodate (reduce vulnerability):** Change **building codes and design standards** along coastlines.
- **Avoidance and planned retreat (reduce exposure): Prevent** new development in **vulnerable** zone and **Physical relocation** of people and critical assets.

1.4.7. OZONE HOLE

OZONE HOLE AT A GLANCE

Ozone layer

- **High ozone concentration region in the stratosphere,** protecting life on earth by absorbing harmful ultraviolet radiations from the Sun.

Arctic hole

- First noticed In 2011.
- Occurs during spring.
- **Arctic vortex prevents cold air from escaping the region.**
  - This keeps the concentration of ozone depleting substances high in the region.
- **Increased concentration of ozone depleting substances** leading to ozone depletion.
  - It occurs due to Polar Arctic vortex.

Causes of Ozone Hole

- High emission of **Ozone Depleting Substances (ODS)**- Man-made chemicals like Chlorofluorocarbons (CFCs), halons, methyl bromide, etc. having high Ozone depleting potential (ODP).
- Formation of **Polar Stratospheric clouds**- high altitude clouds that facilitate conditions for destruction of ozone layer.

Impact of ozone layer depletion

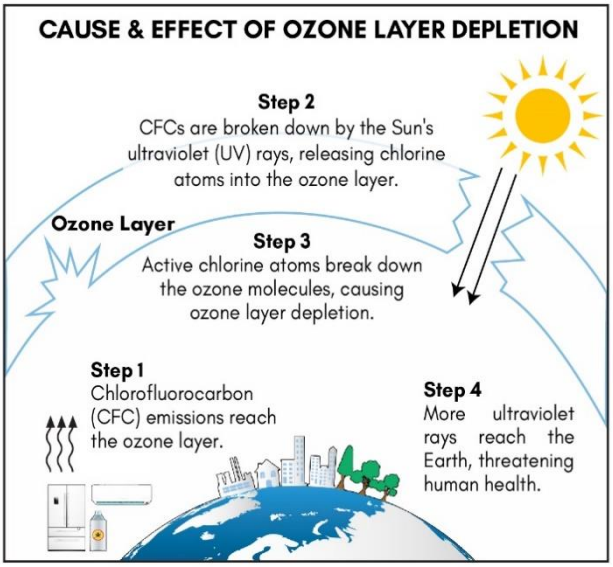
- Increases **risk of skin cancer and cataracts.**
- **Weakens human immune systems**
- **Decreases agricultural** productivity
- **Affects** terrestrial and aquatic **biogeochemical cycles** etc.

Thinning of the ozone layer

- **Confirmed in 1985** through the formation of the ozone **hole over the Antarctic.**

Antarctic hole

- **Develops in August and dissipates in late November**
- **First reported in 1985.**
- The frozen crystals that make up **polar stratospheric clouds provide a surface for the reactions that free chlorine atoms in the Antarctic stratosphere.**



1.4.7.1. MONTREAL PROTOCOL

Why in news?

As per recently published Ozone Recovery Assessment Report, 2022, the ozone layer is on track to recover within decades as **ODSs** are phased out.

Other Key findings of the report

- **Thickness of the ozone layer expected to return** to 1980 values around **2066 in the Antarctic,** around **2045 in the Arctic region.**
- This slow but **steady progress over the past three decades** was achieved by **Montreal Protocol.**

- The study suggests that **decline in ODS emissions due to compliance with the Montreal Protocol avoids global warming** of approximately 0.5–1 °C by mid-century.

About Montreal Protocol, 1987

- It is a **protocol of Vienna Convention** for the Protection of the Ozone Layer, 1985.
- Regulates the production and consumption of ODS such as **chlorofluorocarbons (CFCs), halons, methyl bromide (CH3Br), bromochloromethane (CH2BrCl)** etc.
- Governments, scientists and industry work together **to cut out 99% of all ozone-depleting substances (ODS).**
- One of the rare treaties to **achieve universal ratification.**
- **Membership:** Ratified by all 198 UN Member States (including India).
- Established **Ozone Fund, 1990 to support developing countries in their efforts to phase out the use of ozone depleting substances.**
- **Kigali Amendment:**
  - Adopted in 2016 and **entered into force in 2019.**
  - Provided a path to achieve an **80% reduction in HFCs consumption by 2047.**
  - Adopted because **Montreal Protocol** led to **replacement of chlorofluorocarbons (CFCs) with Hydrofluorocarbons (HFCs)** which do **not destroy the Ozone layer but are extremely potent in causing global warming.**

India and Montreal Protocol

- Became a **Party to Montreal Protocol in 1992.**
- Has **successfully met phase out targets of all ODS as per Montreal Protocol Schedule.**
- Set up of **Empowered Steering Committee** and **Ozone Cell as a National Ozone Unit (NOU)** by for implementation of Montreal Protocol.
- **Approved the ratification of Kigali Amendment** to Montreal Protocol in 2021.
  - Accordingly, India has to **start phase down by 2028** and cut **HFC emission by 15% of 2024-26 levels** by the year 2047.
- **Other steps for protection of Ozone**
  - Successfully **achieved complete phase out of HCFC-141b** used in manufacturing of foam.
  - **India Action Cooling Action Plan** to reduce the consumption of ozone depleting substances in cooling equipment.

Key challenges highlighted by the report

- **Difficulties in to taking action against unreported emissions** due to **gaps in observation and monitoring networks** for compounds like CFC-11, CFC-12.
- **Unexplained emissions have been identified** for other ODSs such as CFCs-13, 112a, 113a, 114a, 115, and CCl4.
- **Disparity in Ozone recovery:** Recovered better in upper stratosphere then middle and lower stratospheric zones.
- **Gaps in regional atmospheric monitoring** due to lack of monitoring stations.
- **Geo-Engineering Techniques- stratospheric aerosol injection (SAI)** has hinted towards deepening of the Antarctic ozone hole and delay in ozone recovery.

Way Forward

- **Elimination of emission of methyl bromide.**
- **Reduction in anthropogenic N_2O emissions.**
- Emissions of **anthropogenic very short-lived chlorine substances, dominated by dichloromethane,** need to be phased out.
- **Reductions in the future emissions of CFCs and HCFCs** requires proper assessment and monitoring of regional gaps.

1.5. MITIGATION

CLIMATE CHANGE MITIGATION AT A GLANCE

Refers **to efforts to reduce or prevent emission of greenhouse gases** (GHGs).

Emission trends

- **GHG emissions were 54% higher in 2019** than they were in 1990, but growth is slowing.
- Concentration of carbon dioxide is 149%, Methane is 262% and nitrous oxide is 123% of the levels of the pre-industrial level in 1750 (World Meteorological Organization Greenhouse Gas Bulletin).

Mitigation efforts across the globe

- **Sharm el-Sheikh Implementation Plan** requested Countries to revisit and strengthen their 2030 climate targets by the end of 2023 and **finalised the details of Mitigation work programme.**
- As of November 2021, **over 140 countries including India, China, USA etc. announced or are considering net zero targets,** covering 90% of global emissions.
- **Countries like UK, Sweden, Denmark, New Zealand, etc. have enacted net-zero legislations.**
- Under **Global Methane Pledge,** a non-binding agreement, signatory countries have promised to cut **their methane emissions by at least 30% by 2030.**

What needs to be done as per IPCC AR6

To limit global warming to 1.5°C

- Global GHG emissions peak before 2025, reduced by 43% by 2030.
- Reach Global net zero CO_2 emissions in the early 2050s.
- Methane reduced by 34% by 2030.

To limit global warming to 2°C

- Global GHG emissions peak before 2025, reduced by 27% by 2030.
- Reach Global net zero CO_2 emissions around the early 2070s.

For both-

- **Rapid and deep GHG emissions reductions immediate GHG in all sectors** follow throughout 2030, 2040 and 2050.
- **Negative CO_2 emissions after the point of net zero.**

Constraints/Concerns

- **Nationally determined contributions (NDCs) to the Paris Agreement are insufficient** and would likely lead to warming exceeding 1.5°C during the 21st century.
- **Implementation gap:** Policies implemented by the end of 2020 are projected to result in higher global GHG emissions than those implied by NDCs.
- **Emission from existing and planned fossil fuel infrastructure.**
- **Limited Policy coverage for emissions from agriculture.**
- **Financial flows are 3-6 times lower than levels needed by 2030** to limit warming to below 1.5°C or 2°C.
- **Global share of emissions from urban areas is increasing.**

Way forward

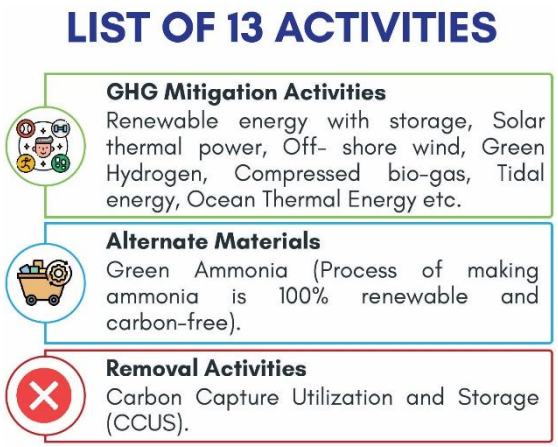
- **Deploying CO_2 removal technologies like reforestation, carbon sequestration etc.**
- **Embedding mitigation efforts within the wider development strategies.**
- **Building equitable partnerships** through engagement with civil society actors, political actors, businesses, youth, labour, media, Indigenous Peoples and local communities.
- **Scaling up mitigation financial flows.**
- **Adopting sectoral mitigation strategies for with interventions in Energy, Industry, Agriculture, Transport, Buildings and Urban** areas for energy efficient and low/zero emission pathways.

1.5.1. CARBON MARKET AND TRADING

1.5.1.1. ARTICLE 6 OF THE PARIS CLIMATE AGREEMENT

Why in News?

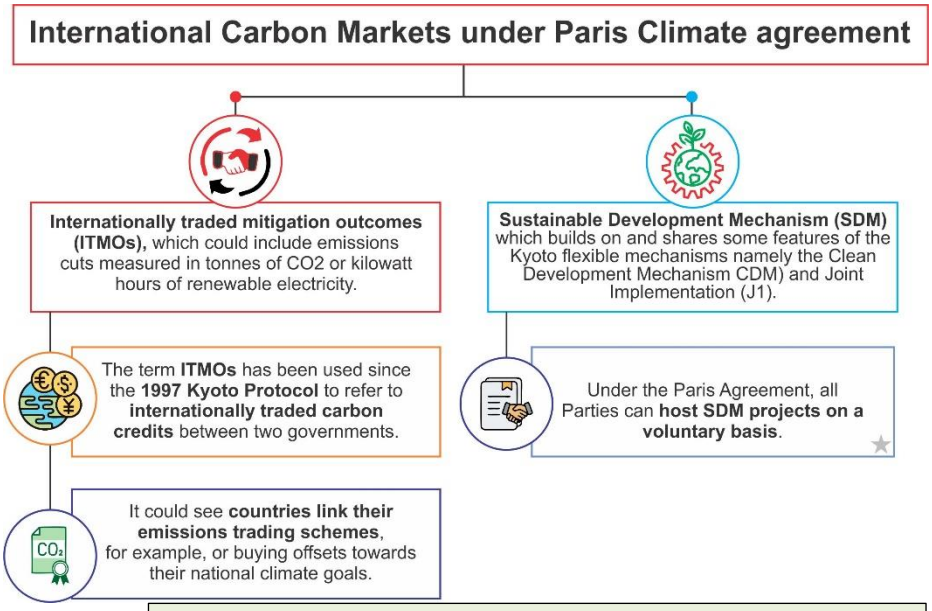
Union government has finalized a list of 13 activities **to facilitate the transfer of emerging technologies** and **mobilise international finance in India.**



More on the News

- Also, **National Designated Authority for Implementation of Paris Agreement (NDAIAPA)** was notified.
- NDAIAPA is **mandated to decide type of projects** that may take part in international carbon market under **Article 6 mechanisms of the Paris Climate Agreement.**

About Article 6



- It pertains to the establishment of **international compliance carbon markets** governed by the rules of the Paris Agreement where countries can trade carbon credits.
- It contains 3 separate mechanisms for **voluntary cooperation** towards climate goals:
  - **Two based on market mechanisms- Internationally Transferred Mitigation Outcomes (ITMO)** under Article 6.2 and **Sustainable Development Mechanism (SDM)** under Article 6.4.
  - One based on **"non-market approaches"- Article 6.8.**
    - ✓ Article 6.8 recognizes non-market approaches to promote mitigation and adaptation, in situations where **no trade is involved.**
    - ✓ It introduces cooperation through **finance, technology transfer, and capacity building.**
- The **rulebook** on Article 6 was adopted at **COP26 in Glasgow,** with discussion on **several modalities and detailed rules being deferred to later conferences.**

Significance of Article 6

- **Allows countries to voluntarily cooperate** with each other to **achieve emission reduction targets** set out in their NDCs.
- Used for **funding adaptation efforts in developing counties.**
- Promotes **higher ambition in countries' mitigation and adaptation actions** and promotes **environmental integrity.**
- Provides a **means of incorporating climate commitments** by **private sector** into the wider UN process.

Contentious issues regarding Article 6

- **Over-reliance on offsetting emissions can take away attention from mitigation efforts** towards the ambitious target of 1.5° C.
- **Highly technical and Slow progress of finalization of rules.**
- **Several terms like Non-Market Approach (NMA), carbon removals etc. are not well-defined** and can be interpreted differently for own convenience.
- **Disagreements among countries** related to multiple issues-
  - Whether **Article 6.4 activities could include Emission avoidance:**
  - **Trade of A6.4ERs** (credits issued without authorisation for use towards the buyers' regulatory requirements) can lead to **double counting** of emission reduction claims.

- **Key Outcomes related to Article 6 at the COP27:**
  - UNFCCC Secretariat requested to **develop a test version of the tracking infrastructure for monitoring carbon credits,** the Centralized Accounting and Reporting Platform (CARP).
  - The **outlines for submission of Article 6 related information** were adopted.
  - Some issues like whether Article 6.4 activities could include **emission avoidance** and conservation enhancement activities were postponed to future conferences.

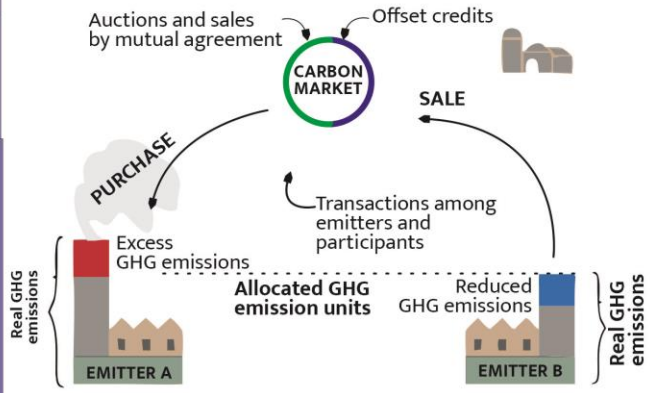
Carbon Credit and Carbon Market

A **kind of tradable permit** that equals one tonne of carbon dioxide or the equivalent amount of a different greenhouse gas (Co_2e) removed, reduced, or sequestered from the atmosphere.

Carbon markets are **a tool for putting a price on carbon emissions**- they establish trading systems where carbon credits can be bought and sold.

Types of carbon markets

Compliance markets	Voluntary markets
Created because of any **national, regional and/or international** policy or regulatory requirement. Mostly operate under a **principle called cap-and-trade.** **Example** - EU's emissions trading systems (ETS).	These are those in which emitters- **corporations, private individuals, and others**- buy carbon credits on voluntary basis. **Example**- In aviation sector, airlines may purchase carbon credits to offset the carbon footprints



Way forward

- **Going beyond offsetting:** Carbon market system should aim to accelerate just transition, facilitated by technological and financial sharing mechanisms focussed towards reducing overall GHG emission.
- **Accelerating negotiations around contentious issues** using innovative mechanisms like multilateral platforms.
- **Transparency mechanisms** can be set up to verify reports and their credibility.
- **Key terminologies should be defined appropriately** to avoid misinterpretation.
- **Countries can voluntarily give up** carbon credits generated under Kyoto mechanisms.
- **Global Collaboration for emission tracking**, e.g., World Meteorological Organization (WMO) has launched the **Global Greenhouse Gas Monitoring Infrastructure (GGMI)** to support the **UNFCCC processes** including **Global Stocktake, enhanced transparency frameworks, National inventories etc.**

1.5.1.2. CARBON CREDIT TRADING SCHEME, 2023

Why in News?

The **Carbon Credit Trading Scheme, 2023** was notified by the Central Government, in consultation with the Bureau of Energy Efficiency (BEE).

More on the news

- It was notified in exercise of the powers conferred by **section 14 of the Energy Conservation Act, 2001**
  - The **Energy Conservation (Amendment) Act, 2022** had **empowered central government to specify a carbon credit trading scheme.**

Significance of the scheme

- **Set up a single carbon market mechanism** at the national level would, which **reduce transaction costs, improve liquidity, enhance a common understanding** and streamline the accounting and verification procedures.
- **Alignment with Article 6 of the Paris Agreement.**
- **Contribution to Sustainable Development.**
- **Gradual decarbonisation of the economy** by **enabling active participation of the private sector** in all potential sectors.
- **Promote transparency** in the institutional and financial infrastructure for carbon market transactions.

Key Features of the Carbon Credits Trading Scheme (CCTS)

- Specifies **the structure of the Indian Carbon Market,** for both voluntary trading and compliance.
- **Creation of accredited carbon verification agencies (ACVAs)** to carry out verification activities under the scheme.
- **Compliance Mechanism:** Ministry of Power (MoP) will decide sectors and the obligated entities to be covered under the compliance mechanism.
  - Obligated entities will be required to achieve **GHG emission intensity** in accordance with the targets as may be notified by the MoEFCC and achieve **any other targets** such as use of non-fossil energy consumption or specific energy consumption as may be notified by MoP.
- **Establishment of institutional structure for the scheme**-

Institution	Functions
New **National Steering Committee for Indian Carbon Market (NSCICM),** with Secretary, Ministry of Power as its ex-officio-Chairperson	• **Governance of the Indian carbon market (ICM)** and monitoring and providing **direct oversight** of its functioning. • Make **recommendations to the BEE** in regards several aspects of the ICM such as- o **procedures for** its **institutionalization,** o **rules and regulations** for its functioning, o **GHG targets** for obligated entities, o **Issue of carbon credit certificate (CCC)** and process or conditions for their **crediting period or renewal or expiry.** o **Guidelines regarding trading of CCC outside India.**
Bureau of Energy Efficiency (BEE) as the **administrator**	• **Identify and recommend sectors for inclusion in Indian carbon market** to the Ministry of Power. • **Develop trajectory and targets,** in terms of **ton of carbon dioxide equivalent (tCO2e)** for the entities under compliance mechanism. • **Issue the CCCs** based on the recommendation of the NSCICM and approval of Central Govt. • **Develop market stability mechanism for carbon credits.** • **Accredit the agencies** in accordance with the approved procedure for ACVA. • **Develop processes and information technology infrastructure** for functioning of ICM. • **Undertake capacity building** activities for the stakeholders.
Central Electricity Regulatory Commission (CERC) as the **regulator** for trading activities	• **Regulate matters relating to trading of CCC.** • **Safeguard interest of both sellers and buyers.** • **Take necessary preventive and corrective actions** to prevent fraud or mistrust. • **Register the power exchanges** and approve the carbon credit certificate trading.
Grid Controller of India Limited as the **registry**	• **Function as meta-registry for India.** • **Registration of obligated or non-obligated entities** • **Maintenance of secure database and records** of all transactions. • **Establishing linkages** with other National or International registries etc.

India's Experience with Carbon Markets

While **India does not have an explicit carbon market,** it has instruments that closely resemble carbon markets.

Clean Development Mechanism (CDM)	Renewable Energy Certificate (REC) Scheme	Energy Saving Certificates (ESCerts) under Perform Achieve and Trade (PAT) Scheme
• **Created by the Kyoto Protocol.** • Certified Emission Reductions (CERs) **equivalent to the mitigation of one tonne of CO2e.** • Implemented by **National CDM Authority** (under MoEFCC).	• 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.** • REC would be exchanged on the **CERC approved power exchanges** and through **electricity traders.** • **Regulated by CERC.**	• Aims at reducing **Specific Energy Consumption (SEC)** i.e., energy use per unit of production for **Designated Consumers (DCs)** in energy intensive sectors. • **Excess energy savings are converted into tradable** ESCerts that are traded at the **India Energy Exchange (IEX)** and **Power Exchange India Limited (PXIL).** • 1 ESCert = 1 MTOE (**Metric Tonne of Oil Equivalent)** • Implemented by **BEE** under **Ministry of Power.**

Challenges to carbon markets in India

- **PAT and REC schemes do not state their certificates' metric unit in terms of carbon dioxide equivalent,** which seriously limits their growth potential and efficacy as a price discovery mechanism for carbon.
- **India's industry stakeholders do not have deep experience of the cap-and-trade market.**
- **Multiple sectoral market instruments** fragments the scale of the domestic energy market and prevents cross-linkages between the PAT and REC schemes.
- **Weak enforceability on DISCOMs**.
- **Poor market transparency** leading to issues like double counting of GHG reductions, poor assessment of climate mitigation efforts.
- **Concerns about greenwashing:** Companies may buy credits to offset their carbon footprints instead of reducing their overall emissions or investing in clean technologies.
- **Challenges in meeting obligations for designated consumers due to** shortage of renewable sources of power.

Way forward

- **Examination of present trade of various environmental instruments** to observe trading trends.
- **Calibration and effective management** of demand and supply of instruments.
- **Developing a provision for fungibility of the unit trading** to emission reduction may attract voluntary buyers and lead to international participation in the market.

About Energy Conservation (Amendment) Act, 2022

- Amends **Energy Conservation Act, 2001** which provides a framework for regulating **energy consumption and promoting energy efficiency and energy conservation.**
- While 2001 act deals **with saving energy,** 2022 amendment deals with **saving the environment and tackling climate change**, thus broadening **scope and objective** of principal Act.
- **Recent Amendments**
  - Empowered central government to specify a **carbon credit trading scheme**.
  - Government may require **designated consumers to meet a minimum share of energy consumption from non-fossil sources** like green hydrogen, green ammonia, etc.
    - ✓ Failure to meet obligation will be **punishable with a penalty** of up to Rs 10 lakh.
  - Replaces Energy Conservation Code for buildings with new norms for green buildings- **'Energy Conservation and Sustainable Building Code'.**
    - ✓ New Code will also apply to the **office and residential buildings** meeting certain threshold criteria. It also empowers state governments **to lower the load thresholds.**
  - **Expands the scope of energy consumption standards** to **include vehicles** (as defined under the Motor Vehicles Act, 1988), **and vessels** (includes ships and boats).
  - **Regulatory powers granted to State Electricity Regulatory Commissions (SERCs)** for discharging their functions.
  - State Governments constitute **energy conservation funds,** which will receive contribution by both Union and State govt.
  - **Increases and diversifies number** of **members and secretaries** in governing council of BEE.

2010 amendments to Energy Conservation Act (ECA), 2001.

The Act was **first amended in 2010** to expand **its scope** and bring the **following subjects under its ambit-**

- **Energy conservation norms for buildings**; enhanced energy efficiency norms for appliances and equipment,
- A framework for the **trade of energy savings** among energy-intensive Designated Consumers (DCs).
- **Increased penalties** for offences committed under the Act, including violation of norms for **efficiency and consumption standards**.
- Provided room for **appeals to be heard by the Appellate Tribunal for Electricity (APTEL).**

1.5.1.3. CARBON BORDER ADJUSTMENT MECHANISM (CBAM)

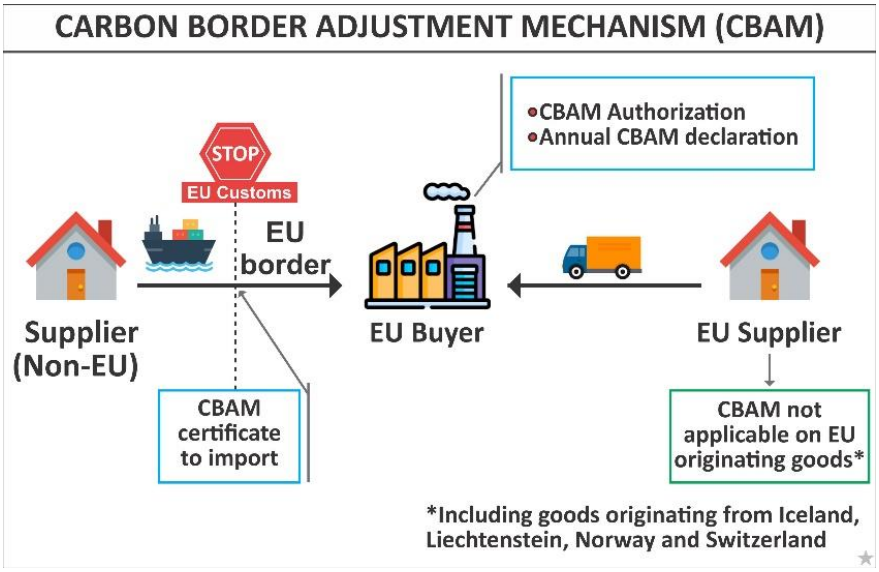
Why in News?

The European Union (EU) has formally notified the implementation of Carbon Border Adjustment Mechanism (CBAM) at the WTO members of the committee on trade and environment.

About CBAM

- It is a **plan to tax carbon-intensive products**, such as iron and steel, cement, fertilizer, aluminium, electricity, and hydrogen, from 2026.

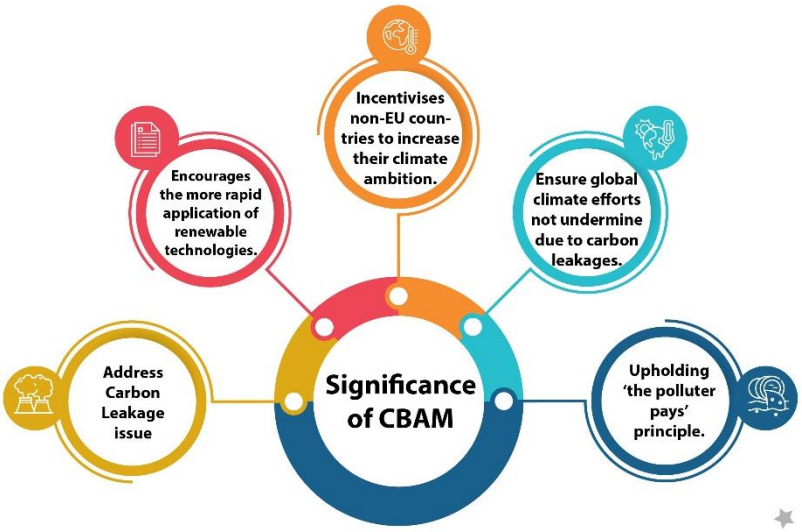
- Also known as**, carbon border tax or a carbon leakage instrument.**
- It is part of carbon market reforms under **EU's Fit for 55 package.**
  - Fit for 55 refers to the EU's target of reducing net greenhouse gas emissions by at least **55% by 2030 from 1990 levels and achieve net zero emissions by 2050.**



- Under the CBAM, **EU importers will have to buy carbon certificates corresponding to the carbon price** that would have been paid had the goods been produced under the EU's carbon pricing rules.
  - If a non-EU producer has already paid for the emission in the country where the production took place, the **EU importer can claim deductions from their CBAM liability against this.**

India's opposition & other concerns

- **Discriminatory** as it will ramp up prices of India's goods in Europe and shrink demand.
- **Huge impact on Indian exports** to EU.
- **Against the Common but Differentiated Responsibilities and Respective Capabilities (CBDR–RC).**
- **Will cause market distortion** along with aggravating the already widened trust deficit amongst parties.
- **Difficulties in measuring carbon prices of goods.**



- **Other concerns:**
  - **May violate World Trade Organization (WTO) rules.**
    - ✓ Companies in the sectors covered **are allowed a limited number of free emissions allowances** and must pay for permits for any emissions beyond this.
  - **Potential economic risks to the Global South who struggle to decarbonize their industries.**
  - **Additional costs will be passed on to the consumers,** eventually.

Way ahead

- **Develop standards to measure carbon embedded** into India's products: India's Bureau of Energy Efficiency (BEE) under the Power Ministry is working on such standards.
- **Financial support for developing countries** to introduce the carbon price.
- **Coordinated application of carbon taxes** and related climate change avoidance measures should be given more priority.
- **Bilateral resolution with EU,** alongside preparing to set up its own carbon trading system.

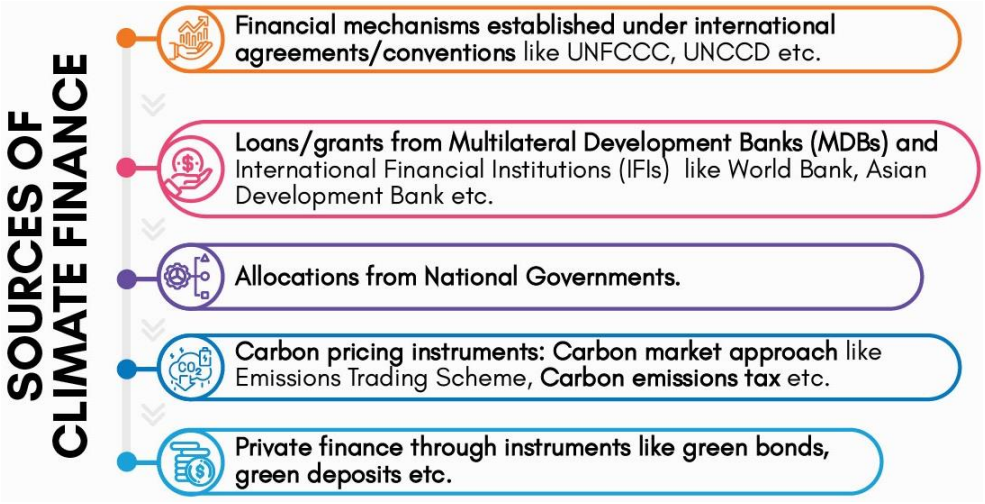
Other Measures adopted by EU

- **Social Climate Fund** will support people in Europe with the costs of transitions.
- **Reforming Emission Trading System (ETS):** European industries and energy companies should cut emissions by 62 % by 2030 compared to 2005 levels, compared to previous target of 43%.

1.5.2. CLIMATE FINANCE

Why in News?

Discussion surrounding climate finance formed an important part of at the UN Climate Change Conference COP27 in Sharm el-Sheikh.



About Climate finance

- According to the **UNFCCC, climate finance is local, national or transnational funding** from public, private and alternative sources that seeks to **support climate change mitigation and adaptation actions.**
- **Scale of finance needed:** A global transformation to a low-carbon economy is expected to require investment of **at least USD 4–6 trillion per year**.
- **Significance of Climate finance:**
  - **Just transition,** including transformation of the low-carbon energy systems to.
  - **Addressing loss and damage** and responding to the growing vulnerability of developing countries to climate change.
  - **Restoring the damage to natural capital and biodiversity**.

Financial mechanisms established for Climate Finance under UNFCCC and related Agreements	
Funds managed by Global Environment Facility (GEF)	• **Special Climate Change Fund (SCCF), established in 2001.** • **Least Developed Countries Fund (LDCF).**
Adaptation Fund	• **Established in 2001** to finance concrete adaptation projects and programmes in developing country Parties to the Kyoto Protocol. • **Receives 5% share of proceeds from new market-based UNFCCC mechanism** established by Article 6.4 of the Paris Agreement.
Green Climate Fund (GCF)	• **Established in COP 16, 2010.** • **Developed countries pledged to mobilise US$ 100 billion per year by 2020 to** support developing countries raise and realize their NDC ambitions towards low-emissions, climate-resilient pathways.

Climate Finance and India

India's climate finance needs

- **Cumulative investments of up to 6–8 trillion USD** required during 2015–2030 to implement the actions required to transform the current energy systems in India.
- **India needs around USD 10 trillion to achieve net-zero by 2070.**

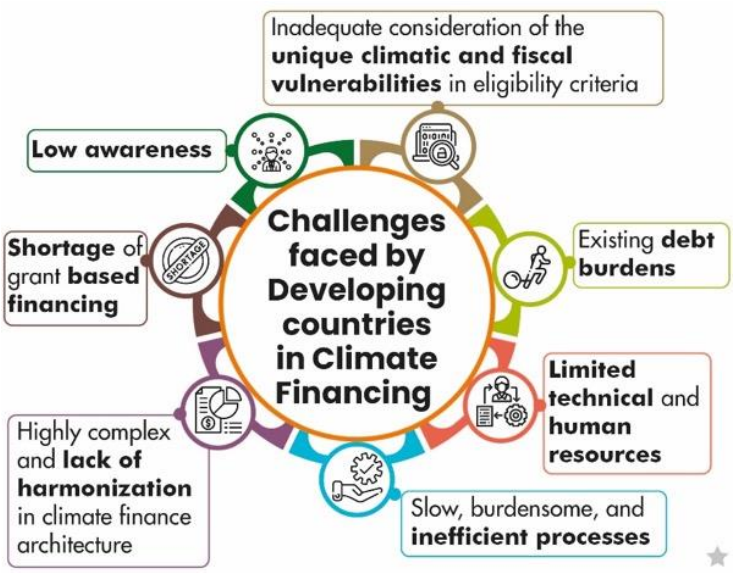
Steps taken to mobilize climate finance

- **National Adaptation Fund for Climate Change (NAFCC)** was established in August 2015.
- **Priority Sector lending to renewable energy projects**.
- **Issuance of Green Deposits and Green Bonds,** India's first green bond was **issued by Yes Bank in 2015.**
- **Sustainable Finance Group (SFG) was set up under RBI**.
- **RBI joined the Network for Greening of Financial System (NGFS)**.
- **Union Budget 2022-23** announced **sovereign green bonds for green infrastructural investments.**

Way Forward

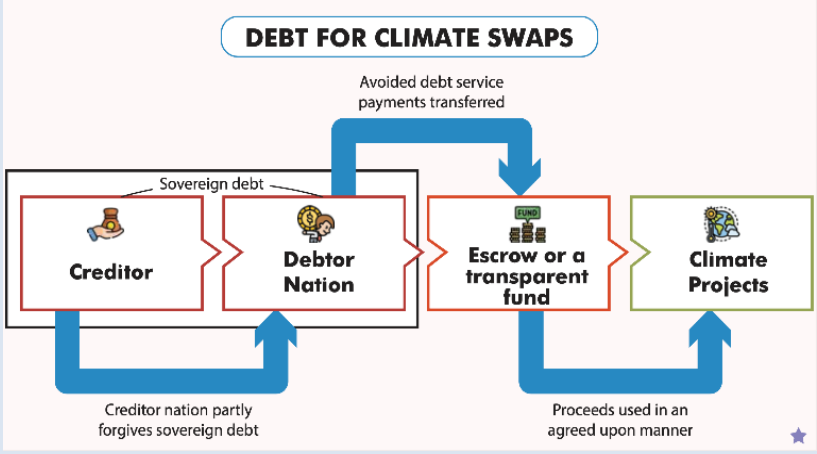
- **Increase the efficiency of financial market** through interventions like the provision of better information, including taxonomies and transparency, etc.
- **Set up climate clubs and cross-border finance initiatives** like just transition partnerships.
- **Transformation of MDBs and IFIs by** reforming operational practices and priorities, aligning and scaling up funding, etc.

- **Doubling availability of low-cost and debt-free finance** from developed countries by 2025 from 2019 levels.
- **Creating common language and standards for climate finance** to bring coherence.
- **Enhance financing avenues for adaptation such as through innovative instruments** like special drawing rights, voluntary carbon markets etc.



Related Concepts: Debt for Climate (DFC) Swaps

- DFC swaps are a type of debt swap in which the **debtor nation, instead of continuing to make external debt payments in a foreign currency, makes payments in local currency** to finance climate projects domestically on agreed upon terms.
  - Introduced as a **debt restructuring device** that **aims to combat climate change by ensuring that debt-ridden countries do not incur additional debt while addressing climate change locally**.
  - First **used in the 1980s in Latin America**.
  - **Grown relatively popular among low and middle-income countries** as a debt-relief measure.
- Envisioned **outcomes** of DFC swaps:
  - **Enhanced climate spending.**
  - **Boosting economy recovery**, while incorporating climate resilience and protecting biodiversity.
  - **Reduced external sovereign debt.**
  - **Fulfill global commitment of developed nation**: DFC swaps serve as a means for the signatories of the Paris Agreement and **the Glasgow Financial Alliance for Net Zero (GFANZ)** to fulfill their global commitment of providing financial assistance to developing countries in their efforts to construct clean and climate-resilient futures.



- **Another concept related to this is Debt for Nature Swap,** which is an arrangement in which countries cut their debt in return for conservation.

1.5.2.1. SOVEREIGN GREEN BONDS (SGB) FRAMEWORK

Why in News?

Ministry of Finance approved India's First Sovereign Green Bonds (SGB) Framework

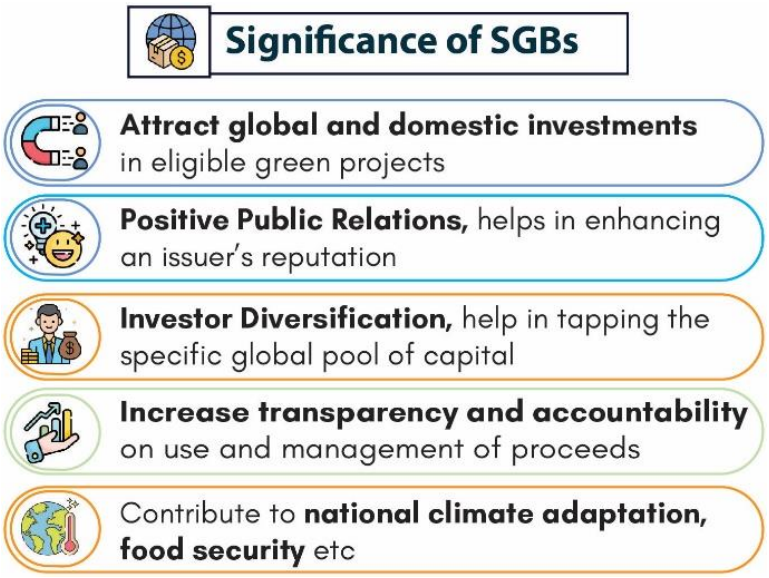
About Sovereign Green Bonds (SGB)

- A green bond is a fixed-income instrument designed to support specific climate-related or environmental projects.
  - **SGBs are issued by the Government.**
- Earlier, Union Budget 2022-23 announced the issuance of SGBs.

Key highlights of framework

- A **'green project' classification** is based on the principles like: Encourages **energy efficiency, reduces** carbon & GHG emissions etc.

- `**Eligible projects under SGB framework:** Projects of renewable energy, energy efficiency, clean transportation, climate change adaptation, sustainable water and waste management, pollution prevention and control, green buildings, and biodiversity conservation.
  - It **excludes,** nuclear power generation, landfill projects, direct waste incineration, hydropower plants larger than 25 MW etc.
- **Green Finance Working Committee** constituted **to validate key decisions on issuance of SGB.**
- Proceeds will be **deposited with Consolidated Fund of India.**



Issues related to Green bonds in India

- **Greenwashing** due to eligibility of wide range of projects.
- **Lack of robust impact assessment framework** to quantify environmental outcomes.
- **Liquidity issues for investors** as it is still a small market.

Way Forward

- Cover all the projects which are **reducing environmental degradation** such as nuclear power generation.
- **Generate public awareness about green bonds as investment.**
- **Incentivize private investment in green projects.**
- **Enhance participation** of state and local self-governments.

Steps Taken in India to promote green bonds

- In 2017, SEBI had brought **disclosure norms for green bonds** whereby issuer will have to **make disclosure** about **environmental objectives** of issue of such securities.
- SEBI expanded the definition of scope of **Green Debt Securities (GDS)** and introduced **concept of blue, yellow and transition bonds.**
  - **Blue bonds:** Comprises **funds raised for sustainable water management** including clean water and water recycling, and sustainable maritime sector including shipping, fishing, ocean energy and mapping etc.
  - **Yellow bonds:** Comprises funds raised for **solar energy generation** and **upstream industries and downstream industries associated with it.**
  - **Transition bonds:** Comprises funds raised for **transitioning to a more sustainable form of operations,** in line with India's Intended Nationally Determined Contributions.
- **RBI issued SGBs in two tranches** of Rs 8000 crore.
- India's **First Green Bond** was issued by Yes Bank Ltd in 2015.

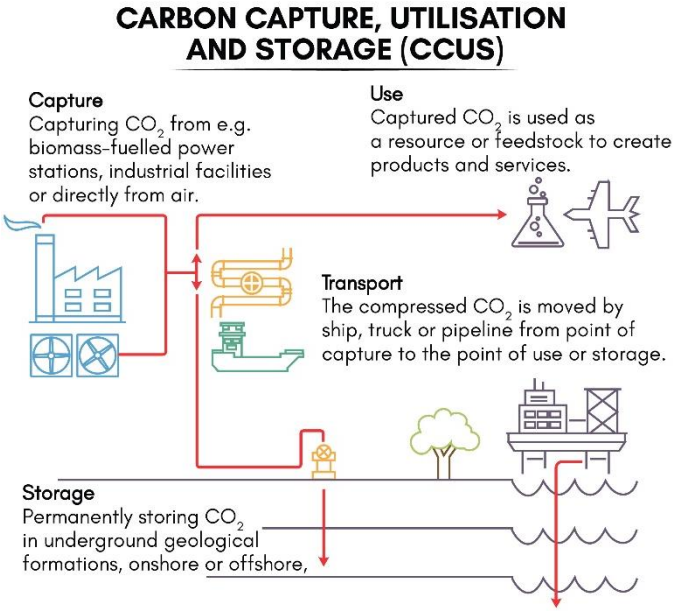
1.5.3. CARBON CAPTURE, UTILIZATION AND STORAGE (CCUS)

Why in news?

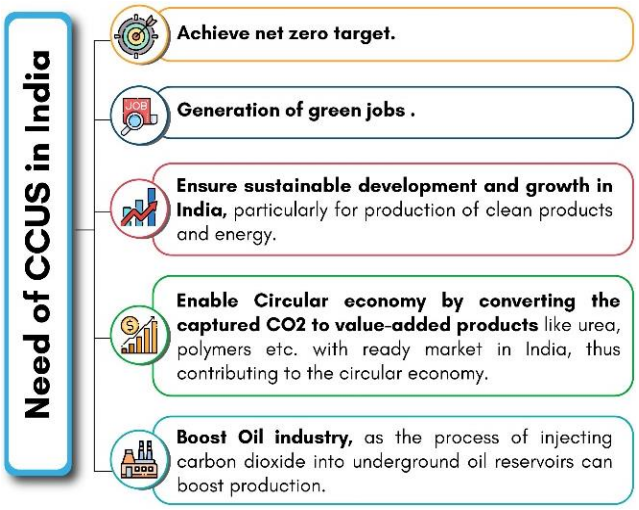
Recently, NITI Aayog released the report titled **'Carbon Capture, Utilisation, and Storage (CCUS) Policy Framework and its Deployment Mechanism in India'.**

Carbon Capture, Utilization, and Storage (CCUS)

- CCUS encompasses technologies to **remove CO_2 from flue gas and the atmosphere,** followed by **recycling the CO2 for utilization** and determining safe and **permanent storage options.**



Different Carbon Capture technologies for different applications	
Technology	**Details**
Chemical Solvent	• Preferred when **dealing with gas streams that are lean in CO_2 and have relatively lower pressures** such as flue gas streams from power plants etc.
Physical Solvent	• Work well on **gas streams with relatively higher CO_2 concentration and pressure** such as pre-combustion capture in case of gasification projects.
Adsorption	• Suitable for gas streams with **moderate to high pressure and moderate CO_2 concentration** such as steam methane reforming (SMR) flue gas.
Cryogenic Separation	• Preferred in cases where **cost of power is low.**



Concerns associated with CCUS

- **High capital investment** for carbon capture technology, etc.
- **Difficult to transport:** Impurities in CO_2 stream including water can **cause damage to pipelines** as the compressed fluid rapidly expands to a gas.
- Lack of CO_2 **transport** and **storage sites** near industries.
- NIMBY (Not in My Back Yard) i.e. **rejecting large projects such projects being built near them** because of the perceived risks etc.
- CCUS project **are not currently regulated by a uniform standard.**
- **Lack of technology transfer by developed nations.**
- **Lack of adequate geological information for risk mitigation.**

Initiative for CCUS in India

- **National Centres of Excellence:** Establishment of two National Centres of Excellence in CCUS at IIT Bombay and JNCASR, Bengaluru.
- **Mission Innovation Challenge on CCUS**: It aims to enable near-zero **CO_2** emissions from power plants and carbon-intensive industries.
- **Accelerating CCS Technologies (ACT):** This initiative aims to facilitate R&D and innovation that can lead to development of safe and cost-effective CCUS technologies.

Related concept: Low carbon technology (LCT)

- Term given to **technologies that emit low levels of CO_2 emissions,** or no net CO_2 emissions.
- **Examples for LCT** include **increasing utilization ratio of available resources** (heat pumps, combined heat and power, etc.), **making use of inevitable emissions (CCUS)** or converting desired products from renewable resources (photovoltaic, geothermal heating, hydrogen, etc.).

Way forward

- **Develop a geological CO_2 storage atlas** to map the source as well as storage sites.
- **Tax incentives for establishing** financing and funding mechanisms for CCUS projects.
- **Promote Environmental and social justice by** distributing economic value created by CCUS.
- **Promoting Low- Carbon products** by encouraging procurement from CCUS-equipped plants.
- **Accelerate technology transfer by developed nations.**
- **Risk mitigation** through EIA and SIA.
- **Promotion of R&D in CO_2 utilization technologies** and new products & applications.
- **Investing in designing new transportation infrastructure.**

1.5.4. METHANE EMISSION

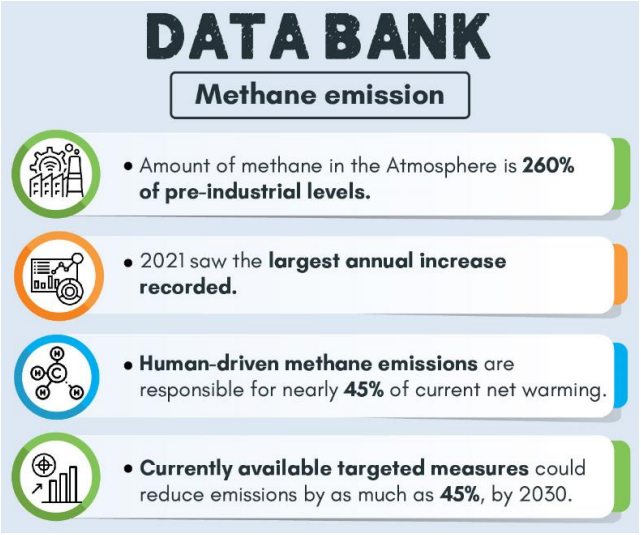
Why in news?

Recently, the **'Global Methane Assessment: 2030 Baseline Report'** was released by **Climate and Clean Air Coalition (CCAC)** and **United Nations Environment Programme (UNEP).**

About Methane

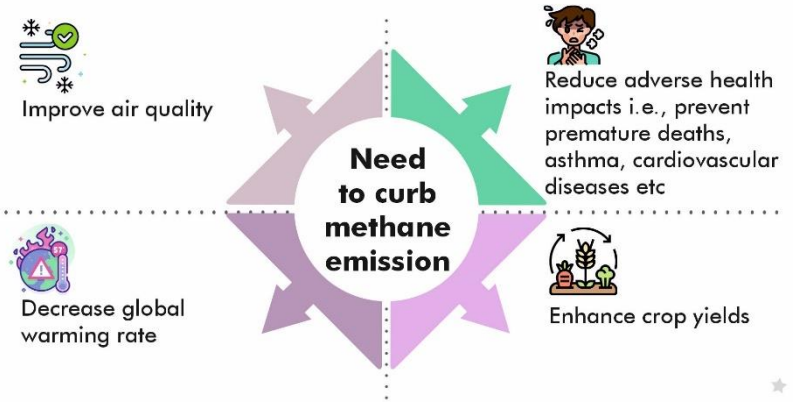
- **Powerful greenhouse gas** (20 years lifespan), with a Global Warming Potential more than **80 times greater than that of carbon dioxide (CO2).**
- Responsible for **more than 25% percent of the warming.**
- **Responsible for around half of the growth** in **tropospheric ozone** formation.

- **India** is among the **top 5 methane emitters in world.**
- **Wetlands** are the most **prominent** methane emitter followed by fossil fuel extraction, livestock and Landfill and agriculture waste**.**



Initiatives for reducing methane emission

- **Switching to Direct Seeded Rice** system.
- **Crop Diversification Programme** for growing **alternate crops** like pulses, oilseeds, maize, cotton, and agroforestry.
- **GOBAR (Galvanizing Organic Bio-Agro Resources) Dhan scheme.**
- **National Livestock Mission**
- **India GHG Program** builds a **comprehensive measurement** and **management** strategies to reduce emissions.
- **Global Initiatives: Global Methane Pledge (GMP),** 2021 (CoP26), Methane Alert and Response System (MARS) (launched at CoP27) etc.



Way Forward

- **Implement policies** to cover all three main **anthropogenic sectors.**
- **Technologies** like **Gas Mapping LiDAR (Light Detection and Ranging) can be used** to detect methane and thus curb emissions.
- **Mapping hotspots** through Global methane emitters monitoring tools along with satellite, aerial surveys, and drones.
- **Catalyzing greater action** by engagement of policymakers, industries, NGOs etc.
- **Capture and use Methane as Fuel**.

Sector specific interventions

Source	How emissions can be reduced?
Agriculture	• **Improve manure management** and animal feed quality. • Apply **intermittent aeration** of continuously flooded rice paddies. • **Improve animal health and husbandry** by combining herd and health management, nutrition and feeding management strategies. • **Introduce selective breeding** to reduce emission intensity and increase production**.** • **Promote farm-scale anaerobic digestion** to control methane emissions from livestock.
Fossil fuels	• **Carry out pre-mining degasification** and recovery and oxidation of methane from ventilation air from coal mines. • **Reduce leakage** from long-distance gas transmission and distribution pipelines. • **Extend recovery and utilization** from gas and oil production. • **Recover and use gas and fugitive emissions** during oil and natural gas production.
Waste management	• **Separate and treat biodegradable municipal waste,** and turn it into compost or bioenergy. • **Upgrade wastewater treatment** with gas recovery and overflow control. • Divert organic waste. • **Collect, capture, and use landfill** gas.

1.5.5. INDIA'S COOLING SECTOR

Why in news?

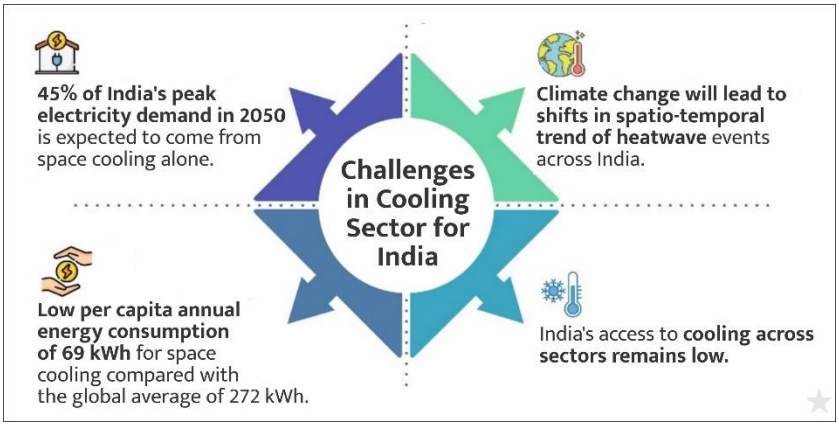
Climate Investment Opportunities in India's Cooling Sector report was released by the **World Bank.**

Key highlights of the report

- By 2030, over **160-200 million people** across India could be **exposed to lethal heat waves annually.**
- By 2030, **Around 34 million people will face job losses** due to heat stress related productivity decline.
- Current **food loss** due to heat during transportation is **close to $13 billion** annually.
- By 2037, **demand for cooling** is likely to be **eight times more than current levels,** leading to an **expected rise of 435% in annual greenhouse gas emissions** over the next two decades.

About ICAP

- **Launched in 2019 to provide sustainable cooling measures across various sectors** like indoor cooling in buildings, Cold chain and refrigeration in agriculture and pharmaceuticals, Air-conditioning in passenger transport etc. It **seeks to:**
  - **Reduce cooling demand across sectors** by 20% to 25% by 2037-38.
  - **Reduce refrigerant demand** by 25 % to 30% by 2037-38.
  - **Recognize "cooling and related areas"** as a thrust area of research.
  - **Recognize "cooling and related areas"** as a thrust area of research under national S&T Programme.



Recommendations for India's cooling sector

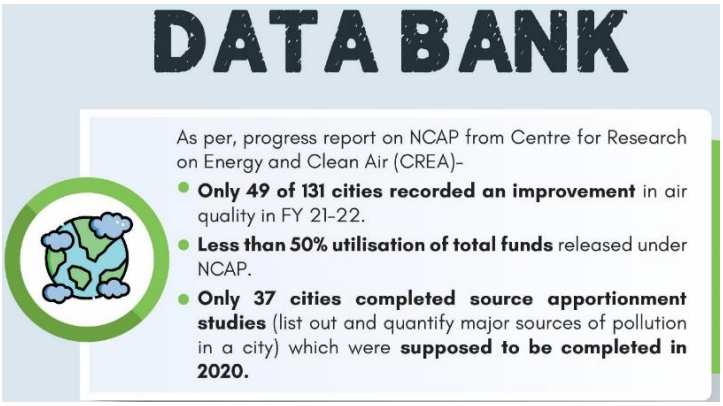
- **Adopting climate-responsive cooling techniques as a norm** in both private and government-funded constructions.
- **Investing in pre-cooling and refrigerated transport** can help decrease **food loss by about 76% and reduce carbon emissions by 16%.**
- **Proposes a roadmap to support India Cooling Action Plan (ICAP)** with new investments in three major sectors: building construction, cold chains, and refrigerants.
- **Improvements in servicing, maintenance and disposal** of equipment that **use hydrochlorofluorocarbons.**

2. AIR POLLUTION

2.1. NATIONAL CLEAN AIR PROGRAMME (NCAP)

Why in news?

The Centre has set a **new target of a 40% reduction in particulate matter concentration** in cities covered under the **National Clean Air Programme** (NCAP) by 2026, updating the earlier goal of 20 to 30% reduction by 2024.



About NCAP

- Launched in 2019 for reducing for comprehensive mitigation actions for prevention, control and abatement of air pollution.
- Under NCAP, **city-specific action plans have been prepared** which include measures for strengthening the air quality monitoring network, reducing vehicular and industrial emissions, increasing public awareness, etc.
- It is **implemented in 132 cities, non-attainment cities and Million Plus Cities,** in the country.
    - Non-attainment cities (NACs) are identified under **NCAP based on non-conforming to National Ambient Air Quality Standards (NAAQS)** consecutively for **five years.**

Other efforts in India to tackle air pollution

- **Vehicular Emission:** Leapfrogging from BS-IV to BS-VI fuel standards from 2020 (2018 for Delhi), Faster Adoption and Manufacturing of Electric Vehicles (FAME) -2 scheme, ethanol blending in petrol etc.
- **Industrial Emission:** Stringent emission norms for Coal based Thermal Power Plants (TPPs),
- **Extended Producer Responsibility (EPR)** for plastic and e-waste management etc.
- **Monitoring of Ambient Air Quality:** through programmes such as National Air Monitoring Programme (NAMP).
- **Air quality standards:** NAAQS (National Ambient Air Quality Standards) are notified for **12 parameters.**
- **Swachh Vayu Sarvekshan (SVS)** was launched to **rank cities in country for implementing City Action Plans** prepared as part of NCAP.
- **Breathelife Campaign** led by WHO, UN Environment Programme (UNEP) and Climate & Clean Air Coalition to mobilizes cities and individuals to take action to bring air pollution to safe levels by 2030.

Challenges faced in implementation of NCAP

- **Inadequate number of monitoring systems:** In 2021, India had only 804 air quality monitors (0.14 monitors per million people).
- **Data-related implementation issues like poor data capture due to substandard monitoring stations.**
- **Underutilization of the funds allotted:** Less than 50% utilisation of total funds released under NCAP.
- **Absence of a clear fiscal and funding strategy at the state level,** no state has formulated the mandatory state action plan.
- **Issues in boundary based approach,** cities cannot control emissions coming from outside.
- **Disbursement of performance-linked funds has considered only PM10 data** makes dust control the primary focus of clean air action.
- **Lack of awareness** among people leading to sub-optimal on-ground implementation of cities action plans.

Way forward

- **Adopt a standardised method for assessing air quality trends.**
- **Strong, coherent and coordinated fiscal response by the government.**
- **Providing legal mandate to targets** for ensuring compliance.
- **Catalysing action in the private sector to curtail air pollution** (designing and financing bold, cutting-edge innovations and unique technology solutions; investing through the Corporate Social Responsibility (CSR) etc.)
- **Invest in technologies** for monitoring, data collection etc.
- **Improving cross-stakeholder cooperation** to bring together multiple stakeholders together.
- **Increase public awareness** to ensure on-ground implementation of cities action plans.

3. WATER

3.1. WATER INSECURITY

WATER INSECURITY IN INDIA AT A GLANCE

- Water insecurity is **lack of availability of sufficient water of good quality to meet basic human requirements, livelihoods and ecosystem functions,** and an increased risk of water-linked disasters.

FACTORS RESPONSIBLE FOR INDIA'S RISING WATER INSECURITY

- **Depletion of groundwater:** Over-extraction for agricultural, industrial and domestic use; Concretization disrupting water recharge: Low water use efficiency in agriculture etc.
- **Surface Water Pollution:** Discharge of untreated or partially treated wastewater in rivers, lakes etc.; Agricultural Run-off etc.
- **Degradation of water bodies:** Encroachment due to rapid urbanisation; Lack of proper maintenance; Increasing siltation, salinity, eutrophication, Illegal sand mining etc.
- **Hydrological factors:** Altered rainfall patterns: Reduced flow of rivers: Higher evapotranspiration.
- **Institutional factors:** Poor enforcement of environmental norms; inadequate wastewater treatment facilities etc.

Current Situation in India

- **91 million people** (6% of the population) lack access to safe water.
- India as **18% of the world's population,** but only **4% of water resources of the world.**
- Many cities like Bengaluru are **running toward day zero** (there will be no water in the taps and the use of water will become restricted for vital services only).

Constrains

- **Total water demand will exceed its utilisable water reserves.**
- **Climate change will reduce spread of rainfall and increase evapotranspiration.**
- **Challenges in enhancing surface water storage capacity.** For instance, issues associated with construction of dams.
- **Fragmented approach** in management of surface and groundwater, drinking water and irrigation.

SCHEMES/POLICIES/ INITIATIVES

- **Jal Shakti Abhiyan (JSA): A campaign for water conservation and water security, with focus** on water stressed districts and blocks.
  - **Jal Shakti Abhiyan: Catch the Rain campaign** focuses on saving and conserving rainwater
- **National Water Mission:** Ensure integrated water resource management.
- **Mission Amrit Sarovar:** Developing and rejuvenating 75 water bodies in each district of the country.
- **Atal Bhujal Yojana:** Sustainable ground water management in water stressed areas in sevenStates.
- **Composite Water Management Index (CWMI)** developed by NITI Aayog.
- **Amrut 2.0:** Targets 100% water supply to all Households in 4700 ULBs.
- **Jal Jivan Mission:** Providing **55 litre potable water per capita per day** to every rural household through **Functional Household Tap Connection (FHTC)** by 2024.

Way Forward

- **Enhance water use efficiency in Agriculture** through micro irrigation, crop diversification agricultural practices etc.
- **Adopt One Water approach.**
- **Invest in enhancing capacity and efficiency of existing treatment plants.**
- **Restore waterbodies using** Nature based solutions e.g., blue-green infrastructure.
- **Expand Traditional water harvesting infrastructure.**
- **Promote circular water economy:** E.g. use of Grey water.
- **Awareness generation and community led interventions.**

3.2. GROUNDWATER

GROUND WATER EXTRACTION IN INDIA AT A GLANCE

EXTENT OF GROUNDWATER EXTRACTION

- **India** accounts for ~**25% of the global groundwater extraction** (highest globally).
- **Out of the total assessment units** surveyed in 2022, around **14% have been categorized as 'over-exploited'** (extraction exceeding the annually replenishable ground water recharge).
- **States with highest 'over exploitation' percentage: Punjab** followed by **Rajasthan, Haryana and Delhi.**
- Agricultural activities account for **90% of the annual ground water extraction.**

IMPACTS OF HIGH EXTRACTION

- **Lowering of the water table.**
- **Increase in concentration of contaminants.**
- **Increased costs of extraction.**
- **Reduced surface water supplies.**
- **Land Subsidence.**
- **Salt water intrusion in coastal areas.**

SCHEMES/POLICIES/INITIATIVES

- **National Water Policy 2012** proposes a framework for creation of a system of laws and institutions.
- **Jal Shakti Abhiyaan,** a time-bound, mission-mode water conservation campaign.
- **Master Plan for Artificial Recharge to Ground Water in India** by CGWB in 2013.
- **Watershed Development Component** (WDC) of the **Pradhan Mantri Krishi Sinchayee Yojana (PMKSY).**
- **Atal Bhujal Yojana.**

CONSTRAINTS

- **Inadequate rainfall and low irrigation coverage.**
- **Increase in water demand** due to rise in population, urbanisation, industrial activity etc.
- **Absence of appropriate regulation and institutional mechanism to discourage over-exploitation** of groundwater.
- **Indiscriminate extraction enabled by Agricultural policies**, like free subsidies on electricity, high MSP for water intensive crops etc.
- **Challenges in recharging declining water table:** hard rock terrain in southern states, variation in rainfall, concretisation, sand mining etc.

WAY FORWARD

- **Collecting groundwater data for monitoring.**
- **Preventing misuse of groundwater in agriculture** through on-farm water management techniques, micro irrigation, crop diversification etc.
- **Bringing the subject of water under the concurrent list** to help evolve a comprehensive plan of action.
- **Implement suitable artificial recharge techniques.**
- **Reinforce human, material and financial resources** of groundwater departments/agencies.

3.3. RIVER POLLUTION IN INDIA

RIVER POLLUTION IN INDIA AT-A-GLANCE

KEY TARGETS

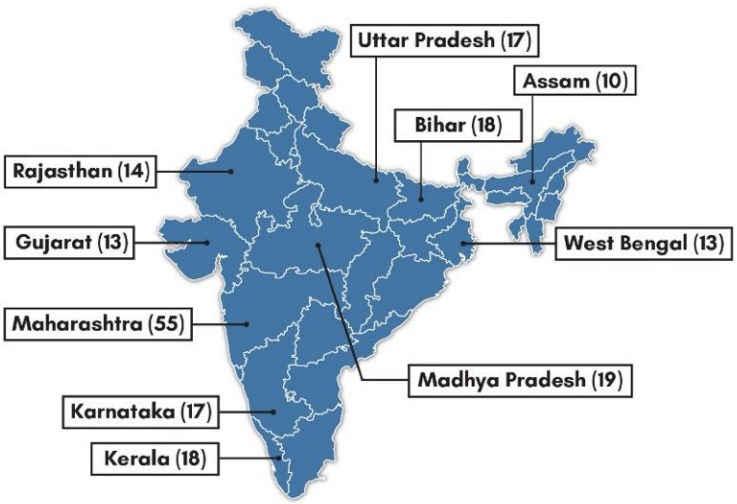
Vision for 2030, unveiled in the **interim budget 2019-2020,** include clean rivers, with safe drinking water to all Indians, sustaining and nourishing life.

CURRENT SITUATION

As per Central Pollution Control Board (CPCB), **number of polluted stretches in India's rivers fell** from 351 in 2018 to 311 in 2022,

- The CPCB considers **a Biological Oxygen Demand (BOD) of less than 3 mg/l an indicator of a healthy river.**

TOP 10 STATES WITH HIGHEST NUMBER OF POLLUTED RIVER STRETCHES



SCHEMES/POLICIES/INITIATIVES

- **National River Conservation Plan**
- **National Water Monitoring Programme (NWMP)** of CPCB.
- **Namami Gange programme.**
- Creation of sewerage infrastructure under schemes like **Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and Smart Cities Mission.**
- **Water Prevention and Control of Pollution Act, 1974**
- To assess the efficacy of river cleaning programmes, the CPCB has been ordered by NGT to launch a **nationwide programme on biodiversity** monitoring and **indexing of the rivers.**
- **River Cities Alliance** for sustainable management of urban rivers.

CONSTRAINTS

- **Improper management of** surface runoff, domestic discharge, agricultural affluents etc.
- **Suboptimal performance of** Sewage treatment plants (STPs) due to inappropriate technology and capacity.
- **Changes in flow of water** due to climate change, temporal and spatial variation of rainfall.
- **Growing urbanisation and industrialisation** in close vicinity of river streams.
- **Lack of regular river quality monitoring.**

WAY FORWARD

- Strict implementation of **recycling and reuse of wastewater** after treatment.
- The drains shall discharge sufficiently treated effluent in proportion to self-cleaning capacity of rivers.
- **Effective Solid waste management.**
- **Suitable bioremediation measures** to not discharge untreated water directly to the river.
- **Widespread and intense awareness programme** to inform them about the serious implications of river pollution.
- Provide sufficient water in the river for **ecological flow and dilution,** by:
  - Constructing storage structures at the upstream, which can continuously release discharge for meeting dilution requirements.
  - Improving water use efficiency so that less diversion of water is needed for consumptive usage.

3.3.1. NAMAMI GANGE

Why in News?

Namami Gange initiative has been recognized by the United Nations (UN) as one of the **Top 10 World Restoration Flagships programmes** aimed at reviving the natural world.

About the UN Decade on Ecosystem Restoration

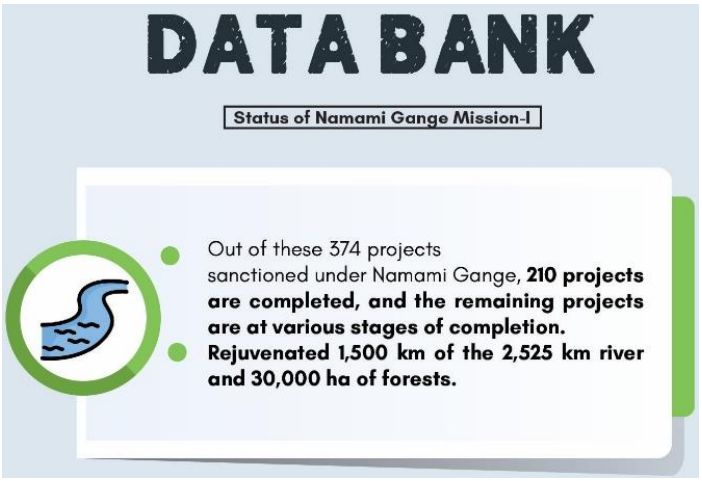
- The United Nations General Assembly has declared the years **2021 through 2030 the UN Decade on Ecosystem Restoration.**
- Led by the UN Environment Programme and the Food and Agriculture Organization of the UN, together with the support of partners, it is designed to **prevent, halt, and reverse the loss and degradation of ecosystems worldwide.**
- It aims at reviving billions of hectares, covering **terrestrial as well as aquatic ecosystems.**

More on the news

- The UN Decade on Ecosystem Restoration declared **first 10 World Restoration Flagships** honouring the best examples of large-scale and long-term ecosystem restoration in any country or region, embodying the 10 Restoration Principles of the UN Decade.
- These initiatives are now **eligible to receive United Nations-backed promotion, advice or funding.**

About Namami Gange Programme

- An **Integrated Conservation Mission** to accomplish the twin objectives **of effective abatement of pollution, conservation, and rejuvenation of National River Ganga.**
  - All new projects sanctioned under it would have 1**00% funding from the Central Government for the entire life cycle cost of the treatment assets created,** which includes 15-year Operation & Maintenance (O&M) cost as well.



Key features of Namami Gange

- **Implemented by the National Mission for Clean Ganga (NMCG)**, 2016, and its state counterparts—State Programme Management Groups.
- **World Bank funded Central Sector Scheme under the Ministry of Jal Shakti.**
- **It has a 5-tiered structure-**
  - **National Ganga Council under chairmanship of Prime Minister of India.**
  - **Empowered Task Force (ETF) under chairmanship of Union Minister of Jal Shakti.**
  - **National Mission for Clean Ganga (NMCG).**
  - **State Ganga Committees.**
  - **District Ganga Committees in every specified district abutting river Ganga and its tributaries in the states.**
  - **Entry-level activities immediate** (for visible impact), Medium-term activities (to be implemented within 5 years of time frame), and Long-term activities (to be implemented within 10 years) are its main segment.
- The Cabinet had approved the **Namami Gange Mission- II (NGM-II)** in 2022 with an outlay of Rs. 22,500 Crore for a period up to 31st March 2026.

Related News

- Recently, **several new initiatives were launched under Arth Ganga** concept during the event of 'Yamuna Par Azadi ka Amrit Mahotsav' organized by National Mission for Clean Ganga (NMCG).
- **Arth Ganga** is **concept** espoused by the Prime Minister during **National Ganga Council meeting in Kanpur in 2019.**
- **Aim:** To contribute about **3% to the GDP from Ganga** Basin.
  - Expected to **generate economic benefit of more than Rs 1000 crores over the next 5 years.**
- Focuses on **creating economic livelihood opportunities to sustain the activities under Namami Gange Programme**, the flagship program of the Government to clean Ganga and its tributaries.

Issues with implementation of Namami Gange program

- **Delay in Project completion** due to **delays in getting permission from National Highways Authority of India (NHAI) and Railways,** etc.

- **Poor financial management**: Only about **13000 Cr. of fund have been released/expended by NMCG** to State Governments, State Missions for Clean Ganga (SMCG) and other agencies.
- **Inadequate Sewage treatment**: Nearly 50% of untreated sewage and substantial industrial effluents are still being discharged in the river or its tributaries.
- **Governance issues** like multiple stake holders, lacks coordination etc.

Way forward

- **The existing and planned STPs need to be verified on efficiency, reliability and technology parameters** by independent agencies.
- Generate **sufficient revenues for O&M** of water and wastewater infrastructure through pricing and valuing water.
- Sharing of best practices using platforms such as the **River Cities Alliance (RCA),** a **dedicated platform for river cities to ideate, discuss and exchange information** for **sustainable management of urban rivers.**
- **Start restoring lower order streams** and smaller tributaries in the Ganga Basin.
- **Develop and restore local storages** (ponds, lakes, wetlands).
- **Map the entire looped length of each and every tributary of the** Ganga and correct the land records.
- **Integrate strategies** like river-linking, riverfront development projects, etc.

3.4. ONE WATER APPROACH

Why in News?

Government is making efforts to adopt one water approach to resolve water-related issues.

About One Water Approach

- An **integrated planning** and **implementation** approach to managing **finite water resources** for **long-term resilience** and **reliability** meeting both community and ecosystem needs.
  - Also, referred to as **Integrated Water Resources Management (IWRM).**
  - It believes that **all water has value**, regardless of its source.
- **Approach emphasizes the following things:**
  - **Wastewater** is recycled to become drinking water.
  - **Stormwater** is allowed to **soak into the ground**, supporting healthy river flows that provide drinking water and assimilate waste.
  - **Drinking water supplies** are **optimized through efficiency** and **conservation** leaving more water in the river.
  - How **land is used** and how the **water cycle is impacted** by land-use decisions.
- **Need of One water approach**: Minimizes environmental pollution; Recharges depleted aquifer; Builds resilience to Drought, Floods, heatwaves etc. and Climate Change; Ensures equity, affordability and accessibility to safe drinking water; Creates new jobs through Water recycling and reuse initiatives; Encourages collaboration and coordination among stakeholders.

Comparison of One Water Approach and Conventional Water Management		
Parameter	**One Water Approach**	**Conventional Water Management**
Basic Principle	All the **water systems, regardless** of their source, are connected.	Drinking water, wastewater, and stormwater are **managed separately.**
Usage	Water is **recycled** and **reused** several times.	**One-way route** from supply to use, treatment, and disposal.
Infrastructure	**Green** infrastructures and a mix of grey and green infrastructure.	**Grey** infrastructure
Collaboration	**Active collaborations** with stakeholders.	**Need**-based collaboration.

Challenges in adopting the approach in India

- **Limited know-how about recognising, measuring,** and **expressing water's worth** and incorporating it into policymaking.
- **Dominance of** single-minded and linear water management**, resistance in shifting towards IWRM** (Urban municipalities, State governments, etc. do not have adequate coordination)**.**
- Lack of **accurate** and **comprehensive data** on water **availability**, **quality**, and **usage**.
- High cost and time involved in **upgradation** of **infrastructure** design and **operation** such as **retrofitting** existing systems, implementing new technologies, or constructing decentralized treatment and storage facilities.

- **Inadequate Public financing mechanisms,** especially at local levels.
- **Jurisdiction issues such as inter-state conflict** over water-sharing and usage.
- **Lack of well-defined standards for reuse of treated wastewater.**

Way Forward

- **Develop and implement comprehensive policies** and regulations.
- **Public awareness campaigns** to educate citizens, policymakers, and stakeholders.
- **Invest in infrastructure development.**
- **Encourage research** and **innovation** in water management technologies and practices.
- **Establish** a **robust monitoring** and **evaluation** framework to track the progress.
- **Use sustainable finance options like green bonds etc.** to generate adequate capital.

Schemes/Policies/Initiatives

- Integrated Watershed Management Programme (IWMP)
- National Water Mission, under the National Action Plan on Climate Change.
- National Aquifer Mapping and Management (NAQUIM).
- Atal Mission for Rejuvenation & Urban Transformation 2.0 (AMRUT 2.0)
- Jal Jeevan Mission (JJM)
- Atal Bhujal Yojana (ABHY)
- Rainwater Harvesting Initiatives (Catch the Rain)
- Establishment of River Basin Organizations (RBOs)

3.5. WATER SENSITIVE CITIES

Why in news?

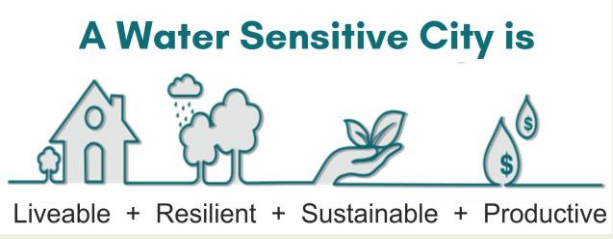
Recently, a research paper highlighted **importance of Water Sensitive Urban Design and Planning (WSUDP) for Cities in the Global South.**

More about research

- **Cities in India and the global south are marked by rising inequity in urban settlement/housing,** translating into inequity in access to basic infrastructure and services (including water supply and sanitation, drainage and wastewater management).

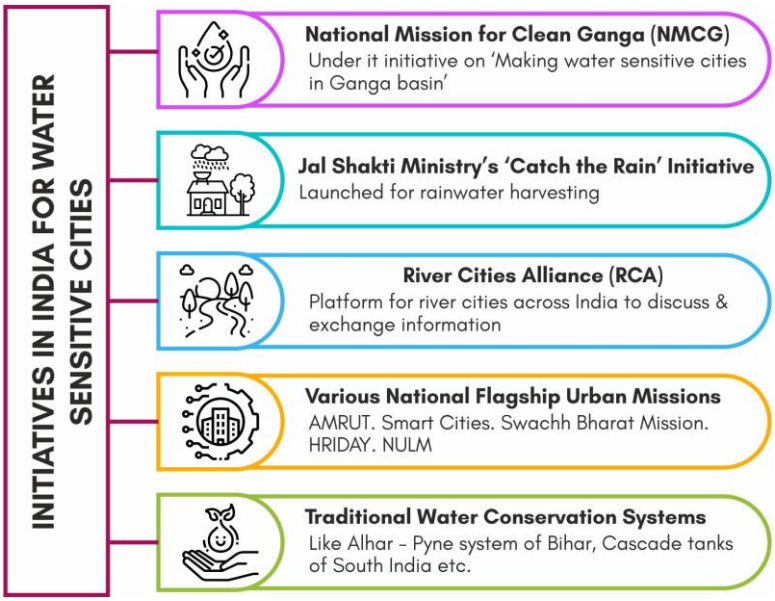
Water Sensitive Cities

- A water sensitive city **aims to achieve higher standards** and **effective water conservation** and **wastewater management** standards of the cities.
- Its key focus area is **Water Sensitive Urban Design and Planning (WSUDP).**



Water Sensitive Urban Design and Planning (WSUDP)

- An emerging urban development paradigm **aimed to minimize hydrological impacts of urban development on environment.**
- **WSUDP includes** -
  - **Protecting local water bodies** (lakes, ponds and wetlands) for supplementary water sources.
  - **Storm water management** at public places, including open areas in cities through elements of landscape design (e.g., **vegetated swales and buffer strips and bio-retention systems**).
  - **Recycling and reusing wastewater** naturally (low cost or low energy) and not treating it as a liability.
  - **Augmenting water conservation approaches** at various scales.
  - **Adding value to the social and ecological aspects of areas** by planning and designing the built environment in accordance with community needs and water issues.
  - **Integrating the urban water cycle** by collaborating with practitioners of different disciplines.
  - **Associating upcoming policies,** regulations and approvals with WSUDP.



Need for water sensitive planning

- **Integration** of water planning and city planning.
- **Ensuring Water security and rejuvenating groundwater tables** through sustainable use of rainwater, groundwater, surface water, etc.
- **Tackle issues in cities of global south** like- **largely informal nature of development**, lack of adequate investment in physical infrastructure, **diverse sources of accessing water** etc.
- **Safeguarding and Restoration of Water Commons** (**shared resources).**
- **Promote Wastewater Reuse and Treatment:** Presently, in developing countries, **80% of industrial and municipal waste is released untreated in the water bodies.**

Challenges

- **Poor understanding of planning** and water values.
- **Incomprehensibility of interconnectedness** between planning system and ecosystem
- **Interstate water conflicts** and poor mechanism for conflict resolution.
- **Complex hierarchies of spatial plans** without much integration and public participation
- **Development of large urban complexes** around metropolitan cities and **overpopulation.**

Measures for effective water sensitive planning

- **Population** needs to be predicted and planned to understand water demand.
- **Embedding Water in Spatial Planning.**
- **Proper legal protection** to be accorded to rivers, streams, lakes, and ponds.
- **Creation of city sponges through integration of Blue and Green spaces** such as water bodies, parks etc.
- **Separation of stormwater, wastewater, and black water through** decentralized sewage treatment systems.

Related news: Water Trading

- NITI Aayog is working on **draft policy regarding trading in water on commodity exchanges** like gold, silver and crude oil.
- **Water Trading:** Refers to **buying, selling or leasing water access right** enabling water to be transferred from one user to another.
  - **Market price of water reflects its demand and supply.**
  - It is already practiced in **Australia, Chile, USA** among others.
  - In 2020, **first tradable water price futures index was launched on Chicago Stock Exchange**.
- **Benefits of Water Trading**
  - Better price **discovery leading to efficient use of resources and encourage water saving.**
  - **Increased flexibility** to manage water availability and water use.
  - **Reduced government expenses** on drought relief measures.
  - **Insures farmers against drought.**
  - **Attracts investments in water economy** through increased business opportunities.
- **Concerns over Water Trading**
  - **Politically sensitive issues** due to greater impact on poor and marginalized sections of society.
  - **Against religious and cultural traditions** of community considering water with spiritual value.
  - Promote **privatisation of water resources (public good or a basic human right),** leaving the state with no control over them.

3.6. UN 2023 WATER CONFERENCE

Why in News?

The United Nations 2023 Water Conference was held in **New York, co-hosted by the Netherlands and Tajikistan.**

About UN water conference

- Most important United Nations-hosted event on water supply, sanitation and hygiene in some 50 years.
  - **Only the second UN Conference dedicated to water**, following the **Conference in Mar del Plata, Argentina in 1977.**
- **Aim:** To promote a comprehensive understanding and appreciation of the **importance of water, sanitation, and hygiene, and to facilitate effective management of these critical resources.**

- Will provide a unique opportunity to **undertake commitments and accelerate action towards achieving SDG 6.**
- Embraces the **principles of inclusion, cross-sectoral responsibility, and action orientation.**

Water Action Decade 2018-2028

- The United Nations General Assembly has declared the period between 2018 and 2028 as the International Decade for Action on "Water for Sustainable Development" in order **to expedite initiatives aimed at addressing water-related challenges.**

It pursues two main goals:

- To **improve knowledge sharing related to water and water pollution control**, including information on the water-related SDGs outlined in the 2030 Agenda for Sustainable Development.
- To **improve communication to achieve the water-related SDGs.**

Key outcomes of the conference

- **New Water Action Agenda,** a **collection of all voluntary commitments to accelerate progress** in the second halves of both the Water Action Decade 2018-2028 and 2030 Agenda for Sustainable Development.
- **Capacity building** through efforts like the **Making Rights Real initiative, Water for Women Fund** etc.
- **Knowledge sharing** through cross-learning tool **W12+ Blueprint** of UNESCO.
- **Demand for formal agreement,** like the 2015 Paris climate accords.

Related news: United Nations (UN) Water Summit on Groundwater (GW) 2022

- Summit was organised by **UN-Water, UNESCO and International Groundwater Resources Assessment Centre (IGRAC)** in Paris to bring attention to groundwater at highest international level.
  - Summit will mark the completion of **"Groundwater: Making the invisible visible" campaign** run by UN-Water throughout 2022.
- Summit uses **UN World Water Development Report 2022** as a baseline and **SDG 6 Global Acceleration Framework (GAF)** to define actions towards more responsible and sustainable use and protection of this vital natural resource.
  - In 2020, **five pillars of SDG 6 GAF** released namely data and information, capacity development, innovation, finance and governance.

3.7. OTHER POLLUTANTS

3.7.1. PERSISTENT ORGANIC POLLUTANTS

Why in News?

18th Meeting of the Persistent Organic Pollutants Review Committee to the **Stockholm Convention (POPRC-18**) was held recently.

More on the news

- The committee concluded its review of **four of the five chemicals** under consideration.
  - It recommended listing of Dechlorane Plus (flame retardant) and UV-328 (stabiliser) under Annex A of the Stockholm Convention.

About Persistent Organic Pollutants (POPs) and Stockholm Convention

- They are chemical substances that **persist in environment** for a long period**, bio-accumulate** in living organisms**, adversely affect human health/ environment** and have the **property of long-range environmental transport.**
- **Impact of POPs:** Exposure can lead to serious health effects including certain cancers, birth defects, dysfunctional immune and reproductive systems, greater susceptibility to disease and damage to the central and peripheral nervous systems.
- Stockholm Convention is a **global legally binding treaty,** adopted and opened for signature in 2001 in Stockholm, Sweden (entered into force in 2004).
- **Objective:** To **protect human health and environment from POPs.**
- India **ratified the convention in 2006.**
  - Ministry of Environment notified the **'Regulation of POP Rules'** in 2018, under the Environment (Protection) Act, 1986.
- The chemicals targeted are listed in the annexes of the convention text.

Annexes of Stockholm Convention	
Categorization of chemicals	**Measures to be taken by parties with respect to listed chemicals**
Annex A (Elimination)	• **Prohibit and/or eliminate the production and use, as well as the import and export.**

	• Specific exemptions available only to Parties registered for them.
Annex B (Restriction)	• **Restrict the production and use** in light of **any applicable acceptable purposes and/or specific exemptions**.
Annex C (Unintentional production)	• **Reduce the unintentional releases** with the goal of continuing minimization and, where feasible, ultimate elimination.

Related news: Per and polyfluoroalkyl substances (PFAS)

- New research suggests that **rainwater around the world is contaminated by PFAS.**
- **PFAs** are chemicals that have **partially or completely fluorinated carbon chains** of varied lengths.
  - Due to these strong carbon-fluorine bonds, they do not degrade easily in the environment and are often referred to as "**forever chemicals**".
  - PFAS like perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) are listed under **Stockholm Convention on Persistent Organic Pollutants** and their production and use are restricted or eliminated in the Parties.
- **Common use of PFAS include:** Non stick cook and bake ware, fire fighting foams, Food packaging, Water and oil proof apparel etc.
- **Concerns associated with use of PFAS:**
  - **Found in the blood of people and animals** due to widespread use.
  - **High exposure associated with health risks** like decreased fertility, developmental effects in children, interference with body hormones, liver damage, etc.
  - **Difficult to capture and destroy**
- **Measures to reduce PFAS contamination:** Safe disposal of PFAS using methods like filtration through activated carbon tanks, incineration etc.; phasing out PFASs listed under the Stockholm Convention and replace them with safer alternatives; Avoid PFAS-based non-stick pans and kitchen utensils; etc.

Related News

- International trade of 2 hazardous pesticides was recommended for 'prior informed consent' (PIC).
- The PIC procedure is a mechanism under **Rotterdam Convention for formally obtaining and disseminating the decisions of importing parties** on their willingness to receive future shipments of hazardous chemicals.

About Rotterdam convention

- An international **legally binding treaty,** adopted by the **Conference of the Plenipotentiaries in Rotterdam in 1998** (entered into force in 2004).
- **Objective:** To facilitate **informed decision-making by countries with regard to the international trade in hazardous chemicals.**
- It **covers pesticides and industrial chemicals** that have been banned or severely restricted for health or environmental reasons by Parties.
- **India is a signatory**.

4. SUSTAINABLE DEVELOPMENT

4.1. SUSTAINABLE DEVELOPMENT

SUSTAINABLE DEVELOPMENT GOALS IN INDIA AT A GLANCE

SUSTAINABLE DEVELOPMENT & ITS NEED

Concept was described by the 1987 Bruntland Commission Report as **'development that meets the needs of the present without compromising the ability of future generations to meet their own needs"**

- **3 Objectives-Economic** growth, Environmental protection, and Social inclusion
- **Ensures good governance & transparency, fight** against climate change & protect biodiversity, contributes to the well-being of communities etc.

INDIA'S OVERALL PERFORMANCE IN ACHIEVING SDG

Dashboard : SDG achieved · Challenges remain · Significant challenges remain · Major challenges remain · Information unavailable

Trends : On track or maintaining SDG achievement · Moderately improving · Stagnating · Decreasing · Trend information unavailable

INDIA'S CHALLENGES IN ACHIEVING SDGS

- **Structural Challenges:** Imbalance in economic development, Rapid Urbanisation, Regional variance.
- **Implementation Challenges:** Financing SDGs, Systemic Weaknesses, Lack of access to resources; Lack of awareness and poor participation by marginalized communities.
- **Monitoring Challenges:** Defining Indicators, Monitoring outcomes, Measuring Progress.

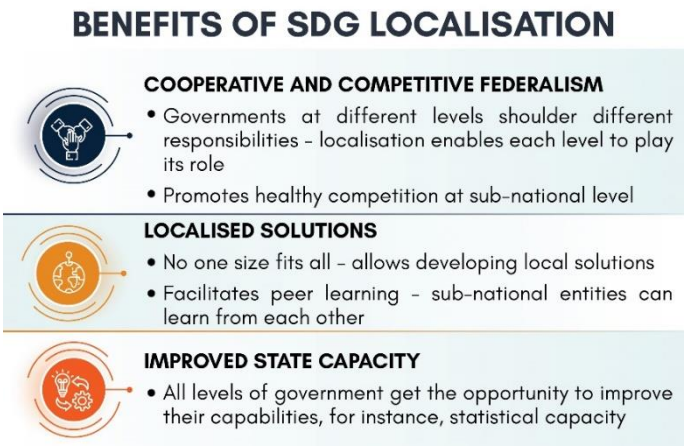
WAY AHEAD TO OVERCOME THE BARRIERS IN ACHIEVING SDGS

- **Localizing SDGs:** NITI Aayog should make regular Interventions to facilitate entrepreneurship, Innovation and new-age leadership on various development fronts.
- **Need to refashion Education, Employment and Human Resource Development:** invest in and enhance quality and accessibility of health care, especially for the economically weaker sections and people in vulnerable situations.
- **Promoting women's entrepreneurship:** For inclusive procurement both in public and private sector.
- **Invest in new and resilient infrastructure.**
- **Enhance funding** for timely achievement of SDGs targets.
- **Focus on 3As (Awareness, Action & Accountability)** to improve the accuracy of the indicator measurement and avoid double counting.

4.1.1. LOCALIZATION OF SUSTAINABLE DEVELOPMENT GOALS (LSDGS)

Why in News?

A MoU has been signed with the **Institute of Rural Management Anand, Gujarat** to collaborate in **Gram Panchayat Development Planning (GPDP) for Localization of (SDGs) through Panchayati Raj Institutions (PRIs).**



More on News

- Ministry of Panchayati Raj **has been taking action in respect of those identified SDGs through GPDP** involving participatory planning by converging various schemes to achieve the respective SDGs.
    - The objective of GPDP process is to fulfil the Constitutional mandate of Gram Panchayats i.e., **to achieve economic development and secure social justice at the grassroots level**.

Challenges in SDG Localisation

- **Limited availability of finance, data and capacities** to perform subnational monitoring.
- **Lack of policy coherence** and coordination among national and local efforts.
- **Enhanced responsibilities with limited funds transfer** and local resource mobilization.
- **Limited awareness** of the SDGs at the sub-national level.
- **Local translation** and **adaptation** in diverse country like India.

Efforts taken for localization of SDGs

- In India, the overall coordination for implementation of SDGs is handled by the **National Institution for Transforming India or NITI Aayog** with twin mandate of:
    - Overseeing the adoption and monitoring of the SDGs in the country, and
    - Promote competitive and cooperative federalism among States and UTs.
- NITI Aayog launched the annual **'SDG India Index'** in 2018 which monitors progress of states and Union Territories (UTs) on SDGs and localisation of SDGs.

Some Examples of Successful Localisation from States	
Andhra Pradesh	• **Navaratnalu**, a cluster of nine flagship programmes, to reach out to vulnerable communities across sectors, such as, agriculture, health, education, housing, etc.
Bhopal	• Launched **India's first city-level Voluntary Local Review (VLR)** of Sustainable Development Goals (SDGs) called '**Agenda for Action: Sustainable Urban Transformation in Bhopal'**. • VLR enables cities and regions to **localize SDGs and report their progress.**
Bihar	• **Viksit Bihar ke 7 Nischay**, a package of programmes which includes schemes on inclusion, entrepreneurship, women's reservation in jobs, provision of water, electricity, concrete streets, toilets and higher education.

Way Forward

- **Break down the goals and implementation to sub-national and local levels** for implementation in a **people-centric manner**, i.e., gender responsive, community responsive localisation of SDGs.
- Provide for **proper monitoring** and **evaluation of SDGs implementation** through effective partnership among all SDG partners.
- Help in learning from the **shared experiences to overcome** the functional silos and adapt to the global challenges through local actions.
- **Create awareness** on SDGs in PRIs and empower rural local bodies by effective devolution of Funds, Functions and Functionaries.

4.1.2. SUSTAINABLE DEVELOPMENT GOALS (SDGS) AND URBANISATION

Why in the news?

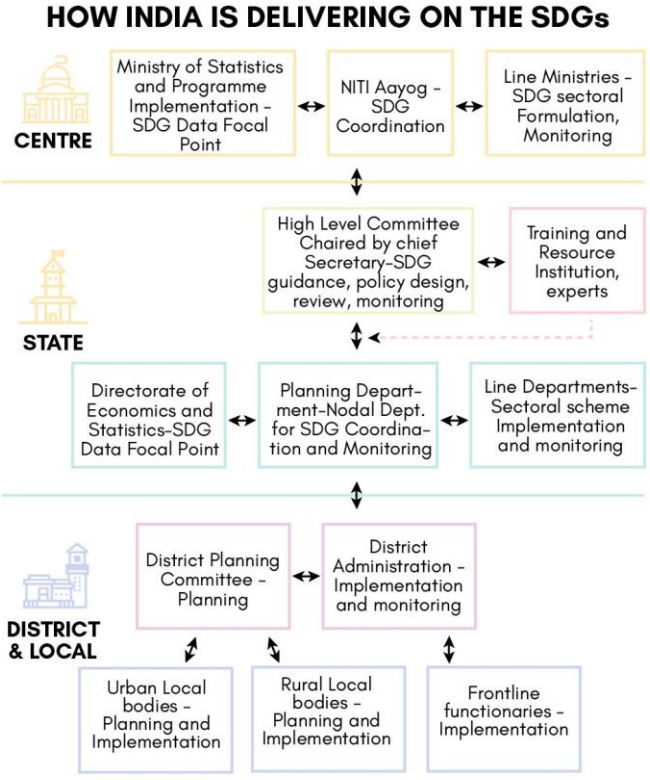
On the event of World cities day on 31st October, experts have highlighted that India's fast-developing urban areas are heading towards catastrophe in the next three decades.

Connection between Urban spaces and SDGs

- **High population density in urban spaces make** them crucial for achieving SDGs.
- **Key stakeholders** like national governments, the private sector, universities, civil society etc. **can be mobilized more effectively at the city level.**
- **As centres of economic activity and resource flow** they are critical in accelerating progress towards SDGs by creating jobs and offering better livelihoods (SDG8); etc.
- **Key for transition to a low-carbon, sustainable economy:** Cities are responsible for at least **70%** of total worldwide gas GHG emissions.
- **Urban spaces are hubs for innovative and ambitious ideas** which can be used to improve resilience and sustainability.

Initiatives

- **Monitoring SDGs at the sub-national level through SDG India Index Baseline Report** released by NITI Aayog.
- **NITI Aayog created a shared understanding of SDGs** among the central and local level government officials. E.g., cooperation on implementation of Energy Conservation Building Code for increased energy efficiency.
- **Forming policies after consultation with local government officials, community-based organizations, civil society organizations, and other stakeholders:** For instance, Mangrove Broadwalk (Panaji, Goa) has balanced Mangrove Restoration and Developmental needs.
- **Urban Waterbody Information System (UWaIS)** provides satellite images of water bodies to various cities to plan their rejuvenation.



Challenges

- **Absence of accurate and actionable data at local level.**
- **Limited financial resources with ULBs.**
- **Local urban challenges may not fit one-size-fits-all approach.**
- **Navigating development vs. sustainability trade-off.**
- **Adoption of a sustainable lifestyle from citizens** requires behavioral change.

Way Forward

- **Whole-of-government approach:** E.g., the approach taken in the Smart Cities Mission (SCM) takes into account economic, environmental, law and order dimensions among others.
- **Generate and use Data at the local level:** For example, using Urban Geospatial Data for better policymaking at the local level.
- **Efficient Financing of local government** by bridging the gaps in expenditure prioritization, revenue augmentation, and efficiency.
- **Enhancing public awareness and sensitization** about SDGs and lifestyle changes using LiFE Mission.
- **Encourage Partnership with Private Sector**.
- **Reducing energy use and greenhouse gas** (GHG) emissions through Urban Forestry, Nature based Solutions (NbS), Nature based infrastructure/green infrastructure etc.

4.2. SUSTAINABLE AGRICULTURE IN INDIA

SUSTAINABLE AGRICULTURE IN INDIA AT A GLANCE

DEFINITION

- Production of plant and animal products, including food, in a **way that utilizes farming techniques that protect the environment, public health, communities,** and **animal welfare.**
- **Includes systems like-** Organic Farming, Natural Farming, Permaculture, Precision farming, Biodynamic farming, Conservation agriculture, Agroforestry, Integrated pest management (IPM), Integrated farming system (IFS), Vertical Farming Techniques, System of Rice Intensification (SRI) and Sustainable Sugarcane Initiative (SSI).

CURRENT SITUATION

- India **ranks 1st in number of organic farmers** and is home to **world's first fully organic state- Sikkim.**
- Practices like **biodynamic faming, conservation farming and permaculture have less than 4% participation.**
- Widely adopted sustainable practices include **Crop rotation, agroforestry and rainwater harvesting.**
- **Natural farming and system of rice intensification (SRI)** saw high growth in past years.

CONSTRAINTS

- **Hesitancy on the part of farmers:** due to concerns like- initial decline in yields; lack of assured market support; cumbersome certification process; etc.
- **Narrow focus and skewed budgetary support** towards conventional agriculture.
- **Limited access to quality and affordable agricultural implements needed for Sustainable agriculture** due to- limited demand; market dominated by subsidized chemical inputs; etc.
- **Other challenges-** Research gaps; Low involvement of private sector; Infrastructural and technological deficiencies; and Small size of farm landholdings.

SIGNIFICANCE OF MOVING TOWARDS SUSTAINABLE AGRICULTURE

- **Secures farmers' income by diversifying source of income;** empowering farmers to set prices and reducing chances of crop failure and losses.
- **Increases soil fertility and resource use efficiency.**
- **Ensures nutritional and food security and produces healthy and clean food.**
- **Conserves biodiversity** by building synergies with natural ecosystems and biodiversity.
- **Empowers rural communities.**
- **Enhances resiliency of agricultural production and contributes to climate change adaptation and mitigation efforts.**

SCHEMES/POLICIES/INITIATIVES

- **National Mission for Sustainable Agriculture (NMSA):** With schemes like Paramparagat Krishi Vikas Yojana (PKVY) and Bhartiya Prakritik Krishi Padhati (BPKP) under Soil Health Management (SHM).
- **Certifications** - Participatory Guarantee System (PGS), National Programme for Organic Production (NPOP), Jaivik Bharat.
- **Policy support** under National agroforestry policy and Agri export policy.
- **Integrated Watershed Management Programme.**
- **Promotion of Zero budget Natural Farming.**
- **Pradhan Mantri Matsya Sampada Yojana (PMMSY).**
- **Financial support under Agriculture Infrastructure Fund (AIF).**
- **Mission Organic Value Chain Development for North East Region (MOVCD).**

WAY FORWARD

- **Reforming policies and institutions:** Provision of transition support plans; strengthening green markets and certification regime; establishing dedicated financial, etc.
- **Broaden perspectives of stakeholders across the agriculture ecosystem** to consider alternative approaches and change consumer perspectives.
- **Widening research and knowledge base** by supporting rigorous evidence generation, promoting Agri-tech and creating publicly available repositories on various sustainable systems.
- **Empowering farmers & rural communities** and conserving rural heritage and indigenous knowledge.

4.2.1. URBAN AGRICULTURE

Why in news?

Many cities of India such as Mumbai, Delhi, Chennai, Bengaluru and Kolkata have adopted **urban agriculture**.

About Urban agriculture (UA)

- Refers to agricultural practices in **urban and peri-urban areas.** Peri-urban areas are those:
  - **Transitioning from rural land uses** and
  - Are located between **outer limits** of urban and regional centres and **rural environment.**
- **Food and Agricultural Organization (FAO)'s Urban Food Agenda** aims to enhance sustainable development, **food security and nutrition** in urban and peri-urban areas, and nearby rural spaces.

Significance of Urban agriculture

- **Food and nutritional security: 222 million urban residents** could be served by **5 % of all urban areas** in India.
- **Building resilience of a city's food supply: UA** can provide **fresh produce to city dwellers** by **reducing time and distance from farm to fork.**
- **Environmental management**: UA can **combat urban heat island effects, reduce carbon emission etc.**
- **Waste management:** Organic waste can be **composted and used** in food production, reducing **the requirement of landfills.**
- **Others:** Create job opportunities, enable **efficient and productive** use of unused and underutilized lands, etc.

Constraints

- **Limited and exclusive practice** due to **high rents, limited accessibility** to land, etc.
- **High water demand** can lead to **water shortages** in the cities.
- **Widely unrecognized nature of UA** with no support system**.**
- **Others:** Pesticides and harmful chemicals can cause soil, water and air pollution.

Way Forward

- **Raising awareness about benefits** of UA in cities.
- **Utilizing community spaces** to conduct UA.
- **Promote UA under existing schemes** like PMSA.
- **Use technological and sustainable interventions** like precision farming, vertical farming, etc. to efficiently use of resources.

4.2.2. NATURAL FARMING IN INDIA

NATURAL FARMING IN INDIA AT A GLANCE

- An **ecological farming approach** where farming system works with the **natural biodiversity,** encouraging the soil's biological activity and managing the complexity of living organisms to thrive along with food production system.
- Considered a **form of regenerative agriculture.**

Current Situation

- **More than 10 lakh ha. area** is covered under natural farming in India.
- **Gujarat has the highest share of area under natural farming,** followed by Andhra Pradesh and Madhya Padesh.

Principles of Natural farming

- **Soil to be covered** with crops 365 days (living root)
- **Minimal disturbance** of soil.
- **Biostimulants** as necessary catalysts.
- Use of **Indigenous seeds.**
- **Diverse crops,** trees 15-20 crops
- **No synthetic inputs.**
- **Integrate animals** into farming.
- Pest management through **botanical extracts.**
- Increase **organic residue on soil.**

Benefits

- **Limits human and environmental exposure** to pesticides & chemicals.
- Builds **healthy soil and produces healthy and clean food.**
- **Fights the effects of global warming.**
- Discourages algae blooms and **supports water conservation** & health.
- **Encourages biodiversity** and supports animal health and welfare.

Challenges

- **Inputs** like biostimulants are more **expensive** than industrially produced chemical fertilizers and pesticides.
- **High Price of natural Produce due to costly farming methods, limited production, supply chain irregularities, etc.**
- **Shortage of good quality indigenous Seeds.**
- **Hesitancy among farmers.**
- **Lack of expertise and knowledge.**
- **Minuscule budgetary** allocations in comparison to chemical fertilizers (Rs 70,000-80,000 crore per annum).

Way forward

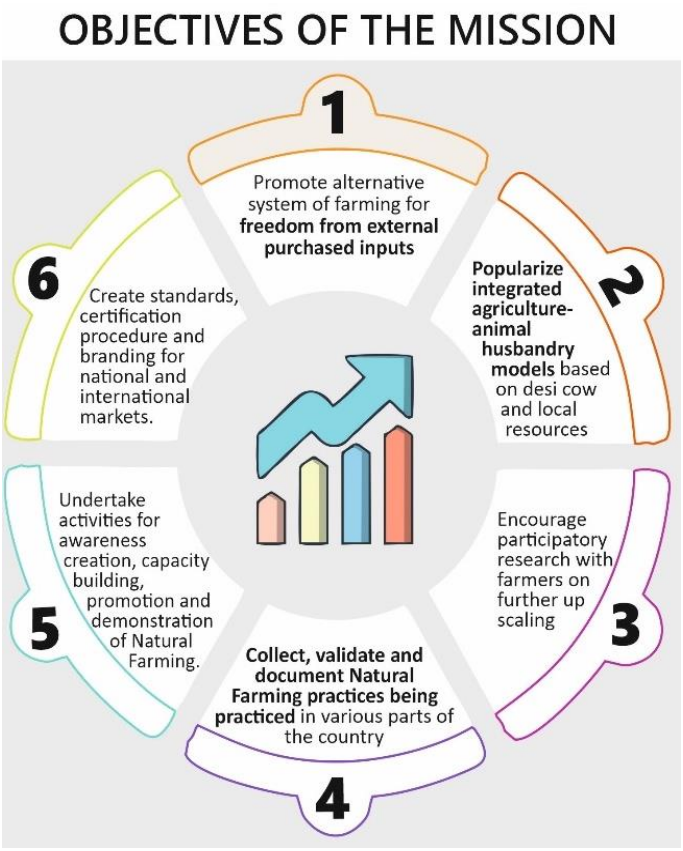
- **Measures to adequately produce** and make **available quality** biofertilizers at low cost should be the priority.
- **Effective mechanism for certification.**
- **Build rigorous scientific data** on the practices and benefits of natural farming.
- A targeted, ambitious and **well-funded nation-wide programme** to drive the transformation towards natural farming.
- An **integrated and community-based approach** is necessary which can be similar to **'Swachh Bharat' for 'Swachh Food'.**

4.2.2.1. NATIONAL MISSION ON NATURAL FARMING

Why in news?

Union Ministry of Agriculture and Farmers Welfare launched a portal on **National Mission on Natural Farming (NMNF)** for the benefit of the farming community.

About National Mission on Natural Farming



- In India, Natural farming is promoted as **Bharatiya Prakritik Krishi Paddhati Programme (BPKP)** and is a sub-mission under centrally sponsored scheme- Paramparagat Krishi Vikas Yojana (PKVY).
- PKVY falls within the umbrella of the National Mission on Sustainable Agriculture (NMSA).
- BPKP is being up-scaled as **'National Mission on Natural Farming (NMNF)/ (Bhartiya Prakratik Krishi Paddhati)'** for implementation all across the country.
- **Tenure:** 6 years **(2019-20 to 2024-25).**
- It will be a demand driven programme and states shall prepare a long-term perspective plan with year-wise targets and goals.
- **Knowledge partner for natural farming extension:** National Institute of Agricultural Extension Management (MANAGE).
- **National Centre of Organic and Natural Farming (NCONF)** shall work towards development of certification programme for Natural Farming, establish secretariat for certification management, portal development, management, maintenance and integration with other portals.

Related concept: ZBNF (Zero Budget Natural Farming)

- It follows the principles of **natural farming, and in addition which farming is done without using any credits** or spending any money on purchased inputs.
- It promises to end a **reliance on loans and drastically cut production costs**, ending the debt cycle for desperate farmers.
- It is a **method of chemical-free agriculture** drawing from traditional Indian practices based on **4 pillars- Jeevamrutha** (a soil inoculant made of cow dung, urine, pulse, jaggery, and soil); **Bijamrita** (a treatment of seeds made of similar ingredients to protect them from diseases); Acchadana (mulching); and **Whapasa** (soil aeration).
- It was originally promoted by **Maharashtrian agriculturist Subhash Palekar and** was introduced in **Union Budget 2019- 20.**

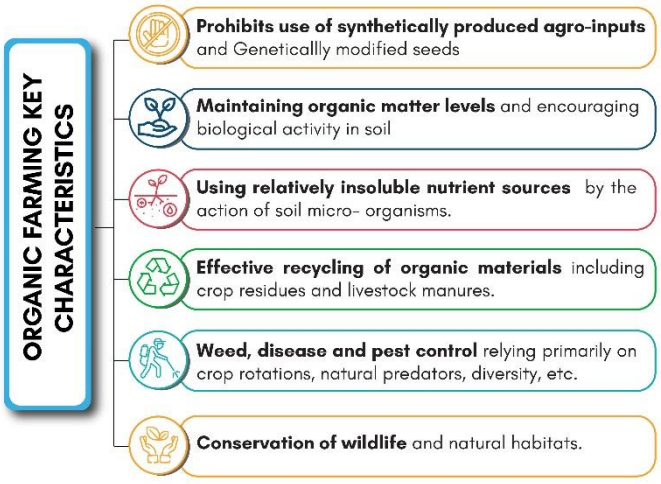
4.2.3. ORGANIC FARMING IN INDIA

Why in News?

Ministry of Commerce and Industry has begun adopting additional onsite **measures to check field-level irregularities in organic farming certification.**

More about news

- This includes **verification of organisations that certify organic farming.**
- The development follows **"various irregularities being observed in the certification activities".**



About Organic Farming

- Sustainable agriculture system that **excludes the use of synthetic inputs in farming** and relies on **on-farm inputs** such as crop residues, farmyard manure, enriched composts, vermi-compost, oil cakes, bio-fertilizers etc. **for nutrient management of crops.**

- **Benefits of Organic Farming**
  - **For the Environment:** Prohibits Use of Harmful Pesticides; Maintains a Healthy Soil; Reduces Erosion; Provides Cleaner Water; Stimulates Biodiversity.
  - **For Farmers:** Reduces the input cost of farmers; Attract more customers.
  - **For Consumers:** No health risk; Higher levels of vitamins, minerals, healthy fatty acids and phytonutrients.
- While both **organic and natural farming are similar in certain aspects** such as **prohibiting use of synthetic fertilizers**, use of **on-farm biomass management** and biological nutrient recycling, encouraging **crop-diversity** etc., they differ in certain aspects as well-

Differences between Natural and organic farming	
Organic Farming	**Natural Farming**
Use of off-farm organic and biological inputs like compost, vermicompost, etc. permitted.	No external inputs used on farmlands, only on-farm-based inputs used.
Open for micronutrient correction through use of minerals	Use of minerals not allowed.
Ploughing, soil tilling, and weeding might be undertaken in organic farms.	Mimics natural ecosystems: no ploughing, no soil tilling, and no weeding done on natural farms.

Constraints

- **Organic farm yields are significantly lower** (~25% lower on average).
- **Low organic manure availability** and **lack of proper knowledge** about organic tools and practices.
- Would require more land for maintaining the current food supply **putting pressure on existing natural habitats.**
- **Fragmented and unorganized** management of entire value chain of organic products.
- **Impact on food security** due to rise in production cost making food less affordable**.**
- **Challenges in India's organic certification regime: Costly and complex** certification and inspection process; **Inadequate knowledge** among farmers; **Multiplicity of certificates; Inadequate number of third-party accreditation agencies; Lack of proper monitoring** etc.

Schemes/Initiatives/Policies

- **Paramparagat Krishi Vikas Yojana (PKVY).**
- **Mission Organic Value Chain Development for North Eastern Region (MOVCDNER).**
- **National Mission on Oilseeds and Oil Palm (NMOOP):** Financial assistance for different components including bio-fertilizers, vermicompost etc.
- **Modern organic testing lab in Sikkim.**
- **Organic certification regime in India:**
  - **National Programme for Organic Production (NPOP)** operated by APEDA;
  - **Participatory Guarantee System (PGS) for India** by Department of Agriculture and farmers welfare; **and**
  - **Jaivik Bharat Logo** introduced by Food Safety and Standards Authority of India (FSSAI).

Way Forward

- **Promoting production of organic inputs.**
- **Supplementing organic farming** with other sustainable farming methods.
- **Undertake capacity building of farmers.**
- **Strengthen the value chain of organic products.**
- **Strengthening certification regime:**
  - **Enhancing the number of third party accreditation agencies;**
  - **Improving the monitoring of certification activities;**
  - **Generating awareness among farmers** regarding the different processes of gaining certification.

Comparison Between Sri Lanka's organic farming model and Sikkim Organic Model		
Features	**Sikkim**	**Sri Lanka**
Process	It was gradual process and it took nearly eight years or so from 2008 to 2016 to be declared as Organic State.	Target based approach was adopted to make the island nation into full-scale organic agricultural production.
Planning	Proper planning was done such as a whole range of biopesticides were also brought in so as to avoid a situation in which there would be crop failure because of a pest attack.	No such long term planning.
Farming system	State farmers were already using less inorganic inputs.	Mainly depend on chemicals inputs.
Support system from Government	When fall in production would affect supplies, imports from the main land India were possible.	No support for farmers to switch over organic farming.
Training	Several agencies with good credentials were brought in to train master trainers who would train others who would go to villages and into the fields.	No such mechanism.

4.2.4. OTHER SUSTAINABLE PRACTICES IN NEWS

Ecological niche modelling	• It is a **predictive tool** for identifying inhabitants for an existing habitat, or new geographical locations **where a desirable plant may grow well**. • The modelling involves the use of **computer algorithms** to compare **data** about the **environment** and to make forecasts about what would be ideal for a given ecological niche. • Researchers at the Institute of Himalayan Bioresource Technology, Palampur, Himachal Pradesh used modelling strategies to examine the economically important spice, saffron.
Regenerative agriculture	• It describes **holistic farming systems** that, among other benefits, improve **water** and **air quality**, enhance **ecosystem biodiversity**, produce **nutrient-dense food**, and **store carbon** to help mitigate the effects of climate change. • These farm systems are designed to work in harmony with nature, while also maintaining and improving economic viability
Miyawaki method	• Fazilka district of Punjab has become a trendsetter in expanding forest cover by applying the Miyawaki method. • Miyawaki method is a **technique of urban afforestation** by **creating micro forests over small plots of land.** o It was **devised by Japanese botanist Akira Miyawaki** in 1980s. o It ensures **10 times faster growth** of plant and 30 times denser than usual. o In this technique, **native trees of region are divided into four layers** (shrub, sub-tree, tree, and canopy) after identification and analysis of soil quality.
Climate Smart Agriculture (CSA)	• Agriculture that sustainably increases productivity, enhances resilience (adaptation), reduces/removes GHGs (mitigation) where possible, and enhances achievement of national food security and development goals". • **3 pillars of CSA:** o **Productivity:** Increase agricultural productivity and incomes from crops, livestock and fish, food and nutritional security through sustainable intensification. o **Adaptation:** Reduce the exposure of farmers to short-term risks and strengthening their resilience by building their capacity to adapt and prosper in the face of shocks and longer-term stresses. o **Mitigation:** Reduce and/or remove GHG emissions by avoiding deforestation from agriculture managing soils and trees in ways that maximizes their potential to acts as carbon sinks and absorb CO_2 from the atmosphere.

4.3. SUSTAINABLE LIFESTYLE

SUSTAINABLE LIFESTYLE AT A GLANCE

- Achieved by **making choices that aim to reduce our individual** and collective environmental impact by making **positive changes to offset climate change** and **reduce environmental damage.**
- Puts **individual and collective** duty on everyone to live a life that is in tune with Earth.
- Sustainable living and lifestyles for the first time appear in the Sustainable Development Goals **(4 Education and 12.8 Responsible Consumption).**

Significance of putting individual/ community at the centre of environmental efforts

- **Facilitates Tailored approach** to environmental efforts.
- **Encourages environmental problem solving** among people.
- Has **long-lasting generational impacts.**
- **Improves procedural legitimacy** of existing environmental policies.
- Improves **physical, mental and social well-being.**
- **Enables effective Monitoring & Evaluation** of environmental efforts at community level.

Examples of the lifestyle changes

Mindful consumption
Individual carefully attends to and be aware of his/her consumption needs, while adopting flexible options and novel approaches in the purchase, usage and disposal of goods.

Circular lifestyle
A model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing, and recycling existing materials and products as long as possible.

Minimalism
Philosophy that **combats mindless consumerism by promoting living simply or living with less.**

Zero waste living
Aims to **reduce the amount of waste an individual creates on a daily basis.**

Constraints

- **Iron Cage of Consumerist lifestyles** in a capitalist world.
- Socio-economic inequity and **limited availability of sustainable choices.**
- **Infeasibility of one-size fits all approach.**
- **Greenwashing from corporates.**
- **Low awareness and disconnect from nature** due to increasing urbanization.
- **Difficulties in measuring sustainability of** lifestyles.

Way ahead

- **Measuring impacts of sustainable lifestyles.**
- **Enabling individual action with collective action** from the Government and Business entities.
- **Transforming societal values** to be more inclined towards environmental protection.
- **Utilizing technological innovation** like IoT, Big data etc. for enabling sustainable living.
- **Building changemakers through education.**
- **Taking inspiration from cultural and traditional practices** like biodegradable utensils (sal tree leaves, banana leaves etc.), clayware (kulhad, matka etc.) etc.

4.3.1. MISSION LIFE (LIFESTYLE FOR ENVIRONMENT)

Why in News?

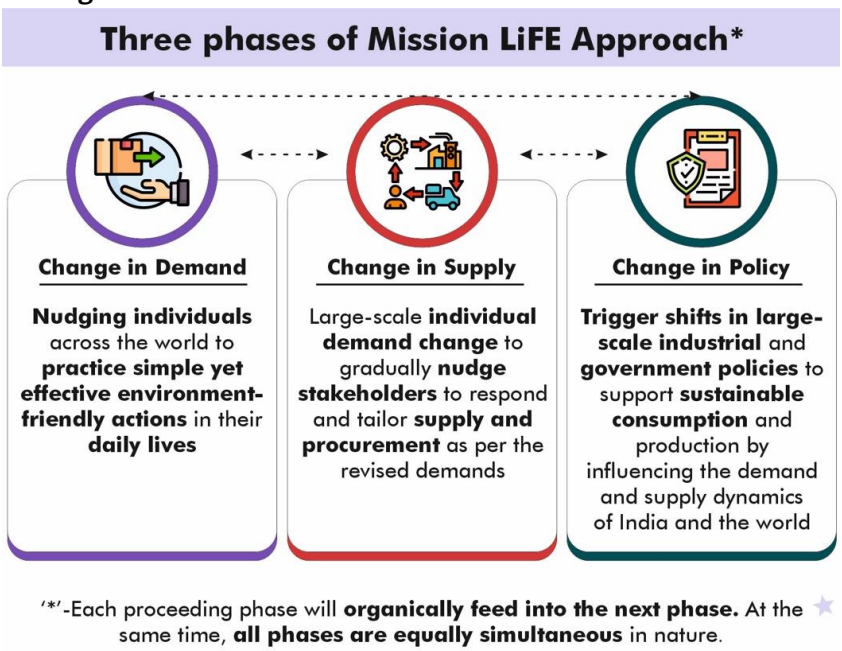
Prime Minister (PM) launched **Mission LiFE** (**Lifestyle for Environment**) at the **Statue of Unity** at Kevadia, Gujarat to protect the environment.

DATA BANK

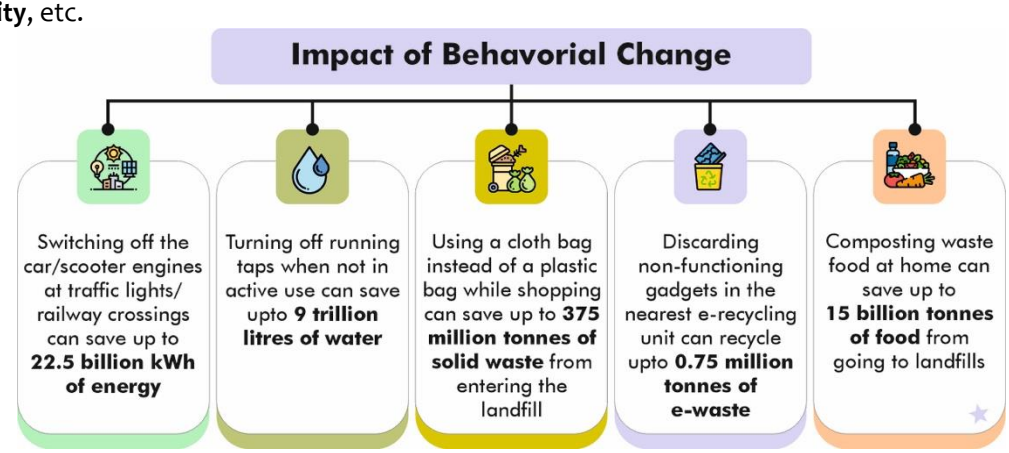
As per **United Nations Environment Programme (UNEP),** if **1 out of 8 billion people** worldwide adopt **environment-friendly behaviours** in their daily lives, global carbon emissions could drop up to 20%.

About Mission LiFE: Objectives and Implementation

- An **India-led global mass movement** which **aims** to **nudge individual** and **collective action** to protect and preserve the environment.
  - Its concept was introduced by the PM at the **United Nations Framework Convention on Climate Change (UNFCCC) COP-26 (Conference of the Parties)** in **Glasgow**.
- **Objective:** Mobilise at least **1 billion Indians and other global citizens** to take individual and collective action for protecting and preserving the environment in the period **2022** to **2027**.
  - Within India, at least **80% of all villages** and **urban local bodies** are aimed to become **environment-friendly** by **2028**.
- **Mission Duration:** A **5-year programme**, visualizing **three core shifts** in our collective approach towards sustainability (see **image**).
  - In 2022-23, the mission will focus on Phase I.
- **Implementation: NITI Aayog** will curate and incubate **Mission LiFE** in the **first year**.
  - Subsequently, it will be implemented by the **Ministry of Environment, Forest and Climate Change (MoEFCC)** in a non-linear and non-sequential manner.



- The Mission unveiled a **list of 75 lifestyle practices that can promote climate-friendly behaviour**.
  - These are listed under **7 categories**- Energy saving, water saving, reducing single use of plastic, adopting sustainable food system, reducing waste, adopting healthy lifestyle and reducing e-waste.
  - These actions are **specific and measurable**, **Easy to practice** by and **Non-disruptive to ongoing economic activity**, etc.
- **Benefits of Mission LiFE:**
  - Tackle environmental degradation and climate change.
  - Help India achieve its climate goals and SDGs.
  - Helping to change individual and community behaviour.



Steps taken by India in line with the objectives of LiFE

- **Individual-led programs** such as **Swachh Bharat Mission**, **GOBARdhan Scheme, Ujjwala Scheme** etc.
- Ban on single use plastic, right to repair framework etc.
- India has revised its INDCs and **Mission LiFE** is made part of it to combat climate change.

Way Forward

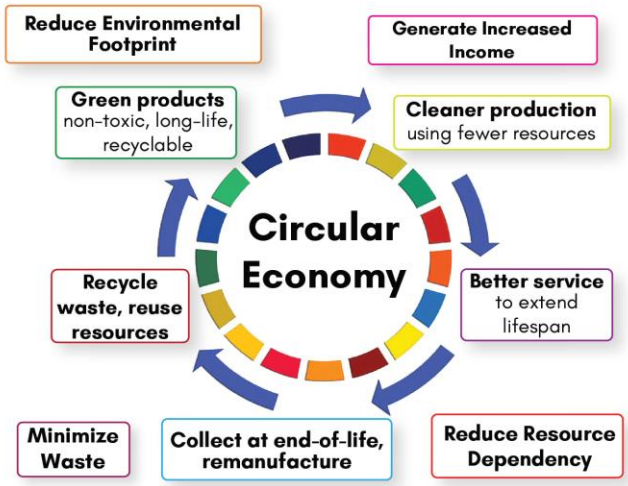
- Emboldening the spirit of the **P3 model**, i.e. **Pro Planet People**.
- Replacing the prevalent **'use-and-dispose'** economy (mindless and destructive consumption) with **'circular economy'**.

- **Leverage the strength of social networks** to influence social norms; contributing directly and indirectly to almost all the SDGs, especially **Sustainable Cities and Communities (SDG 11), Responsible Consumption and Production (SDG 12), etc.**

4.3.2. CIRCULAR ECONOMY

CIRCULAR ECONOMY (CE) IN INDIA AT A GLANCE

- An economic system where **means of production** are **organized around reusing** and **recycling** the inputs.



Need of CE in India

- **Replacing Linear Economic Model:** From 1970 to 2015, India witnessed a **six-fold increase** in its **annual material consumption.**
- **Reduction in negative externalities** such as GHG emissions, noise/air pollution, land degradation etc.
- **Minimise waste** and **facilitate sustainable and environment-friendly mode of production.**
- **Increase household disposable income** through lower costs for products and services.
- **Job Creation** through **repair** and **refurbishment** of goods, **recycling** and **recovery** of materials, etc.
- **Reduce dependency** on **imported resources.**

Constraints

- **Require Systemic Change** in how goods and services are **designed, produced, consumed,** and **disposed**.
- Businesses need incentivization due to **costly** and **time-consuming nature of transition.**
- **Inefficiency in the waste management sector** due to **informal nature** and lack of **waste collection** vehicles, **sorting** facilities, **etc**.
- Limited research and development focus.
- **Downcycling:** Process of **recycling materials** into **products** of **lower value** and **quality compared** to the original material).
- **Lack of awareness about the concept.**

Current Situation

- **Only 7.2% of the global economy is circular** with a declining trend **(Circularity Gap Report 2023).**

Key Principles

- **Cradle to Cradle design** where there is no concept of waste and everything is a resource for something else.
- Use of **clean and renewable energy.**
- **Celebrate diversity to build resilience** in natural and human systems.

Expected benefits of Circular economy for India

- **₹40 lakh crore annual value created in 2050,** amounting to 30% of India's current GDP.
- **44% reduction in GHG emissions in 2050 compared to the current development path.**

(Ellen McArthur foundation)

Schemes/Policies/Initiatives

- **Regulatory measures: National Resource Efficiency Policy (NREP)**, 2019, Extended Producer Responsibility (EPR) etc.
- **Awareness campaigns: Swachh Bharat Mission, etc.**
- **Financial Incentives: Tax benefits, subsidies, and** low-interest loans to the recycling industry.
- **Capacity building: Atal Innovation Mission, action plans are also formulated across** 10 sectors including e-waste, lithium-ion batteries, end-of-life vehicles, scrap metal, etc.

Way Forward

- **National-level vision document** of a CE to establish **clear goals, strategies,** and **initiatives** that promote circular practices across different sectors.
- **Provide incentives** for **businesses** and **consumers** to adopt circular solutions.
- **Investing in innovation** and **technology in Waste disposal and Waste Management.**
- **Awareness campaigns and education programs** to promote the adoption of circular economy practice.

4.3.3. RIGHT TO REPAIR

Why in News?

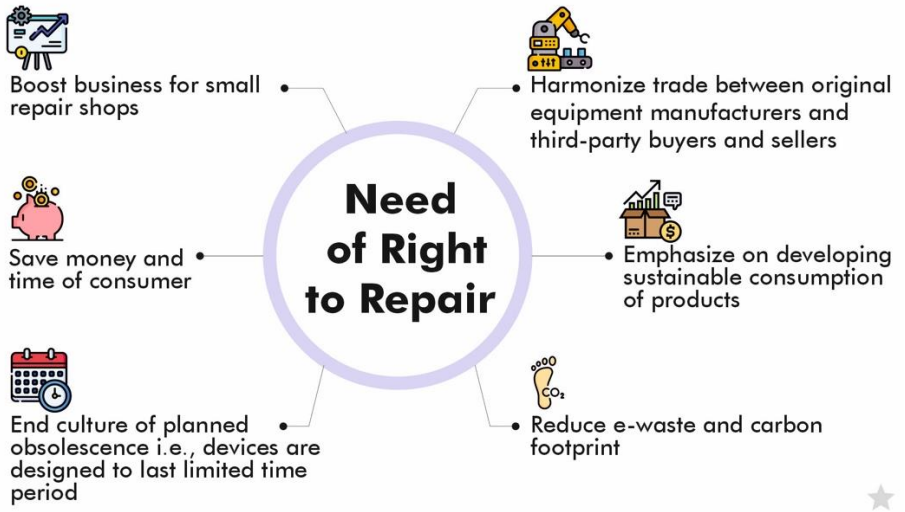
The Ministry of Consumer Affairs (MCA) has set up a committee to come up with a Right to Repair framework and launched a **'right to repair' portal**.

Right to Repair across the World

- **USA:** The first country to bring the "Right to repair" in place. The legislation requires companies, at least in the state of New York, **to provide patented tools and remove software restrictions that prevent users from repairing their own products.**
- **UK:** Requires **manufacturers to make spare parts available** to their customers and third parties **for up to ten years** after the product is first released.
- **France:** imposes a **mandatory repairability score** through the Anti-Waste Law, 2020, which ranks products based on their ease of repair and **informs users how to repair them before purchasing them.**

More on news

- On the portal, **manufacturers would share manual of product details with customers** so that they could either repair by self, by third parties, rather than depend on original manufacturers.
- Initially, **mobile phones, electronics, consumer durables, automobile and farming equipment would be covered.**



About Right to Repair

- Refers to **legislative framework that enables the consumers to repair their goods at their own preference,** where repairs by other entities are not encouraged by the manufacturers.
  - Commonly done by **limiting access to tools and components** or by putting up software barriers to prevent independent repair or modification to the product.
  - This **obliges the customers to use only their services**.
  - There is **no specific law on RTR in India**.

Implementation Challenges

- **Cost to the Exchequer:** Unorganised and promoting the small repair shops will invariably reduce the tax inflow to the Government.
- **Lack of Awareness** among stakeholders about its benefits.
- **No effective mechanism to test quality of the third-party spare parts.**
- **Inhibits Innovation** as manufacturing companies may reduce their R&D expenses.
- Giving access to third party repair services may lead to **violation of intellectual property rights (IPR) and impact the safety and security of consumers devices.**
- **Lack of repair tools and knowledge with third party repair services.**
- Making products more repairable may require **reducing their efficiency by accommodating modulation and reparability.**

Way ahead

- **Creating Awareness among the consumers about their rights.**
- **Bring legislation** to achieve a **balance between intellectual property and competitive rules**.
- **Bridging the Quality gap between the Manufacturer and the third-party service provider.**
- **Servicing tools** should be made available to third parties.
- **Tech companies should promote transparency** by providing complete product knowledge, access to manuals, schematics, and software updates to ease repairing.

4.4. WASTE MANAGEMENT

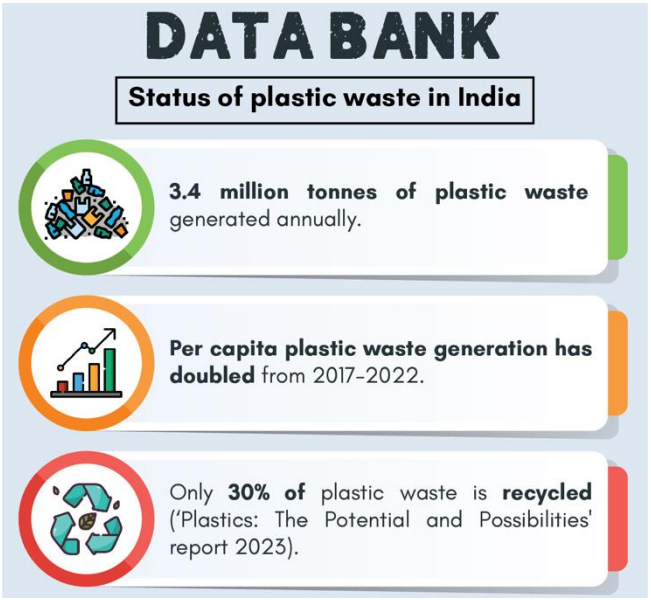
4.4.1. EXTENDED PRODUCER RESPONSIBILITY (EPR) ON PLASTIC PACKAGING

Why in news?

Ministry of Environment, Forest and Climate Change (MoEFCC) shared details of progress made under Extended producer responsibility (EPR) for Plastic Packaging.

Key details stated by MoEFCC

- **2.26 million tonnes of plastic** packaging have been **covered under EPR** for year **2022-23.**
  - Total plastic waste generated in country during year 2019-20 was around 3.4 million tonnes.
- **Number of Producers, Importers and Brand Owners (PIBOs)** registered on centralized EPR portal on plastic packaging has **increased.**



About EPR

- **EPR is a policy approach where producers are given the responsibility – financial/physical – for environmentally sound treatment** or disposal of post-consumer products.
- **Background**
  - **First introduced in India to manage e-waste** in 2012.
  - **Plastic Waste Management (PWM) Rules, 2016** introduced EPR to manage plastics.
  - **EPR Guidelines given legal force** through Plastic Waste Management (PWM) Amendment Rules, 2021.
- **Benefits of EPR:** Promotes the principles of **circular economy** and **polluters pay principle** by holding producer accountable for entire life cycle of product; reduce burden on government agencies; etc.

Guidelines for EPR in PWM Amendment rules, 2021

- **Applicability to both pre-consumer and post-consumer plastic packaging waste:**
- **Classification of plastics into four categories:** Rigid plastic packaging; Flexible plastic packaging; Multi-layered plastic packaging and plastic sheets.
- **Establishment of Centralised online portal** by CPCB for tracking and monitoring obligations.
- **Compulsory Registration of producers, importers and brand-owners (PIBO)** and Plastic Waste Processors on the portal.
- **Targets and Obligations:** The EPR target for PIBOs will be **increased to 70% in 2022-23 and 100% from 2023-24 onwards**.
- **Setting up a market mechanism for plastic waste management through introduction of EPR Certificates.**
- **Environmental compensation** shall be levied based upon polluter pays principle w.r.t. non fulfilment of targets by PIBOs.
- **Annual Reporting:** SPCBs or PCCs shall submit annual report on EPR portal.

Other initiatives to manage plastic waste in India

- **Swachh Bharat Mission 2.0** provides additional Central Assistance to States/UTs for solid waste management including plastic waste management.
- **Clean and Green** campaign of MoHUA encourages States and UTs to take up of activities like- large scale cleaning and plogging drives, etc. with special emphasis on plastic waste collection.
- **India had piloted a resolution in the 4th United Nations Environment Assembly held in 2019,** on addressing single-use plastic products pollution.
- **Private sector collaborations:** India Plastics Pact (IPP), Un-Plastic Collective (UPC)

Potential issues in implementation

- **Lack of accurate data to monitor target fulfilment.**
- **Non-compliance from stakeholders.**
- **Difficulties in inclusion of informal sector.**
- **Lack of awareness among consumers** on the nature of waste and lack of **segregation at source.**

- **Inadequate Infrastructure** for waste disposal, collection, processing, and recycling facilities.
- **High penal** condition may lead to a large number of cases.

Way Forward

- **Brand owners should be encouraged to gradually decrease the number of plastics they introduce in the market by adopting alternatives** such as paper, glass, metals, among other things.
- **Research and development for lower-cost recycling technologies** as this will enable safer recycling and the growth of the formal sector.
- **Adopting practices from successful public partnerships** in the field of collection and distribution logistics and incentives.
- **Awareness creation** regarding the repercussions of improper disposal **to bring behavioural change**.

Other Key Features of Plastic Waste Management (PWM) Amendment Rules, 2021

- Several single use plastic (SUP) **items** which have low utility and high littering potential **were identified whose manufacture, import, stocking, distribution, sale and use was prohibited** with effect from 1st July, 2022.
- **Categories of SUP items banned: Plastic sticks** (used in earbuds, balloons, flags etc.); **Cutlery items** (like plates, cups, forks, spoons etc.); **Wrapping or packing films** (used for sweet boxes, cigarette packet etc.); **and other items** like plastic or PVC banners less than 100 micron, stirrers, Thermocol for decoration.
- **Thickness of plastic carry bags increased from 50 microns** to 75 microns with effect from 30th September 2021 and to **120 microns with effect from the 31st December, 2022.**
- **Complete ban on** use of sachets using plastic material for **storing, packing, or selling gutkha, tobacco and pan masala.**

4.4.2. SOLID WASTE MANAGEMENT

SOLID WASTE MANAGEMENT AT A GLANCE

Unwanted or useless solid materials generated from human activities in residential, industrial or commercial areas.

Current Situation

- Total quantity of **Solid waste generated in the country is 1.6 lakh tonnes per day,** of which-
  - **Collection efficiency of waste is 95.4%.**
  - **50 % of waste is treated** and 18.4% is landfilled.

Harmful Effects of improper treatment of solid waste

- Landfill fires emit **toxic gases** such as formaldehyde, hydrogen cyanide, hydrogen sulfide, nitrogen oxides etc.
- Source of **persistent organic pollutants (POPs)** and harms human health due to air pollution, and groundwater pollution.
- Increases in the **risk of severe health implications** such as birth defects, low birth weight, and in adjoining areas

Schemes/Policies/Initiatives

- **Swachh Bharat Mission-Urban (SBM-U) 2.0** to make **all cities Garbage Free by 2026.**
- Effective implementation of **segregation of waste at source** under **Solid Waste Management Rules 2016.**
- Ministry of Housing and Urban Affairs signed a Memorandum of Understanding with Engineers India Limited to develop **Waste to Energy and bio-methanation projects** in cities with a population of million plus.
- **Garbage Free Star Rating Protocol** to assess the City's Municipal Solid Waste Management by 3rd party verification.
- Adopting **zero landfill model** based on principles of circular economy.
- One-stop centres called **Reduce, Recycle and Reuse** set up to serve as one-stop solution.

Challenges in handling Solid waste in India

- **Lack of Funding** with local **bodies.**
- **Poor Implementation** of rules and regulations.
- **Segregation is not done** at source.
- **Informal and unorganised** waste collection and segregation facilities.
- **Recycling of the waste is not cost efficient for the companies.**
- Lack of **trained manpower.**
- Issues with handling **legacy waste** (old waste at landfill sites that has remained dumped for more than three months).

Way Forward

- **Adoption of remedial technologies** like- Incineration, Gasification, Pyrolysis etc.
- **Raising awareness about segregation at source through public campaigns etc.**
- **Incentivizing recycling of solid waste by private companies.**
- **Formalization of waste collection and segregation industry.**
- **Scientific management of legacy waste** through methods like Scientific capping, Biomining (extraction of recyclables and other revenue-generating fractions from waste materials aided by bioremediation) etc.

4.4.3. WASTE TO WEALTH

WASTE TO WEALTH AT A GLANCE

Waste to Wealth Techniques

Biological Processing	◉ **Composting** biodegradable and organic waste to yield bio-fertilizer. ◉ **Biomethanation** (anaerobic fermentation of biodegradable matter) to yield biogas, fertilizer etc.
Thermal or Waste to Energy Processing	◉ Use technologies **like Incineration, Gasification and Pyrolysis** for production of electricity and heat/light from Municipal Solid Waste (MSW).
Processing for Reuse	◉ Using Plastic waste in road construction, recycling Construction and demolition waste, extraction of high value metals from e-waste etc.

Potential

India has the potential to **generate 3GW of electricity from waste by 2050.**

Significance

- **Derive economic benefits from energy generation and extraction of valuable resources.**
- **Protect environment from toxic waste.**
- **Recycle materials and promote circular economy.**
- **Sustainably manage high generation of waste, especially from urban areas.**
- **Encourage entrepreneurship and job creation.**

Schemes/Policies/Initiatives

- **Waste to Wealth Mission under PM-STIAC** to identify, develop, and deploy technologies to treat waste to generate energy, recycle materials, and extract resources of value
  - It has components like-**Swachhta Saarthi Fellowship, Su-Dhara Community** Engagement project on urban **waste management, Waste to Wealth portal, Biomedical Waste Treatment Innovation Challenge etc.**
- **Promotion under Policies and guidelines for waste management** like- Solid Waste Management Rules, 2016; Plastic Waste Management Rules, 2022; Construction & demolition waste Management Rules, 2016 etc.
- Under the **'Green Growth' segment** of Union Budget 2023-24, **500 new Waste to Wealth plants** will be established under the GOBARdhan scheme.
- **Mandating use of Plastic Waste in Road Construction.**

Constraints

- **Informal and inefficient** collection, segregation and processing infrastructure.
- **Limited financial capacity of Local Bodies for processing.**
- **Lack of reliable data** of waste inventory.
- **Costly and complex technologies.**
- **Limited Private Participation.**
- **Lack of public awareness on waste categories** and behavioral issues.
- **Environmental concerns related to improper waste handling and processing.**

Way forward

- **Ensuring segregation at source and 100% waste collection through awareness generation.**
- **Institutional support** in the waste processing rules to encourage private sector participants.
- **Creation of formal forward and backward Infrastructure** for waste processing activity.
- Financially strengthening local bodies.
- **Training waste collectors, processors** etc.
- **Invest in development of affordable, environment friendly technologies.**

4.4.4. E-WASTE IN INDIA

E-WASTE IN INDIA AT A GLANCE

E-waste

Discarded and end-of-life electronics products ranging from computers, equipment used in Information and Communication Technology (ICT), home appliances, audio and video products and all of their peripherals.

Significance of E-waste mangement

- **Promoting circular economy** based on recycling precious and semi-precious material extracted from e-waste.
- **Unscientific extraction of e-waste can be hazardous to environment** with impact on-
  - **soil through leaching** of hazardous contents from landfills;
  - in water due to **contamination of rivers, wells and other water sources;**
  - in air due to **emission of gases and burning of e-waste.**
- **E-waste contains several potentially toxic and hazardous substances** such as heavy metals, plastics, glass etc., which can impact human health.

Constraints

- **Poor tracking and monitoring** of the quantum of e-waste being produced.
- **Involvement of Informal sector** and their **lack of knowledge about safe handling and extraction processes.**
- **High waste handling, extraction and procurement costs** needed for safety equipment, extraction technologies etc.
- **Rapidly growing waste:** "Internet of things" gadgets are expected to generate e-waste at a faster rate.
- **Limited number of dismantlers and recyclers and** inadequate recycling capacity.
- **Poor segregation and collection of waste.**

Current situation

- **Only 22.7 % of total e-waste generated in 2019-20 in India** was collected, dismantled, and recycled or disposed off
- **India is the world's third-largest e-waste** generator after China and USA as per **Global E-waste Monitor 2020.**
- **Computers contributed towards 70%** of the total e-waste generated in India, while telecommunication equipment accounted for 12 %.
- **Over 90% of electronic waste management** is done by informal sector workers.

Toxic/ Hazardous substances found in e-waste

Pollutant	Found in
Lead (Pb)	Cathode ray tube
Cadmium(Cd)	Chip resistors and semiconductors
Mercury (Hg)	Relays and switches, printed circuit boards,CFL
Beryllium (Be)	Motherboard
Hexavalent chromium (Cr) VI	Corrosion protection of untreated and galvanized steel plates, decorator or hardner for steel housings.

Way Forward

- **Formalize collection of e waste** by designated organizations, producers etc.
- **Create awareness on the environmental benefits** of reuse and recycling among consumers.
- **Train informal sector for safe and environmentally sound handling and extraction.**
- **Effectively monitor e-waste generation.**
- **Invest in alternative cost effective technology** for e-waste management.

4.4.4.1. E-WASTE (MANAGEMENT) AMENDMENT RULES, 2023

Why in news?

Ministry of Environment, Forest and Climate Change (MoEF&CC) has notified E-waste (management) Rules 2023, in the exercise of the powers conferred by **the Environment (Protection) Act, 1986.**

Key Provisions mentioned in E-waste (management) Rules 2023

- Seek **amendment to E-waste (management) Rules 2022.**
- **Adds two substances** to the exemptions listed in **Schedule II of E-waste (management) Rules 2022** as follows:
  - **Cadmium and lead in Solar panels/cells,** solar Photovoltaic panels/cells/ modules.
  - **Lead in Medical Devices** (with the exception of all implanted and infected products).
- **Every producer shall provide the detailed information** on the constituents of the equipment and their components or consumables or parts or spares.

About E-waste (management) Rules 2022

- **Replaces E-waste (Management) Rules, 2016.**
- **Launched a new Extended Producer Responsibility (EPR) regime** for e-waste recycling and **schedule I was expanded.**
- **Applicability:** To **every manufacturer, producer, refurbisher, dismantler and recycler.**
  - **Certain exceptions-**Waste batteries, Packaging plastics, Micro enterprise Radio-active wastes.
- **Recycling Target:** Quantity of e-waste to be recycled through registered recycler by the producer in fulfilment of EPR.
  - **Target may be made stable for 2 years** and **start from 60%** for the year 2023-2024 and 2024-25.
- **New Features**
  - Added rules for **management of solar PV modules /panels cells.**
  - Introduced provision for **generation and transaction of EPR Certificate.**
  - Introduced provision for **environment compensation and verification & audit.**

Related news: Solar Waste Treatment under E-Waste (Management) Rules, 2022

- The Union Minister of Renewable Energy & Power has shared details regarding **solar waste related provisions under e-waste (management) rules, 2022,** which were notified by MoEFCC.
- **Solar waste** is electronic waste generated by discarded solar panels.
  - **International Renewable Energy Agency (IRENA)** estimated that global PV waste will touch **78 million tonnes by 2050**, with **India** expected to be **one of the top five PV-waste creators.**
  - **Concerns associated with solar waste: High cost gap between recycling and discarding panels**; Contain **lead, cadmium and other toxic materials** that are **carcinogenic etc.**
- As per these rules, **every manufacturer and producer of solar photo-voltaic (PV) modules or panels or cells shall-**
  - **Ensure registration** on portal.
  - **Store solar PV modules** or panels or cells **waste generated** up to **year 2034-2035.**
  - **Ensure that processing of waste other than solar PV modules** or panels or cells shall be done as per **applicable rules or guidelines for the time being in force.**
  - Comply with standard **operating procedures and guidelines laid down by Central Pollution Control Board.**

4.4.5. FLY ASH UTILIZATION

FLY ASH UTILIZATION IN INDIA AT A GLANCE

Fly Ash

- **Particulate material** produced from the combustion of coal in thermal power plants.
- **Created when the mineral impurities in the coal fuse together** as they come out of the combustion chamber, then cool down and harden.

Composition

- **Silica, aluminium, iron, calcium, and oxygen.**
- **Arsenic and lead can be found at trace levels.**

Current Situation

- Fly ash utilization in India has **increased from nearly 10% in 1996 to highest 92% in 2020-21.**
- Still over **17 million tonnes out of the 222 million tonnes fly ash generated still remain** un-utilised.

Need of Fly Ash utilization

- **Occupies a lot of land space.**
- **Indian coal has much more ash** content than other countries.
- **Tackle adverse impacts-**
  - Ash ponds **may leach heavy metal traces into groundwater.**
  - **Increases concentration of particulate matter.**
  - **Reduces the rate of photosynthesis and transpiration** in the plants.
  - **Adversely impacts human health** due to respiratory illness.

Potential uses of Fly Ash

- **Cost Effective substitute for Portland cement.**
- **Durable as it increases the life of concrete roads and structures.**
- **Can be utilized for carbon sequestration.**
- Has potential in **wastewater treatment** owing to its chemical composition.
- Effective for the **removal of mercury.**

Initiatives for fly ash utilisation in India

- In 2009 it was made it a **saleable commodity.**
- **ASH TRACK Mobile App** has been launched by the Ministry of Power.
- National Green Tribunal (NGT) directed the constitution of a **'Fly Ash Management and Utilisation Mission'.**
- Rationalizing the GST on fly ash bricks and blocks at concessional GST rate of 5%.

State Level

- Maharashtra has a State Fly Ash policy 2016.
- Rajasthan govt decided that power plants will give fly ash to NHAI free of cost for road construction

Challenges in Fly Ash utilization

- **Lack of awareness** about fly ash products.
- **Strength gain occurs at a slow pace**
- **Seasonal limitations as** low temperatures lengthen setting times.
- **Color variability** as it is more difficult to control the color of concrete containing fly ash.
- **Secondary environmental pollution as it** may cause leaching of some elements into water.

Way Forward

- Utilization of ash should be made mandatory for **backfilling of mines and road construction.**
- **Railway track** may be extended from the coal yard of TPP to the ash dyke.
- **Transport subsidy** may be contemplated to encourage fly ash utilisation.
- **Incentives to private sector entrepreneurs** for setting up fly ash bricks and tiles manufacturing units.
- **Export potential** of fly ash should be explored.

4.4.5.1. NEW NOTIFICATION ON FLY ASH UTILIZATION

Why in News?

Recently the Union Ministry of Environment, Forests and Climate Change (MoEFCC) has released notification on fly ash utilization under the power conferred on the central government under **Environmental Protection Act 1986.**

Key Highlights of the Amendments

- **Wider Scope: Extends the compliance of fly ash utilization targets to new thermal power plants.**
- **Time Limit:** New Thermal Power Plants (TPP) have a time period of **4 years to achieve 100 % fly ash utilization.**
- **Legacy Ash Utilisation:** Legacy ash (ash which is being stored from past years) have to be **fully utilized within a period of 10 years.**
- **Reclamation:** Allowed reclamation activity in solar and wind power plants.
- **Time Limit for Reclamation and Certification:** Increased the time period to **three years (earlier only one year).**
- **Clarifying definition of legacy ash:** Ash ponds/dykes other than currently operational ones shall be treated as legacy ash.
- **Guidelines for Ash Ponds:** Existing TPPs (earlier only newly established TPPs were allowed) to **set up a temporary ash pond of the size (0.1 hectare per MegaWatt).**
- **Competent Authority for Certification: CPCB along with Central Electricity Board** shall provide guidelines for operational and reclaimed and stabilized ash ponds.
- **Ban on** establishing or designating any **new operational ash ponds**.
- **Pricing of Ash Ponds:** Rate not more than the price specified by Central Public Works Department (CPWD)

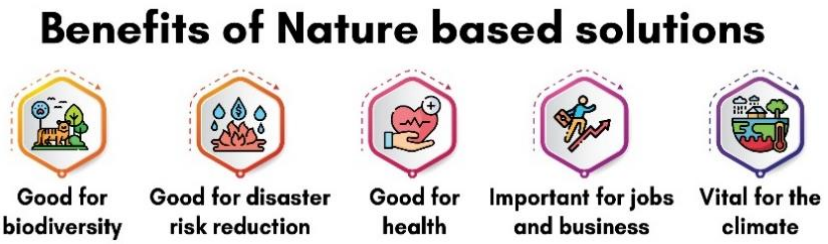
Key Highlights of 2021 Notification

- **Introduction of Polluter Pays Principle** with a fine for non-achievement of targets.
- **Role of CPCB to review ways** to utilise fly ash.
- Earlier, a 4-year cycle was present for utilisation of fly ash. This notification **reduced it to 3 years**.

4.5. NATURE BASED SOLUTIONS

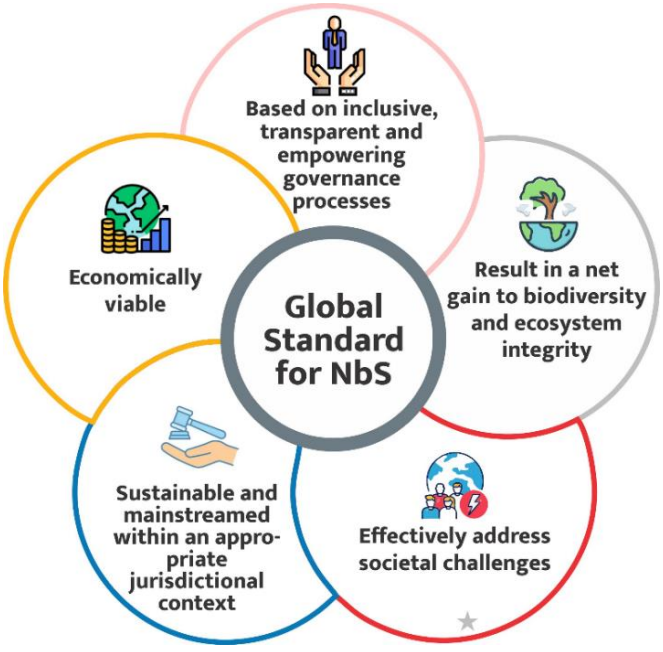
Why in news?

'State of Finance for Nature (SFN) 2022' report by the UN Environment Programme (UNEP) and the BMZ-financed Economics of Land Degradation (ELD) Initiative revealed that **nature-based solutions (NbS) are still significantly under-financed.**



About NbS

- An umbrella term that **aims to protect, sustainably manage, and restore natural or modified ecosystems to meet critical societal needs** today while building long-term environmental and economic resilience.
- Involves the **protection, restoration and/or management of a wide range of natural and semi-natural ecosystems** on land and in the sea.



Challenges associated with NbS

- **Lack of investment:** Finance flows to NbS in 2022 were less than half of the investment in NbS needed by 2025.
- **Limited Private Participation:** Private sector investment in these finance flows was very low (17%).

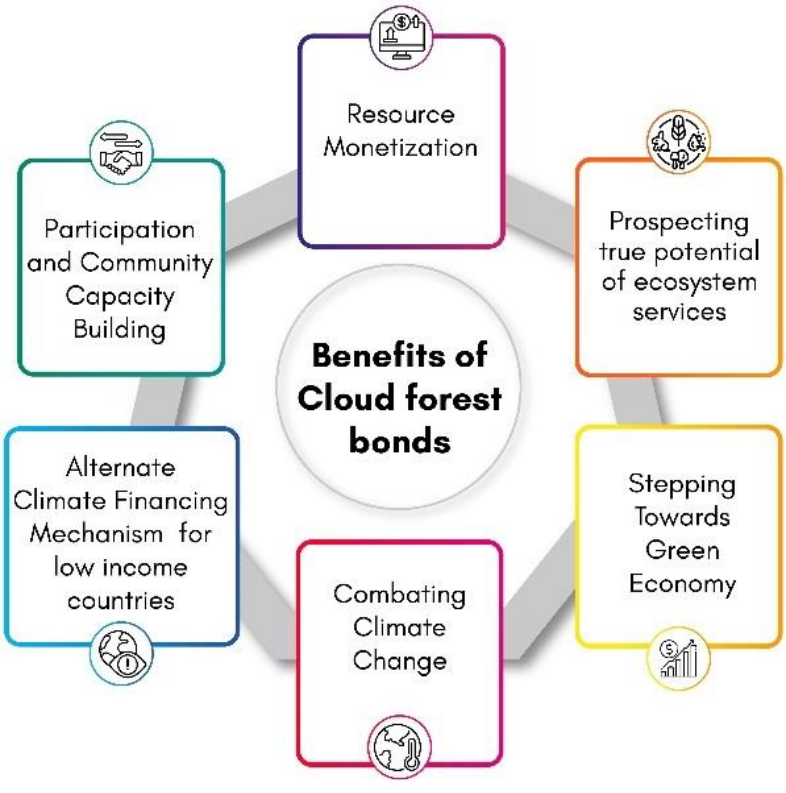
- **Prevalence of Nature Negative finance in government expecditure** in form of environmentally harmful subsidies to fisheries, agriculture and fossil fuels.
- **Uncertainties about their effectiveness** under changing climate conditions.
- **May infringe upon rights of indigenous peoples and local communities (IPLCs)** raising concerns around the security of land tenure rights, access etc.
- **Benefits can be misinterpreted and misused by decision-makers and stakeholders.**
  - E.g., a tree-planting project using just one non-native species could result in poor soil biodiversity, ultimately making it more costly or impossible to sustain a diverse forest in the future.
- **Difficulties in monitoring and governance.**

Way forward

- **Mainstream NbS within national governance**, climate action and climate policy-related instruments, etc.
- **Governments can spur investment** by reorienting their policies, subsidies and public investments.
- **Robust monitoring and evaluation of NbS.**
- **Empower locally led action on NbS** that is built on respect for the rights of **Indigenous peoples and local communities.**
- **Promote the positive impacts that NbS can deliver to vulnerable groups** - such as women, Indigenous People, the elderly, and youth.
- **Enhancing regional and international co-operation**, in ways that encourage ambition, transparency and environment integrity.

Related Concept: Cloud Forests

- A recent report suggested Cloud forest bonds as per the report are a part of **'Nature Based Solutions (NBS)'** and their financing to protect Cloud forests.
- **Cloud Forest** are **mountain tropical forests** generally **found at the river headstreams** and **mostly covered with clouds**.
  - **Serve as the storage of clean water** for communities, industries and hydropower plants.
  - **Majority of Cloud Forest i.e., 90% are found in 25 developing countries** in tropical regions **which bear the disproportionate impact of climate change.**
- **Initiatives: Cloud Forest 25 (CF25) initiative** is an **Investment Initiative** to bring countries, their creditors and multilaterals organizations together to accelerate, and consolidate the progress and scale such investment products.



4.6. ENVIRONMENTAL, SOCIAL AND GOVERNANCE (ESG)

ESG IN INDIA AT A GLANCE

- A form of **sustainable investing** that measures **the impact of a company's ethical contribution to its stakeholders.**
- **ESG investing** is sometimes referred to **as sustainable investing, responsible investing, impact investing, or socially responsible investing (SRI).**

ESG Criteria

- **Environmental:** Energy usage, carbon footprint etc.
- **Social:** Employee welfare, gender equality etc.
- **Governance:** Transparent accounting, investor relationship etc.

Significance

- **Building resilience of financial sector to risks posed by climate change:**
  - **Physical risks:** economic costs and financial losses from floods, heatwaves etc. like supply disruption in food sector.
  - **Transition risks:** arising from process of adjustmenttowards a low-carbon economy like unexpected retirement of coal-fired power plants.
  - **Liability risks:** arising from people or businesses seeking compensation for losses suffered from physical and transition risks.
- **Addressing Negative Externalities** such as a company's GHG emissions, effects on labor markets, and consequences for health and safety
- **Improved operations, better stock performance and lowered cost of capital to companies.**
- **Customer attitudes are changing** with investors demanding more transparency and accountability from companies.
- **Enabling investors to make better and informed decisions**

Schemes/Policies/Initiatives

- In 2021, SEBI issued **new sustainability reporting requirements under Business Responsibility and Sustainability Report (BRSR).**
  - BRSR aims to establish **links between financial results of a business with its ESG performance**.
  - BRSR was made **mandatory for top 1,000 listed entities (by market capitalisation) from 2022–23.**
- **Sustainable Finance Group (SFG) was set up under RBI** to co-ordinate with other national and international agencies on issues relating to climate change.
- **RBI joined the Network for Greening of Financial System (NGFS)**—a group of central banks and supervisors willing to share best practices and contribute to the development of environment and climate risk management in the financial sector.
- **Task Force on Sustainable Finance** set up by the Department of Economic Affairs, Ministry of Finance.
- **SEBI has proposed the concept of blue bonds** (debt instrument issued to support investments in healthy oceans and blue economies).

Constraints

- **Inadequate board-level engagement** in companies and lack of transparency.
- **High costs** of integrating ESG practices.
- **Lack of standard rules for reporting** on ESG parameters.
- **Insufficient availability of data, processes and methodologies.**
- **Shortage of skilled ESG professionals.**
- **Concerns around ESG-washing.**
- **Inadequate awareness around sustainable investing.**

Way Forward

- **Developing standard reporting framework** for ESG.
- **Develop Tools for ESG Data Management.**
- Create a **pool of skilled ESG professionals.**
- **Recording evidence of ESG behaviour for investors.**
- **Improve transparency in corporate structures.**

4.6.1. FRAMEWORK ON ESG (ENVIRONMENTAL, SOCIAL AND GOVERNANCE)

Why in news?

SEBI came up with new decisions on environmental, social and governance (ESG) funds.

About the decisions

- **To facilitate balanced approach to ESG, SEBI approved:**
  - **Regulatory framework for ESG** (Environmental, Social and Governance) **Disclosures, Ratings and Investing.**

- **Amendments to SEBI** (Listing Obligations and Disclosure Requirements) **Regulations, 2015 and SEBI** (Mutual Funds) **Regulations, 1996.**

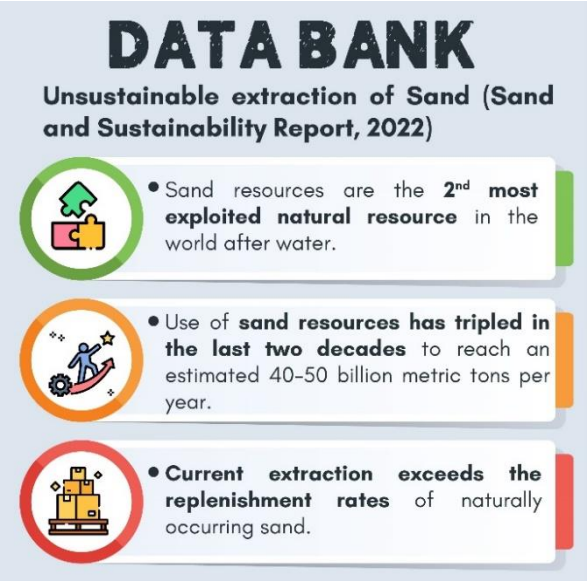
- **Key Decisions**

On ESG Disclosures	• Introduction of **BRSR (Business Responsibility and Sustainability Report) Core to enhance disclosures reliability.** • BRSR Core **will contain a limited set of Key Performance Indicators (KPIs)**, for which listed entities will be required to obtain **'reasonable assurance'.** • **ESG disclosures** for **value chain** of **listed entities** having **significant ESG footprints.**
On ESG Ratings	• **ESG Rating Providers (ERPs)** to consider **India/Emerging Market parameters** in **ESG Ratings.** • **Core ESG Rating'** from ERPs - a **separate category** of **ESG Rating** based on **assured parameters under BRSR Core.**
On ESG Investing	• To **promote ESG investing**, address **risk of mis-selling, greenwashing** etc, it mandates: ○ **At least 65% of AUM** (Assets Under Management) **in listed entities by ESG schemes** where assurance on **BRSR Core** is undertaken. ○ **Third party assurance** and certification by Board of AMCs (Asset Management Companies) **on compliance with ESG scheme objectives etc.**

4.7. SUSTAINABLE SAND MINING IN INDIA

Why in news?

Rajasthan government promoted manufactured sand (M-Sand) as easy alternative to river sand, to control excessive sand mining.



More about news

- M sand is **produced by crushing rocks**, and quarry stones to a stipulated size of **150 microns**. It is different from River Sand.
- **Benefits of M- Sand** in comparison to natural sand**: More cost-effective**; higher concrete strength; zero silt content etc.

About Sand Mining

- It is an **activity referring to the process of the actual removal of sand from the foreshore including rivers, streams, and lakes.**
- River sand is preferred for construction because **it requires less processing and has better quality than other sources.**

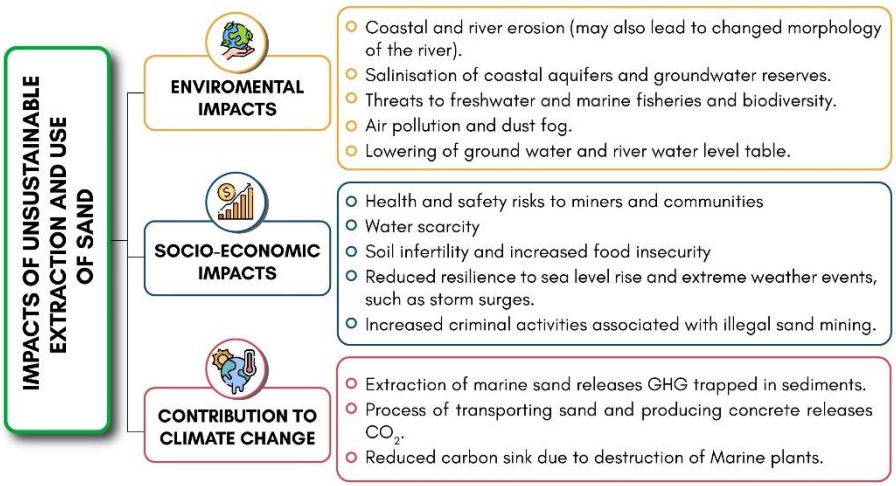
Highlights of Enforcement and Monitoring Guidelines for Sand Mining 2020

- **Source to Destination Monitoring:** Effective monitoring of sand mining from the identification of sand mineral sources to its dispatch and end-use by consumers and the general public and look at a uniform protocol for the whole country.
- **Extraction of sand:** The amount of sand removed should be in proportion to its replenishment rate and river width.
  - **Manual mining is preferred** over the use of machines.
- **Audits:** States to carry out river audits**,** put detailed survey reports of all mining areas in the public domain.
- **Transparency:** Online sales and purchase of sand and other riverbed materials (RBM) for transparency in the process.

Sand Mining Governance in India

- Sand is a **minor mineral** defined under Mines and Minerals (Development and Regulation) Act, 1957 (MMDR Act).
- The act **empowers state governments to frame rules** to prevent illegal mining, transportation and storage of minerals (both major minerals and minor minerals) and for purposes connected therewith.
- The MoEFCC formulated the **Sustainable Sand Management Guidelines 2016** which focuses on the Management of Sand Mining in the Country.
- **Sand Mining Framework, 2018,** prepared by **Ministry of Mines,** envisages **alternative sources of sand in form of M-Sand from crushed rock fines** (crusher dust), etc.
- In 2020, MoEFCC released **Enforcement and Monitoring Guidelines for Sand Mining 2020 to** check illegal sand mining in the country.

- Central Pollution Control Board (CPCB) has published **Environmental Guidelines for Stone Crushing units** that include measures for air pollution control to be followed in stone-crushing units.



Significance of legal and sustainable mining

- **Increase in State Revenue** in the form of royalty.
- **Curbing organized criminal activities** associated with illegal mining.
- Legal mining will lead to the **consumers getting the sand at reasonable prices**.
- Enhancing **compliance with Environmental regulations**.
- **Address growth in demand in the construction sector** with increase in infrastructure development.

Way forward

- **Use of technologies like- geo-fencing, and GPS-enabled transportation etc.** to check illegal mining.
- **Integration of transportation of sand with the online sale mechanism.**
- **Regular audits of sand reserves: Women self-help groups** can be employed to check illegal mining.
- **Restoration of existing sand** by promoting nature-based solutions.
- **Create incentives for public and private investment** for use of **alternative options** for natural sand.

4.8. GREAT NICOBAR ISLAND (GNI) MEGA MULTI DEVELOPMENT PROJECT

Why in news?

Ministry of Environment, Forests and Climate Change (MoEFCC) has granted **environmental clearance for diversion of 130.75 sq. km of forest in Great Nicobar Island** (GNI) for mega ₹72,000-crore multi-development projects.

About the Mega multi development project

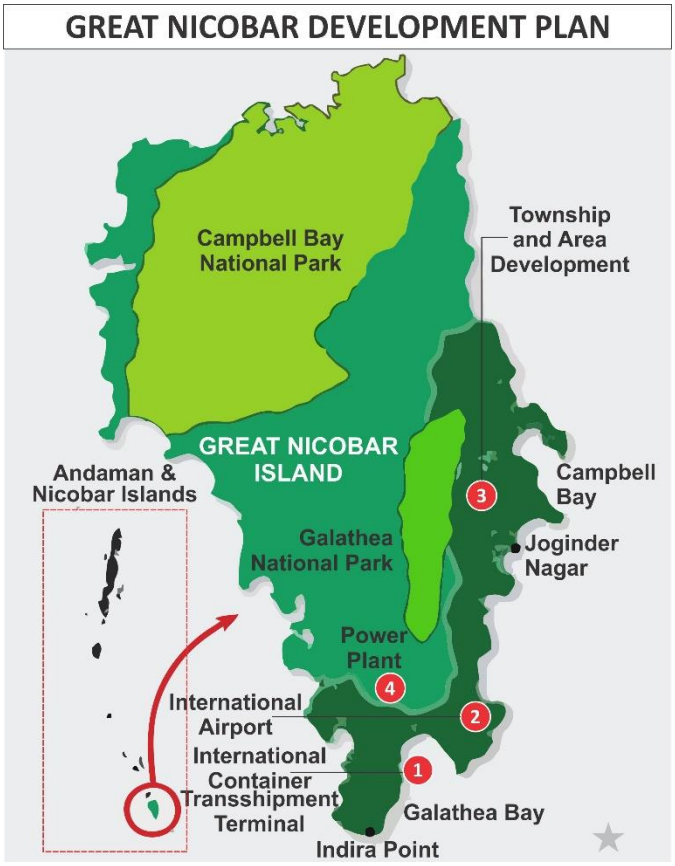
- NITI Aayog has come up with a plan for the **Holistic Development of Great Nicobar Island**.
  - Implementation agency is the **Andaman and Nicobar Islands Integrated Development Corporation (ANIIDCO).**
  - Mega project includes **international container trans-shipment terminal (ICTT)**, a **military-civil dual-use airport**, a **solar power plant** and an **integrated township**

Significance of ICTP project

- **Strategic Location:** Proximity to the International Trade Route (40 nautical miles from Malacca Strait) with existing transshipment terminals like Singapore, Klang, etc.
  - Availability of **natural water depth** of more than 20 metres.
- **Economic efficiencies:**
  - **Reduce logistics inefficiencies and push to allied businesses** such as ship supplies, etc.
  - **Reducing risks to the country's export competitiveness** and create an opportunity for India to become a **large hub for Asia-Africa, Asia-US/Europe container traffic trade**.
  - Other benefits include **forex savings, foreign direct investment, increased economic activity** at other Indian Ports.
- **Development of the region:** With development of ICTP at Great Nicobar, there is a huge potential for improvement in socio-economic variables like **creation of around 1,700-4,000 jobs.**

Concerns with the project

- **Environmental and ecological concerns** like impact on endangered species, coral reefs, mangroves etc.
  - Ecologically rich island was declared a **biosphere reserve in 1989 and included in UNESCO's Man and Biosphere Programme** in 2013.
- **Could disturb livelihood and culture of tribals**, also compromising their forest rights under the Forest Rights Act 2006.
  - **90% area of the island** is **designated as a tribal reserve** under the Andaman and Nicobar Protection of Aboriginal Tribes Regulation, 1956.
- **Vulnerability to disasters like Earthquake, land subsidence etc,** region comes under the **high-risk seismic zone V category**.
- **Environmental Pollution** from the terminal project, coastal surface runoff, ballasts from ships, etc.
- **Financial viability concerns** as all the construction material will have to be shipped to this remote island.
- **Clearance Issue**:
  - **National Green Tribunal** has ordered a stay on the ICTT and formed a committee to re-examine the environmental clearance granted.
  - **Local Tribal council withdrew NOC** for the project as it fears that their rights will be violated.
  - **National Commission for Scheduled Tribes (NCST)** alleged discrepancies in forest clearance under Forest Rights Act (FRA), 2006 on grounds that project will affect the rights of local tribes' people and that NCST was not consulted.



Steps taken to address concerns

- Successfully **translocated a coral reef from Gulf of Mannar to Gulf of Kutch** earlier.
- Conservation plan for the **leatherback turtle** is also being put in place.
- Project site is **outside the eco-sensitive zones** of **Campbell Bay and Galathea National Park**.

Way forward

- **Translocation of affected coral reef**.
- **Biodiversity conservation plans:** Expert Appraisal Committee (EAC) also imposed **specific conditions for wildlife conservation** for leatherback sea turtles, Nicobar megapodes, saltwater crocodiles and several other species, as well as mangrove restoration.
- **Addressing concerns of tribals** by providing **adequate compensation** for the loss of their habitat and ensuring their **unique identity, culture and heritage is protected**.
- **Establishment of Disaster resilient infrastructure**, early **warning systems and contingency plans**.

5. RENEWABLE ENERGY AND ALTERNATIVE ENERGY RESOURCES

5.1. RENEWABLE ENERGY

RENEWABLE ENERGY AT A GLANCE

Key Targets

- **50% of energy requirements** will be met from renewable energy by 2030. (Panchamrita)
- **500 GW of non-fossil energy** capacity to be installed **by 2030.** (Panchamrita)
- **227 GW of renewable energy** capacity to be installed **by the year 2022.**

CURRENT SITUATION

- **India stands at 4th position in the world** in terms of installed RE capacity, **4th in Solar** and **4th in Wind energy** capacity.
- As per Power Ministry, Energy from renewable energy sources (including Hydro) makes **41.4% of total installed capacity** (April 2023).

CONSTRAINTS

Solar energy (Grid connected and Off-grid)	Wind energy (Onshore and Offshore)	Small Hydro energy	Waste to energy	Bio Energy (Bagasse & Non-Bagasse)	Other: Ocean Energy, Hydrogen Energy, Geothermal
Unsustainably Low tarrifs Dependence on imports for components	Impact on local birds & wildlife Profitable only for large scale projects Topographic and geological limitation	Sedimentation Displacement Environmental concerns Disrupted Supply due to low Supply	Poor quality of municipal waste Weak supply chain Environmental and health impacts	Non-availability and high procurement cost of biomass	Scarcity of cost-competitive and scalable projects

- Intermittent supply
- Lack of power storage at an affordable cost

- Land acquisition issues
- High intial cost of installation
- Low investment in R&D related to RE leading to technological backwardness
- Shortage of skilled labour
- Difficulties in Grid integration
- Lack of information and awareness about benefits and need of RE

SCHEMES/POLICIES/ INITIATIVES

- National Solar Mission
- PM KUSUM
- Atal Jyoti Yojana (AJAY)
- Grid Connected Solar Rooftop Scheme
- Solar Parks and Ultra Mega Solar Power Projects
- Suryamitra Skill Development Programme
- National offshore wind energy policy
- Small Hydro Power Programme
- Programme on Energy from Urban, Industrial and Agricultural Wastes Residues
- Scheme to Support Promotion Of Biomass Based Cogeneration In Sugar Mills And Other Industries In The Country
- National Biogas and Organic Manure Programme (NNBOMP)

WAY FORWARD

- **Higher allocation for clean energy from governments,** via subsidies and other measures.
- **Revise tariff structures** to make renewable energy profitable and promote private investment.
- **Explore Hybrid renewable energy systems** to tackle fluctuations.
- **Conduct awareness generation programmes.**
- **Appropriate training and skills development** among Indian workforces.
- **Push for technology transfers** from Developed nations for elements such as battery and storage systems under international frameworks.
- **Promote innovation and entrepreneurship** in new and upcoming renewable technologies.

5.2. SOLAR ENERGY

SOLAR ENERGY AT A GLANCE

KEY TARGETS

- **National Solar Mission:** Total installed capacity 100 GW by 2022, including 60 GW of utility-scale and 40 GW of rooftop solar capacity, and 300 GW by 2030.

CURRENT SITUATION

- Globally, **India currently ranks 4th in terms of installed solar power capacity**
- As per Ministry of Power total installed Solar capacity= 67 GW (April 2023)

SCHEMES/POLICIES/INITIATIVES

- **National Solar Mission.**
- **Grid connected solar rooftop programme.**
- **Developments of solar parks and ultra-mega solar power projects.**
- **Production Linked Incentive Scheme** "National Programme on High Efficiency Solar PV Modules" to support and promote manufacturing of high efficiency solar PV modules.
- **Others:** PM-KUSUM; Solar Transfiguration of India (SRISTI); Suryamitra programme; Atal Jyoti Yojana (AJAY); Renewable purchase obligations etc.
- **International level:** International Solar Alliance (ISA) and its One Sun One World One Grid and Green Grids initiative.

CONSTRAINTS

- **Shortfall in domestic manufacturing capacities** coupled with **high taxes on imported cells and modules.**
- **Inconsistencies in Solar policies** for rooftop solar and open access etc.
- **Low Tariffs enforced by the states** leads to compromise in the quality of solar panels and low private sector participation.
- **Financing, storage, transmission issues** in establishing solar rooftops.
- **Other issues:** Unsigned power supply agreements by DISCOMs; Net metering limits on rooftop solar capacity; conflicts with local communities and biodiversity protection norms etc.

WAY FORWARD

- **Uniform policies to apply nationally** for rooftop solar, net metering, banking facilities etc.
- **Enhance access to affordable finance** for **Battery Energy Storage Systems, grid integration, purchase of solar PV modules etc.**
- **Embrace circular economy for PV waste** to improve Domestic manufacturing.
- **Reduce duties on solar cell.**
- Stricter enforcement of the **renewable purchase obligation (RPO)** by states.

5.2.1. INTERNATIONAL SOLAR ALLIANCE (ISA)

Why in news?

In its General Assembly meeting, ISA approved the 'Solar Facility'.

More on the news

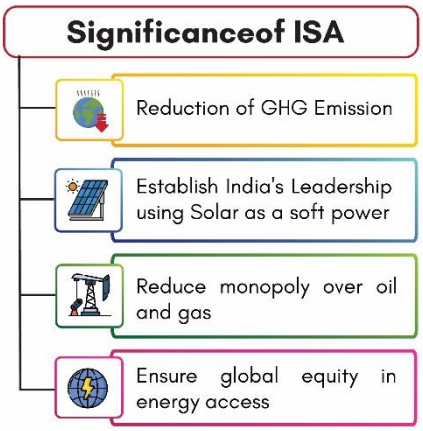
- Objective of the facility is to attract private capital to flow into **"underserved markets" in Africa.**
- **Payment guarantee mechanism** expected to stimulate investments into solar projects. It has **two financial components:**
  - **Solar Payment Guarantee Fund**: Enable investments in geographies that do not receive investments.
  - **Solar Insurance Fund**: Will **reduce the burden of insurance premium** for solar developers in pre-revenue phase of project.

About ISA

- It is a **joint effort by India and France** to mobilize efforts against climate change through the deployment of solar energy solutions.
- Conceptualized on the sidelines of the 21st Conference of Parties (COP21), 2015 to the UNFCCC.
- **ISA assembly is the apex decision-making body**.
- It is guided by its **'Towards 1000'** strategy which aims-
  - to **mobilise USD 1,000 billion of investments** in solar energy solutions by 2030.
  - Delivering **energy access to 1,000 million people** using clean energy solutions.
  - Installation of **1,000 GW of solar energy** capacity.
- **Priority Areas**: Analytics & Advocacy, Capacity Building, Programmatic Support and Readiness and enabling activities.
- It is **open to all member states of the UN.**

Other Major Initiatives of ISA

- **Solar Technology and Application Resource Centre (ISTAR-C)** to support capacity-building efforts in the ISA member countries through training.
- **ISA Solar Fellowship for Mid-Career Professionals,** for the creation of a skilled and qualified professional manpower for management of solar energy projects etc.
- **One Sun One World One Grid (OSOWOG)**, building a global ecosystem of interconnected renewable energy resources, launched in **partnership with ISA and World Bank Group**.



Challenges

- **Funding Constraints:** No fixed mechanism for mobilization of the funds.
- **Technology Transfer and Intellectual Property Rights:** Developing countries often face barriers to accessing advanced solar technologies due to patent restrictions and high costs.
- **Still in evolving stage** as a global organization.
- **Geopolitical vulnerabilities** with China dominating the solar supply chain.
- **Limited membership.**

Progress/Achievements

- **International cooperation:** 115 countries are signatories to the Framework Agreement, of which 93 countries have ratified it.
- **United Nations General Assembly (UNGA)** has granted it an observer Status.
- **Facilitating Finance:** Launched initiatives to mobilize funds such as **Solar Risk Mitigation Initiative (SRMI), etc.**
- **Solar Training and Capacity Building:** India is implementing the Solar Mama program (Barefoot College for vocational training centers where women were provided local-level training) in different African nations.
- **Innovation and Entrepreneurship: Promotion of R& D** to make solar more affordable and efficient. Encouraging people to get into it as entrepreneurship.
- **Promoted Solar Technology Transfer.**

Way forward

- **Ensuring sustainable finance** through innovative mechanisms like green bonds**.**
- **Promoting international cooperation** with other initiatives such as **United Nations Sustainable Energy for All (SEforALL) and the International Renewable Energy Agency (IRENA).**
- **Facilitate technology transfer from developed to developing nations.**
- **Encouraging members** to ratify its framework**.**

5.3. WIND ENERGY

WIND ENERGY IN INDIA AT A GLANCE

KEY TARGETS

- Achieve total installed capacity of 60 GW of wind energy by 2022.

INDIA'S WIND POWER POTENTIAL

- Gross potential of **302 GW at 100 meter** and 695.50 GW at 120 meter above ground level (Ministry of New and Renewable Energy).
- Most of this potential exists in **seven windy States- Gujarat (highest),** Rajasthan, Maharashtra, Tamil Nadu, Madhya Pradesh, Karnataka, Andhra Pradesh.

CURRENT SITUATION

- **Installed capacity of wind energy (April, 2023):** ~43 GW (10.3 % of total installed capacity in India) Globally, India ranks 4**th in installed wind capacity.**

SCHEMES/POLICIES/INITIATIVES

- **National Wind Solar Hybrid policy, 2018** and **National Offshore Wind Energy Policy, 2015.**
- **Technical support including wind resource assessment and identification** of **potential sites** through the National Institute of Wind Energy.
- **Waiver of Inter State Transmission System (ISTS) charges** for inter-state sale of wind power for projects.
- **Concessional custom duty exemption on certain components** required for manufacturing of wind electric generators.
- **Standard Bidding Guidelines for tariff based competitive bidding process** for procurement of Power from Grid Connected Wind Projects.

CONSTRAINTS

- **High construction, operational and maintenance expenditure,** especially in offshore wind projects.
- **Difficulties in land acquisition** at windy sites.
- Challenges in **maintaining competitive pricing.**
- **Impact on local wildlife** (collision, noise pollution from turbines etc.)
- **Variable wind, intermittent supply** and high cost of energy storage.
- **Other challenges** related to grid integration, procurement and transport wind farm components, need of skilled workforce for maintenance etc.

WAY FORWARD

- **Consider wind energy for Renewable purchase obligation.**
- Waiving excise duties and GST during **early stages of project development.**
- **Feed-in tariff (FiT)** policy for promoting RE expansion where the government offers a guaranteed purchasing price for electricity produced from RE sources for fixed periods of time.
- Invest in research and development for **affordable energy storage systems.**
- **Developing offshore projects** to overcome land acquisition issues.

5.4. BIOENERGY IN INDIA

BIOENERGY IN INDIA AT A GLANCE

Bioenergy

- Refers to **electricity and gas that is generated from organic matter, known as biomass.**

Potential

- **Surplus biomass availability** at about 230 million metric tones per annum in India covering agricultural residues correspond to a potential of about **28 GW.**
- About **14 GW additional power** could be generated through **bagasse based cogeneration in the India's Sugar mills.**

Utilisation

- **Biofuels:** Bio ethanol, Biodiesel, Compressed Bio-Gas (CBG), Bio-hydrogen etc.
- **Biopower:** Convert renewable biomass fuels into heat and electricity.
- **Bioproducts:** Plastics, lubricants, industrial chemicals, etc.

BIOFUELS

First Generation	Second Generation
Edible biomass ★ Sugar beet ★ Sugar cane ★ Wheat ★ Corn ★ Oil crops	**Non-Edible biomass** ★ Wood ★ Grass ★ Straw ★ Waste
Third Generation	**Fourth Generation**
Algal biomass ★ Macroalgae ★ Microalgae	**Breakthrough** ★ Pyrolysis ★ Solar to fuel ★ Genetically modified organisms

Significance of Bioenergy/ Biofuels

- **Promote green energy transition** in country.
- **Reduce air pollution** and improve quality of life.
- **Reduce garbage dumped in landfills and cost of landfill** disposal.
- **Reduces overreliance of fossil fuels.**
- **Contribute to achieve UN mandated SDG** such as zero hunger, clean water and sanitation etc.

Schemes/Policies/Initiatives

- **National Policy on Biofuels, 2018.**
- **Pradhan Mantri JI-VAN** (Jaiv Indhan- Vatavaran Anukool fasal awashesh Nivaran) **Yojana, 2019.**
- **GOBAR** (Galvanizing Organic Bio-Agro Resources) DHAN scheme, 2018.
- **Sustainable Alternative Towards Affordable Transportation (SATAT)** to establish an ecosystem for CBG production.
- **Directorate General of Foreign Trade (DGFT) amended Biofuels' Export Policy, allowing export of biofuel from Special Economic Zones (SEZs) and Export-Oriented Units (EOUs)** for both fuel and non-fuel purposes without any restrictions if biofuel is produced using imported feed stock.

Constraints

- **Technological barriers:** For example, in Gasification, variations in power delivered depend on quality of biomass.
- **Competition:** Energy pricing policies and subsidies in India favour **fossil fuel-based energy sources.**
- **Food vs. fuel:** Agricultural land may be diverted to production of bioenergy crops.
- **Financial barriers:** High initial cost of gasifier, engine generator etc.
- **Shortage of Quality Raw material:** High **moisture content in biomass causes biological degradation,** mold formation and losses etc.
- **Biodiversity loss** during cultivation.

Way Forward

- **Rigorous R&D** aimed at cost reduction, improved reliability etc.
- **Revise tariff structures** through promotion of Feed-in-tariffs (FITs).
- **Focus on cultivation and production of algae as algal** biofuels.
- **Market development by creating special funds** for projects demonstrating new technologies and by promoting collaboration between industry and academia.
- **Instituting measures to ensure sustainable exploitation** and **development** of bioenergy resources.

5.4.1. NATIONAL BIOENERGY PROGRAMME

Why in news?

Recently, **Ministry of New and Renewable Energy (MNRE)** has notified that **National Bioenergy Programme (NBP) will continue from FY 2021-22 to 2025-26** for the first phase.

More on news

- NBP will comprise the three sub-schemes namely **Waste to Energy Programme, Biomass Programme, and Biogas Programme.**
  - Biomass is **renewable organic material** that comes from **plants and animals**. Biomass is the **raw material to produce biogas.** Major component of biomass is **carbon.**
  - Biogas is a **renewable fuel produced by the breakdown of organic matter** such as food scraps and animal waste by microorganisms **in absence of oxygen**.
  - Biogas is composed mostly of **methane (CH_4), and carbon dioxide (CO_2).**

Sub-scheme	Objective
Waste to Energy Programme (Programme on Energy from Urban, Industrial and Agricultural Wastes /Residues)	• To support the setting up of Waste to Energy projects for generation of **Biogas/ Bio-CNG/ Power plants** (excluding municipal solid waste to power project)/ **producer or syngas** from urban, industrial and agricultural wastes/residues. • **Indian Renewable Energy Development Agency (IREDA)** will be the implementing agency. ○ IREDA, established in 1987, is a **Mini Ratna (Category-I) Enterprise under administrative control of MNRE.**
Biomass Programme (Scheme to Support Manufacturing of Briquettes & Pellets and Promotion of Biomass (non-bagasse) based cogeneration in Industries)	• To support setting up of **Biomass Briquette/Pellet manufacturing plants** and to support Biomass (non-bagasse) based **cogeneration projects** in Industries. • **IREDA shall be the implementing agency.**
Biogas Programme	• Setting up of biogas plants for small power needs of users. • Implemented by designated **Programme Implementing Agency (PIA) of State/ Union Territory**/Biogas Development and Training Centres (BDTC). • IREDA, NABARD/ RBI approved Financial Institutions may also implement it in consultation with PIAs.

5.4.2. ETHANOL BLENDING

ETHANOL BLENDING IN INDIA AT-A-GLANCE

ETHANOL BLENDED FUEL

- **A blended motor fuel containing ethyl alcohol** that is at least 99% pure, derived from agricultural products, and blended exclusively with gasoline.
- Considered to be a renewable fuel.

BENEFITS

Use of E20, a blend of 20% ethanol and 80% petrol, **leads to an estimated reduction of carbon monoxide emissions** by about **50% in two-wheelers and about 30% in four-wheelers** compared to E0 (neat petrol).

KEY TARGETS

Under National Policy on Biofuels 2018, India aims to achieve **10% ethanol-blending in petrol by 2022 and 20% ethanol-blending in petrol by 2025.**

CURRENT SITUATION

- India has **achieved 10% ethanol blending target** in June 2022.
- **E20 fuel, launched 2 year ahead of target** and will be rolled out across country in a phased manner.

Schemes/Policies/Initiatives

- **Ethanol blending petrol (EBP) programme,** wherein Oil Marketing Companies sell petrol blended with ethanol.
  - **Financial assistance** provided under it to **sugar mills and grain-based distilleries through interest subvention.**
- **PM-JIVAN (Jaiv Indhan- Vatavaran Anukool fasal awashesh Nivaran) Yojana** for setting up of Second Generation (2G) Bio-Refineries.
- **Reduced Goods & Service Tax** (GST) on ethanol meant for Ethanol Blended with Petrol (EBP) Programme from 18% to 5%.
- Use of automotive **fuel E12** (12% ethanol with 88% petrol) & E15 notified.
- **Amended the Industries (Development & Regulation) Act, 1951** to ensure free movement of ethanol in the country.
- **Flexi-fuel engine & components** (capable of running up to E85 fuel) included **under Production Linked Incentive (PLI) scheme.**

Constraints

- **Production Side**
  - **Impact on Food and Water Security** due to high demand of food grains and sugarcane (water intensive crop).
  - **Inconsistent availability of sufficient feedstock.**
  - **Higher prices of ethanol** in India due to the fixed price of raw materials.
  - **Lack of Ethanol production facilities and delay in environmental clearance.**
  - **Limited private investment in the sector.**
- **Transportation, Storage and Usage Side**
  - **Non-uniform availability of ethanol** across states for blending.
  - **Increased implementation cost** related to additional storage tanks, ethanol complaint dispensing units, calibration of nozzles etc.
  - Ethanol blended fuel **require modification of vehicles, raising their cost.**

Way Forward

- **Ensuring uniform availability of ethanol blends** across India by incentivizing development of advanced generation biofuels (2nd and above).
- **Augmenting Infrastructure of Oil Marketing Companies,** i.e., ethanol storage, handling, blending and dispensing infrastructure.
- **Focus on Sustainability of supplies** by improving plant biomass, overcoming inter-state movement issues, expediting regulatory clearances for new production units and supporting cash constrained sugar mills in bioethanol production.
- **Provide tax incentives** to absorb the R&D cost on E20 compatible design.

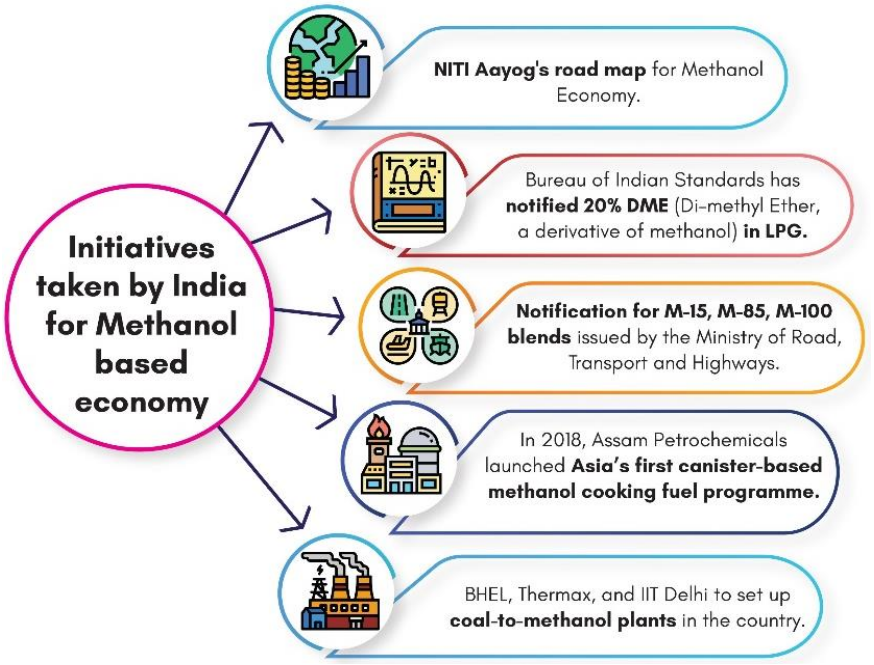
5.4.3. METHANOL BLENDING

Why in News?

Demo-run of Vessel named SB Gangadhar powered by Methanol blended Diesel (MD15) was held **in run-up to India Energy Week 2023** (IEW 2023).

About Methanol

- Methanol (CH_3OH), **also known as wood alcohol,** is a **low carbon hydrogen carrier fuel** produced **from high ash coal, agricultural residue, CO2 from thermal power plants** and natural gas.
  - Has **properties similar to ethanol**.
  - **Used in various products,** including plastics, paints, cosmetics etc.



- **Significance of Methanol economy for India**
  - Blending of 15% methanol in gasoline **can result in at least 15% reduction in import of gasoline/crude oil.**
  - **Would bring down GHG emissions by 20%** in terms of particulate matter, NOx, and SOx.
  - Although **slightly lower in energy content** than petrol and diesel, methanol **can replace these fuels in transport sector, energy sector** and **retail cooking**.
  - **Cost to convert vessels to run on methanol is significantly less** than other alternative fuel conversions.
  - **Would create close to 5 million jobs**.

5.5. HYDROGEN ENERGY IN INDIA

HYDROGEN ENERGY IN INDIA AT A GLANCE

Hydrogen fuel

- A **clean-burning fuel** with water as its by-product.
- Also, an **energy carrier that can be used to store, move, and deliver energy** produced from other sources.

Categories of Hydrogen (Based on production method)

Grey Hydrogen	Blue Hydrogen	Green Hydrogen
Process: Steam Reforming	Process: Steam Reforming With Carbon Capture	Process: Electrolysis
Source: **Natural Gas**	Source: **Natural Gas**	Source: **Renewable Energies**

Black Hydrogen	Pink Hydrogen	Turquoise Hydrogen	Yellow Hydrogen
Process: Gasification	Process: Electrolysis	Process: Pyrolysis	Process: Electrolysis
Source: **Coal**	Source: **Nuclear Energy**	Source: **Natural Gas**	Source: **Solar Energy**

Targets

Production of 5 million tonnes of Green hydrogen by 2030

Advantages over conventional fuel

- **High Calorific Value: Has almost 2.5 times the energy per tonne compared as to natural gas.**
- **Abundance** in environment.
- **Alternative to Coke and Coal in Steel production.**
- **Can be used in Fuel Cells in Electric Vehicles.**
- **Refueling can be done at fast rate.**

Schemes/Policies/Initiatives

- **National Hydrogen Mission.**
- **National Hydrogen energy Roadmap.**
- In 2020, **Delhi became the first city in India** to operate buses with hydrogen-enriched CNG etc.
- Ministry of New and Renewable energy to **launch a Hydrogen fuel cell-based bus project in Leh.**
- National Hydrology portal.
- Hydrogen Valley platform (To facilitate a **clean energy transition** by promoting the emergence of **integrated hydrogen projects** along the value chain and **raise awareness among policy makers**).

Constraints

- **High Capital Cost** of the electrolyser technology and **Green Hydrogen in India.**
- **Difficult to store and transport due to its highly flammable nature.**
- **Most of Hydrogen is presently being produced from fossil fuels**, leading to high emissions.
- **Nascent Stage Technology** discourages many private players from actively participating in its development.

Way Forward

- **Creation of safe and cost-effective infra-structure** for Hydrogen storage and transportation.
- **Promotion of Green Hydrogen** over other production methods.
- **Introduce major R&D programmes** linking Hydrogen fuel with applications to enhance market acceptance.

5.5.1. NATIONAL GREEN HYDROGEN MISSION

Why in News?

Union Cabinet has approved the **National Green Hydrogen Mission.**

More about the Mission

- Proposed **to make India a global champion in Green Hydrogen production,** thereby reducing the dependence on Fossil fuels gradually.
- **Ministry of New and Renewable Energy (MNRE) is to formulate the guidelines** for the implementation of the mission.

Sub-Components of the Mission

- **Strategic Interventions for Green Hydrogen Transition Programme (SIGHT):** Incentives are to be provided for **targeting domestic manufacturing of electrolysers** and for **production of Green Hydrogen**.
- **Pilot projects:** Will **support pilot projects in emerging end-use sectors,** supporting large scale production or utilization of Hydrogen will be identified and developed as **Green Hydrogen Hubs.**
- **Strategic Hydrogen Innovation Partnership (SHIP):** Public-Private Partnership framework for **R&D will be facilitated under the Mission,** which will be goal-oriented and suitably scaled up for global norms.
- **Skill Development:** Programme, for the **workforce** in the sector will also be undertaken under the Mission.

Challenges in Scaling up Green Hydrogen Market

- **Low level of technology readiness.**
- Hydrogen production and conversion involve significant **energy losses at each stage of the value chain.**
- Lack of sufficient **renewable electricity availability.**
- **Policy / Regulatory Uncertainty.**
- **Lack of institutionalized mechanisms** to track the production and consumption of any shade of hydrogen and identify its characteristics.

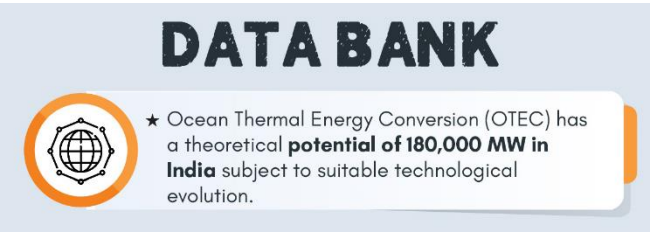
Key Policy Interventions needed

- Facilitate **access to low-cost renewable electricity.**
- Allow **hydrogen mixed with natural gas** to be used in existing natural gas infrastructure.
- Develop appropriate mechanisms to **price the emissions of GHGs,** which would encourage decarbonization of the economy.
- **PLI schemes** for different components in green hydrogen or ammonia value chain.
- Partial **exemptions of grid charges, taxes, and levies** for electrolysers.

5.6. OCEAN THERMAL ENERGY

Why in news?

The National Institute of Ocean Technology (NIOT), an autonomous Institute under Ministry of Earth Sciences (MoES) is **establishing an Ocean Thermal Energy Conversion (OTEC) plant with a capacity of 65kW in Kavaratti, Lakshadweep.**

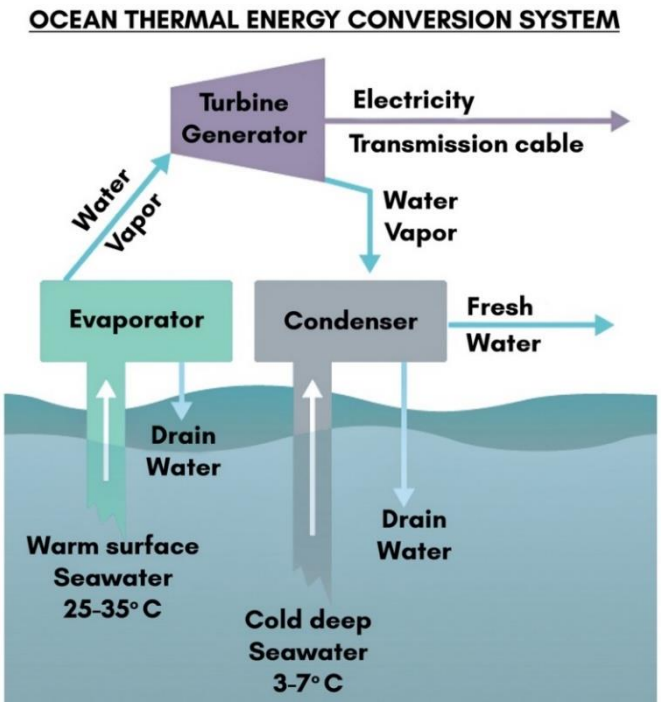


More on the news

The OTEC plant will power the Low Temperature Thermal Desalination (LTTD) based desalination plant for **conversion of Sea water into Potable water,** with capacity of 1 lakh litre of potable water per day.

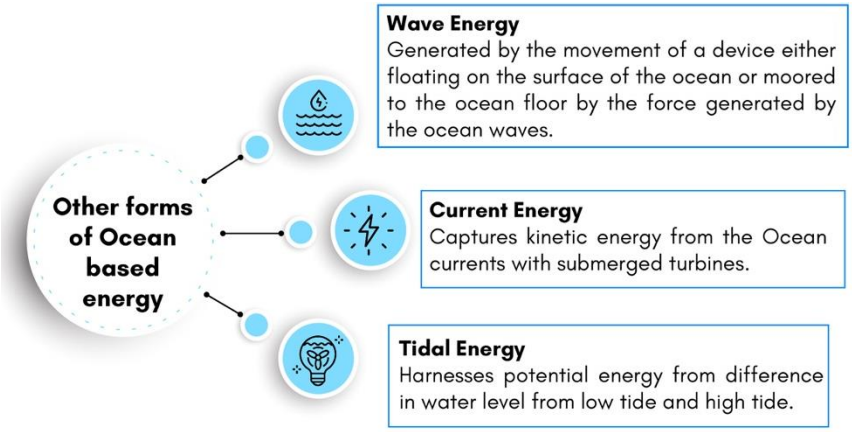
About Ocean Thermal Energy Conversion (OTEC)

- OTEC is a process for **producing energy by harnessing the temperature differences** (thermal gradients) between **ocean surface waters and deep ocean waters.**
  - In tropical regions, surface water, heated by Sun's energy, can be much warmer than deep water. This temperature difference can be used to produce **electricity and to desalinate ocean water**.
- OTEC systems use a **temperature difference of at least 20° Celsius** to power a turbine to produce electricity.
- **Types of OTEC methods include** Closed cycle method and Open cycle system.
- **Advantages:**
  - **India is geographically well-placed** for development of OTEC facilities.
  - **Generates a constant, clean source of electricity** unlike intermittent electricity from renewable resources like wind and solar.
  - **Potential to generate potable water, hydrogen, and ammonia.**
  - **Cold and nutrient rich water from the OTEC process can benefit commercial products** such as air conditioning, aquaculture, seawater cooled greenhouses enabled food production etc.



Challenges associated with OTEC

- **High up-front capital costs** and significant maintenance costs of pumping and piping infrastructure.
- **Economical only at very large scales.**
- **Most OTEC Technologies are currently at pre-R&D/demonstration stage or the initial stage of commercialization.**
- **Environmental concerns:** Potential impact on marine organisms and ecosystem due to **discharge of cooler, denser and nutrient rich water** from OTEC facilities, **entanglement** in cables, **entrapment**, noise generation, accidental release of biocides (used for water treatment) or other potential pollutants etc.
- **Increased Biofouling** i.e., unwanted accumulation of algae, microorganisms, plants etc.



Way Forward

- **Accelerate financial and policy support for the deployment of OTEC.**
- **Invest in R&D in and promote international collaborations** the field of ocean energy.
- **Develop more Demonstration projects** for OTEC at feasible sites **to carefully assess environmental impacts** before large scale deployment.

Related News: Ocean Wave Energy Converter

- IIT Madras develops 'Ocean Wave Energy Converter' **(Sindhuja-I)** to generate electricity from sea waves.
- **Advantages of Ocean Wave Energy:** No pollution, Renewable, Higher available energy densities, Predictable and Less volatile in comparison to some other RE sources.
- **Disadvantages of Ocean Wave Energy:** High Initial Cost, Threat to Marine Life and Navigation, Location dependent and risk of damage from natural forces.

5.7. GEOTHERMAL ENERGY

GEOTHERMAL ENERGY AT A GLANCE

- An **energy source** that is **stored in the form of heat beneath earth's surface.**
  - **Magma in inner layer of earth heats nearby rocks** and underground aquifers, **as a result hot water is released** through geysers, hotsprings, steam vents, underwater hydrothermal vents, and mud pots.
  - **Hot water and steam** can be piped up through underground wells and **used to generate electricity in a power plant.**

Potential and Distribution in India

- **Total estimated geothermal power potential India:** 10 gigawatt (GW).
- **Around 300 geothermal hot springs** exist in India (Geological Survey of India).
- **Puga and Chumathang in eastern Ladakh** are the **most promising** geothermal sites.

Benefits of Geothermal Energy

- **Carbon-free**
- **Renewable in nature.**
- **Provides a continuous uninterrupted supply** etc.

Constraints

- **Location-specific energy** source.
- Associated with other **emissions like sulphur dioxide and hydrogen sulphide.**
- **Causes mini tremors** in area of operation.
- **High initial cost of plants distribution etc.**

Way Forward

- **Adequate geological mapping of potential energy.**
- **Incentives for Research and development** for developing low-cost and clean extraction technology.
- **Promoting infrastructure construction for distribution of power.**

5.8. ELECTRIC VEHICLES (EVS) POLICY

Why in News

Parliamentary Committee on Estimates presented a report on 'Evaluation of Electric Vehicle (EV) Policy' suggesting formulation of a comprehensive national policy on EV.

About Electric Vehicles

Type of vehicle that uses **one or more electric motors for propulsion instead of an internal combustion engine** (ICE).

Need of a National EV policy in India

- **Improve Air Quality of Cities** by reducing Vehicular pollution arising from the increasing stock of private vehicles, especially internal combustion engines (ICE).
- **Fulfilling rising demand of EV vehicle in India.**
- **Achieve target of EV sales penetration** of 30% of private cars, 70% of commercial cars, 40% of buses and 80% of two and three-wheelers by 2030.

Types of EVs

1. Battery Electric Vehicles (BEVs)
- Run entirely on battery-powered electric driven motor.

2. Hybrid Electric Vehicle (HEV)
- Also known as series hybrid or parallel hybrid.
- HEVs have both engine and electric motor.

3.Plug-in Hybrid Electric vehicle
- Also know as series hybrids.
- They also have both engine and a motor.
- The battery can be charged externally.

4.Fuel Cell Electric Vehicle (FCEV)
- Also known as Zero-Emission Vehicles.
- They employ fuel cell technology to generate the electricity.

DATA BANK

STATUS OF EVS IN INDIA

- **5th largest** Automobile market in the world.
- **As per Vahan portal**
  - EV sales: FY 21-22-**4.3 lakh units (3.3 times of FY 20-21)**

- **Fulfil International Commitments** such as Panchamrita target of **Net-Zero carbon emissions by 2070**.
- **Reduce oil import**.
- **Improve penetration of Battery rechargeable infrastructure**.
- **Need of uniform EVs policy across India as** different States have formulated an EV policy for themselves.

Challenges of EVs and EV Industry

- **Inadequate charging Infrastructure** due to factors like unsurety in utilization rates of charging stations, huge operating costs, load on electricity DISCOMs, etc.,
- **Deterrents for consumers** like high cost of EVs, fire accidents, satisfactory resale value, scarcity of charging infrastructure, unreliable electricity etc.
- **Scarce battery technology** and limited availability of **rare earth metals** and other raw materials.
- **Limited Manufacturing Capabilities of domestic industry**.
- **Need for Scrapping Policy:** Electric vehicles contain high-voltage components that are harmful to the environment.
- **Shortage of skilled manpower for servicing and repair of EVs**.

Suggestions for EVs and EV Industry as per report

- **Reducing upfront costs** by enhancing the subsidy on electric four wheelers, encouraging States to waive off road tax etc.
- **Promotion of other technologies along with EVs** such as flex fuel vehicles, Hydrogen ICE, Hydrogen fuel cell vehicles etc.
- **Expediting extraction of Lithium.**
- **Building trust among consumers** through formulating safety standards.
- **Strategy for reuse or disposal of EV Batteries**.
- **Apprenticeships and traineeships** to frame new courses for specialization in EVs.
- **Solar charging stations** setting up of Solar charging stations. Virtual Power Plants (VPPs)
  - VPP is a **network of decentralized power generating units that pool together thousands of energy resources** like electric vehicles (EVs) or electric heaters.

Government Steps to promote EVs

- **National Electric Mobility Mission Plan (NEMMP) 2020**.
- **Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME India) Scheme:**
  - **FAME-II** was launched in 2019 and **will continue till 2024** focusing **electrification of public & shared transportation.**
- **GST on electric vehicles reduced from 12% to 5%**; GST on chargers/ charging stations for electric vehicles has been reduced from 18% to 5% by GST Council.
- Battery operated vehicles given **green license plates** and be **exempted from permit requirements**.
- Issuance of **performance norms for lithium-ion battery packs** and **traction systems** by **Bureau of Indian Standards**.
- Railways would **replace 20% of its fleet with EVs by December 2023**, 60% by December 2024 and achieve **100% by the end of 2025.**

Related news: FAME II subsidy for Electric Vehicles (EVs) at only 52% of the target

- Findings are part of a **parliamentary standing committee report highlighting issues and suggesting ways** to improve implementation of **Faster Adoption & Manufacturing of Electric (& Hybrid) Vehicles (FAME) Scheme.**
- **Issues highlighted**
  - **Lacklustre progress** in both **physical and financial targets.**
  - Only **few cities were covered for e-Buses.**
  - **EV charging stations** sanctioned **only for a few cities.**
  - **Varying utilization of subsidies** across EV segments. While **target for e-buses was achieved** but in **three-wheelers just 15.17% of the target** has been reached.
- **Recommendations**
  - Scheme **should be extended further with new targets, incentives, and measures.**
  - Place greater **emphasis on implementation and extend subsidy to private vehicles,** along with exemption from road tax, registration fee, etc.
  - **Boost to charging** infrastructure.
- Ministry of Heavy Industries **launched FAME scheme** in 2015 **under National Electric Mobility Mission Plan (NEMMP)** to encourage electric and hybrid vehicle purchase by providing financial support.
  - **FAME Phase I**, functional till 2019, had **four focus areas** i.e., technological development, demand generation, pilot project and charging infrastructure components.
- **FAME-II** was launched in 2019 and **will continue till March 2024** focusing **electrification of public & shared transportation.**

5.8.1. BATTERY ENERGY STORAGE

Why in News?

'Need for Advanced Chemistry Cell (ACC) Energy Storage in India' report was released by NITI Aayog.

About Energy Storage

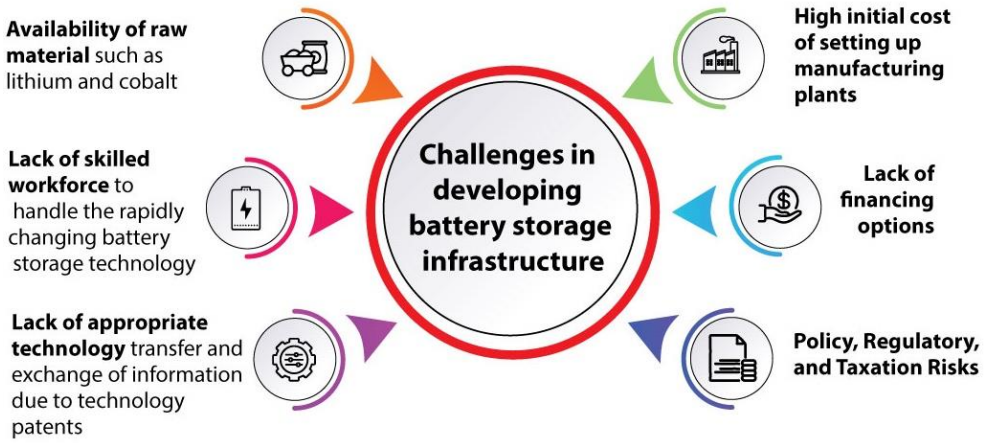
- Energy storage is the **capture of energy produced for later use to reduce imbalances** between energy demand and energy production.
- Based on the application, **battery energy storage can be classified into three categories:**
  - **Consumer electronics applications** (for mobile phones, tablets, laptops, cameras, etc.)
  - **Stationary applications** (such as for commercial and industrial applications).
  - **Transportation applications**.
- Battery energy storage technologies include:

About Advanced cell chemistry (ACC) battery storage

- ACCs are the **new generation of advanced storage technologies** that can store electric energy either as electrochemical or as chemical energy and convert it back to electric energy as and when required.
- They will **cater not only to electric vehicles but also to the consumer electronics industry,** solar rooftops, and electricity grids.
- **India's annual demand for ACC batteries** would rise to **between 104 GWh and 260 GWh by 2030** (from close to 2.7 GWh now) across multiple sectors.

Type	Advantage	Disadvantage
Lead Acid batteries	**Mature technology, low cost** and ruggedness compared with other battery technologies.	**Heavy and bulky,** do not cycle well.
Nickel-cadmium batteries	**Availability in all sizes,** can be moved around easily.	**Environmental concerns** related to cadmium.
Nickel metal hydride batteries	Widely used in **consumer electronics,** addresses the issues arising from the environmental effects of cadmium.	**Not considered for large stationary applications because of high cost** of Nickel, also have a high self-discharge rate and generally take a long time to charge.
Lithium-ion batteries	Superior with **higher energy densities, lighter and smaller.**	**Raw material dependency,** challenges in manufacturing, overcharging in certain types.
All solid-state batteries	**High energy densities** and charge/discharge current limits, a higher life even in harsh conditions.	Challenges in both **manufacturing and fundamental technology understanding.**
Metal air	**High energy density** than lithium-ion batteries.	**Not electrically rechargeable,** lower charge/discharge rates compared with Lithium-ion batteries
Sodium ion batteries	Wider operational temperature range and are safer. Cheaper than Lithium-ion.	Lower energy density than lithium-ion batteries.

- **It has become prominent in recent time with**
  - **Use of rechargeable batteries** in consumer electronic applications like mobile phones, laptops, tablets, etc. and automobile applications.
  - **Commitments to reducing greenhouse gas (GHG)** emissions and attaining net zero.
  - **Intermittent Renewable Energy sources in the grid** calling for storing excess energy needs for use when needed.



Need for Battery storage technology ecosystem in India

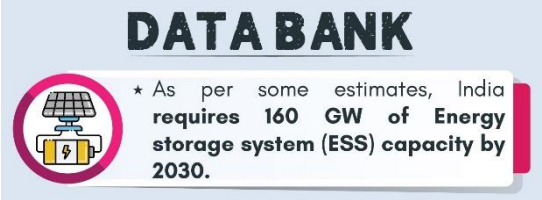
- **Competitive advantage** in the mobility, grid energy storage, and consumer electronics spaces.
- **Energy security and reduced dependence on oil imports.**
- **Reducing GHG emissions.**
- **Meeting the EV 30@30 goals** (setting the objective to reach a 30% sales share for EVs by 2030).
- **Benefit to overall economy:** Establish India as a centre for cutting-edge research and innovation, boost its manufacturing capabilities, create new jobs, and foster economic growth.

Initiatives Taken

- Government approved **PLI Scheme 'National Programme on Advanced Chemistry Cell (ACC) Battery Storage'** for achieving manufacturing capacity of 50 Giga Watt Hour (GWh) of ACC.
- **Faster Adaption of Manufacturing of Electric Vehicles (FAME) I and II.**
- **PLI Scheme for automotive sector.**
- **National Mission on Transformative Mobility and Battery Storage.**

Way Forward

- **Incentives to manufacturers** like direct fiscal incentives, tax credits, partnerships with industry leaders etc.
- **Securing raw material supply** by developing external supply chains and investing in battery recycling.
- **Special Economic Zones** for battery manufacturers.
- **Investment in R&D and Innovation** for newer and niche battery technologies.



- **Specific policy instruments** including direct benefits in the form of capital subsidies, interest subsidies, electricity duty exemptions, etc.
- **Promoting Public Private Partnership (PPP)** in battery manufacturing industry.

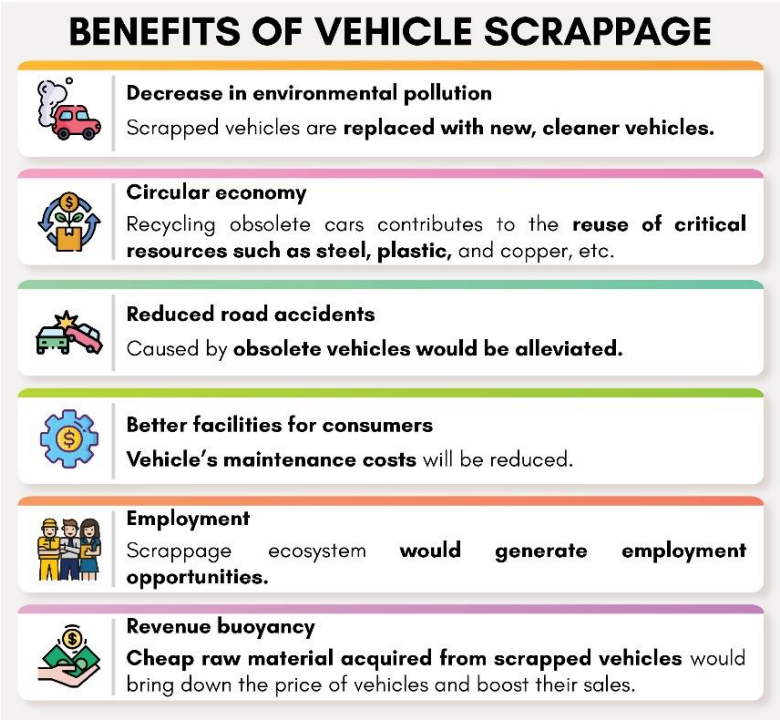
5.9. VEHICLE SCRAPPAGE

Why in news?

Centre has earmarked ₹3,000 crore for scrapping old vehicles as incentives to states under the 'Scheme for Special Assistance to States for Capital Investment' in fiscal year 2023-24.

Vehicle scrappage policy landscape in India

- **Automotive Industry Standard-129 (AIS-129), 2016:** It places requirements for the **collection and dismantling centres and vehicle manufacturers** to comply with the **reusability, recyclability, and recoverability (RRR) calculations.**
- **Guidelines for Environmentally Sound Facilities for Handling, Processing and Recycling of End-of-Life Vehicle (ELV), 2019:** It mentions procedures for removal of common hazardous substances, environmentally sound dismantling and processing of residues of ELVs.
- **Voluntary Vehicle Fleet Modernisation Programme or Vehicle Scrappage Policy 2021:** Under the scheme, **private vehicles older than 20 years** and **commercial vehicles older than 15 years** will need to **undergo a mandatory "fitness" test** and will be scrapped on failing the test.
- **Motor Vehicles (Registration and Functions of Vehicle Scrapping**

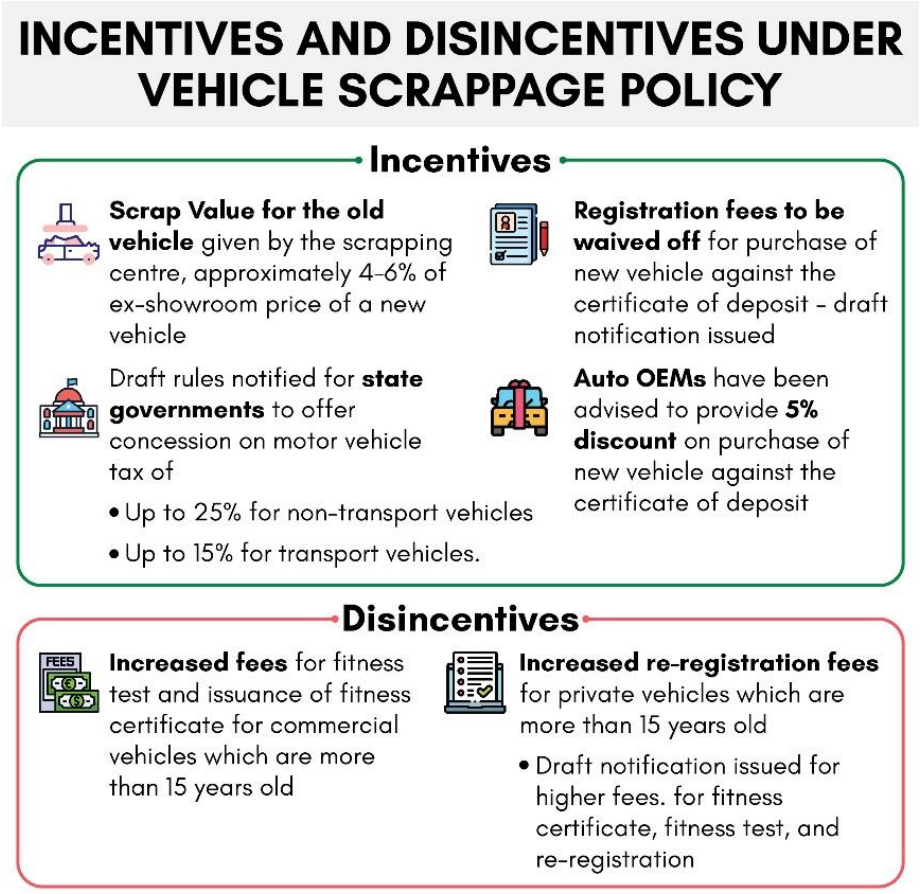


Facility) Rules, 2021: Details process and procedures to be followed for setting up the **Recognised Vehicle Scrappage Facility** (RVSF).

- **The Central Motor Vehicles (Amendment) Rules:** 23rd Amendment incorporated an **upward revision of registration, fitness testing, and fitness certification fee** for vehicles.
- **Recognition, Regulation & Control of Automated Testing Stations (ATS) Rules**: ATS authorized by the state governments conduct vehicle fitness tests.

Challenges in vehicle scrappage in India

- **Poor infrastructure:** Lack of testing facilities; most automobile scrapping centres managed by the informal sector etc.
  - No ATS is functional as per the Central Motor Vehicles (Twenty-first Amendment) Rules, 2021.
- **Inadequate scraping facilities:** Only 6 vehicle scrapping centres have been functional under the Motor Vehicles Rules, 2021.
- **Financial constraints:** The entire onus of providing incentives to owners for ELV scrappage depends on the discretion of the **state governments and Original Equipment Manufacturers (OEMs).**
- Changing vehicles every 15 years **not affordable for consumers.**
- **Limited monitoring of the testing certification** due to the **lack of a centralized database** linking **vehicle registration with the testing facilities.**
- **Extended producers' responsibility (EPR)** for OEMs to handle the ELVs **is absent.**
- **Usage of recycled materials** as circular economy framework is **missing.**



Way forward

- **Phased Implementation**: A study can be conducted for the **commercial vehicles** segment to scrap heavy trucks and buses **that are pre-BS-II vintage as the first step**.
- **Incentives to customers such as purchase discount** by OEMs in exchange for certificate of deposit.
- **Disincentives**
  - **OEMs**: An **advanced recoverability fee** based on the weight of non-recoverable materials, **Landfill taxes etc.**
  - **Customers**: An **advanced recycling fee** from the customers at the time of purchase.
- **Dispute resolution of ELVs:** Faster resolution and deregistration, with the help of the local police.
- **3Rs - recycle, reuse, reduce:** OEMs should use materials that can be easily **recycled and recovered.**
- **Skill development of dismantlers**.

5.10. FLEX FUEL

Why in news?

Ministry of Road Transport & Highways has launched **first of its kind pilot project on Flexi-Fuel Strong Hybrid Electric Vehicles (FFV-SHEV) in India** which would run on 100% petrol as well as 20 to 100% blended ethanol and electric power.

About Flex Fuel vehicles (FFV)

- Like traditional vehicles, flex fuel vehicles **have an internal combustion engine, but instead of regular petrol, it can run on blended fuel** — petrol with ethanol or methanol.
  - The ethanol mix can **vary between 20% and 85%.**
- The vehicle has **additional sensors and different programming** of the engine control module to assess the blend of the fuel and adjust accordingly.
  - **Upgrading existing vehicles** to run on high blend of ethanol fuel, however, is possible **but expensive and not considered feasible.**
- Unlike electric hybrid vehicles, **no bulky parts need to be added** to the basic gasoline vehicle architecture.
- **An FFV-SHEV** possesses a flex-fuel engine and an electric powertrain.
  - This setup **extends dual advantages of higher ethanol use and greater fuel efficiency**, as it can run on its EV mode for a good amount of time, while the engine stands shut off.
- **Significance of FFV:** Less polluting; can manage glut in sugar production; efficient burning facility; reduced import bill; additional revenue stream for farmers etc.

Alternate fuels – a comparison		
Fuel Type	**Significance**	**Challenges**
Ethanol as a fuel	• **Renewable, domestically produced** transportation fuel. • Has a **higher octane number** than gasoline, which provides increased power and performance. • Ethanol production **creates jobs in rural areas**	• **Sporadic availability of ethanol** • Ethanol can also cause **corrosion and damage to the engine.** • Ethanol is also **not as economical as gasoline** as it does not provide the same level of fuel efficiency.
Flex Fuel	• With much lower cost of running, they also offer **better economy for consumers.**	• The **benefit for the environment is less as compared to battery EVs** or hydrogen fuel cell vehicles of the future
Hydrogen as a fuel	• Can be produced from **diverse domestic resources** • **Potential for near-zero greenhouse gas emissions**	• **Storing hydrogen is difficult** as it has a lower volumetric energy density • **High production cost**
Biodiesel	• **Lean-burning, renewable substitute** for petroleum diesel. • **Improves fuel lubricity** and raises the cetane number of the fuel • It is **safer than petroleum diesel** because it is less combustible.	• **Higher viscosity, lower energy content, higher nitrogen oxide (NO x) emissions,** lower engine speed and power.
Electricity	• **Improve fuel economy,** lower fuel costs, and reduce emissions.	• **Public charging stations are not as ubiquitous as gas stations.** • The advanced batteries in electric vehicles are **designed for extended life but will wear out eventually.**
Natural Gas	• **Domestic availability,** established distribution network, relatively low cost, and emissions benefits.	• **Driving range of Natural gas vehicles (NGVs) i**s generally less than that of comparable gasoline and diesel vehicles

Challenges of FFV

- **Lack of direct benefit to the consumer** with oil companies pocketing cost differential.
  - It is also **controlled by the government**. So, chances of frequent revision are high.
- **Investment in infrastructure needed** for mass adoption, adequate supply of different types of ethanol blends.

- **Issues with ethanol supply** due to drought, diversion of food crops etc.
    - NITI Aayog in a report mentioned that over 90% of ethanol in India came from sugarcane alone, and other food crop like maize.
- **Less vis-à-vis environmental benefits** as compared to battery EVs or hydrogen fuel cell vehicles.
- **Less Mileage:** It will take 1.5 times more ethanol to provide the same energy levels.
    - The report by Ministry of Petroleum and Natural Gas mentioned that **E20 blending will result in drop in fuel efficiency by nearly 6-7%** in 4 wheelers calibrated to E10.

Steps taken by government

- **Target of achieving average 10% blending** was **achieved in June, 2022** and target of **20% ethanol blending was advanced to 2025** (from 2030).
- Recently, **PM launched pilot project on E20 fuel,** a blend of 20% ethanol and 80% petrol, **2 years ahead of target.**
- **Bharat Stage Norms** - India directly shifted from BS-IV to BS-VI norms.
- Government has included **automobile & auto components of flex-fuel engines into the Production Linked Incentive (PLI) scheme.**
- Finance Minister in the Union Budget announced that **unblended fuel shall attract an additional differential excise duty of ₹2/ litre from October 2022.**

Way forward

- **Research and development** for optimization of engine for higher ethanol and alternate fuels like methanol, LNG, CNG blends and improved durability.
- **Incentives and low pricing for better acceptability of higher flex fuels.**
- **Infrastructure development** for ethanol storage, handling, blending and dispensing infrastructure.
- **Augmentation of ethanol production** technology for production of ethanol from non-food feedstock.

6. CONSERVATION EFFORTS

6.1. FOREST CONSERVATION

FOREST CONSERVATION IN INDIA AT A GLANCE

Key Targets

- **India's INDC:** To create an **additional carbon sink of 2.5 to 3 billion tonnes of CO_2** equivalent through additional forest and tree cover by 2030.
- **National Forest Policy of India, 1988:** To have a **minimum of 1/3rd of the total geographical area** of the country under forest and tree cover.

Current Situation (India State of Forest Report 2021)

- **Total forest and tree cover is 24.62%** of the geographical area of the country.
  Total forest cover in India has **increased by 0.22% since 2019.**
- 17 states/UTs like Lakshadweep, Mizoram, Andaman & Nicobar Islands, Arunachal Pradesh and Meghalaya etc. have above 33% of the geographical area under forest cover.

Significance of Forests

- **Habitat** for diverse species of plants, animals and micro-organisms.
- **Provides humans** with shelter, livelihoods, water, food and fuel security.
- **Ecosystem services:** Prevent soil erosion, purify water and air, replenish groundwater, regulate microclimate, support recreational activities, serve as a buffer in natural disasters like flood, etc.
- **Act as carbon sink for Climate change mitigation:** After oceans, forests are the world's largest storehouses of carbon.

Threats to forests

- **Natural Threats:** Forest Fires; Natural disasters such as floods, landslides, snow avalanches etc.; invasive species; Plant Diseases, Insects and Pests etc.
- **Anthropogenic Threats:** Climate Change induced increase in temperatures and frequency and intensity of extreme weather events; Deforestation, overgrazing and diversion of forest lands for development purposes; Environmental pollution; etc.

Schemes/Policies/Initiatives

- **Forest (Conservation) Act of 1980** regulates diversion of forests for non-forestry purposes.
- **Wildlife Protection Act 1972 enables protection of forests by declaring protected areas** like- National Parks, Wildlife Sanctuaries, Community Reserves and Conservation Reserves.
- **Other Legislations:** Compensatory Afforestation Fund (CAF) Act of 2016, Environment Protection Act, 1986, etc.
- **National Afforestation Programme (NAP) and National Mission for a Green India (GIM)** for afforestation of degraded forest land.
- **Forest Fire Prevention and Management Scheme** to assist the states in dealing with forest fires.
  Tree plantation under schemes like- **School Nursery Yojana, Nagar Van Yojana, Sub-Mission on Agroforestry (Har Medh Par Ped) etc.**

Constraints in Forest management in India

- **Need of a new, updated and scientific Forest policy.**
- **Limited government budgeting** for forest conservation initiatives.
- Poor **enforcement of legislations and illegal encroachment** of forest lands.
- **Inadequate capacity of forestry and wildlife** departments to undertake implementation and monitoring activities.
- **Definition of 'forest cover' includes plantations**, including monocultures plantations which are distinctly different from natural forests.
- **Undue restriction on rights of indigenous people** and lack of recognition of their role in forest conservation in certain areas.

Way forward

- **Policy Reforms:** Redefine India's 'forests'; Strict enforcement of legislative measures; Enhance budgetary allocation; Capacity building of forestry departments; Create an updated policy framework on forest management etc.
- **Encourage community-based forestry management** to enhance the role of local and indigenous communities in governing and managing forest resources.
- **Undertaking Restoration of Forest Landscapes** method to regain ecological functionality of degraded forest ecosystems.
- **Adoption of innovative mechanisms** such as Environmental Fiscal Reforms, Agri-horti-forestry system, etc.

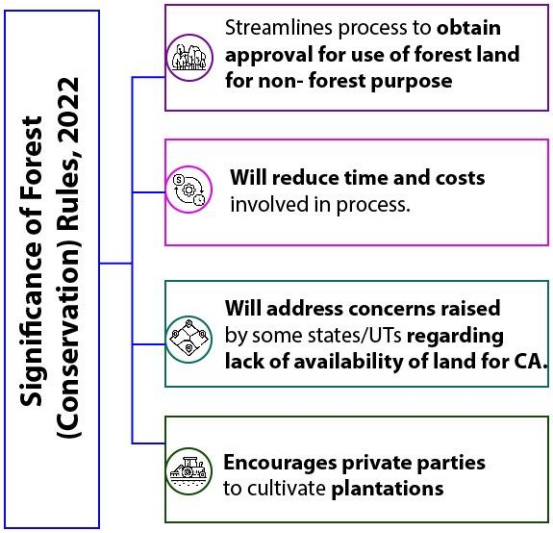
6.1.1. FOREST (CONSERVATION) RULES, 2022

Why in news?

The National Commission for Scheduled Tribes (NCST) reiterated that Forest (Conservation) Rules, 2022 are violative of the Forest Rights Act, 2006.

More in News

- Earlier, the commission had expressed concern that the **Forest Conservation Rules of 2022 could severely affect the rights of Scheduled Tribes and other individuals who have historically lived in forested areas.**
- NCST position on the Forest (Conservation) Rules, 2022 **is that it violates of the Forest Rights Act, 2006.**



About Forest (Conservation) Rules, 2022

- Promulgated solely to **implement the provisions of the Forest (Conservation) Act, 1980.**
  - The Rules **do not inhibit the commencement of processes envisaged in other laws like Wildlife (Protection) Act, 1972, Environment (Protection) Act, 1986, Land Acquisition Act, 1896, Forest Rights Act, 2006**, etc.
  - Provisions envisaged in other statutory laws can be undertaken simultaneously by the respective nodal implementing agencies.
- Will **replace the Forest (Conservation) Rules, 2003.**
- Lay **down the procedural framework** to obtain prior approval from the Union Government for the **use of forest land for non-forest purposes** as provided in **1980 act.** Such non-forest **purposes may include**-
  - Diversion of forest land for a **commercial or infrastructure project,**
  - **De-reservation of land** recognized as forest or
  - Assignment of forest land to any private person by **way of lease.**

Key features of Forest (Conservation) Rules, 2022

- **Establishment of Committees:** Rules provides for constitution of **advisory committee and Regional Empowered Committee** by central government and **Project Screening Committee** by State Government and Union territory Administration.
  - These committees will **advise union and state governments/UT administration** in matters involving use of forest land for **non-forest purposes.**
- **Prior Approval of the Central Government:** The approval shall be accorded by the Central Government **in two stages:**
  - **'In- Principle' approval,** after considering the **recommendation of the Advisory Committee** subject to fulfilment of stipulated conditions.
  - **'Final' approval** after having **received compliance report** and ensuring its completeness.
- **Compensatory Afforestation (CA):** Rules aims to make land availability for compensatory afforestation easier.

Related discussion: Natural Vs Plantations ecosystems

- IPCC's Synthesis Report for the Sixth Assessment Cycle (AR6) highlighted that **preventing the degradation of existing natural ecosystems** will be more effective to lower the impact of the climate crisis than restoring ecosystems that have been destroyed.
- **Reasons for natural ecosystems being better than afforested ecosystems:**
  - **Natural ecosystems have diverse species** of flora while afforestation focuses on **monoculture** (creating single-species plantations).
  - **Plantation of Non-native species** or invasive species in place of native species (species suitable to a particular climate) poses threat to indigenous species.
  - Afforested ecosystem's capability to **sequestrate carbon is time consuming and low compared to the natural ecosystem.**
  - **Afforestation Away from Deforestation Site** poses a threat of **extinction** to **endangered** species **which will get displaced.**
  - **Afforested ecosystems need more maintenance costs in comparison** to natural ecosystems which are self-sustaining.

- The Rules have allowed CA to be undertaken in states/UTs other than one in which forest land is **being diverted, de-reserved or leased.**

- **Accredited compensatory afforestation**: The purpose is to **encourage people** to raise vegetation **on its land and sell it to persons** who need to meet **compensatory afforestation targets** under the Act.
- **Creation of Land Bank:** State/UT, may for purpose of Compensatory Afforestation **create a Land bank** under the administrative control of the **Department of Forest**.

Issues with Forest (Conservation) Rules, 2022

- **Contradicts with Forest Rights Act 2006** which requires governments to seek **prior and informed consent** of forest dwellers before allowing a project on their traditional lands.
  - Now, **Gram Sabha consent is not required** before the grant of the in- principle approval.
  - After approval, central Government will **leave it to the state government** to pass an order for de-reservation or diversion or assignment.
- **New plantation cannot compensate for the loss of carbon stocks and other ecosystem services** provided by old-growth forests in any realistic timeframe.
- **Compensatory afforestation of land in another** state could have a significant **impact on local biodiversity and climate.**

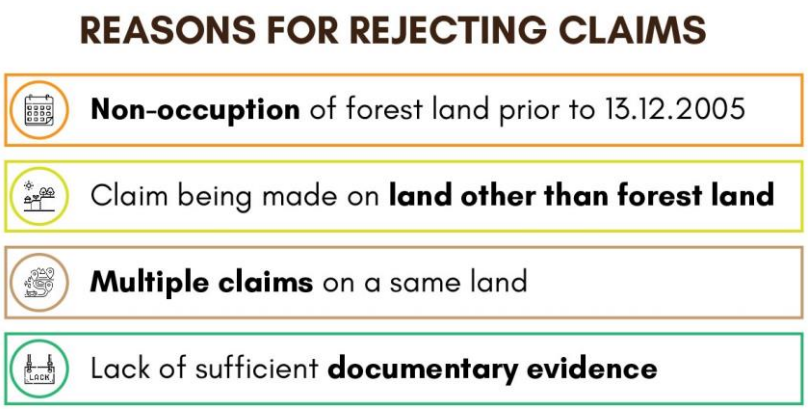
Conclusion

It is important to **build strong partnerships between forest-dwelling communities, civil society organizations, and government agencies**. Such partnerships can help facilitate the sharing of knowledge, skills, and resources for effective forest conservation. There is a need to strengthen legal frameworks that protect and promote the rights of forest dwellers and indigenous communities. This includes the **implementation of the Forest Rights Act**, which grants legal recognition to the rights of forest-dwelling communities over forestlands.

6.1.2. FOREST RIGHTS IN INDIA

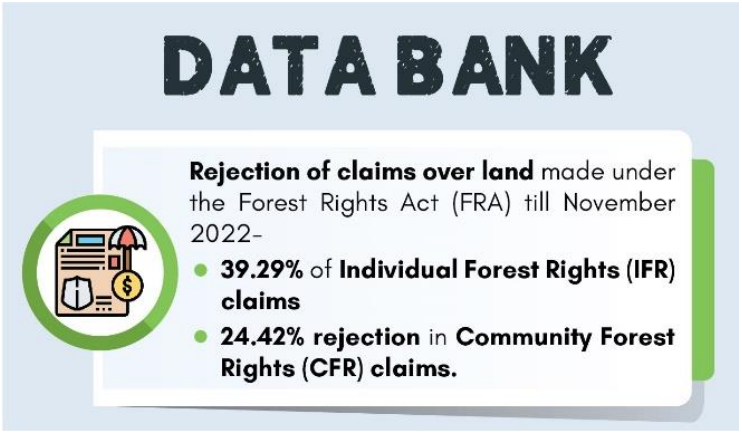
Why in News?

According to the **Ministry of Tribal Affairs (MoTA)** about **38% of all claims over land** made under the **Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act**, 2006 [Also known as **Forest Rights Act (FRA)**] till November 2022, have been rejected.



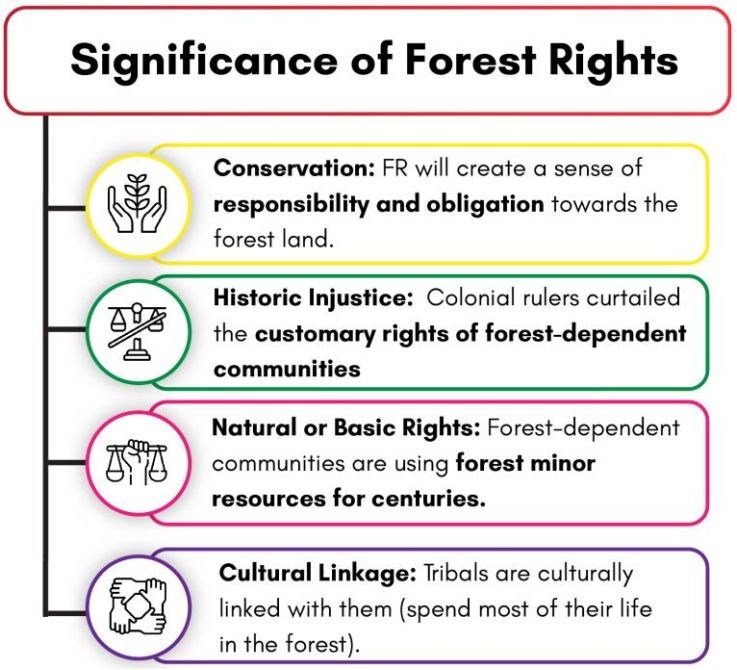
About Forest Rights Act (FRA), 2006

- **Objective:** Recognizes the rights of the **forest Dwelling Scheduled Tribes (FDST)** and **other traditional forest dwellers to forest resources (OTFD)**, on which these communities were dependent for a variety of needs, including livelihood, habitation, and other socio-cultural needs.
- **Eligibility for FR:** A **member or community** can claim rights over forest lands that they primarily reside in for at **least three generations (75 years)** or prior to **December 13, 2005**.
  - A person should be a bonafide dependent on the forest, its land, and resources for their livelihood.
- **Rights Under the Act**
  - **Individual Forest Rights (IFR):** Includes the **right of self-cultivation** and **habitation.** Provides **ownership of land (maximum of 4 hectares)**, only for land that is being **cultivated by the beneficiary no new lands** are granted.



- **Community Forest Rights (CFR):** Provides **collective rights** to the community. Some of these include **grazing** and **fishing** rights; and **ownership**, access, use, and **disposal** rights of Minor Forest produce (MFP) traditionally collected within or outside village boundaries.
  - ✓ Also includes the right to **protect**, **regenerate** or conserve or manage any **community forest resource** etc.

- **Recognition, Restoration, and Procedure for Vesting of FR: Gram Sabha, Sub-Divisional Level Committee, District Level Committee, State Level Monitoring Committee.** etc. have been set up for recognizing and vesting FR.
  - **Forest Rights Committees (FRC)** are set up by the Gram Sabha to assist it in discharge of its function.



Challenges/Issues in Granting Forest Rights

- **Jurisdiction Overlap**: MoTA is the implementing agency of FRA, 2006, while the **Forest Department** grants titles.
- **Excessive Bureaucratic Control** and involvement of Multiple agencies in **verification process**.
- **Frivolous grounds of rejection** such as claimants being government employees, etc.
- **Lack of Awareness** among tribals about their rights**.**
- **Disparity in Implementation**: States with more forest cover have higher claim distribution rates, while states with the presence of **left-wing extremism** are associated with higher claim rejection rates.
- **Low involvement of forest-dwelling communities in conservation process**.
- **Diversion of forest land** for non-forest purposes.

Way Forward

- **Civil Society** can play significant role by helping beneficiaries get their rights, e.g., NGOs in the Dang district of Gujarat**.**
- **Resolving Pending Cases** of forest land claims needs to be done on a priority basis**.**
- **Avoid One size fit approach** for verification, for instance using satellite images etc.
- **Strengthening Gram Sabhas and their role in the claiming process**.

Steps Taken to Promote Forest Rights

- FRA process will only be completed when the **record of rights (RoR) have been created.**
- As per **FRA, Amendment Rules, 2012,** all government schemes are provided to such claimants and communities whose rights have been recognized and vested under the Act.
- **FRA transferred all powers on the use and governance of** non-timber forest products (NTFP) from the **forest department to village assemblies.**
- **Capacity Building through Training of forest officials.**
- **Coordination between MoEF&CC and MoTA:** A **Joint Communication** was signed between them in 2021.
- A scheme **'Mechanism for Marketing of MFP through MSP and the Development of Value Chain for MFP'**.

6.1.3. ECO-SENSITIVE ZONES (ESZ)

ECO-SENSITIVE ZONES (ESZ) AT A GLANCE

ESZ

- **Ecologically important and fragile areas around protected areas** designated under Environment Protection Act (EPA), 1986.
- **As per National Wildlife Action Plan** (2002-2016), **land within 10 km of boundaries** of national parks and wildlife sanctuaries is **to be notified as ESZ.**

Regulation of Activities

- Activities in the ESZ are **generally regulated and not prohibitory in nature** barring a few such as-
  - **commercial mining, stone quarrying and crushing units, major hydroelectric project, handling of hazardous substances, discharge of untreated** effluents, setting up of brick kilns and setting up of polluting industries.

Significance of ESZ

- **Protection of natural heritage and biological diversity.**
- **Act as a transition zone and create a kind of shock-absorber** around protected areas.
- **Minimize impact of urbanization** and other developmental activities.
- Help in **in-situ conservation.**
- **Minimize man-animal conflict.**

Constraints

- **Opposition from States** due to their impact on **developmental activities** and state revenue.
- **Lack of participatory planning exercises** while implementing the ESZ.
- **Enforcing a one-size-fits-all** approach in all protected areas.
- Lack of **ground investigation** for proposals with areas being randomly marked on topographic sheets.
- **Restricts land-use change and affects livelihood prospects of people** living in human settlements located close to the forest boundary.
- **Practical difficulties in ESZ implementation** due to high density of human population around the forest lands.

Way Forward

- **Undertaking participatory planning** of ESZs which addresses the needs and aspirations of the local and indigenous people.
- **Conducting on-ground investigations** to verify environmentally fragile zones.
- **Building capacity among locals** for eco-friendly livelihood practices such as natural farming, agroforestry etc. in areas lying in notified ESZs.
- **Building consensus among States** through negotiations.
- **Extensively studying the impact of infrastructural projects** on the forest and wildlife before giving permission.

6.1.3.1. MODIFIED ORDER ON ECO-SENSITIVE ZONES (ESZ) AROUND PROTECTED FORESTS

Why in news?

Supreme Court (SC) has modified its order on eco-sensitive zones (ESZ) around protected forests.

More on the news

- **Modifying its June 2022 order** that mandated **a minimum 1-km ESZ around national parks or wildlife sanctuaries,** SC stated that **ESZ cannot be uniform across the country and has to be "protected area-specific".**
  - Earlier, Centre and several States had **sought modification of the order** as **it affected villages in the peripheries of forests.**
- **Key highlights of modified order**
  - **2022 order,** mandating a minimum 1 km eco-sensitive zone (ESZ) around all protected areas**, will not be applicable:**

- ✓ **To ESZs for which draft and final notifications have been issued** by Ministry of Environment, Forests and Climate Change (MoEF&CC) and in respect of **proposals which have been received** by Ministry.
- ✓ **Where national parks and sanctuaries are located on inter-state borders** or share common boundaries.

- o **No mining would be allowed,** either within national parks and sanctuaries or in a 1-km radius.
- o **Any developmental activities undertaken** within ESZs **should follow the MoEF&CC 2011 guidelines** and also provisions of the 2022 Office Memorandum by MoEF&CC.

6.2. WETLAND CONSERVATION

WETLANDS MANAGEMENT IN INDIA AT A GLANCE

Wetlands

- Any land area that is **saturated or flooded with water, either seasonally or permanently.**
- Includes **marsh, fen, peatland,** marine water the depth of which at low tides does not exceed six meters etc.

Current Situation

- In India, there are 7 lakh wetlands covering **~16 Mha** i.e., **4.86% of the total geographic area** of the country.
- India lost 2 out of 5 wetlands in last 3 decades (Wetlands International).

Significance of Wetlands

- **Carbon Sink** Peatlands alone store twice as much as all the world's forests.
- **Habitat** for wide range of biodiversity and **key role in annual migration patterns**
- **Nature's shock absorbers**
  - Act as a natural barriers during floods, tidal surges, storms etc.
  - Prevent Coastal erosion.
  - Delay onset of droughts.
- **Water Storage** Help soak rainfall and recharge groundwater
- **Intrinsic cultural and recreational value**
- **Create Livelihood** in sectors like food, fishing, aquaculture, tourism etc.
- **Kidneys of the Landscape** Purify water by locking up pollutants in their sediments and vegetation

Schemes/Policies/Initiatives

- **Wetland (Conservation and Management) Rules 2017** to conserve aquatic ecosystems, through implementation of sustainable conservation plans.
- **Establishment of Centre for Wetland Conservation and Management (CWCM).**
- **National Plan for Conservation of Aquatic Eco-systems (NPCA):** It prohibits activities like conversion of wetland for non-wetland uses including encroachment, solid waste dumping, etc.
- **National Mission for Clean Ganga (NMCG):** Under the mission, a scientific and community-based program to develop Health card and management of 10 wetlands in each of the 50 plus Ganga districts was launched.
- **Party to Ramsar Convention**

Constraints

- **Alteration of natural hydrological regimes** due to factors like- groundwater salinization and over extraction, encroachment etc.
- **Growing waste disposal** from urban and peri-urban areas and runoff from Agricultural fields etc.
- **Proliferation of invasive species** like Water hyacinth, Salvinia etc.
- **Unsustainable harvesting of wetland resources** such as wood, fish, water, sand etc.
- **Unregulated development of tourism infrastructure** and recreation facilities without appropriate protection.
- **Impacts of Climate change**- sea level rise, drought etc

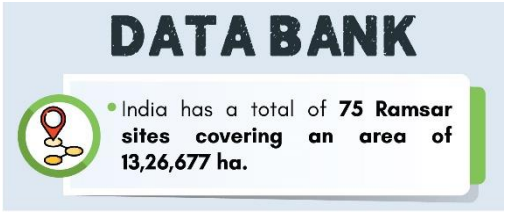
Way Forward

- **Developing a holistic and standardized protocol for monitoring.**
- **Restoration of degraded wetlands** through de-siltation, recharging groundwater aquifers, etc.
- **Strict implementation of pollution norms** and proper treatment and disposal of waste.
- **Ensuring optimal and sustained water flow** to wetlands.
- **Participatory conservation of wetlands** enabled by capacity building of local communities.

6.2.1. COP 14 OF RAMSAR CONVENTION ON WETLANDS

Why in news?

14th Conference of the Parties (COP14) to Ramsar Convention on Wetlands concluded with adoption of Wuhan Declaration.



About Wuhan Declaration

- Wuhan Declaration calls for practical **actions to promote conservation, restoration, management and sustainable use of wetlands** worldwide.
- **Key priorities of Wuhan declaration are**
  - **Take measures to halt and reverse wetland loss** globally.
  - **Incorporate wetlands into national actions** to contribute to domestic legislation, plans and implementation of SDGs.
  - **Define strategic goals and priority areas for wetlands** in partnership with civil society stakeholders, academia and private sector.
  - **Importance of healthy wetland ecosystems as nature-based solutions** for climate mitigation, adaptation and disaster risk reduction.

About Ramsar Convention

- An **intergovernmental treaty** that provides the framework for the conservation and wise use of wetlands and their resources, adopted in 1971 (came into force in 1975).
  - **Wise use of wetlands** is defined as the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development.
- **Criteria for designation of Ramsar sites:** A wetland must meet at least 1 of 9 criteria as defined by the Ramsar Convention such as supporting vulnerable, endangered, or critically endangered species or threatened ecological communities or, if it regularly supports 20,000 or more waterbirds among others.
- **Examples of Ramsar sites in India:** Yashwant Sagar (Madhya Pradesh), Tampara Lake (Odisha), Pichavaram Mangrove (Tamil Nadu),Thane Creek (Maharashtra) etc.

6.2.2. MANGROVE CONSERVATION IN INDIA

MANGROVES CONSERVATION IN INDIA AT A GLANCE

Mangroves

- **Characteristic littoral plant** formations of **tropical and subtropical** sheltered coastlines.
- Described as **'coastal woodland', 'tidal forest', and 'mangrove forest'**

Characteristics of Mangroves

Appearance

Is a **small shrub that does not grow tall**

Habitat

Grows in **brackish or coastal saline water**

Adaptations

Has a complex root system and a complex salt filtration system which enables them to withstand wave action, saltwater immersion and also makes them survive in **waterlogged mud and low oxygen conditions**

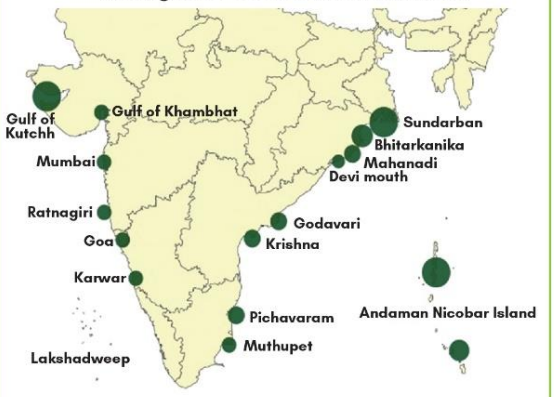
Benefits of mangroves

- **Carbon sequestration:** Mangroves can store **3 to 5 times more carbon** per area than tropical upland forests.
- Valued source of **timber and fuel.**
- **Protects coasts** from storm surges, tsunamis etc.
- **Supports biodiversity:** Habitat and nursery for over 3000 fish species.
- **Support livelihoods** in sectors like fisheries, tourism etc.

Mangrove distribution in India

- **Total mangrove cover in India:** 4,992 sq km (The State Forest Report 2021).

Mangrove distribution in India



Schemes/Policies/Initiatives

- India joined **Mangrove Alliance** for Climate during COP27.
- **Central Sector Scheme** under **National Coastal Mission Programme** on Conservation and Management of Mangroves and Coral Reefs.
- **Save Wetlands Campaign** to enable affirmative actions for wetlands conservation at all levels of society and involving all strata of society.
- **Sustainable Aquaculture in Mangrove Ecosystem (SAIME) Initiative** (community-based pilot project in West Bengal)
- Budget 2023-24 announced **MISHTI (Mangrove Initiative for Shoreline Habitats & Tangible Incomes) scheme** which aims at mangrove plantation along the coastline and on salt pan lands.
  - It will operate through convergence **between MGNREGS, CAMPA (Compensatory Afforestation Management and Planning Authority) Fund,** and other sources.

Threats to Mangrove in India

- Climate change and **sea level rise.**
- **Lack of mudflow due** to construction of upstream dams.
- **Logging of mangroves** for timber and charcoal production.
- **Extension of settlements, agriculture and aquaculture,** degrading habitat.
- **Unsustainable tourism** causing pollution.
- **Lack of stringent protection regulations.**

Way Forward

- Establish **regulations and target** for mangrove protection, restoration, and promotion.
- **Promote Sustainable tourism** focussing on habitat restoration.
- Management of mudflow to be taken into consideration while construction of dams.
- Accelerate mitigation actions.

6.3. COASTAL ECOSYSTEM MANAGEMENT

COASTAL ECOSYSTEM MANAGEMENT AT A GLANCE

ABOUT COASTAL ECOSYSTEM

- An area **where land and water come together.**
- It has **distinct and recognizable** landforms such as beaches, cliffs and coral reefs which are highly vulnerable to disturbances.

BENEFITS OF COASTAL ECOSYSTEM

- **Provide habitat for a wide variety of marine plants and animals as well as provide resources and homes to humans.**
- **Play a critical role in global climate and the carbon cycle by sequestering carbon.**
- **Absorb energy from incoming waves and slow down these storm surges.**

Conservation of Coastal areas in India

- Notifications under **Environment Protection Act, 1986** to regulate activities along coasts.
- **Coastal Regulation Zone Notification (CRZ) 2019** classifies coastal area into different zones to manage infrastructure activities and regulate them.
  - **CRZ I** - Areas which are **ecologically sensitive.**
  - **CRZ II** -Areas within the **existing municipal limits/other urban areas** which are substantially built-up.
  - **CRZ III- Relatively undisturbed /do not belong to either CRZ-I or II;** this includes coastal zone in the rural areas, areas within existing municipal limits or other urban areas which are not substantially built up.
  - **CRZ IV-** Designated to water area from Low Tide Line to twelve nautical miles on sea ward side and inland waters influenced by tide.
- Three institutions responsible for implementation of CRZ are:
  - NCZMA at Centre,
  - SCZMAs/UTCZMAs in every coastal State and UT,
  - District Level Committees in districts with a coastal stretch.

Challenges

- **National Coastal Zone Management Authority (NCZMA)** still not notified as a permanent body and was functioning as an ad-hoc body.
- **State/UT Coastal Zone Management Authorities (SCZMAs/UTCZMAs)** were either not reconstituted (Karnataka) or there were delays in reconstitution (Goa, Odisha and West Bengal).
- Projects approved **despite inadequacies in Environmental Impact Assessment (EIA)** Reports.
- Integrated Management Plans for Critically Vulnerable Coastal Areas yet to be prepared by coastal states.

Way Forward

- SCZMAs and NCZMA be made **as permanent bodies.**
- Project proponent carry out in-depth **ecological evaluation before granting them clearances.**
- **Mapping and preparation of Management** Plans for coral reefs, turtle nesting sites etc.

6.4. BIODIVERSITY

6.4.1. COP15 TO THE UNITED NATIONS CONVENTION ON BIOLOGICAL DIVERSITY (CBD)

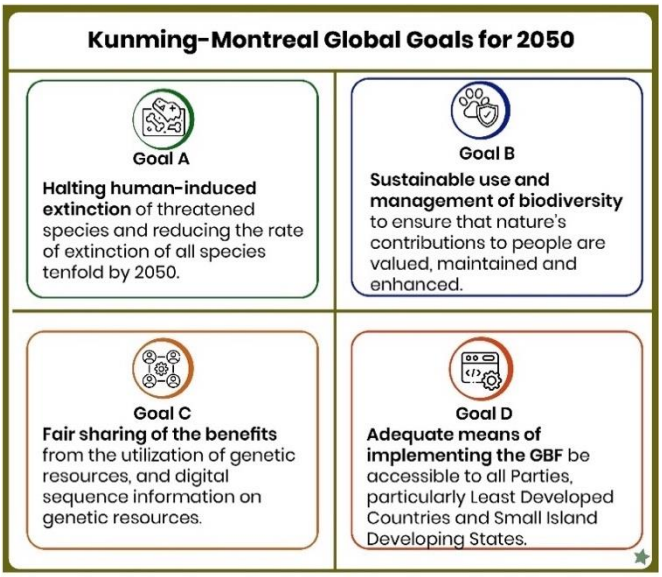
Why in news?

15th Conference of Parties (COP15) of the **Convention on Biological Diversity** concluded in Montreal, Canada.

About Convention on Biological Diversity (CBD) and COP15

- CBD is an **international legally binding multilateral treaty**, opened for signature in 1992 at the Rio **"Earth Summit".**
- **Objectives:** Conservation of biological diversity; Sustainable use of the components of biological diversity; and Fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

- **Has 3 Supplementary agreements:** Cartagena Protocol on Biosafety; Nagoya Protocol on Access and Benefit-sharing; Nagoya – Kuala Lumpur Supplementary Protocol on Liability and Redress to the Cartagena Protocol on Biosafety. (India has signed all 3)
- **Objective of COP15:** To adopt a **global biodiversity framework (GBF),** which will **replace the Aichi Biodiversity Targets that expired in 2020.**
    - GBF and its underlying documents are not legally binding.



Major outcomes of COP15

- **Adoption of Kunming-Montreal Global Biodiversity Framework (GBF):** Aims to address biodiversity loss, restore ecosystems and protect indigenous rights.
    - The framework has **four long-term goals for 2050** related to the 2050 Vision for Biodiversity and **23 action-oriented global targets** for urgent action over the decade to 2030.
- **Dedicated and accessible GBF Fund: Global Environment Facility** has been requested to **establish a Special Trust Fund** in 2023, and support GBF till 2030.
- **Effective mechanisms for planning, monitoring, reporting and review** through National biodiversity strategies and action plans (NBSAPs), National reports, Global review of collective progress, Voluntary peer reviews etc.
- **Multilateral mechanism for benefit-sharing from the use of digital sequence information on genetic resources.**
- **Adoption of the Gender Plan of Action for** the gender-responsive implementation of the GBF.

Categories of Kunming-Montreal 2030 Global Targets		
Reducing threats to biodiversity	**Meeting people's needs through sustainable use and benefit-sharing**	**Tools and solutions for implementation and mainstreaming**
Examples: • Reducing loss of highly important biodiverse areas close to zero by 2030; • Effective restoration of at least 30% of degraded ecosystems by 2030; • Halt human-induced extinctions etc.	**Examples:** • Increase the area and quality of green and blue spaces in urban areas; • Ensure sustainable use and management of wild species; • Fair and equitable sharing of the benefits arising from the use of genetic resources and from digital sequence information and traditional knowledge etc.	**Examples:** • Encourage sustainable consumption, including by reducing food waste by half by 2030; • Eliminate, phase out or reform harmful subsidies in a just way; • Substantially increase financial resources, mobilise $200bn per year by 2030 etc.

Concerns related to Kunming-Montreal GBF

- **30×30 target** (protecting '30% of land and 30% of sea area by 2030') **was diluted.**
- **Lack of finance:** Estimated at roughly $700bn per year for conservation over the decade, the target to mobilise $200bn per year by 2030 falls short.
- **Limited direction on which terrestrial and marine areas** to prioritize for conservation.
- **Lack of clarity regarding for Digital Sequencing Information (DSI) mechanism.**
- **Absence of USA,** the second largest emitter (not signed UN Convention on Biological Diversity) of GHGs.
- **Greenwashing concerns due to presence of** Large pharmaceutical and fossil-fuel companies.

About Digital Sequencing Information

- DSI, is a term that refers to data derived from or linked to genetic resources.
- It is a placeholder term for what has variously been called **genetic information, bioinformation, sequence information, natural information,** genetic sequence data, nucleotide sequence data or genetic resources.

Way Forward

- **Raising adequate finance,** especially through public finance.

- **Following principles of science and equity, and the sovereign right** of nations over their resources, as provided for in the CBD.
- **Undertake affirming measures to formulate a mechanism** for benefit-sharing from the use of digital sequence information on genetic resources.
- **Adopting zero tolerance towards greenwashing**.

India's stance in negotiations for Post-2020 GBF

- **Support to 30x30 goal** as a part of the High Ambition Coalition (HAC) for Nature and People.
- **Believes conservation of biodiversity must also be based on 'Common but Differentiated Responsibilities and Respective Capabilities' (CBDR)** as climate change is profoundly linked with nature.
  - Further, as developing countries bear most of the burden of implementing the targets for conservation of biodiversity, they require adequate funds and technology transfer from developed nations.
- **Does not support numerical targets regarding use of pesticides and reducing highly hazardous chemicals** without the necessary baseline and relevant scientific evidence.
- **Encourages mindful and deliberate utilization**, to protect and preserve the environment through its LiFE initiative India.
- **Wants DSI to be linked to access and benefit sharing** in a just and fair manner.
  - ABS refers to the way in which genetic resources may be accessed, and how users and providers reach agreement on the fair and equitable sharing of the benefits that might result from their use.
- **Against complete elimination of subsidy in the agriculture sector.**
- Therefore, subsidies need to continue but in such a way that doesn't harm nature, e.g., by adopting agroecology practices like natural farming.

6.4.2. MAINSTREAMING BIODIVERSITY IN FORESTRY

Why in News?

The **Food and Agriculture Organization (FAO)** published a paper on forestry titled 'Mainstreaming Biodiversity in Forestry' in partnership with the **Center for International Forestry Research (CIFOR)**.

Connection between Forests and Biodiversity

- Covering **31%** of the world's land surface, forests are the source of **fibre, fuel, food,** and **fodder** to over **1/3rd of world population**.
- Home to almost **80% of terrestrial biodiversity** with over **50%** being accounted for by **tropical rainforests alone**.
- Serve as a **safety net for global beings**, helping **mitigate** and **adapt to climate change**, help in atmospheric carbon sequestration, natural disasters mitigation etc.
  - E.g., they store an estimated **296 gigatonnes of carbon**.

About Mainstreaming Biodiversity

Refers to 'the process of **embedding biodiversity considerations into policies, strategies and practices of key public and private actors** to promote conservation and sustainable use of natural resources.

Significance

- **Integrates biodiversity** concerns into everyday forest management practice and finding optimal outcomes **across multiple objectives**, including productive economic benefits, maintaining or enhancing ecosystem services etc.
- **Prioritizes forest policies, plans, programmes, projects** and **investments** with positive impact on biodiversity at the ecosystem, species and genetic levels.
- **United Nations Strategic Plan for Forests 2017– 2030** recognized the role of forests in maintaining biodiversity.

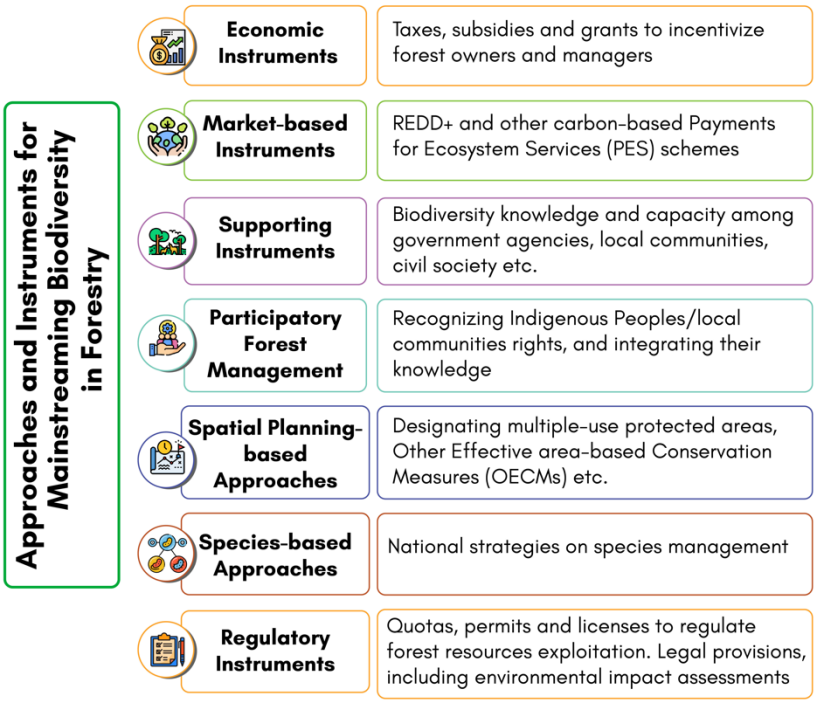
Barriers and Threats to Biodiversity Mainstreaming

- **Deforestation** continues at an alarming rate of **10 million ha per year** especially in lower income tropical countries.
- **Illegal forest activities:** Illegal timber harvesting is estimated to account **for 15–30 percent of global timber production.**
- **Low profile of conservation** outside protected areas.
- **Insufficient capacity:** Developing countries struggle to enforce forest and biodiversity regulations.

- **Lack of Indigenous Peoples and local community** participation.

Way Forward

- **Recognizing the forest rights of Indigenous Peoples and local communities,** with emphasis on enhancing the equitable sharing of benefits.
- **Preventing the conversion of natural forests** into monospecific forest plantations.
- **Ensuring the sustainable management of harvested species** to control overharvesting of plants and wildlife.
- **Adopting a multisectoral perspective** by mainstreaming biodiversity across other land use sectors.
- **Providing economic incentives,** like compensation for reduced production to promote biodiversity benefits.
- **Facilitating market-based instruments** like engaging in public–private partnerships to leverage corporate social responsibility commitments.



Related Concepts : Assisted Natural Regeneration (ANR)

- ANR is a blend of **active planting and passive restoration, where local people intervene to help trees and native vegetation naturally recover** by eliminating barriers and threats to their growth, leaning on their knowledge of the land and on ancestral traditions.
  - **For instance,** to prevent the spread of wildfires, people can build firebreaks and clear the forest floor of dry debris; to give native trees enough room to grow, invasive grasses and shrubs can be removed.
- **Advantages of ANR**
  - Trees and forests can be restored using ANR at **less than a third of the cost of tree planting, based on WRI estimates.**
  - Can restore much more land, much **more quickly**, as it requires very **little human intervention.**
  - ANR can **ensure that restored land effectively mimics native habitat** of local plants and wildlife.
  - Can **create jobs and bring income to landholders**, as they play role in protecting the new recovery by building fences, patrolling for fires, monitoring progress etc.
  - Plays a **critical role in achieving global goals,** including Paris Climate Agreement, Bonn Challenge (restore 350 million hectares of degraded and deforested lands by 2030).

6.4.3. COP 19 CITES (CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA)

Why in news?

The 19th Meeting of Conference of the Parties (CoP 19) to **CITES,** also known as the **World Wildlife Conference,** was held in Panama.

Outcomes of the conference

- Multiple species of **sharks and rays, trees, amphibian, turtle and tortoise,** and several songbirds brought under CITES' protection.
- **Accepted a proposal to include sea cucumbers in Appendix II** of Convention.
- On India's initiative a proposal to **clarify the quantity of Shisham (Dalbergia sissoo) items** such as furniture was considered.
- Resolution documents on tortoises and freshwater turtles specifically mentioned commendable result achieved by India's **Operation Turtshield (by Wildlife Crime Control Bureau).**
- **Proposal to allow a regular form of controlled trade in ivory was defeated.**

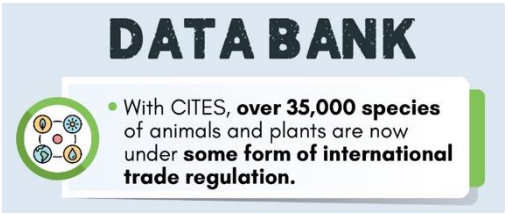
- Abandoning its **decades-old stance** of strongly opposing **ivory trade**, India **for the first time abstained** from voting.
- International ivory trade **was banned in 1989** when all African elephant populations were put in CITES Appendix I.
- Later, populations of several countries including Namibia, Botswana etc. **were transferred to Appendix II.**

About CITES

- An international agreement between governments which was drafted as a result of a **resolution adopted in 1963 at a meeting of members of IUCN (The World Conservation Union).**
- **Objective:** To ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species.
- **Legally binding** on the Parties, **but does not take the place of national laws.**
  - **Each Party** has to **adopt its own domestic legislation** to its implementation at the national level.
- The species covered by CITES are listed in **3 Appendices**, according to the degree of protection they need:
  - **Appendix I** includes species threatened with extinction;
  - **Appendix II** lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled;
  - **Appendix III** is a list of species protected in atleast one country, which has requested the cooperation of other countries to prevent unsustainable or illegal exploitation.

Significance of CITES

- **Strengthens international regime against wildlife trafficking** through cooperation among countries NGOs, research institutes, police and customs authorities etc.
- **Wide ranging resolutions** such as demand reduction strategies to combat illegal trade, measures to detect and counter corruption etc.
- **Sustainability discourse in combating wildlife trade** to address the **socio-economic dimensions.**
- Addresses **cybercrime aspects** of wildlife trafficking and **community awareness** of the crime-type.



India and CITES

- **Extensive use of Appendix III:** Since its ratification of CITES in 1976, India has **listed 39 taxa in Appendix III.**
- **Monitoring the Illegal Killing of Elephants (MIKE) programme:** There are currently **28 sites participating** in MIKE programme in Asia, distributed **across 13 countries** (India has 10 sites).
- **Wildlife (Protection) Amendment Act, 2022** was enacted to incorporate more species protected under the law and implement the CITES.
- The **Director of Wildlife Preservation, Government of India has been designated responsibility as the Management Authority for CITES (CITES-MA)** in India.
- **Government of India has also appointed five Scientific Authorities which assist the CITES MA** on scientific aspects of CITES.
- **International trade in all wildlife species of India**, including the species covered under CITES in particular, is **regulated collectively through the provisions of the, Wild Life (Protection) Act of 1972, Export–Import Policy (EXIM Policy) under the Foreign Trade (Development and Regulation) Act of 1992 and Customs Act of 1962.**

Limitations of the CITES

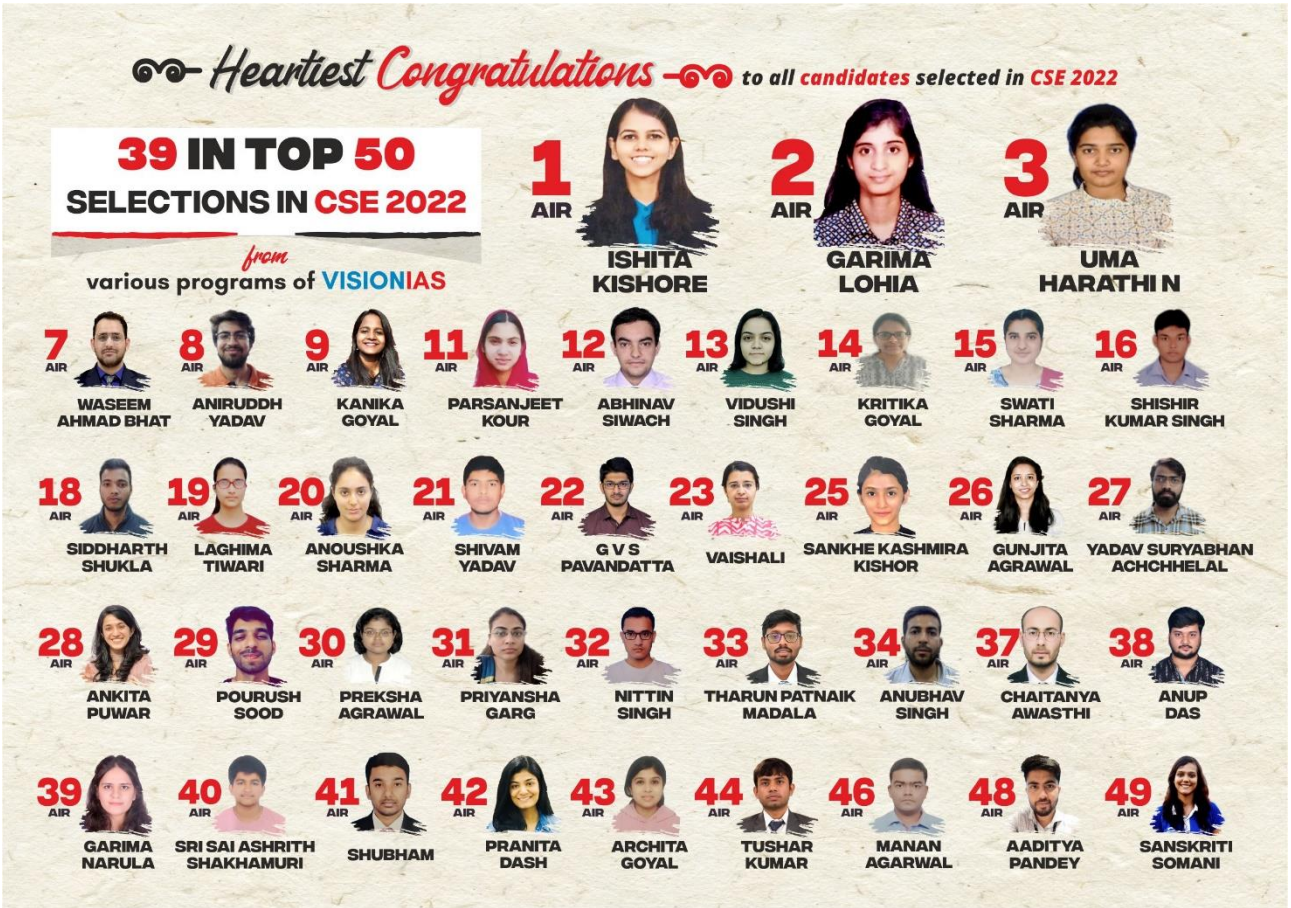
- **Only applies to flora and fauna that is traded internationally with** no application to domestic markets and wildlife trafficking occurring intra-state.
- **No protection to** species not listed in an appendix.
- **Inadequate attention to welfare of animals.**
- **Political nature of negotiations.**
- Reservation system where States Parties may **enter reservations to certain species** being included in an Appendix, if they find the listing of the **species unacceptable.**
  - Where a reservation is entered, the **party is treated as being a non-party State** by other States Parties with regard to trade in the species.
- **Others:**
  - Several widely traded species have become **critically endangered or extinct** despite their **inclusion in the CITES' Appendix system.**
    - ✓ For example, Northern White Rhinoceros, while listed in CITES Appendix I, **became functionally extinct** in 2018 following excessive poaching.
  - **Incomplete data** on trade of species and the effect of trade on numbers in the wild**.**

Way Forward

- **Strengthening implementation mechanisms** by strengthening information and intelligence sharing, trafficking on internet, species identification, seizures and disposal, public awareness and empowerment and so on.
- **Prescribe particular penalties** which will ensure **uniformity among countries** in terms of penalties imposed.
- **Enhancing Cooperation and coordination with relevant organisations** such as **World Customs Organisation** and infrastructure of **INTERPOL and** United Nations Office on Drugs and Crime (**UNODC),** among others.

Related news: Impact of Illegal Wildlife Trade on Climate Change

- United Nations Office on Drugs and Crime (UNODC) released A paper on Illegal Wildlife Trade and Climate Change.
- Paper highlights **cascading impacts of Illegal wildlife trade (IWT), on ecosystem functions and processes** that affect the climate.
- It documents **five types of relationships between IWT and climate change:**
  - **Large-bodied species storing carbon –** removal of **hardwood species like timber** from the wild **stops long-term sequestration, affects soil carbon, and limits forest regeneration.**
  - Many animal species targeted by IWT are also **ecosystem engineers**, species that modify their environment in a significant manner.
  - **Species with unique functional traits,** such species lead to more rapid collapse of ecosystem service supply. E.g. Pangolins regulate insects population.
  - **Co-location of biodiversity and ecosystem services:** Habitats heavily affected by IWT can geographically overlap with sites that offer important ecosystem services, including carbon stocks.
  - **Governance overlaps –** IWT is a reflection of **weak environmental governance** associated with weak monitoring and enforcement, organized crime etc.



6.5. HUMAN-WILDLIFE CONFLICT

HUMAN-WILDLIFE CONFLICT (HWC) IN INDIA AT A GLANCE

Refers to struggles that **arise when the presence or behavior of wildlife poses actual or perceived direct, recurring threats to human interests or needs,** often leading to disagreements between groups of people and negative impacts on people and/or wildlife.

Status in India
Between 2018-19 and 2020-21

- **222 Elephants were electrocuted** while 45 were killed by trains and 29 by poachers.
- **29 tigers were killed by poachers** and the reasons for the death of 197 tigers during the period remain suspected.
- **Elephants took 1549 human lives** while 125 lives were taken by tigers.

Schemes/Policies/Initiatives

- Ministry of Environment, Forest and Climate Change released **14 species specific guidelines to address Human-Wild-life Conflict (HWC).**
- **Standing Committee of the National Board of Wildlife** approved the advisory for management of HWC in the country.
- **National Wildlife Action Plan (2002-2016)** gave two new concepts of conservation reserves and community reserves.
- **Legal Protection to wild animals and their habitat** under Wildlife Protection Act 1972, Indian Forest Act, etc.
- **Re-Hab (Reducing Human Attacks using Honey Bees) Project,** Bee-fences are created by setting up bee boxes in the passage ways of elephants to block their entrance to human territories.
- **State level Initiatives**
  - **Odisha government** spread seed bombs in order to support growth of natural forest.
  - **Bio-fencing** is being undertaken by the **Uttarakhand government.**
  - **Including man animal conflict in the list of disasters by the Uttar Pradesh government.**

Reasons for Man Animal Conflict

- **Habitat loss and fragmentation** due to construction of developmental infrastructure and encroachment, expansion of agricultural land, invasive alien species etc.
- **Growth of population of wild animals** and expansion of human settlement.
- **Illegal activities** like poaching, illegal removal of timber, etc. facilitated by better connectivity.
- **Adverse climatic events** forcing animals move towards human habitations for food, water, and shelter.
- **Changing cropping patterns and animal husbandry** attract wild animals to farmlands

Impacts of Human-Wildlife conflict

- **Loss of life and Property.**
- **Retaliatory killing** against wild animals.
- **Growing antipathy against animals leading to-**
  - **Difficulties in community engagement** for forest officials.
  - **Negative perception of public** related to conservation activities.

Way Forward

- **Use of drone technology to monitor the migration pattern** of big species like elephants.
- **Integrating wildlife corridors in developmental planning** like Eco bridges for enabling smooth migration of wild animals.
- **Ecotourism can help bring attitudinal changes** towards wildlife conservation.
- **Buffer Zone** can help reduce man animal conflict by providing sufficient feed stock and prey population to wild animals in their natural habitat.
- **Electric Fencing** can be installed around the agricultural fields and remote villages.

6.6. SPECIES SPECIFIC EFFORTS

6.6.1. TIGER CONSERVATION

TIGER CONSERVATION IN INDIA AT A GLANCE

Key Targets

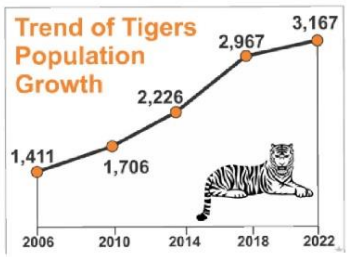
- **Double the number of wild tigers by the year 2022.** (Tx2 initiative adopted in 2010 at the St. Petersburg Tiger Summit)

Significance of tiger conservation:

- **Ecological:** Both an Umbrella species and a Keystone species- its protection leads to conservation of entire ecosystem (habitat and other species).
- **Economic:** Enhances Ecotourism and related industries, generated livelihood etc..
- **Cultural and spiritual:** Symbols of power, strength, and beauty, National animal of India.

Achievements of India

- **Achieved the targets set under TX2 initiative in 2018** (4 years in advance).
- **Increase in Estimated Tiger population** from 1,411 in 2006 to 3,167 **in 2022. (5th cycle of All India Tiger Estimation)**



- **53 tiger reserves (TRs) cover over ~75,800 sq. km.**

Factors that Led to the Rise of Tiger Population

- **Conservation efforts** such as Project Tiger, Wildlife Protection Act, 1972 and other initiatives.
- **Curbed poaching due to increased vigilance** by the Forest Department.
- **Rehabilitating villages outside core areas** has led to more inviolate space for tigers.
- **Habitat Restoration.**

Constraints

- **Lack of confidence and trust building between the forest department and the local communities.**
- **Low capacity among local forest officials** to effectively conduct surveillance and monitoring.
- **Financial constraints** to undertake activities like restoration of habitats.
- **Human wildlife conflicts and Retaliatory killings.**
- **Habitat loss/fragmentation/degradation** due to land use change, climate change, invasive species etc.
- **Other prominent threats:** Inadequate protection to tigers in areas outside TRs; Some TRs nearing carrying capacity; Inbreeding in isolated and small populations; Illegal poaching and wildlife trade; severe loss of natural prey populations, etc

Way Forward

- **Expanding and improving the quality of occupied habitat.**
- **Recovery of prey species.**
- **Minimisation of human-tiger conflict** through practices like- building outreach systems, compensation policies to cover the financial cost of losing livestock or crops, etc.
- **Participatory conservation efforts through** formal dialogue with Indigenous Peoples and local communities.
- **Create safe connectivity among habitats** through structural measures and non-structural measures.

6.6.2. 50 YEARS OF PROJECT TIGER

Why in News

PM recently inaugurated the programme 'Commemoration of 50 years of **Project Tiger'** in Mysuru, Karnataka.

More on News

- **The International Big Cats Alliance (IBCA)** was also launched by India during the event.
- The '**Amrit Kaal Ka Vision For Tiger Conservation'**, a summary report of the 5th cycle of **Management Effectiveness Evaluation** (MEE) of Tiger Reserves and the summary report of **All India Tiger Estimation (5th cycle) was also released.**
  - MEE is a global framework, is an evaluation of management effectiveness of protected areas based on **six main categories**- Context, Planning, Output, Input, Process and Outcomes.

International Big Cats Alliance (IBCA)

- **Genesis:** It was first proposed by India at an international group against poaching and illegal wildlife trade in 2019.
- **Aim:** IBCA has been launched for the conservation of seven big cats namely Tiger, Lion, Leopard, Snow Leopard, Cheetah, Jaguar and Puma.
- It aims to reach out to **97 range countries** covering the natural habitats of the aforementioned species.
- **Timeline:** It will provide assured support over five years with guaranteed funding of over Rs. 800 crores.

About Project Tiger

- A **Centrally Sponsored Scheme** of the Ministry of Environment, Forests and Climate Change (MoEFCC), launched in **1973**.
  - Initially launched in 9 Tiger reserves (TRs) in different states of India.
- Provides central assistance to tiger range States for **in-situ conservation** of tigers in designated tiger reserves.
- **Objective**: To ensure the maintenance of a **viable population of tigers** in India for scientific, economic, aesthetic, cultural and ecological values.
- **Implementing Agency**: Statutory body, **National Tiger Conservation Authority (NTCA).**
  - Overarching supervisory/coordination role and approves the Tiger Conservation Plan prepared by the State Governments.
- **Activities undertaken under Project Tiger**
  - **Establishment and development of new TRs**: 53 tiger reserves account for 2.3% of India's land area.
  - **Core-buffer strategy for TRs**: Core areas are kept free of all human activities, a co-existence agenda adopted in buffer and fringe areas with landscape approach.
    - ✓ NTCA **banned new construction in tiger reserves' core areas.**
  - NTCA conducts assessment using application **M-STrIPES (Monitoring System for Tigers Intensive-Protection & Ecological Status)**: Uses GPS to geotag photo-evidence.
  - **Independent monitoring** and the evaluation of tiger reserve by developing **Management Effectiveness Evaluation (MEE)** Framework.
  - **Special Tiger Protection Force (STPF)** deployed in several TRs for focused anti-poaching operations.
  - **Technological advancements**: **E-Bird project** uses Unmanned Aerial Vehicles (UAV) for Surveillance and Monitoring.

International Efforts

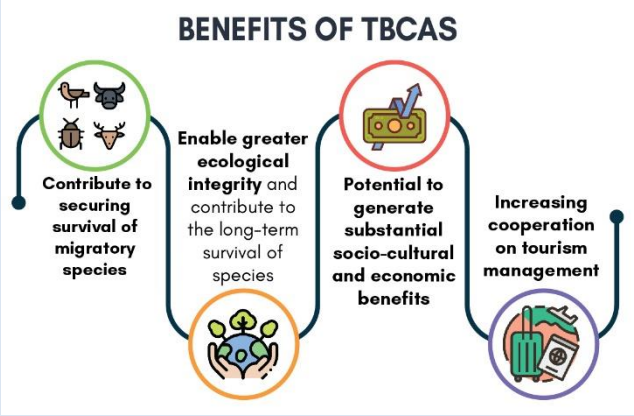
- **Global Tiger Forum, 1993** exclusively set up for the conservation of tigers in the wild in the range countries.
- **Global Tiger Initiative (GT), 2008** is a global alliance of governments, international organizations, civil society and the private sector.
- **St. Petersburg declaration**, 2010 adopted to double tiger numbers by 2022 (India has achieved this).
- **Global Tiger Day** (July 29 every year) to raise awareness.
- **Conservation Assured | Tiger Standards (CATS) framework**, 2013 to check if their management will lead to successful tiger conservation.

Related concept: Transboundary Conservation (TBC)

- Bangladesh, India needs trans-boundary collaboration for Bengal tiger conservation
- Transboundary Conservation (TBC) is a process of **cooperation to achieve conservation goals across one or more international boundaries.**
- Three kinds of **TBC Areas (TBCAs)** include-
  - **Transboundary Protected Area (TPA),** geographical space that consists of protected areas.
  - **TBC Landscape and/or Seascape**, an ecologically connected area that sustains ecological processes and crosses one or more international boundaries.

- **Transboundary Migration Conservation Areas**, wildlife habitats in two or more countries that are necessary to sustain populations of migratory species.

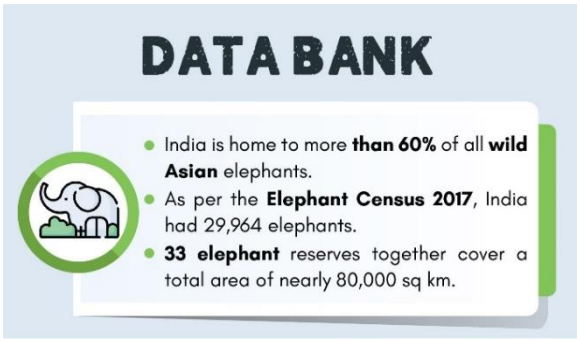
- **India shares such TBCAs with Nepal and Bhutan viz**
  - **Kanchenjunga Conservation Area,** in **northeast corner of Nepal** near the **border with India and Tibet.**
  - **Terai Arc Landscape (TAL)** spread across Indian states of Uttarakhand, Uttar Pradesh, Bihar, and low-lying hills of Nepal.
  - **Sacred Himalayan Landscape** whose 74% area falls in Nepal, 25% falls in Sikkim of India, and remaining falls in Bhutan.
  - **Transboundary Manas Conservation Area (TraMCA)** across Eastern Himalayas that connect Bhutan with North East India.



6.6.3. PROJECT ELEPHANT

Why in News?

President Participated in **Gaj Utsav** at Kaziranga National Park and Tiger Reserve (KNPTR) in Assam to mark **30 years of Project Elephant.**



More on News

- **Objective** of the Gaj Utsav was to raise awareness of **elephant conservation, protect** their **corridors** and **habitat,** and reduce **human-elephant conflict.**

Project Elephant

- Launched in **1992** as a **Centrally Sponsored Scheme.**
- **Support and Coverage: Financial** and **Technical** support are being provided to major **elephant-bearing States** in the country. Presently the Project is being implemented in 22 States/Uts.
- **Main activities under the Project:**
  - **Conserve** and **protect** viable populations of wild elephants in their natural habitats.
  - To **conserve, protect** and to **restore** natural habitats and traditional **corridors**/migratory routes used by the elephants through eco-restoration, acquisition etc.
  - Protect the elephants from **poaching** and other threats by taking suitable measures like **deployment of patrolling squads, intelligence gathering,** etc.
  - Ensure **inter-state** and **regional** and **national level coordination** in protecting and conserving the elephant and its ranges.

- **Steering Committee:** It includes **representatives** of the Government as well as **non-government wildlife experts** and **scientists.**
  - It **advises** the centre on the project related issues.
- **Elephant reserves:** Declared as an **administrative category** by the government to demarcate **large landscapes** that hold elephants and their movements.

Other Conservation measures

- **National Level:**
  - **Elephant Corridor** formed by the **Wildlife Trust of India (WTI)**
  - **National Awareness Program – Gaj Yatra (launched by NGO Wildlife Trust of India (WTI) and Haathi Mere Saathi.**
  - **Elephant Task Force** (2010) set up to review the existing policy of elephant conservation in India and formulate future interventions.

- **Global Level**
  - **Monitoring of Illegal Killing of Elephants (MIKE) Programme**- Launched (COP resolution of CITES) in South Asia in the year 2003.

Conclusion

The consistent efforts of the government and all the stakeholders have played a key role in enhancing the population of elephants in India. A dedicated authority based on the line of NTCA needs to be set up so that conservation efforts are more effective.

6.6.4. CHEETAH RELOCATION

Why in news?

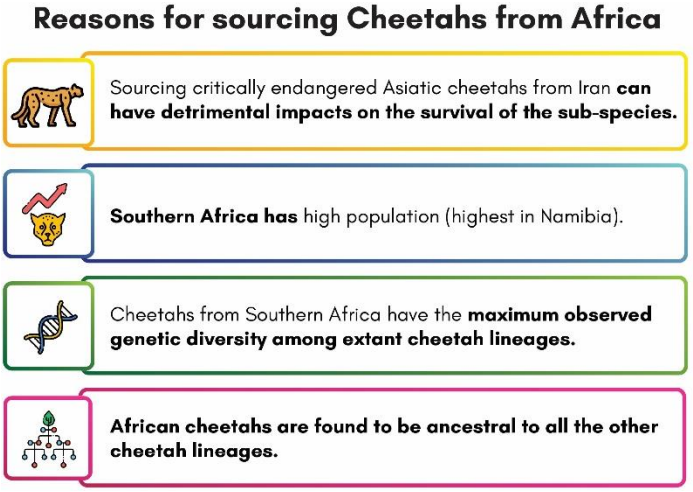
Wild African Cheetahs from Namibia were introduced in Kuno National Park (KNP), Madhya Pradesh under **Project Cheetah**.

About Project Cheetah

- **World's first inter-continental large wild carnivore translocation project** (part of the centrally Sponsored Scheme- 'Project Tiger' of India).
- **Nodal Agency: National Tiger Conservation Authority (NTCA)** is the nodal agency.
  - It has constituted **Cheetah Project Steering Committee (CPSC)** to keep watch on cheetah project.
- Under the project, the **government plans to introduce at least 50 cheetahs** into various national parks over the next five years.
- **Reasons for choosing Kuno NP for cheetah reintroduction:** Suitable habitat; part of the larger Sheopur-Shivpuri dry deciduous open forest; Adequate prey base; Devoid of any human settlements; Offers the prospect of housing four big cats of India (tiger, lion, leopard and cheetah) as in the past.

Measures taken for ensuring success of the programme

- **Soft-release for acclimation to local environment.**
- All cheetahs were **vaccinated** and **fitted with Satellite radio collars** for monitoring them at all times.
- **Action Plan for Introduction of Cheetah** followed the modern scientific approach recommended by the International Union for Conservation of Nature (IUCN) guidelines.
- **Public awareness campaigns for the local communities**:
  - **Cheetah mitras,** dedicated team of volunteers, trained by the forest department trained to create awareness among the villagers about protecting cheetahs.
- **Cheetah Task Force** constituted by MoEF&CC for a period of two years to monitor.



Importance of relocation

- Cheetah **being flagship species will help in reviving grasslands and its biomes and habitat.**
- **Enhancing and maintaining diversity in lower trophic levels of the ecosystems.**
- **Additional habitat for other species.**
- **Boost ecotourism and enhance livelihood options** among the local communities where the cheetah is introduced.
- **Support global effort to conserve cheetah by** extending the range of the cheetah**.**
- **Support climate change mitigation goals** by enhancing India's capacity to sequester carbon through **ecosystem restoration activities** in cheetah conservation areas.

Concerns

- **Coexistence of large predators like** cheetahs, lions, tigers and leopards in the same habitat.
- **Size of Indian parks can be smaller for** cheetah.
- **Might generate negative effects on indigenous wildlife species.**
- **May divert resources from ongoing wildlife protection efforts** to protect endangered animals.
- **Increase in Human-Wildlife Conflict** as **cheetahs hunt more during the daytime.**
- **Rehabilitation of people** to make sufficient space for Cheetah's habitat.
- **Single species imported from a foreign country cannot serve as the ambassador for the conservation of all grasslands** occurring in India.

Way forward

- **Community Participation & awareness programs to gain confidence of local villagers**.
- **Regular in-house training** of the forest officials, veterinary team, frontline staff and cheetah tracking teams.
- **Inter-sectorial collaborations** with police and revenue department.
- **Encourage Sustainable and conservative tourism** subservient to the conservation needs of the to create jobs and business opportunities for the local people.
- **Annual Review and Monitoring** for informed management of the project.

6.7. THE WILDLIFE (PROTECTION) AMENDMENT ACT, 2022

Why in News?

Recently, the Wildlife (Protection) Amendment Act, 2022 was enacted **to amend the WLPA, 1972 to incorporate more species** protected under the law and implement the **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)**.

About Wildlife (Protection) Act (WLPA), 1972

- Provides for the **protection of wild animals, birds, and plants** with a view to ensuring the ecological and environmental security of the country.
- Empowers the State to declare protected areas, under four categories- **National Parks, Wildlife Sanctuaries, Community Reserves and Conservation Reserves.**
- Important bodies established under the act include-
  - **National Board for Wildlife**
  - **National Tiger Conservation Authority**
  - **Central Zoo Authority**
- The **Act has created 6 schedules** for specially protected plants (one), specially protected animals (four) and vermin species (one), which gave varying degrees of protection to classes of flora and fauna.

Key Provisions of Amended Act 2022

Key Amendments	

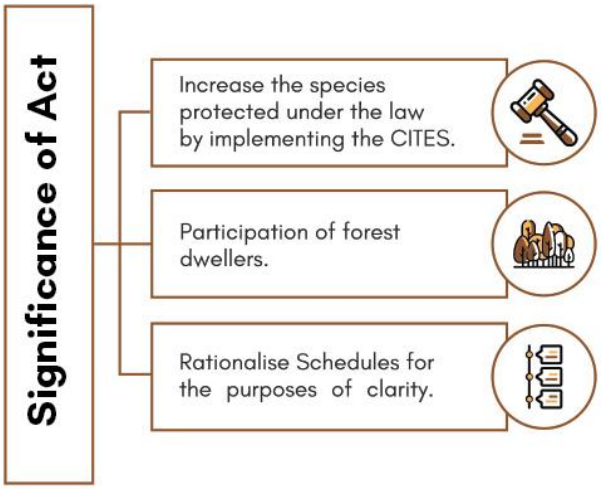
New Chapter VB for implementation of CITES	• **Designation of authorities**: The Central government will designate-
	  ○ **Management Authority (MA)**- Responsible for issuance of permits and certificates for trade of scheduled specimens in accordance with the Convention.
	  ○ **Scientific Authority**- To advice MA on aspects related to impact on the survival of the specimens being traded.
	• **Identification mark** to be used by the MA for a specimen, as per CITES. Modification or removal of the identification mark is prohibited.
	• **Registration certificate to be obtained by person possessing live specimens** of scheduled animals from the MA.
	• **Breeders of species in Appendix I of Schedule IV required to make an application for license** to the Chief Wildlife Warden within 90 days of the commencement of the amendment.
	• Conditions for export, import, re-export and introduction from sea of scheduled specimens have been specified.

Rationalization of schedules	**Number of schedules from 6 to 4** by: • Reducing the number of schedules for specially protected animals from 4 to 2. • **Inserting a new schedule for specimens listed in the Appendices under CITES** (scheduled specimens). • **Removing the schedule for vermin species.** ○ **Wild animals will be declared as Vermin by Central Government** by the way of **notification** (any area and for a specified period)**.** 
Control of sanctuaries	• **Chief Wildlife Warden will manage and protect sanctuaries in accordance with the management plans** prepared as per guidelines of the **central** government. • **In case of sanctuaries falling under Scheduled Areas or areas where Forest Rights Act 2006 is applicable,** the management plan for such sanctuary prepared after due consultation with the **Gram Sabha** concerned.

Increase in Penalties	• For **General violation** increases to 1 lakh from Rs25,000. • For **specially protected animals** increases to 25,000 from Rs10,000.
Exemptions for 'live elephant' (section 43)	• **Transfer or transport of live elephants allowed for a religious or any other purpose** by person having ownership certificates in accordance with conditions prescribed by the Central Government.
New section 42A for Surrender of captive animals	• **Any person having a certificate of ownership for captive animals or animal products, can voluntarily surrender** them to the Chief Wildlife Warden. • **No compensation to be paid to the person for surrendering** such items and the items will become the property of the State Government.
Relaxation of certain restrictions	• **Filmmaking** (without causing any adverse impact to the habitat for wildlife) as one of the purposes for which permits may be granted to enter or reside in a sanctuary. • **Certain activities** such as, grazing or movement of livestock, bona fide use of drinking and household water **by local communities** etc. **allowed without a permit** in a sanctuary.
Other Provisions	• **Central government empowered to regulate or prohibit the import, trade, possession, or proliferation of invasive alien species.** • **No renewal of any arms licences to be granted to any person residing within 10 kilometres** of a sanctuary except under the intimation to the Chief Wildlife Warden or the authorized officer. • **State Board for Wildlife permitted to constitute a Standing Committee.**

Concerns about new Act

- **May provide an open sale and purchase** of elephants, which was earlier possible only through **inheritance** of captive elephant.
- **Centre's hold over 'vermin' declaration continues.**
- **Concern over federal structure:** Protection of wild animals and birds is a subject under **Concurrent List.**
  - Amendment **renders the State Boards for Wildlife chaired by Chief Ministers defunct and provides for establishing Standing Committee of Board for Wildlife** to be headed by the Forest Minister with maximum 10 nominated members.



Way Ahead

- **Need to certify elephants' ownership.**
- The Management and Scientific Authorities must adhere to **the strong principles of Federalism** and need to ensure constructive engagement of State governments**.**
- Need to encourage research and the organic incorporation of scientific information in conservation planning.
- **A temporary restriction can be placed on the time period for which animals can be declared vermin,** to ensure review of the conservation status of the wildlife population.

6.8. PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Why in News?

India hosted the Ninth Session of the Governing Body (GB9) of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA).

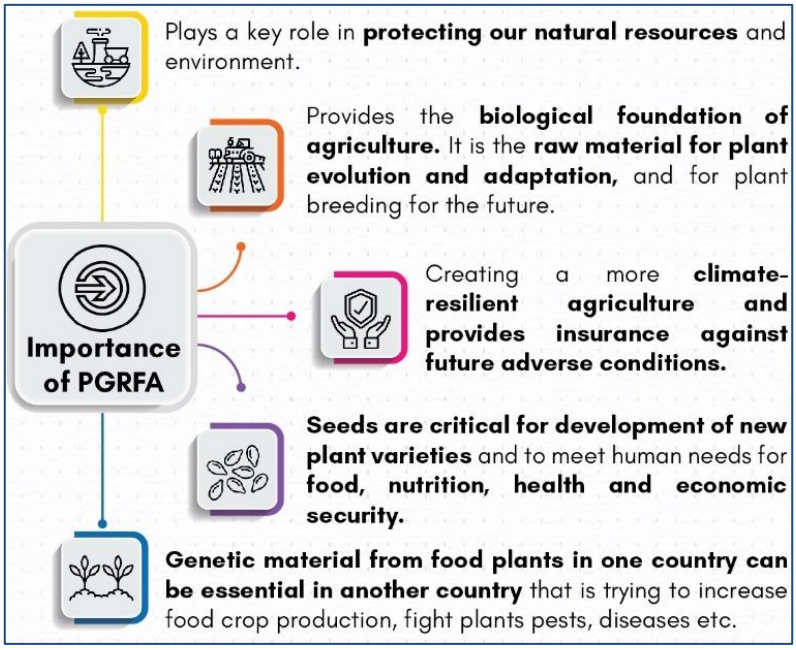
Major decisions taken at GB9

- In a historical first, Federation of Seed Industry of India (FSII) contributed Rs **20 lakhs to the Benefit-Sharing Fund (BSF).**
- **India appointed as Co-Chair** of the Working Group on Enhancement of Multilateral System of Access and Benefit-sharing (MLS).
- **Consensus on implementation of Farmers Rights** reached after extensive negotiations at GB9.
  - GB9 considered the options **for encouraging, guiding and promoting the realization of Farmers' Rights.**

- Contracting Parties acknowledged the intervention made by India, and supported by many African nations, regarding **effect due to institutional reform within the CGAIR** system (a global research partnership for a food-secure future) on funding of gene-banks globally.

About Plant Genetic Resources for Food and Agriculture (PGRFA)

- **Any plant materials, include the traditional crop varieties and their wild relatives**, modern cultivars, breeding lines etc. which **provide food, feed for domestic animals, fibre, clothing,** shelter, medicine and energy.
- Can be used to develop new varieties or improve the quality and productivity of crops.
- **National Bureau of Plant Genetic Resources (NBPGR)**, established in 1976, is the **nodal organisation in India.**



Threats to PGRFA conservation and utilisation

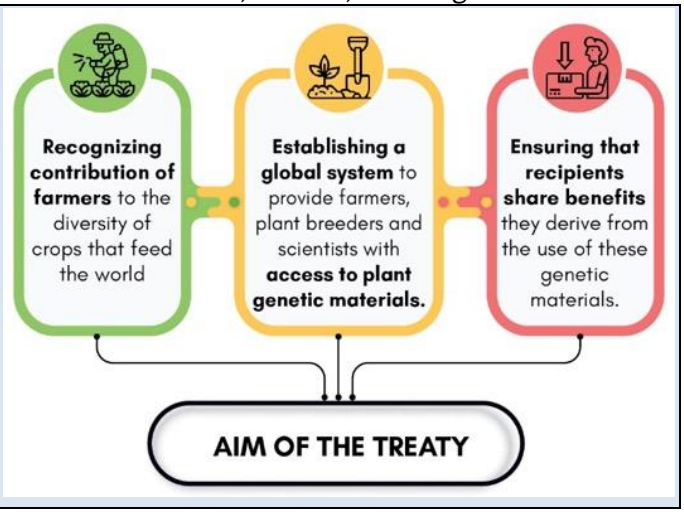
- **Population growth and Urbanization** caused over exploitation of PGR as witnessed during the Green Revolution.
- Soil and atmospheric biodiversity are under **threat of pollution.**
- **Climate Change induced variation** in **rainfall patterns** likely to diminish crop yields in many areas.
- **Invasive alien species (IAS)** threaten biological diversity, ecosystems and habitats, and human well-being.
- **Genetic vulnerability and erosion due to Mono-cropping pattern.**
- **Imbalance between Intellectual property (IP) rights** provided to breeders of modern plant varieties and the rights of farmers.

Way Forward

- **Constructing a comprehensive information retrieval system** for plant genetic resources with the help of early warning systems.
- Using techniques like **in-vitro genebank, Field genebank (Ex-situ) and cryobank** for protecting plant varieties.
- **Developing an understanding of the extent and distribution of diversity in plant species** and ecosystems through efficient survey, inventory, etc.
- **On-farm management and improvement of plant genetic resources** by adopting integrated approaches.
- **Providing better and more accessible documentation** to breeders, farmers, and indigenous etc.

About International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)

- Also known as seed treaty, is a **major international agreement to conserve, use and manage Plant Genetic Resources for Food and Agriculture (PGRFA)** around the world for the benefit of people everywhere.
- A **legally binding agreement** that was adopted by 31st session **of Food and Agriculture Organization (FAO)** in 2001 and **entered into force in 2004.**
- **India is a party** to the treaty.
- It also **provided international legal framework** needed for **establishment of Svalbard Global Seed Vault** in Norway.
- **Funding for the treaty comes from its Contracting Parties** and from FAO.



6.9. ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

Why in news?

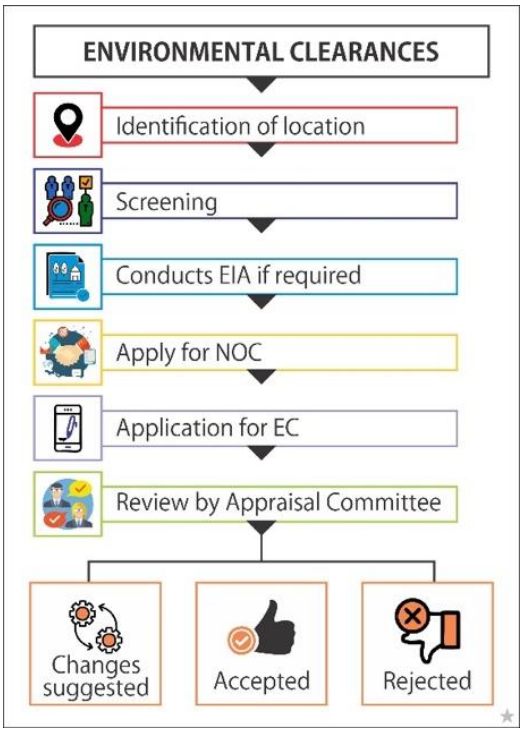
Ministry of Environment extends tenure of Environmental Clearance for selected projects.

More on the news

- The tenure of Environmental Clearances (EC) given has been extended for the following projects –
  - **River valley projects** to have **13-year validity.**
  - **Nuclear power projects** or those involving the processing of nuclear fuel to have **15 years** validity.
  - For projects and activities **other than mining and river valley projects** will be valid for **10 years.**
- EC for mining leases is also under review as presently, **mining leases are granted for 50 years and EC is valid for 30 years.**
- **Need for the extension arose as –**
  - **Nuclear power and hydropower projects have high gestation period** due to geological surprises, delays in forest clearance, etc.
  - **Considering the time taken for addressing local concerns** including environmental issues relating to implementation of such projects.

Other recent Amendments to Environmental Impact Assessment (EIA) rules 2006

- **Exempts highway projects related to defence and strategic importance within 100 km of Line of Control or border** from requirement of environmental clearance.
- **Increases exemption threshold of biomass-based power plants which use auxiliary fuels** such as coal, lignite or petroleum products up to 15% and fish handling capacity of ports and harbours which exclusively handle fish.
- Exempts **projects pertaining to expansion of terminal buildings at airports** (without an increase in existing area of airport) from seeking green nod.
- **Any Category 'B' projects of national importance shall be appraised at the Central level** as Category 'B' projects. These projects are related to-
  - National Defence or strategic or security importance
  - Notified by the Central Government on account of exigencies such as pandemics, natural disasters or to promote environmentally friendly activities under National Programmes or Schemes or Missions



About EC

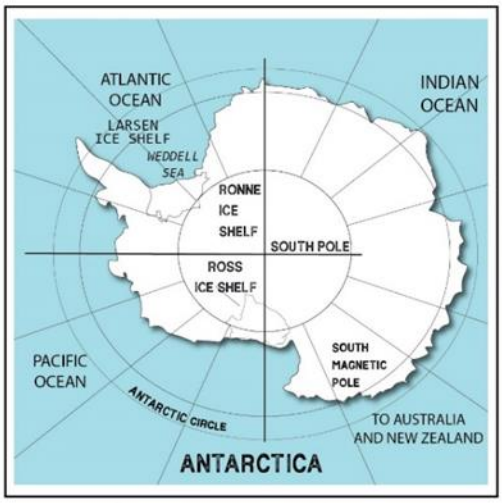
- **First made mandatory under the Environmental (Protection) Act 1986** for expansion or authorization of any activity or for setting up new projects listed in Schedule 1 of the notification.
- Currently, EIA process in India is ruled by **EIA Notification, 2006 and its subsequent amendments.**
- **Key Features of Environmental Impact Assessment (EIA) rules 2006**
  - **Prior Environmental Clearance (EC) mandatory for notified projects such as mining, thermal power plants, river valley, infrastructure and industries** like electroplating or foundry units to get.
  - **EC process for projects comprises of 4 stages** namely screening, scoping, public consultation and appraisal.
  - **Categorization of the projects** based on the spatial extent of potential impacts and potential impacts on human health and natural and man-made resources.
  - **All Category 'A' and Category B1 projects or activities shall undertake Public Consultation** with some exemptions like- modernization of irrigation projects, expansion of Roads and Highways which do not involve any further acquisition of land, etc.

6.10. INDIA AND ANTARCTICA

ANTARCTICA AT-A-GLANCE

About Antarctica

- World's 5th largest, southernmost and the **driest, windiest, coldest, and iciest** continent.
- It is not a country and **has no government and no indigenous population.** Instead, the entire continent is set aside as a scientific preserve.
- **It holds 90% of the Earth's total ice volume** and **70% of its fresh water.**
- Due to cold desert climate supports only cold-tolerant land plant and plant like organisms.



Significance of Antarctica

- **Ocean systems:** Antarctica and the surrounding Southern Ocean are **key drivers of Earth's oceanic and atmospheric systems.**
- **Recreational value:** It is vast, remote, otherworldly and beautiful beyond imagination.
- **Biodiversity:** Support masses of the world's sealife like whales, dolphins and penguin.
- **Natural laboratory:** Helping us understand global climate change. Antarctica's thick ice sheet are studied to predict planet's climate over almost a million years ago.
- **Vital for survival:** The Antarctic ice deflects some of the sun's rays away from the Earth, keeping temperatures liveable.
- **Ocean food chain:** The nutrient-rich waters encourage blooms of tiny plankton, the basis of the ocean food chain.
- **Resources:** It is a **rich source of minerals** (oil and gas) and **marine life** (finfish, krill, squid).
- **Climate change mitigation and adaptation:** Melting of the Antarctic Ice Sheet is enough to increase sea level by more than 60 m.

Challenges faced by the Antarctica

- **Territorial dispute between parties.**
- **China's growing interests in Antarctic** resources, especially fisheries and minerals.
- **Reaching Tipping point:** Climate change can cause significant and permanent biophysical change to Antarctica through changing patterns of sea ice formation and destabilization of ice sheets.
- **Ice shelf collapses due to soaring temperatures,** e.g., **Conger Ice Shelf** recently collapsed in **eastern Antarctica.**
- **New and emerging challenges posing threat to the fragile ecosystem** -Tourism, rise in IUU (i.e., illegal, unreported, and unregulated) fishing, biological prospecting (commercialization of knowledge gained from research with regard to bio-organisms) etc.
- **Conflict in international laws governing it,** like Antarctic Treaty and United Nations Convention on the Law of the Sea.

Way Forward

- Effective implementation of the Antarctic Treaty to ensure full protection.
- Formulating new regulation based on scientific findings and to address new challenges.
- A dedicated tourism convention for the region.
- Raising awareness about fragile nature of Antarctic environment.

6.10.1. THE INDIAN ANTARCTIC ACT, 2022

Why in news?

Recently, the **Indian Antarctic Act, 2022** was enacted.

About Indian Antarctic Act, 2022

- This act aims to provide national measures for protecting the Antarctic environment and dependent and associated ecosystems and **to give effect to the Antarctic Treaty, the Convention on the Conservation of Antarctic Marine Living Resources and to the Protocol on Environmental Protection to the Antarctic Treaty.**

Prohibited activities under the Act

- Nuclear explosion, disposal of radioactive wastes.
- Introduction of non-sterile soil.
- Introduction of specified substances and products.
- Discharge of garbage, plastic, or other substance harmful to marine environment in Antarctica.
- Damage, destroy or remove any historic site or monument.
- Possession, sale or offering for sale, trading, transporting, transferring or sending anything that has been obtained by violating provisions of the act.

- **Key Objectives of the Act**
  - **Prohibit Indian expedition to Antarctica or carrying of certain activities** in Antarctica **without a permit;**
  - **Eliminating mining or illegal activities.**
  - **Fulfilling India's obligations under Antarctic Treaty and related conventions.**
  - **Facilitating India's interest and pro-active involvement** in the management of growing Antarctic tourism and sustainable development of fisheries resources in Antarctic waters.
  - **Increasing international visibility, credibility of India in Polar governance** leading to international collaboration and cooperation in scientific and logistics fields.
  - Building a well-established legal mechanism for **efficient and elective operations of Indian Antarctic Programme.**

About Antarctic Treaty

- This treaty came into force in 1961 after ratification by 12 original members**:** Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, South Africa, USSR (now Russia) the UK, and the US.
- **India signed the treaty** in 1983 and is **one of the 29 Consultative Parties to the treaty.**
- **Objectives of the treaty**
  - **Demilitarize Antarctica,** making it free of nuclear tests and the disposal of radioactive waste.
  - **Establish it as a zone for peaceful research activities.**
  - **Set aside disputes over territorial sovereignty.**
- It **covers the area south of 60°S latitude.**
- The Treaty parties have also negotiated three international agreements which govern activities in Antarctica, collectively known as the **Antarctic Treaty System**-
  - **Convention for the Conservation of Antarctic Seals, 1972**
  - **Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR), 1980** (ratified by India in 1985)
  - **Protocol on Environmental Protection to the Antarctic Treaty (Madrid Protocol), 1991** (signed by India in 1998).

Key Provisions of the Act

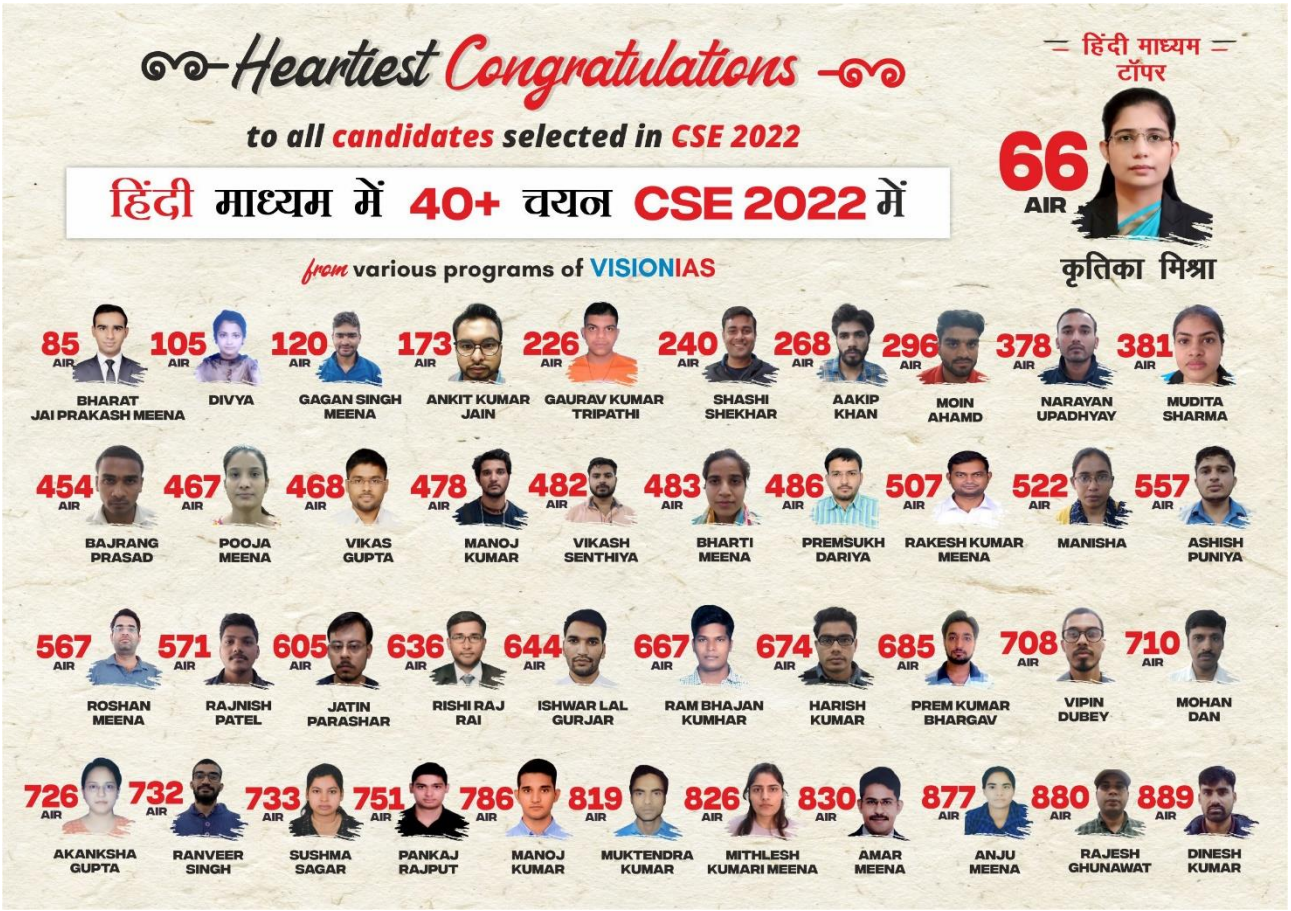
- **Applicability:** Provisions applicable to **any, Indian or foreign Citizens**; entities incorporated, established or registered under any law in force in India; vessel or aircraft registered in India or involved in any Indian expedition to Antarctica.
- **Establishment of a Committee on Antarctic Governance and Environmental Protection** to be chaired by the **Secretary of the Ministry of Earth Sciences.** Various functions of the Committee include:
  - **Grant, suspension or cancellation of permits** for various activities;
  - **Monitoring, implementing and ensuring compliance** of relevant international laws, emission standards and rules for protection of Antarctic environment;
  - **Negotiating fees/charges with other parties** for activities in Antarctica;
  - Establishment of **waste classification system and waste management plans** etc.
- **Permit system:** A permit by the Committee or written authorization from another party to the Protocol (other than India) will be required for various activities such as**:**
  - **Entering and staying in Antarctica,**
  - **Mineral resource activities,**
  - **Introduction of non-native animals and plants or microscopic organisms,**
  - **Removal of biological specimen,**

- **Entering into Antarctic Specially Protected Area or Marine Protected Area,**
- **Waste disposal** etc.

- **Constitution of the Antarctic fund** to be applied towards the welfare of Antarctic research work and protection of Antarctic environment.
- **Stringent penalties for contravention of its provisions:** E.g., Conducting a **nuclear explosion** in Antarctica could lead to **imprisonment of 20 years** etc.
- **Designated court to try punishable offences:** The central government may notify one or more Sessions Courts to be the Designated Court. It can also specify its territorial jurisdiction to try offences punishable under the Act.
- **Grant of Special permit for commercial fishing in Antarctica.**
- **Provision for inspection in India** by an officer designated by the Central Government as an Inspector and to constitute an inspection team to carry out inspections in Antarctica.

India's endeavor in Antarctica

- India is also **a member of-**
  - **Council of Managers of National Antarctic Programme (COMNAP)**: It comprises the heads of each of the national Antarctic operating agencies.
  - **Scientific Committee of Antarctica Research (SCAR)**: It coordinates Antarctic research programs and encourages scientific cooperation.
- **India's Research stations: Maitri** at Schirmacher Hills, **Bharati** at Larsemann Hills (Dakshin Gangotri was the first Indian base established in 1984).
- **Indian Antarctic program managed by National Centre for Polar and Ocean Research (NCPOR), Goa:** Under it, India has successfully launched 40 annual scientific expeditions to Antarctica till date.



7. DISASTER MANAGEMENT

7.1. DISASTER MANAGEMENT IN INDIA

DISASTER MANAGEMENT IN INDIA AT A GLANCE

Disaster Risks in India

- **58.6% of the landmass** is prone to earthquakes of moderate to very high intensity.
- **Over 40 million hectares (12% of land)** is prone to floods and river erosion.
- **5,700 km** of the 7,516 km long coastline is prone to cyclones and tsunamis.
- **68% of the cultivable area** is vulnerable to drought.

India's Vision and Approach to DM

- **Approach:** Proactive prevention, mitigation and preparedness-driven approach for conserving developmental gains and to minimise loss of life, livelihood and property.
- **Vision as per NDMP, 2016:**
  - Make India disaster resilient across all sectors.
  - Achieve substantial and inclusive disaster risk reduction by building local capacities starting with the poor.
  - Decreasing significantly the loss of lives, livelihoods, and assets (economic, physical, social, cultural, and environmental).
  - Enhancing the ability to cope with disasters at all levels.

Government Initiatives/ Schemes/Policies/Acts

- **National Disaster Management Act 2005**
- **National Disaster Management Plan (NDMP), 2016**
- **NDMA guidelines** for disasters like earthquakes, cold wave, cyclone etc.
- **National Policy on Disaster Management, 2009**
- **National Disaster Response Fund** managed by the Central Government.
- Signed **Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR)**
- **Coalition for Disaster Resilient Infrastructure (CDRI)**
- **Model Building Bye Laws, 2016**

Constraints

- **Climate change is expected to increase disaster frequency and intensity.**
- **Weak compliance of policies,** e.g., violation/poor implementation of building laws.
- **Asymmetric impact of disasters on vulnerable sections** like poor, migrants, elderly etc.
- **Difficulties in mobilization of largescale financing** at all levels.
- **Absence of specific goals and targets** in NDMP.
- **Poor co-ordination** among multiple authorities, especially at local level.
- **Lack of fundamental infrastructure** (early warning system, search and rescue facilities etc.) in several disaster-prone areas.
- **Paucity of trained dedicated clinicians** for relief and rescue operations.
- **Low community empowerment and capacity building** to effectively mitigate, prepare and respond to Disasters.

Way Forward

- Strengthening DM plans and strategies to **prepare for predicted impacts of Climate change.**
- **Incorporate programs to protect the most vulnerable segments** of society-the poor, marginalized, women, children, disabled, and elderly.
- **Expanding financial resources** through international collaborations, public-private partnerships etc.
- **Raising awareness about insurance** among citizens for financial resilience.
- **Equipping existing infrastructure** like Common Service Centres (CSCs) for early warning, relief and rescue etc.
- **Developing and popularising innovative, location-specific technologies,** materials, designs and methods.
- **Undertaking adequate capacity building** to prepare citizens and administrative authorities at local levels.
- Setting specific **goals and targets aligned with Sendai Framework.**

7.1.1. CULTURAL HERITAGE AND DISASTER MANAGEMENT

Why in news?

Climate change induced disasters are increasingly posing a threat to World's heritage sites.

Key Issues in disaster management at cultural heritage sites in India

- **Natural vulnerabilities of cultural site: Examples-**
  - The **Bhuj Earthquake in 2001** caused wide-spread devastation to both rural and urban settlements including many nationally and state protected monuments.
  - In 2011, the **Sikkim Earthquake destroyed many Buddhist monasteries** and temples.
- **Inadequate Risk assessment** due to lack of continuously hazard mapping and identifying vulnerabilities.
- **Poor Risk Mitigation** due to poor management, neglect and lack of awareness.
- **Difficulties in implementing Emergency preparedness and Response procedures** in cultural heritage sites without significantly impacting the values of the heritage site.
- **Post Disaster Recovery and Rehabilitation** pose a threat to the heritage value and aesthetics.

Way Forward

- **Collaboration at various scales and among diverse institutions.**
- **Mainstreaming and implementing Disaster Risk Reduction (DRR) approaches, including Ecosystem-based DRR (Eco-DRR) as per the** UN Sendai Framework and templates for **Disaster Risk Reduction in World Heritage sites.**
- **Short and long-term strategies for enhancing the management capacity of heritage sites** and supporting the livelihoods of associated communities.
- **Training, capacity building and raising awareness** are central aspects of disaster risk management and must be undertaken at multiple scales.

Legal framework for protecting the heritage sites.

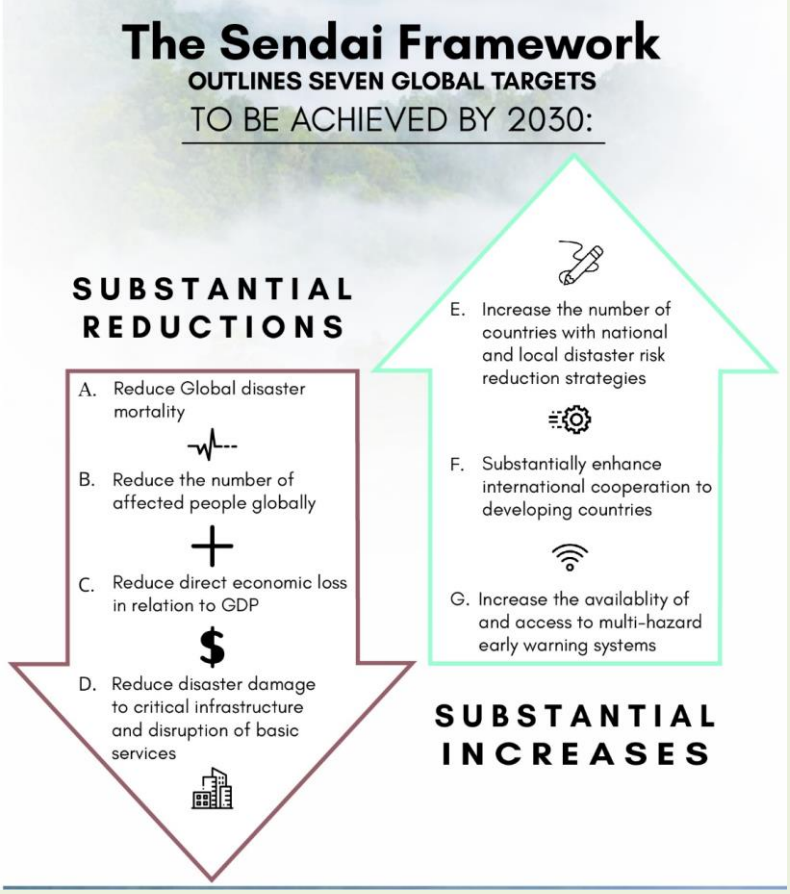
The Apex Body for the implementation for protecting cultural heritage is the Ministry of Culture (MoC), which acts through the Archaeological Survey of India (ASI).

National legislations that apply to cultural heritage in India include the following:

- The **Ancient monuments and Archaeological Sites and Remain Act** (AMASR ACT 2010)
- The **Ancient Monuments and Archaeological Sites and Remains Act, 1958** and its Rules in 1959
- The **Antiquities and Art Treasures Act, 1972** and its Rules in 1973.

Sendai Framework for Disaster Risk Reduction 2015-2030

- Adopted at the **Third UN World Conference on Disaster Risk Reduction** in Sendai, Japan, in 2015.
- It outlines **7 clear targets and 4 priorities** for action to prevent new and reduce existing disaster risks
- **Understanding disaster risk**
  - Strengthening disaster risk governance to manage disaster risk
  - Investing in disaster reduction for resilience and
  - Enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction.



7.2. DISASTER RESILIENT INFRASTRUCTURE (DRI)

DISASTER RESILIENT INFRASTRUCTURE AT A GLANCE

Disaster Resilient Infrastructure (DRI)

- Disaster resilience is the ability of individuals, communities, organisations and states **to adapt to and recover from hazards, shocks or stresses** without compromising long-term prospects for development.
- DRI include vital buildings, public communal facilities, transit systems, telecommunications, and power systems **that are strategically designed to withstand the impact of a natural disaster** like a flood, earthquake, or wildfire.

Significance

- Could **bring down the economic cost** of rebuilding the whole infrastructure after natural disasters.
- Assist in achieving **targets pertaining to a reduction in mortality due** to disasters.
- Help in **non-disruption of Energy, transportation, and telecommunications** for an effective post-disaster response.
- **Frequency and severity of disaster events have been increasing** which makes DRI inevitable e.g., Turkey Earthquake.

Initiatives

- India announced the creation of a **Coalition for Disaster Resilient Infrastructure (CDRI)** after the Asian Ministerial Conference on Disaster Risk Reduction (2016).
- **Sendai Framework for Disaster Risk Reduction (2015-2030)** identifies investing in Disaster Risk Reduction (DRR) for resilience and to "build back better" in reconstruction as priorities.
- **Infrastructure Resilience Accelerator Fund** was announced in 2023 acts as a financial resource and is key to the success of initiatives.
- Inclusion of the **CDRI in working groups of G20.**

Constraints

- **Unplanned development** in India and less attention toward this aspect.
- **Lack of long-term plan and institutional mechanism** to assess it.
- **Universal accepted standards** are missing.
- **Effective global cooperation is not vibrant.**

Way Forward

- Should be **integral part** of **policy making** on infrastructure.
- Adopting **global standards.**
- Review of **existing infrastructure** on a regular basis.
- Sensitization of people about its **importance.**

7.2.1. COALITION FOR DISASTER RESILIENT INFRASTRUCTURE (CDRI)

Why in news?

India signed 'Headquarter Agreement' with CDRI, thereby according the status of an **'independent and international legal entity' to CDRI.**

About Headquarters Agreement (HQA)

- An **agreement between an international organisation and host state** to determine the **privileges and immunities necessary for its good functioning.**

About International legal personality

- Refers to entities endowed with rights and obligations under public international law. This **includes states, international organizations, NGOs** etc.
- It will allow CDRI to
  - **Deputing experts** and **also bringing in experts from member countries** to India.
  - **Deploying funds globally and receiving contributions** from member countries.
  - Making available **technical expertise** to assist countries to develop resilient infrastructure.
  - **Leveraging international engagement** to foster disaster resilient infrastructure at home.

- Enables **CDRI to pursue functions internationally with all rights, immunities, and privileges,** as per Section-3 of **United Nations (Privileges & Immunities) Act, 1947.**
  - India enacted UN (Privileges & Immunities) Act, 1947 to give effect to **Convention on Privileges and Immunities of United Nations**, adopted by **UN General Assembly in 1946**.

About Coalition for Disaster Resilient Infrastructure (CDRI)

- A **global partnership of national governments**, UN agencies and programmes, private sector, and academic and research institutions, launched in **2019 by India** at **UN Climate Action Summit (New York).**
- **Objective**: To promote **resilience of infrastructure systems to climate and disaster risks**, thereby ensuring **sustainable development**.

Related News: Multi-Hazard Early Warning Systems (MHEWS) - Target G

- **Joint report** by United Nations Disaster Risk Reduction and World Meteorological Organisation **assesses current global status of MHEWS against Target G** (one of the seven targets) of Sendai Framework.
  - **Sendai Framework** is a global **blueprint for disaster risk reduction and prevention.**
  - **Target-G aims to increase availability of and access to MHEWS** and disaster risk information and assessments by 2030.
- Early warning systems (EWS) **reduce harm to people and damage to assets** ahead of impending hazards, including storms, tsunamis etc.
  - **Four elements of EWS:** Risk knowledge; Technical monitoring and warning service; Communication and dissemination of warnings; Community response capability.
  - **MHEWS addresses several hazards** that may occur alone, simultaneously, or cascadingly.
- **Need of EWS**
  - **Increasing frequency and intensity** of extreme weather events/disasters due to human-induced climate change and unpredictable weather events.
  - **Half of the countries** globally are **not protected by MHEWS.**
  - 3.6 billion people live in areas highly vulnerable to climate change and related disasters.
- **Recommendations to achieve Target G**
  - **Investing in all elements of EWS**, especially in risk knowledge for better planning and capacity building.
  - **Investing in enhanced data and better access to technology** for stronger monitoring, faster communication etc.

Initiatives taken in India

- Geological Survey of India has developed a prototype regional **Landslide Early Warning System (LEWS).**
- Indian National Centre for Ocean Information Services (INCOIS) has set up Storm Surge EWS and Indian **Tsunami Early Warning Centre (ITEWC).**
- Defence Geo-Informatics Research Establishment provides advance warning of avalanches.

Global Initiatives

- **Early Warnings for All initiative** of World Meteorological Organization (WMO) aims to ensure that every person on Earth to be **protected by early warning systems by 2027**.
- **Global Basic Observing Network (GBON)** to generate and exchange basic weather and climate data.
- **Climate Risk and Early Warning Systems (CREWS)** for people living in the LDCs and SIDS.
- **Risk-informed Early Action Partnership (REAP)** to enhance collaboration.

7.3. EARTHQUAKES

EARTHQUAKE MANAGEMENT IN INDIA AT A GLANCE

Vulnerability in India

- **59%** of the Indian landmass classified as earthquake-prone.
- **11% fall in very high-risk zone V,** 18% in high-risk zone IV, and 30% in moderate-risk zone III.
- Region referred to as **the seismic gap** between Himachal and the western part of Nepal including Uttarakhand is prone to earthquakes that might occur at any time.
  - **Seismic gap** is an area within a known active earthquake zone within which no significant earthquakes have been recored.

Causes of the Earthquake

- **Tectonic Plate Movements:** Plates in **Earth's lithosphere interact** at their boundaries.
- **Fault Slippage:** When stress builds up along a fault line, it can eventually overcome the friction holding the rocks together, causing them to slip suddenly.
- **Volcanic and Anthropogenic Activities** (mining, reservoir-induced seismicity, etc).

Examples of Recent Earthquakes

- North India (2023), and Assam (2021)
- Turkey and Syria (2023)

Impacts

- **Social and Psychological:** Loss of human lives, injuries, **temporary or long-term displacement,** creating a need for emergency shelter, food, etc.
- **Economic:** Destruction of **infrastructure,** disruption of businesses, damage to buildings, etc.
- **Environmental:** Trigger secondary hazards such as landslides, avalanches, and tsunamis.

Initiatives

- **Earthquake Risk Assessment and Mapping** by the **Geological Survey of India (GSI)** and other research organizations have **identified seismic zones** and classified areas based on their vulnerability to earthquakes.
- **Bureau of Indian Standards (BIS)** has developed the **Indian Standard Code for seismic design and construction of structures (IS 1893).**
- **National Disaster Management Authority's (NDMA)** guidelines for earthquakes.
- **Others: Earthquake Early Warning System (EEWS), National Earthquake Risk Mitigation Project (NERMP),** Mobile application 'India Quake' etc

Challenges in Management

- **Prediction** is almost impossible even **early warning systems** are not much efficient to detect them.
- Lack of **earthquake-resilient infrastructure** due to poor implementation of building norms.
- **Indian and Eurasian** plates are in activity moving towards each other.
- **High financial cost of retrofitting** (upgrading or modifying existing structures).

Way Forward (NDMA Guidelines)

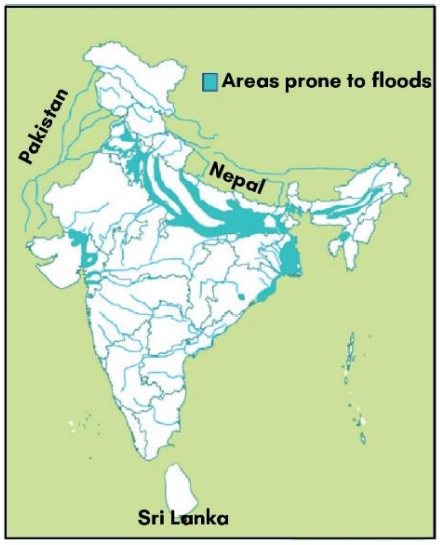
- **Ensure the incorporation of earthquake-resistant** design features for the construction of new structures.
- **Facilitate selective strengthening and seismic retrofitting** of existing priority structures.
- **Improve the compliance regime** through appropriate regulation and enforcement.
- Introduce appropriate **capacity development interventions for effective earthquake management (including education, training, R&D, and documentation).**
- **Strengthen the emergency response capability** in earthquake-prone areas.

7.4. FLOODS IN INDIA

FLOOD MANAGEMENT IN INDIA AT A GLANCE

Extent of Floods in India

- **More than 40 million hectare** area in India is flood prone.
- On an average every year, due to floods, **75 lakh hectares of land is affected, 1600 lives are lost** and **the damage caused to crops, houses and public utilities is Rs.1805 crores.**



Major causes of Flood

- **Natural:** Heavy precipitation, Rise in riverbed, Meandering tendency of rivers, Cyclones and storm surges, Cloud bursts, Glacial Lake outbursts etc.
- **Anthropogenic:** Inadequate drainage management, Improper reservoir management, Concretization of catchment area, Deforestation, Climate change etc.

Recent examples

- 2021 Maharashtra floods, 2022 Assam floods

Schemes/Policies/Initiatives

- **Flood Management Programme (FMP)**: It was implemented during XI Plan for taking up works related to **river management, flood control, anti-erosion, drainage development, etc.**
- **National Water Policy-2012** emphasizes construction of large storage reservoirs and other non-structural measures for integrated flood management.
- **Setting up of Ganga Flood Control Commission (GFCC)** and **Brahmaputra Board** for advising the Ganga Basin States and North Eastern-States respectively on Flood Management measures.
- **Integrated Watershed Management Programme (IWMP)** implemented by Department of Land Resources of Ministry of Rural Development.
- **Early flood warning systems like Mumbai's integrated flood warning system (IFLOWS) Constitution of Rashtriya Barh Ayog (RBA)** in 1976 for recommending measures of flood control.
- **NDMA guidelines on Floods** suggests Structural and Non-structural measures for flood management.

Constraints in Flood management

- **Reactive approach focused on post disaster management** rather than preparedness and mitigation.
- **Lack of integrated management of water resources** and **issues in Land-use policy.**
- **Passiveness on part of states** such as in implementing the flood plain zoning approach.
- **Problems in synchronization, collaboration or coordination** among various agencies.
- Flaws in structural measures like **construction of embankments without proper assessment and unrealized potential of multipurpose dams.**
- Outdated estimates of the flood-prone area.

Way forward

- **Modernization in collection of hydrometeorological data, flood forecast formulation and forecast dissemination** using artificial intelligence, remote sensing and GIS etc.
- **Prioritizing preventive and preparedness measures** such flood forecasting, flood plain zoning, flood proofing etc.
- **Integrated flood management** that works simultaneously for water management, physical planning, land use, agriculture etc. and nature conservation.
- **Enhance coordination among agencies at all levels** along with involvement of community.
- **Re-mapping of the entire flood-prone area.**
- **Formation of Flood Management Plans at state** and local levels.

7.4.1. URBAN FLOODING

Why in News?

Amid flooding in major metropolitans of India, the Centre highlighted the success of two cities- **Davanagere** (Karnataka) and **Agartala** (Tripura) – as cities which have **curbed urban flooding**.

About Urban Flooding

- Defined as **an excessive runoff in developed urban areas, where the stormwater doesn't have anywhere to go due to poor capacity of the drainage system, causing inundations**.
  - Indian cities such as Bengaluru (2022), Hyderabad (2020) etc. often face it.
- A combination of **three aspects- Heavy Rain, developed surfaces** and **insufficient capacity of drains**.
- **Significantly different from rural flooding** as the developed catchments of urban areas increase the **flood peaks from 1.8 to 8 times** and **flood volumes by up to 6 times**.
- **Causes of urban floods:**
  - **Direct Factors:** Climate change induced weather pattern changes and extreme rainfall; Topography; Unplanned development and encroachment of floodplains; Increment in impervious surfaces; Improper drainage infrastructure; etc.
  - **Indirect Factors:** Improper and inadequate drainage infrastructure due to heavy siltation, poor maintenance, outdated capacity etc.; Improper waste management causing waterlogging etc.

Impacts of urban flooding

- **Socio- Economic impact:**
  - **Damage to urban infrastructure** and **temporary disruption of utility services.**
  - **Economic losses** due to disruption in industrial activity and supply chains, damage to vital infrastructure and rebuilding costs.
  - **Risk of epidemics** due to spread of waterborne diseases.
  - **Casualties due to accidental fires, electrocution.**
  - Can **trigger mass migration or population displacement,** especially of people in low lying areas etc.
- **Environmental: Destruction of biodiversity and wildlife habitats** by floodwater and contamination of **rivers and habitats.**

Initiatives to tackle urban flooding

- **Sponge Cities mission** promotes positive interactions between socio-economic systems within the cityscape and with the urban water cycle to enhance local urban resilience.
- **Standard Operating Procedures (SOP) for mitigating Urban Flooding** by the Central Government under the **Atal Mission for Rejuvenation and Urban Transformation (AMRUT).**
- **Flood management programme** provides financial assistance to the state governments for undertaking flood management works in critical areas.
- **Uniform System of Alerts and Warnings** by the **Ministry of Home Affairs**- categorizing alerts in stages – **Yellow, Orange and Red.**
- **Integrated Flood Warning system like IFLOWS-Mumbai.**
  - Similar system was also **introduced in Chennai (C-FLOWS)**

Success of Davangere and Agartala: Steps Taken by Local Administration

- **Mapping** of Existent Drainage Systems.
- **Removal of Illegal Encroachments** over drainage networks.
- **Construction of storm water drains** to curb water logging and ensure drainage of water after heavy rainfall within few hours.

Way Forward

- **Adopting integrated ecological approaches** which combine the watershed land-use planning with the regional development planning.
- **Enhancing capacity of drainage systems** by removing encroachments, redesigning storm water drainage based on scientific methodology etc.
- **Creating detailed flood hazard and zonation maps.**
- **Conservation and restoration of urban water bodies** by providing legal protection to lakes, remove encroachments, etc.
- **Participatory approach for a risk-based early action coordination** among stakeholders to mitigate flood risks.
- **Adopt hybrid approaches** of integrating or replacing grey infrastructure with new **Blue-Green Infrastructure (BGI)**.

Related concept: Blue-Green Infrastructure (BGI)

- An eco-friendly route to combat climate change and environmental degradation by **harnessing blue** (seas, rivers, lakes etc.) and **green** (trees, parks, forests, etc.) **elements** for flood resilient cities.
- **BGI** is part of Delhi's 2041 Master plan.

- **Adopting Natural Flood Management (NFM) techniques** such as creating temporary storage, increasing catchment and channel roughness, de- synchronising peak flows from tributaries etc.
- **National Guidelines on Management** on **Urban Flooding** by the **National Disaster Management Authority (NDMA)** with Ministry of Housing and Urban Affairs as Nodal Ministry for Urban Flooding.
    - It includes establishment of **Urban Flooding Cells** in the Ministry of Housing and Urban Affairs, State Nodal Departments and Urban Local Bodies (ULBs) along with other measures such as:
        - ✓ **GIS Platform Mapping** of all **Class I, II** and **III cities and towns,**
        - ✓ **Establishing Urban Flood Early Warning System,**
        - ✓ **Rainwater Harvesting as an integral component of the Building Utility,**
        - ✓ **Removal of Encroachments on Drains and in Floodplains etc.**

7.5. LANDSLIDES

LANDSLIDES IN INDIA AT A GLANCE

Landslides
- Landslides are **defined as the movement of a mass of rock, debris, or earth down a slope** due to the direct the impact of **gravity.**

Recent Examples
Landslides Manipur (2022), Mumbai (2021) and Kerala (2021)

Causes of Landslide
- **Natural causes:** Heavy rainfall, earthquakes, snow melting and undercutting of slopes due to flooding.
- **Anthropogenic activities:** Excavation, cutting of hills and trees, excessive infrastructure development, and overgrazing by cattle.

***Rainfall variability pattern** identified as the single biggest cause **(Landslide Atlas of India, 2023).**

India's vulnerability to Landslides (Landslide Atlas of India, 2023)
- India among the top **four countries with highest landslide risk.**
- **12.6% of India's land area,** excluding snow covered **area, is prone to landslide.**
- **Landslide prone areas:** Highest in **Northeast Himalayas followed by Northwest Himalayas, Western Ghats and Easter Ghats.**

Impacts of Landslide
- **Damage/destroy ecosystems and built infrastructure** such as roads, electricity supply lines etc.
- **Loss of lives and social disruption.**
- **Disrupts economic activities, puts financial burden of rebuilding of States.**
- **Can lead to Other Hazards such as flooding.**

Schemes/Policies/Initiatives
- **Landslide Early Warning System (LEWS) by GIS under LANDSLIP project.**
- **Geological Survey of India's landslide susceptibility mapping in different parts of the country.**
- **National Disaster Management Authority (NDMA) guidelines for Landslide Hazard Zonation.**

Constraints
- **Development of Critical Infrastructure Development** such as border roads necessary in landslide prone areas.
- **Human Settlement in landslide-prone areas makes it difficult to take quick and proactive action.** For example, Joshimath is situated on sand and stone deposits, which exacerbates the risk of landslides.
- **Rising impact of Climate Change.**
- **Lack of Disaster-Resilient Infrastructure planning in hilly regions.**
- **Human-Caused Fatal Landslides:** In India, 28% of incidents of stone falls occur due to construction work.

Schemes/Policies/Initiatives
- **Following National Landslide Risk Management Strategy** released by National Disaster Management Authority (NDMA):
    - **Landslide Hazard Zonation (LHZ)** maps to be prepared at macro scale and meso level.
    - **Awareness Programmes.**
    - **Capacity Building and Training of Stakeholders.**
    - **Preparation of Mountain Zone Regulations and Policies.**
- **Adopting Different models for different regions** based on scientific mapping and early warning systems.
- **Proper assessment of environmental and social risks** of development projects in prone areas.
- **Structural measures such as Improving surface and subsurface drainage, constructing piles** (metal beams) **and retaining walls etc.**

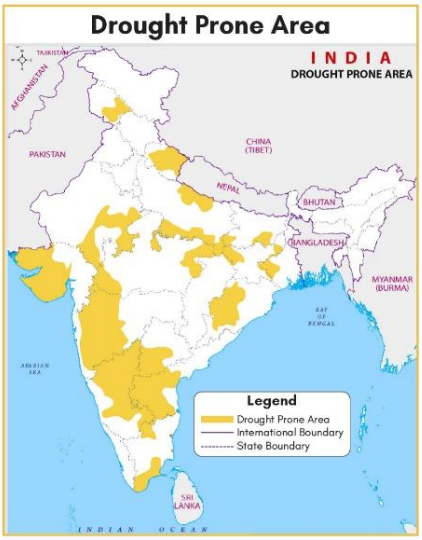
7.6. DROUGHTS

DROUGHT MANAGEMENT IN INDIA AT A GLANCE

Drought is characterized by a lack of precipitation such as rain, snow, or sleet, for a protracted period of time, resulting in a water shortage.

Extent of drought in India

- **16% of the India's total area is drought prone.**
- Over **68% of sown area is subject to drought in** varying degrees.
- Nearly **2/3rds of the India suffered** drought during 2020-2022.
- Severe droughts are estimated to have reduced **India's gross domestic product by 2-5 per cent** from 1998-2017.



Causes of recurring drought in India

- **Concentrated and Uneven distribution rainfall in relatively short window of the South-West Monsoon season.**
- **Over-exploitation of ground water and sub-optimum conservation of surface water.**
- **Limited irrigation coverage, prevalence of rainfed agriculture and poor irrigation techniques.**
- **Climate change.**

Schemes/Policies/Initiatives

- **Integrated Watershed Management Programme (IWMP)** to develop rainfed/degraded areas and wastelands.
- **National water policy 2012** emphasises on preparedness for flood / drought.
- **Desertification and Land Degradation Atlas** of India by ISRO.
- **Jal Jeevan Mission** aims at providing potable water in adequate quantity and prescribed quality.
- **NDMA Guidelines on Drought Management with components like-** Institutional framework and financial arrangements, Assessment and Early Warning, Prevention, Preparedness and Mitigation, Capacity Development, Relief and Response, Preparation of Drought Management Plans (DMP) etc.

Constraints in drought management

- **Reactive and relief centric approach** and **limited focus on mitigation, adaptation and preparedness.**
- **Issues in Assessment and Early Warning** like communication gaps, late forecasts, conflicting information, low accuracy, etc.
- **Lack of accurate and reliable data on water, climate parameters etc.**
- **Lack of proper planning, coordination** between different functioning units and implementation at the ground level.

Way Forward

- **Adoption of integrated management** emphasizing on prevention, mitigation and preparedness and adaptation strategies.
- **Adopt an approach of co-development** of drought early warning and climate risk management approaches, tools and guidance.
- **Focus on proper communication of climate information.**
- **Popularise adaptation strategies** like crop diversification, micro irrigation etc.
- Improve coordination enabled by **capacity building at local level.**

7.7. HEATWAVES

Why in News?

India Meteorological Department (IMD) started issuing heat index for different parts of the country, based on the air temperature and relative humidity.

IMD CRITERIA FOR DESCRIBING HEATWAVES

When maximum temperature reaches **40°C** in plains and at least **30°C in 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 > **4°C or more.**

Based on Actual Maximum Temperature

Heat Wave: When actual maximum temperature ≥ **45°C.**

Severe Heat Wave: When actual maximum temperature ≥ **47°C.**

Criteria for describing Heat Wave for coastal stations

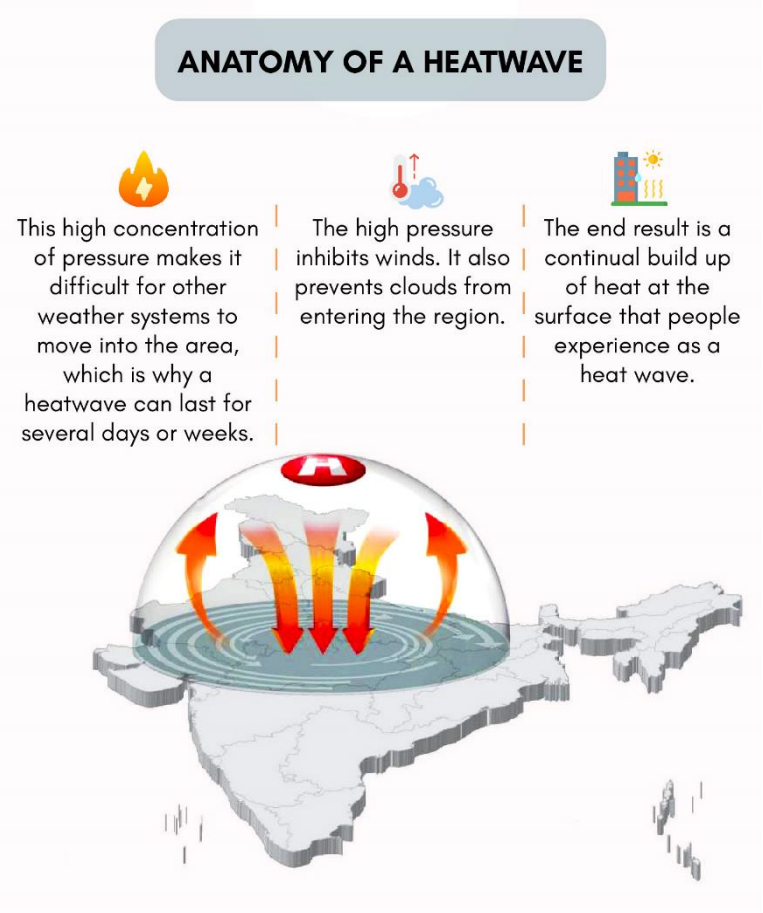
When maximum temperature departure is **4.5°C or more** from normal, Heat Wave may be described provided actual maximum temperature is **37°C or more.**

About Heatwaves

- A **period of abnormally high temperatures, more than the normal maximum temperature that occurs during the summer season** in the North-Western parts of India.
- Typically **occur between March and June,** and in some rare cases even extend till July.
- One **of the Natural hazards under National Disaster Management Act, 2005** (others are: Floods, Urban flooding, Landslide, Heat Wave, Tsunami, Cyclone, Earthquake).
- **Favourable conditions for Heat wave**
  - **Transportation / Prevalence of hot dry air over a region**.
  - **Absence of moisture in the upper atmosphere** which restricts the temperature rise.
  - **Cloudless sky** which allows maximum insolation over the region.
  - **Large amplitude anti-cyclonic flow over the area:** During an anti-cyclone, air pressure is high on the surface, causing the air above it to come down. This air warms up as it comes down on account of high pressure.

Reasons for intense and prolonged heatwaves in 2022

- **Weak western disturbances** which bring rainfall and cloudy skies to northwest India and regulate temperatures.
- **Anticyclones** led to hot, dry weather over parts of western India in March.
- Impact of heatwave was **more pronounced in cities due to Urban heat islands (UHI)** effect.
  - UHI occur when cities replace the natural land cover with dense concentrations of pavement, buildings, and other surfaces that absorb and retain heat.
- **Climate Change** has led to extremes of hot weather and heatwaves becoming more frequent and more intense.



Impacts of Heatwaves

- **Heat-related illness** like Dehydration, heat cramps, heat exhaustion, heat stroke and in serious cases death; etc.

- **Ecosystem damage** like accelerated melting of glaciers; impact on biodiversity; deterioration in air quality; drying up of shallow aquatic ecosystems etc.
- **Impact on Agriculture** like Drought conditions and decrease in crop yield; adverse health impact on livestock due to heat stress; etc.
- **Economy impact** like Lost wages due to **diminished working hours; drastic increase in energy demand; food price volatility**; etc.
- **Social impact** like Higher exposure and vulnerability of certain sections like street vendors, construction and farm workers, etc.

Steps taken to tackle heatwaves in India

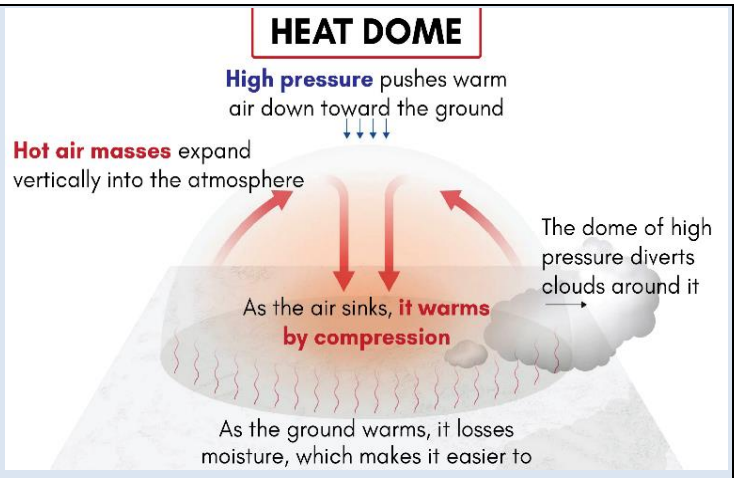
- India Meteorological Department (IMD) and the National Disaster Management Authority (NDMA) are working with **23 Heat wave prone states** identified in **2019 to develop HAPs.**
- **IMD issues colour code impact-based heat warning** jointly with NDMA with suggested actions classified under 4 colors-
  - **Green Alert**- No action
  - **Yellow and Orange Alerts**- Preparatory actions.
  - **Red Alert**- Action for Severe heatwaves.
- Telangana launched **Cool Roof policy** to reduce the impact of heat on building.
- **Indian Agricultural Research Institute (IARI) developed InfoCrop simulation model** to forecast heatwave impact on farm yield in real time.
- IMD, in addition to giving out day's maximum and minimum temperatures, **will soon issue a HI- a reading that gives estimation of what temperature actually feels like.**
- **India Cooling Action Plan (ICAP) launched in 2019,** aims to provide **sustainable cooling measures across various sectors** like indoor cooling in buildings, etc.

Way Forward

- **Establishing Heat Action Plans (HAPs) in every city** to protect communities and save lives from extreme heat with elements like- **Community outreach** to build Public Awareness, **Early warning Systems** to alert residents and inter-agency coordination, **Capacity building** among healthcare professionals, etc.
- **Retrofitting of infrastructure with cool roof technologies** to keep indoor temperatures lower and can help decrease the dependence on air conditioners.
- **Increasing the amount of and access to green space and other cool environ**ments (pools, air-conditioned spaces) in **urban design.**
- **Mitigate climate chang**e by reducing greenhouse gas emissions (GHG) and minimize the rise in global mean temperatures.
- **Heatwave mitigation in agriculture**: Opting for the **right crop varieties, bathing animals, and adopting the mulching** technique (e.g., Plastic Mulching); **Timely sowing and adoption of heat-tolerant** wheat crop varieties etc.

Related Concept: Heat domes

- **Heat-spewing anticyclone over North-West India** has led to **unusual heat in February.**
  - India Meteorological Department (IMD) predicts that it is likely to **recede from land and back off into Central Arabian Sea** soon, making way for **moisture-laden western disturbance** and **associated cloud cover** with **rain or snow in Western Himalayas** and adjoining plains.
- Heat dome is a **high-pressure circulation in atmosphere** which acts like a dome or cap, trapping heat at surface and favoring heatwave formation.
  - It occurs when **hot ocean air** is **trapped over a large area.**



- Typically, **heat domes are tied to the pattern of jet stream** (fast winds high in atmosphere that generally runs **west to east**).
  - Normally, **jet stream has a wavelike pattern**, meandering north and then south and then north again.
  - When these meanders in jet stream become bigger, they move slower and can become stationary and resulting into heat domes.
  - **Hot air typically rises into atmosphere**, but dome's lid causes air to sink. As air sinks, it **compresses and becomes warmer** that causes temperature in dome to rise continually.
- **Impact of heat dome:** Affects sessional agricultural products; Increased risk of wildfire, heat-related illnesses such as heat rash, heat stroke, heat exhaustion etc.

7.8. FOREST FIRES/WILDFIRES

WILD FIRES/FOREST FIRES AT A GLANCE

- Wildfire is an **unusual or extraordinary free-burning vegetation** fire that may be started maliciously, accidently, or through natural means.
- **Occurrence in India:** Most commonly reported **during March and April.**

Causes

- **Natural-** Lightning, friction of rolling stones, volcanic eruptions, etc.
- **Anthropogenic-** slash and burn cultivation, accidental fires from campfires, etc.

Significance of controlled and Forest fire

- **Natural forest development** and regeneration.
- Reduced **risk of a forest fire.**
- Increasing forage, habitat opportunities etc.

India's Vulnerability

- **More than 36% of the India's forest cover is prone to frequent forest fires.**
- **6% is 'very highly'** fire-prone, and almost 4% is 'extremely' prone. (India State of Forest Report (ISFR) 2021)

Recent examples

- Rajasthan' Sariska Tiger Reserve, Madhya Pradesh's Ladkui jungles etc. (2022), Odisha's Similipal Tiger Reserve (2021) etc.

Impact of Wildfires/forest fire

- **On Ecosystem:** Changes in species mix, habitat structure, loss in forest cover etc.
- **On Environment: Changes in microclimate,** release of vast quantities of CO_2, increased soil erosion, changed soil composition, etc.
- **Socio-Economic impacts:** Threatens livelihood of people who are directly/indirectly dependent on forest ecosystems etc.

Schemes/Policies/Initiatives

- **National Action Plan on Forest Fires (NAPFF),** 2018 and Centrally Sponsored **Forest Fire Prevention and Management Scheme**
- **Initiatives by Forest Survey of India (FSI): Near Real-Time Forest Fire Monitoring and issuing alert, Large** Forest **Fire Monitoring using SNPP-VIIRS sensor, Early Warning** Alert based on **Forest Fire Danger Rating System and FSI Van Agni Geo-portal.**

Constraints

- **Absence of proper institutional mechanisms** for tackling forest fires **within the forest department.**
- **Lack of holistic approach with main focus on the response and less importance to other aspects** i.e., mitigation, preparedness, awareness creation etc.
- **No provision for separate budget and insufficient financial Allocation under Central Schemes.**
- **Inadequate capacity and training** of forest departments officials for forest fire management.
- **Extreme gaps in knowledge sharing and its use due to lack of coordination.**

Way Forward

- **Recognize and respond to the impact of climate change.**
- **Dedicated institutional mechanism** within Forest Department covering **all aspects** of Forest fire management.
- **Develop and update forest fire manuals.**
- **Empower communities and local authorities and integrate indigenous, traditional,** and contemporary fire management practices into policy.
- **Enact appropriate legal framework** at national and state level.
- **Adequate preventive and preparedness measures** such as clearing fire lines, removing the fuel (dead wood, leaves etc.), etc.
- **Recognise forest fires as a disaster type.**

7.9. OTHER DISASTERS IN NEWS

<table>
<tr><th>Disaster</th><th>Details</th></tr>
<tr><td>Chemical Disaster</td><td>

Several agencies including National Disaster Response Force (NDRF), DRDO, and health ministry are drafting a mechanism to deal with chemical accidents.
India produces and stores more than 3,000 hazardous chemicals.
SOPs for chemical disasters is a mandatory requirement as per International Health Regulation (IHR) to which India is a signatory.
IHR (adopted by World Health Assembly in 2005) requires countries to build capability to detect and report potential public health emergencies.
Frequency and severity of chemical disasters has increased due to rapid development of chemical and petrochemical industries and increase in size of plants, storage and carriers, specifically in densely populated areas.
Issues and gaps in dealing with chemical disasters

Lack of coordination and communication: Multiple agencies work independently.
Unavailability of information: Lack of robust inventory of all chemicals used in industrial processes in India.
Presence of factories in unorganized sector dealing with hazardous materials
Lack of infrastructure and support

Provisions to deal with Chemical disasters in India

Doctrine of absolute liability propounded in M.C. Mehta v. UOI (Oleum Gas leak case), 1986.
✓ Under this, enterprises engaged in hazardous activities shall be liable for compensation.
Environment Relief Fund to provide immediate relief to victims.
Under Environment Protection Act, 1987, Centre has notified Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 and Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 for regulating hazardous substances.
NDMA Guidelines on Chemical Disasters (Industrial)

</td></tr>
<tr><td>Cold Waves</td><td>

Cold wave, sometimes known as a cold snap or deep freeze, is a weather event involving a cooling of the air, or the invasion of very cold air, over a large area.
Criteria used to determine cold wave

<table>
<tr><td>For Hill stations</td><td>When the minimum temperature is less than or equal to 0°C and the minimum temperature is 4.5 °C to 6.4 °C below the normal.</td></tr>
<tr><td>In plains</td><td>• When the minimum temperature is equal to or less than 10°C and -
○ Temperature is 4.5°C to 6.4 °C below the normal temperature for that period or when the minimum temperature is less than or equal to 4 °C.</td></tr>
<tr><td>For coastal areas</td><td>When minimum temperature departure is less than or equal to 4.5 °C below normal and actual minimum temperature is less than 15 °C.</td></tr>
</table>

Weather Situation behind Cold Wave in India

Build up of a ridge (an extended area of relatively high atmospheric pressure) in the jet stream over northwest Asia.
Formation of surface high-pressure centre over north and Central India.
Movement of cold air masses in response to steering by upper-level winds.
Extensive snow covers over Northwest Himalayas.
Triggering mechanism like strong westerly waves approaching northwest India to enhance winds for transport cold air southeastward.
Studies highlight that cold waves are favoured by La-Nina over most parts of India as compared to El-Nino with cold waves confined to northwest India.

Government has notified 'cold wave' as a disaster and National Disaster Management Authority (NDMA) in 2021 issued guidelines and action plans on cold wave.
Key Strategy of action plan includes- Identification of cold wave risk and vulnerability assessment; Establish qualitative early warning, forecasting and alerts dissemination etc.
Also, in consultation with the NDMA, IMD has developed a colour coded alert for warning dissemination.

</td></tr>
<tr><td>Atmospheric River Storm</td><td>

A powerful storm is heading towards California, threatening the state with flooding, landslides, high winds and power outages.
About Storm

Atmospheric rivers are long, narrow regions in the atmosphere like rivers in the sky that transport most of the water vapour outside of the tropical region to higher latitudes.
When the atmospheric rivers make landfall, they often release this water vapour in the form of rain or snow.

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	• Most **Atmospheric River** are weak systems but larger **Atmospheric River** can create **extreme rainfall and floods**, causing catastrophic damages.

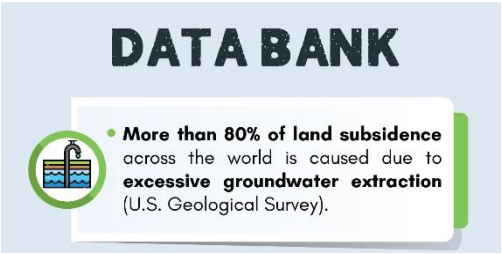
Volcanic Eruption	• Volcanic eruption on Tonga Islands in the South Pacific Ocean triggered massive 'Equatorial Plasma Bubble'.
	  ○ **Plasma bubbles** are regions with a **much lower density** of the charged particles called plasma than are generally found in the upper atmosphere.
	  ○ These bubbles usually form when various types of waves in the atmosphere destabilize the lower edge of the ionosphere.
	• **Different types of volcanic eruptive events:** Pyroclastic explosions, with is fast-moving hot gas and volcanic matter; Hot ash releases; Lava flows; Gas emissions; Glowing avalanches, when gas and ashes release.
	• **Other Major Volcanic eruption in recent times:** Mauna Loa (Hawaii, 2022), Mount Semeru (Indonesia, 2021) etc.
	• **Other Impacts of Volcanic Eruption**:
	  ○ **Health:** Acute and chronic respiratory diseases, burns and traumatic injuries etc.
	  ○ **Environment**: Concentration of sulfur dioxide (SO_2), ash, and other aerosols.
	  ✓ Also, aerosols reflect sunlight back into space, leading to a cooling effect on the Earth's surface.
	  ○ **Triggers other disasters**: Volcanic ash can also **mix with water** and create **lahars**, which are **fast-moving mudflows** that can pose a **significant hazard** to nearby communities.
	  ○ **Agricultural and Economic**: Has detrimental effects on agriculture, infrastructure, and other economic activities.
	  ○ **Largescale displacement** of people.
	• **Measures to Mitigate Impacts**: Monitoring with the help of seismometers, gas sensors, satellite monitoring, ground deformation measurements, and thermal imaging.
	  ○ **Efficient Response system and** expertise in **evacuation**.
	  ○ **Effective rehabilitation.**
	  ○ **Capacity building of people**.

8. GEOGRAPHY

8.1. JOSHIMATH LAND SUBSIDENCE

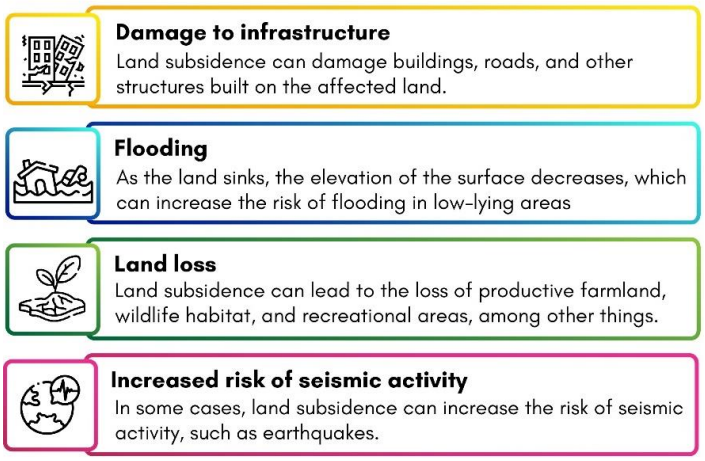
Why in news?

Uttarakhand's Joshimath has been declared as a landslide and subsidence-hit zone.



About Land subsidence

- A **gradual settling or sudden sinking** of Earth's surface due to **removal or displacement of subsurface** earth materials.
- **Causes:**
  - **Removal of water, oil, natural gas, or mineral resources** out of the ground by pumping, **fracking, or mining** activities.
  - **Natural events** such as earthquakes, soil compaction, erosion and sinkhole formation.



Causes of land subsidence in Joshimath

- **Location and topography:**
  Situated in **middle slopes** of a hill bounded by:
  - ✓ **Karmanasa and Dhaknala streams** on west and east and
  - ✓ **Dhauliganga and Alaknanda rivers** on south and north.
  - **Area around town is covered with thick layer of overburden material** which makes it **highly vulnerable** to sinking.
  - Snow in upper reaches, and highly weathered rocks with low cohesive characteristics makes it **prone to landslides.**
- **Geology:**
  - **Situated on a fault line (Vaikrita Thurst)** and is close to another two (**Main Central Thrust and Pandukeshwar Thrust**) which makes it highly vulnerable to sinking because of **tectonic activity.**
  - Has been built on an **ancient landslide material** i.e rests on a **deposit of sand and stone**, not rock, which doesn't have **high load-bearing capacity**.
- **Unplanned construction (blocking of the natural flow of water, which eventually results in frequent landslides).**
- **Due to improper water drainage**, natural and anthropogenic liquid waste seeps into the ground and weakens the land.
- **Climate change acts a force-multiplier**.

Measures taken to prevent land subsidence in India

- Central Ground Water Authority (CGWA) has been regulating groundwater extraction in over-exploited and critical areas to prevent land subsidence.
  - Indian Institute of Remote Sensing recently signed an MoU with the Central Groundwater Board **to study the effect of land subsidence in northern India.**
- **Remote Sensing and GIS** technologies are used **to monitor land subsidence over time and to identify vulnerable areas.**
- **Monitoring and regulation of large infrastructure projects**

Mahesh Chandra Mishra committee (1976)

- Was appointed for **reconnaissance of the land subsidence near the Himalayan border.**
- Report stated that Joshimath was **situated on an old landslide zone**, and it does not have high load bearing capacity.
  - Joshimath could sink if development **continued unabated.**
- **Recommendation**
  - **Restrictions on heavy construction work**, agriculture on slopes, felling of trees.
  - **Construction of pucca drainage** to stop seepage of rainwater, proper sewage system, and cement blocks on riverbanks to prevent erosion.

- Other factors
  - **NTPC's Tapovan Vishnugad Hydro Power Project**
  - **Increasing population and tourism** in Joshimath

Way Forward

- **Ban on construction activities such as** hydroelectric projects in the area.
- **Detailed investigation of** geotechnical **and geophysical investigation** of the area to determine its **carrying capacity.**
- **Revise town planning by adopting** a risk **sensitive urban development plan.**
- **Replantation in region** to **retain soil capacity.**

8.2. LAND DEGARADATION

LAND DEGRADATION IN INDIA AT A GLANCE

- Defined as a **negative trend in land condition,** caused by direct or indirect human-induced processes including anthropogenic climate change, expressed as long-term reduction or loss of at least one of the following: biological productivity, ecological integrity, or value to humans.

IMPACTS

- **Threatened food and water security.**
- **Adverse impact on livelihoods of indigenous populations, small farmers** etc.
- **Exacerbation of migration** and existing societal tensions.
- **Creates ground for zoonotic, water and food-borne diseases.**
- **Drives climate change** through increased GHG emission from degraded lands like permafrost, peatlands etc. and reduced ability of land to act as a carbon sink.

KEY TARGETS

- **Land Degradation Neutrality** (LDN) Target under UNCCD: **Restoration of 26 Million ha of degraded land by 2030.**

CURRENT SITUATION

- **Area that underwent land degradation during 2018-19: ~30%** (97.85 million ha) of the Total Geographic Area of India. (Desertification and Land Degradation Atlas of India)
- States like **Jharkhand, Rajasthan, Delhi, Gujarat, and Goa have more than 50%** of their area under desertification/land degradation.
- **Area currently under restoration:** 9,810,940 ha.

SCHEMES/POLICIES/INITIATIVES

- **Signatory to United Nations Convention to Combat Desertification (UNCCD).**
- Part of **Bonn Challenge** with global goal to bring 350 million of degraded and deforested landscapes into restoration by 2030.
- MoEFCC launched **National REDD+ Strategy in 2018.**
- **Green Highways** Policy, 2015, Compensatory Afforestation Fund Act, 2016.
- **Forest conservation:** National Afforestation Programme (NAP), National Mission for a Green India (GIM), Forest Fire Prevention & Management Scheme (FFPM), etc.
- **Sustainable land management practices in agriculture:** Soil Health Card Scheme, Pradhan Mantri Krishi Sinchayee Yojna (PKSY), Paramparagat Krishi Vikas Yojana etc.

CONSTRAINTS

- **Rapid land use change for developmental activities** like housing, hydroelectricity projects, mining etc.
- **Illegal logging and encroachment** of land and **unregulated livestock** grazing and fodder collection.
- **Limited knowledge and High capital cost** of restoration programmes.
- **Low resource** (water, fertilizers, pesticides etc.) **use efficiency** in agriculture.

WAY FORWARD

- **Utilizing Local and indigenous knowledge** for addressing land degradation.
- **Land reclamation programmes based** on afforestation and ecosystem restoration.
- **Promoting restorative agronomic practices** like natural farming, agroforestry etc.
- **Building a cadre of trained land management officials and local community members.**

8.2.1. SOIL DEGRADATION

SOIL DEGRADATION AT A GLANCE

Soil

- **Loose surface material** that covers most land consisting of inorganic particles and organic matter.
- Generating a **few centimeters of top soil takes about 1,000 years.**

Types of Soil degradation

- **Soil erosion** due to deforestation
- **Nutrient Imbalance** due to use of fertilizers
- **Salinity and alkalinity**
- **Compaction** due to use of heavy machineries, construction of buildings etc.
- **Pollution and waste disposal**
- **Soil sealing** (soil covered by an impenetrable material such as roads, pavements etc.) due to urban expansion.
- **Loss of Organic carbon**

Current Situation

- Over last 150 years, **50% of planet's** topsoil has **been lost via erosion.**
- Over **6.74 million hectares** of lands in India is estimated to be **salt affected.**
- About **11 mha of arable land** in India suffers from acute soil acidity (pH < 5.5).
- **World's cultivated soils have lost up to 75% of their original carbon stock.**

Significance of conserving soil

- **Supports Agriculture and Forestry**
- **Highly efficient carbon sinks: After oceans,** world's soils are the second largest carbon pool on Earth.
- **Supports biodiversity:** Plays host to some **25% of our planet's biodiversity.**
- Contribute to **water, nutrient and nitrogen cycling.**
- Stores water and plays role in **preventing flooding** under extreme weather conditions.
- **Used as a primary building material for man-made structures.**
- Foundation of **basic ecosystem functions** and helps **regulate Earth's temperature.**

SCHEMES/POLICIES/INITIATIVES

INDIA

- **Soil Health Card (SHC)** promotes balanced and integrated use of fertilizers.
- **Soil Health Management (SHM)** component of National Mission for Sustainable Agriculture.
- **Commitment to achieve Land Degradation Neutrality** and restoration of 26 million hectares of degraded land by 2030.
- **Promotion of organic farming** through Paramparagat Krishi Vikas Yojana (PKVY) etc.

GLOBAL

- **UNCCD Land Degradation Neutrality (LDN)** with aim to **counterbalances the expected loss** of productive land with the recovery of degraded areas.
- **Global Soil Biodiversity Initiative (GSBI):** Forum to address the **loss and maintenance of soil biodiversity.**
- **Global Soil Partnership (GSP): Hosted by** FAO, its mission is to **position soils in the Global Agenda** and to promote sustainable soil management.
- **"4 per 1000" Initiative** to increase soil organic matter content and carbon sequestration.

CONSEQUENCES OF SOIL DEGRADATION

- Food and nutrition insecurity
- Water scarcity
- Rapid climate change
- Poverty and social insecurity
- Migration
- Reduction of ecosystem services

Way Forward

- **Regulate soil pollution** in line with international agreements/standards like: **Stockholm Convention** (Persistent Organic Pollutant); **and Basel Convention** (Transboundary Movements of Hazardous Wastes and their Disposal) etc.
- **Promote afforestation:** India's forest policy has a target of forest and tree cover for over 33% of the total geographical area.
- **Improving awareness and communication.**
- **Adopt Sustainable farming practices** like Conservation tillage, organic farming etc.
- **Farmscaping (whole-farm, ecological approach)** which includes methods like use of insectary plants to support beneficial organisms such as insects, spiders, amphibians etc. that parasitize or prey on insect pests.

8.2.2. SOIL ORGANIC CARBON

SOIL ORGANIC CARBON (SOC) AT A GLANCE

- A **measurable component of soil organic matter.**
  - **Organic matter contributes to nutrient retention and turnover, soil structure, moisture** retention and availability, degradation of pollutants, and carbon sequestration.
- Hotspots such as **peatlands, permafrost and grasslands contain the highest amount of soil organic carbon.**

Benefits of SOC

- **Carbon sequestration:** After oceans, soils are the second largest carbon pool on Earth and large amount of carbon is currently stored in soil organic matter.
- **Inclusion of SOC targets in national climate policies** can improve transparency and accountability in soil management practices.
- **Improves fertility of soil and crucial for food production:** Organic matter contributes to nutrient retention and turnover, soil structure, moisture retention etc.
- **Improve the soil's water holding capacity,** leading to better water retention, preventing flooding.
- Soils with high carbon content are **better able to filter and purify water.**

Constraints

- **Decreasing SOC** due to **Anthropogenic stresses** like intensive agriculture practices, overgrazing etc. combined with climatic conditions.
- **Farmers of developing and least developed countries (LDC) have low incentives** to improve management practices.
- **12 million hectares of land are lost** every year to desertification and drought alone (UNCCD).
- **Lack of proper mechanism for accurately monitoring SOC stocks,** thus SOCS are not being included in National Determined Contributions (NDCs).

Way Forward

- **Improve soil fertility for better SOC** by applying gypsum and lime etc.
- Good rotational grazing strategy with **Multi-species perennial pasture blends.**
- **Promotes dynamic nutrient management** strategy to improve carbon sequestering capacity of soil.
- **Undertaking restoration of** degraded farmland.
- **Promoting specific plants:** Plants linked with fruiting, or mushroom-type, fungi stored 70 percent more carbon per unit of nitrogen in soil.

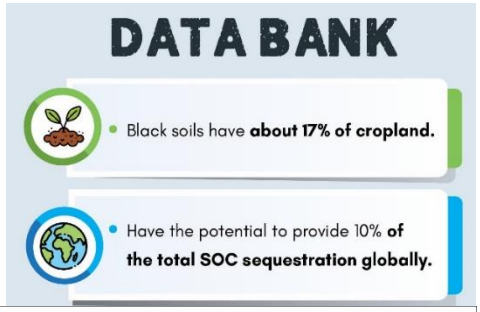
8.2.2.1. BLACK SOILS

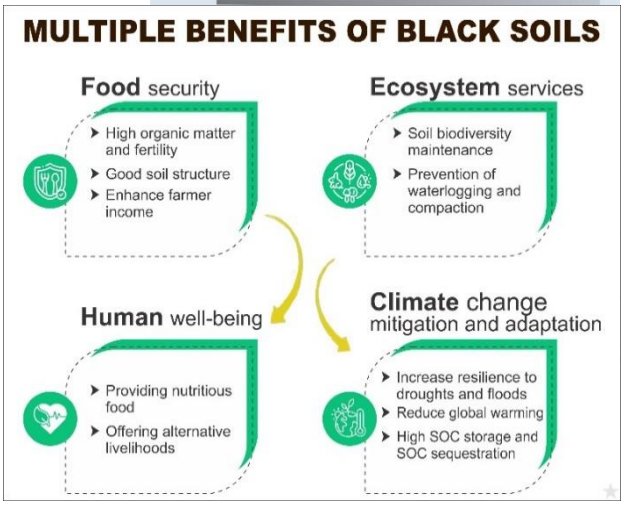
Why in news?

Recently a report titled 'Global Status of Black Soil' was published by the Food and Agricultural Organization.

About Black Soils

- Black soils are **mineral soils which have a black surface horizon, enriched with organic carbon that is at least 25 cm deep.**
  - Black colour is a result of accumulation of organic matter originating from numerous dying roots of gramineous vegetation **in a process known as melanization.**
- **Status of Black soils:** Constitute 5.6% of global soils but contain 8.2% of the world's soil organic carbon (SOC) stocks.
  - In India it is spread mostly across interior **Gujarat, Maharashtra, Karnataka, and Madhya Pradesh** on the Deccan lava plateau and the Malwa Plateau.





- **Threats to Black soil**
  - **Loss of organic matter** through both conversion of natural landscapes to agriculture and by continuing mismanagement of cultivated black soils.
  - In drier climates in these soils are naturally susceptible to **high rates of wind erosion.**
- **Solutions suggested**
  - **Preservation of the natural vegetation cover on black soils** under grassland, forest and wetland vegetation.
  - **Adoption of sustainable soil management approaches** on cropped black soils.

8.3. LARGE DAMS IN INDIA

Why in news?

A new study by United Nations highlighted that **around 3,700 dams** in India will lose **26% per cent of their total storage by 2050** due to accumulation of sediments.

About Large Dams

- Dams with **maximum height of more than 15 meter** from its deepest foundation to the crest.
- A dam between 10 and 15 meter in height is also included in this category conditionally.
- **India's Status:** 3rd largest number of large dams (5,334) after China and USA.
  - **Maharashtra has highest number** of large dams followed by Madhya Pradesh and Gujarat.
- **Examples of Large dams in India:** Sardar Sarovar Gujarat Dam on Narmada river in Gujarat, Tehri Dam on Bhagirathi river in Uttarakhand
- **Dams of National importance:** Dams with height 100 metre and above or gross storage capacity of 1 billion cubic metre and above.
- **Benefits of Large Dams:** Hydro power generation; Water for drinking and industrial use; Recreational use of reservoirs; Irrigation; Inland navigation; Flood control etc.

Issues associated with large dams

- **Structural issues** like ageing large dams; **sedimentation** reducing the water storage capacity of the reservoir and affecting the dam's structural integrity; **construction in seismically active areas,** vulnerable to earthquakes.
- **Creates Environmental** issues such as **loss of wildlife habitats, alteration of river ecosystems, and changes in the hydrology of the area, GHG emission etc.**
- **Social and Cultural Impacts: Large scale displacement** and **cultural loss,** including the loss of sacred sites, the disruption of cultural traditions, and the destruction of historical sites.
- **Interstate Water disputes**, e.g., **dispute among Punjab, Haryana, and Rajasthan** regarding the allocation of water from the **Bhakra Nangal dam**.
- **Other issues:**
  - Expensive to build and **lack of funds** for repair and maintenance.
  - **Increases in water sourced illnesses** like typhus, typhoid fever, etc.
  - **Lack of information** particularly with regard to **utilisable surface water (USW), and ultimate gross irrigation potential (UGIP) etc.**

Initiatives taken for large dams in India

- **Dam Safety Act, 2021** provides for **surveillance, inspection, operation and maintenance** of the specified dams and **institutional mechanism**.
- **Central Water Commission (CWC)** compiles and maintains **nation-wide register of Large Dams** i.e. National Register of Large Dams (NRLD).
- **Dam Rehabilitation and Improvement Project (DRIP)** aims to improve **safety and operational performance** of selected existing dams.

- **Web-based asset management tools** named **Dam Health and Rehabilitation Monitoring Application (DHARMA) and Seismic Hazard Analysis Information System (SHAISYS).**
- **Guidelines for Safety Inspection of Dams.**

Key provisions of Dam Safety Act, 2021

- **Setting up of 2 National bodies:**
  - **National Committee on Dam Safety** to **formulate policies and recommend regulations** regarding dam safety standard.
  - **National Dam Safety Authority** to **implements policies of the National Committee,** and resolves matters between State Dam Safety Organizations (SDSOs), or between a SDSO and any dam owners.
- **Two state bodies:** State Committee on Dam Safety, and State Dam Safety Organisation.
- Drawing up of **emergency action plans and comprehensive dam safety reviews** by an independent panel of experts.
- **Regular inspection and hazard classification of dams.**
- **Emergency flood warning system** to address the safety concerns of downstream inhabitants.

Way Forward

- World Commission on Dams lists **seven steps as a remedy** to issues arising from dams (see infographics).
- **Decommissioning of large dams.**
- **Integrated water management** considering hydrological units involving **allied disciplines** such as soil management, land use, etc.
- **Using advanced technology for collecting information** such as **remotely operated underwater vehicles** (ROVs) and drones for upstream underwater inspection of dam body and reservoir floor.
- **Assessing the alternatives to large dams such as** building medium or minor irrigation based **small storage structures.**

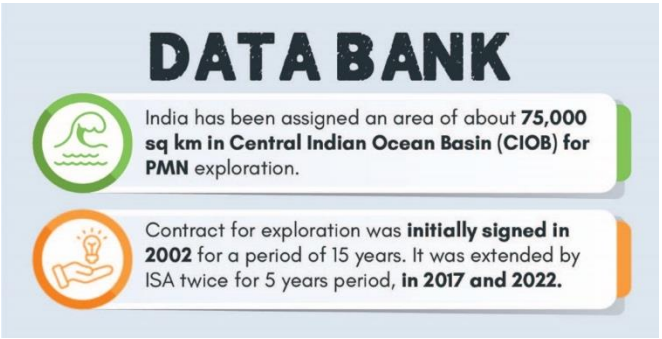
8.4. SAMUDRAYAAN MISSION

Why in news?

Union ministry of earth sciences (MoES) shared details of **Samudrayaan Mission.**

About Samudrayaan Mission

- Aimed to develop a self-propelled **manned submersible (MATSYA 6000)** to carry three human beings to a water depth of 6,000 meters for **deep ocean exploration.**
  - It has developed 6000m depth rated **Remotely Operated Vehicle (ROV)** and various other underwater instruments such as **Autonomous Coring System (ACS),** Autonomous Underwater Vehicle (AUV) and Deep-Sea Mining System (DSM) for the exploration of deep sea.



About Deep Ocean Mission

- Aims to **explore Deep Ocean** for resources and develop **deep sea technologies** for sustainable use of ocean resources.
  - The part of the ocean that lies **below a depth of 200 metres** is defined as the **deep sea.**
  - Considering importance of **oceans on sustainability,** UN declared 2021-2030 as **Decade of Ocean Science** for Sustainable Development.

Major components of Deep Ocean Mission

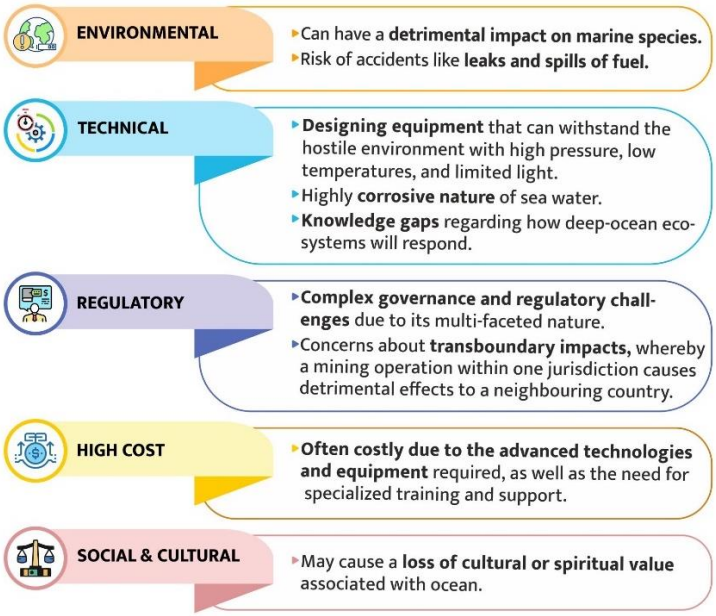
Thematic area and Targeted Blue Economy priority area	Details
Technologies for Deep Sea Mining, and Manned Submersible for Exploring and harnessing of **deep-sea minerals and energy.**	Development of a **manned submersible** and an **Integrated Mining System** for mining Polymetallic Nodules.

Ocean Climate Change Advisory Services for Coastal tourism	Suite of **observations and models** will be developed to understand and provide **future projections of important climate variables** on seasonal to decadal time scales.
Exploration and conservation of deep-sea biodiversity for Marine Fisheries and allied services	Bio- prospecting of deep-sea flora and fauna including microbes and **sustainable utilization of deep-sea bio-resources** will be the main focus.
Deep Ocean Survey and Exploration for Deep-sea exploration of ocean resources.	**Explore** and **identify** potential sites of **multi-metal hydrothermal sulphides mineralization along the Indian Ocean mid-oceanic ridges**.
Energy and freshwater from the Ocean for Off-shore energy development	Studies and detailed engineering design for **offshore Ocean Thermal Energy Conversion (OTEC)** powered desalination plant.
Advanced Marine Station for Ocean Biology for Marine Biology, Blue trade and Blue manufacturing.	Development of **human capacity and enterprise** in ocean biology and engineering.

Significance of Deep Ocean mission

- **Energy and mineral security** by **utilizing** Polymetallic nodules (PMN) reserve available in seabed.
  - India has been allotted a site of **75,000 sq. km**. in Central Indian Ocean Basin (CIOB) by International Sea Bed Authority for **exploitation of PMN.**
  - PMN consists **of metals like copper, nickel, cobalt and manganese etc**. used in electronic devices, batteries, solar panels etc.
- Support to **fisheries and aquaculture, tourism, livelihoods and blue trade w**ill help India in achieving the target of **over Rs. 100 billion "Blue Economy"**.
- **Help in mitigating climate crisis** through-
  - Future **projections or predictions like** trends in **sea level,** cyclone etc.
  - Implementation of **National Biodiversity Targets for deep seas.**
- **Drug discovery and development**: Deep Sea harbours several **novel biomolecules** of industrial and **biomedical** importance.

CONCERNS ASSOCIATED WITH DEEP OCEAN MISSION



Way Forward

- **Establish an international research agenda** to collect and synthesize **high-quality, deep-sea scientific data,** helpful for **decision-making and environmental management**.
- **Regulatory framework f**or stringent **precautionary measures** and **mitigation strategies.**
- **Strengthen legal framework to enforce liability** with regards to **identifying and enforcing liability** for **compensation, clean-up or remediation** must be addressed**.**
- An "**Environmental Compensation Fund**" can be created to fund any **environmental remediation.**

8.5. EARTH'S INNER CORE

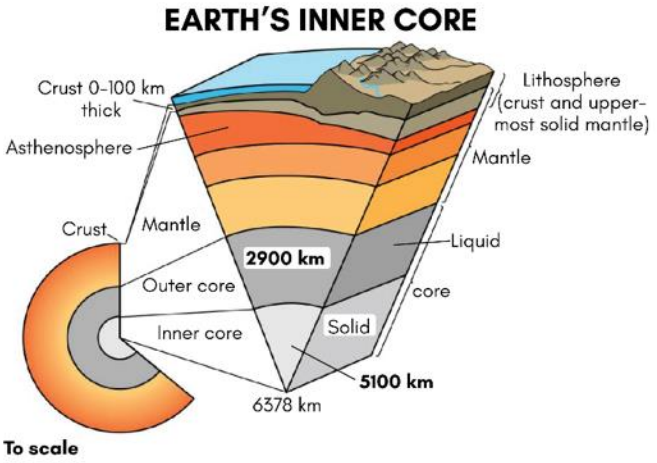
Why in news?

Recently, **Scientists discovered new layer** at Earth's inner core.

More on the news

- Discovered by Australian National University seismologists, **'solid metallic ball'** is deep **inside inner core of Earth,** dubbed as "**innermost inner core**".
  - It is **solid due to high pressure deep within the Earth** that stops iron alloy from melting.
  - It is a **crystallized structure within inner core's innermost region** that is different from outer layer.

- **First hypothesised about 20 years ago,** it was identified through **data gathered from seismic waves caused by earthquakes.**



- So far, **four layers of Earth's structure** have been identified (refer image). This includes:
  - **Crust: Topmost** or **outermost layer** of earth which makes up **1%** of **Earth Volume.** It has two parts - **thinner Oceanic Crust** and **thicker Continental Crust.**
  - **Mantle: Solid/plastic layer of earth** which makes up about **84%** of **Earth Volume.** It is divided in two parts - **Upper Mantle** and **Lower Mantle. Uppermost mantle** and **crust** constitute **lithosphere.**
  - **Outer core: Liquid portion of core,** composed of **80% iron** along with **nickel** and some other **lighter elements.**
  - **Inner core: Solid portion of core,** composed of **Iron and nickel** with presence of heavy elements like **gold, platinum, palladium, silver and tungsten.**
- **Significance of Fifth Layer**
  - **Provide information on past events on Earth** that happened hundreds of millions to billions of years ago.
  - Provide a **new way to probe Earth's inner core** and its centermost region.
  - Inform about **evolution of earth's magnetic field** etc.

8.6. OTHER CONCEPTS IN NEWS

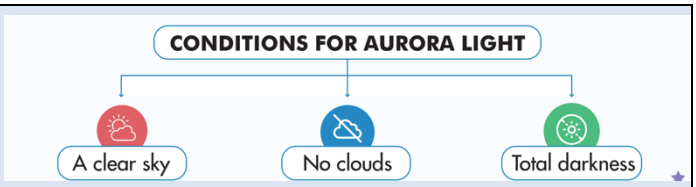
Concept	Details

South Atlantic Anomaly (SAA)	• Actively monitored by US space agency NASA, **SAA** is a strange anomaly in **Earth's magnetic field.**
	• SAA is a giant region of **lower magnetic intensity** in skies above planet, stretching out between **South America** and **southwest Africa.**
	• Arises from two features of Earth's core: The tilt of its magnetic axis, and the flow of molten metals within its outer core.
	• Like a dent in **Earth's magnetic field** or a kind of **pothole in space**, it can affect **orbital spacecraft** when passing directly through SAA.
	  ○ Example, **Causing short-circuit** and **malfunction** in **technological systems onboard satellites** when struck by **high-energy protons** from the Sun.
	  ○ It increases the risk of significant **data loss** and even **permanent damage.**

Global Overturning Circulation (GOC)	• New studies conducted to understand modern form of Global overturning circulation (GOC).
	• GOC is an **Equatorward transport of cold, deep waters** and **poleward transport of warm, near-surface waters.**
	• **Responsible for transport of carbon and heat** among ocean basins and between ocean and atmosphere.
	• GOC is a **system of two connected overturning cells:**
	  ○ **Upper cell** is linked to **formation of North Atlantic Deep Water** (NADW) and its shallower **return flow to form Atlantic Meridional Overturning Circulation** (AMOC).
	  ○ **Lower cell** (referred as Southern Ocean Meridional Overturning Circulation) is associated with **formation of Antarctic Bottom Water** (AABW) and its **return flow as Pacific Deep Water** (PDW).
	• Studies have indicated that **tectonically driven changes in ocean gateways** such as **closure of Central American Seaway** (CAS), since late Miocene period, **had impacted GOC.**
	  ○ CAS is a **body of water** that once **separated North America from South America.**
	• **Now,** National Centre for Polar and Ocean Research **reconstructed Deep Water Circulation record of Indian Ocean** and provided evidence in **support of theory that closure of CAS** led to evolution of **modern form of GOC.**
	• **Indian Ocean does not have any major deep-water formations** of its own. It acts only as **a host for both GOC components.**

Aurora	• The Indian Astronomical Observatory (IAO) in Ladakh successfully documented the **occurrence of a rare Aurora phenomenon for the very first time.**

- IAO is situated above Mount Saraswati in the **Hanle Valley of Changthang, Ladakh,** at nearly 14,800 feet above sea level.



- Auroras are **geomagnetic storm** which are seen due to an **intense interaction of the sun's plasma waves and the earth's magnetic field.**
  - During a **coronal mass ejection,** billions of charged particles move into space at ultra-high speeds, **some reaching up to 3 million kilometers per hour**. When they arrive in the direction of Earth, they cause a **disturbance in the Earth's magnetic field and enable us to see the aurora lights.**
- The **shape of Earth's magnetic field creates two auroral ovals above the North and South Magnetic Poles.**
  - It is called an **aurora borealis or northern light near the North pole and aurora australis or the southern lights near the South pole.**
- They are **more frequent at higher latitudes** and places like Alaska, Canada, and Antarctica, closer to the Earth's poles.
  - However, Due to a geo-effective coronal mass ejection (CME), the **Northern Lights were observed at unprecedented mid-to-low latitudes across the United States, brightly lit European cities, and even over China and India.**
  - According to reports, this remarkable plunge in auroral activity has not been witnessed since 2015.
- They **occur at any time of the day,** but it **can't be seen with the naked eye unless it's dark.**
- Colors and patterns are from the types of ions or atoms being energized as they collide with the atmosphere and are affected by lines of magnetic force.
  - **Altitude affects the colors.** Blue violet/reds occur below 100 km, with bright green strongest between 100-240 km. Ruby reds appear above 240 km.

APPENDIX

APPENDIX: KEY DATA AND FACTS

CLIMATE CHANGE

Outcomes of UNFCCC COP27

- Finalised the details of **Mitigation work programme.**
- **New funding arrangements** proposed **for Loss and damage.**
- **Glasgow–Sharm el-Sheikh work programme** to develop framework for the global goal on adaptation.
- **Koronivia Joint Work for Agriculture (KJWA) given another four-year lease.**
- **Initiatives launched:** International Drought Resilience Alliance (IDRA), Sustainable Debt Coalition Initiative, Mangrove Alliance for Climate (MAC) etc.

India and COP

- Submitted updated 2030 NDC targets and **Long-Term Low Emission Development Strategy (LT-LEDS)** to the UNFCCC.
- **Updated NDCs:**
  - **45% reduction** in emission intensity from by 2030 from 2005 levels.
  - **50% all electricity to be generated by non-fossil fuel** energy by 2030.
- **Initiatives launched during COP27:** In Our LiFEtime campaign; LeadIT (Leadership for Industry Transition) Summit 2022 etc.

India's GHG emissions

- **Contribution to historical cumulative CO_2 emissions:** 3%
- **Share of global emissions** (2021): 7.5 % (**3rd highest** globally)
- **Per capita carbon emissions:** 1.3 tonnes per person per year in 2021 (**very low** compared to the USA's 4.0 tonnes).
- **India** among the **top 5 methane emitters in world.** (Global Methane Tracker, 2022)

India's Performance on Climate change indicators

- Current climate targets and policies as "**Highly insufficient**," with Paris Agreement's 1.5°C temperature limit (Climate Action Tracker).
- **Progress Towards NDCs:**
  - Achieved **emission reduction of 21% over 2005 levels.** (The Green Shift Report by MoP&NG)
  - Achieved **43% of installed electricity capacity** (April 2023) **from non-fossil fuel sources.** (Ministry of Power)
  - Current run rate of **1.9 to 2.0 GtCO2e in additional carbon sink by 2030.** (The Green Shift Report by MoP&NG)
- **Initiatives:** National Missions for Green Hydrogen, Bioenergy etc., Solar rooftop programme, Perform Achieve and Trade (PAT) scheme, etc.
- **International leadership:** International Solar Alliances (ISA), Coalition for Disaster Resilient Infrastructure (CDRI), Green Grids Initiative-One Sun One World One Grid project, LiFE Mission etc.

Carbon Inequality

- Bottom **50% of households contribute 12% of the global total GHG emissions,** whereas the top 1% emit contribute 17% of the total. (Emission gap report, 2022)

 **Impacts of Climate change on Vulnerable sections**	▶ **On Women:** UN figure estimate that **80%** of people displaced by climate change are women. ▶ **On Children:** Estimated **1 in 7 children** globally exposed to at least 5 major climate change and environmental hazards.
 **Impacts of climate change on Arctic Region**	▶ Heating up **more than 2 times as fast as** the rest of world (**Arctic Amplification).** ▶ 2022 **sea ice extent is well below long-term average.** ▶ **Acidity** levels **increasing 3 to 4 times faster** than ocean water elsewhere.
 **Extreme Weather Events**	▶ **India's Vulnerability: More than 80% of India's population lives in districts** highly vulnerable to **extreme hydro-met disasters** (Environment and Water's Climate Vulnerability Index). ▶ **Examples:** Megadrought in Europe (2022), Heatwaves in India (2022), Floods in Pakistan (2022), Bushfire crisis (Black Summer) in Australia (2019–20) etc.
 **Sea Level Rise**	▶ Sea levels **rose 4.5 mm a year** on average between 2015 & 2022 (highest ever). ▶ **India**, **China**, **Bangladesh**, and **Netherlands** face the **highest threat of sea-level rise** globally. ▶ **Initiatives in India**: Integrated Coastal Zone Management Project (ICZMP), Airborne LIDAR Terrain Mapping (ALTM), etc.
 **Ozone hole and Montreal Protocol**	▶ **Thickness of the ozone layer expected to return** to 1980 values around **2066 in the Antarctic,** and around **2045 in the Arctic region** (Ozone Recovery Assessment Report, 2022). ▶ **Kigali Amendment** to **Montreal Protocol** aims to achieve an 80% reduction in HFCs consumption by 2047.
 **Global GHG emission trends**	▶ **Trends in GHG emissions**: 54% higher in 2019 than they were in 1990, **but growth is slowing.** ▶ Atmospheric levels of the **3 main GHGs** - carbon dioxide, methane and nitrous oxide- all **reached new record highs in 2021.** (Greenhouse Gas Bulletin, 2022) ▶ **Methane emissions**: Current methane concentrations are now 260% of pre-industrial levels. (Global Methane Assessment)

Climate Change Mitigation

- **Emission gap:** Policies currently in place with no additional action are projected to result in **global warming of 2.8°C** over the twenty-first century.
- **Mitigation targets prescribed by IPCC:**
  - **To limit global warming to 1.5°C:** Global GHG emissions peak before 2025, reduced by 43% by 2030 and Reach Global net zero CO_2 emissions in the early 2050s.
  - **To limit global warming to 2°C:** Global GHG emissions peak before 2025, reduced by 27% by 2030 and each Global net zero CO_2 emissions around the early 2070s.

Carbon Market and Trading

- **Market mechanisms under Article 6** of the Paris Agreement: **Internationally Transferred Mitigation Outcomes (ITMO)** under Article 6.2 and **Sustainable Development Mechanism** (**SDM**) under Article 6.4.
- **Mechanisms in India:** Carbon Credits Trading Scheme (CCTS), Renewable Energy Certificate (REC), Energy Saving Certificates (ESCerts) etc.

Climate Finance

- **India's financial needs:** Around **USD 10 trillion** to achieve **net zero by 2070.**
- **Initiatives in India:** National Adaptation Fund for Climate Change (NAFCC), Issuance of Sovereign Green Bonds (SGB), Priority Sector lending to renewable energy projects, etc.

AIR POLLUTION

Air Pollution in India

- **India ranked 8th** in the list of countries with the **worst air quality index.** (IQAir's Annual World Air Quality Report, 2022)
- **Delhi ranked** as the second **most polluted capital city globally.** (IQAir's Annual World Air Quality Report, 2022)
- **Initiatives**: National Air Quality Index (AQI), NAAQS (National Ambient Air Quality Standards), Swachh Vayu Sarvekshan (SVS) etc.

National Clean Air Programme (NCAP)

- **New Target: 40% reduction in particulate matter concentration** in cities covered under it by 2026.
- **Progress**: Only 49 of 131 cities recorded an improvement in air quality in FY 21-22.

WATER

Water Security

- **6%** of India's population **lacks access to safe water**.
- **Initiatives:** Jal Shakti Abhiyaan, National Water Mission, Atal Bhujal Yojana, Jal Jivan Mission, etc.

Ground Water Extraction

- **India is the world's largest user of groundwater**. (UN World Water Development Report 2022)
- **Extent:** Out of the total assessment units surveyed in India in 2022, around **14% have been categorized as 'over-exploited'.**

River Pollution in India

- **Status**: CPCB in 2022 identified **311 polluted river stretches in India**.
- **Initiatives**: National River Conservation Plan, Namami Gange programme, River Cities Alliance (RCA) etc.

Namami Gange

- **Progress**: Out of **374 projects sanctioned under Mission-I, 210 projects** are completed.
- **Rejuvenated 60% of km total river lengths** and 30,000 ha of forests.

SUSTAINABLE DEVELOPMENT

SDG Performance

- **Rank in Sustainable Development Report 2022:** India ranked 121 out of the 163 countries falling from 117 in 2020 and 120 in 2021.
- **Progress**: India is facing major challenges in achieving 11 of 17 Sustainable Development Goals, **while it is on track to achieving SDG 13 on climate action and SDG 12 on Responsible consumption and production.**

Localization of SDG

- **Examples: Bhopal** launched **India's first city-level Voluntary Local Review (VLR)** of SDGs; **Andhra Pradesh's Navaratnalu**, a cluster of nine flagship programmes for vulnerable communities etc.

SDGs and Urbanisation

- Cities are responsible for at least **70%** of total worldwide GHG emissions.
- **Initiatives: SDG India Index Baseline Report** released by NITI Aayog, **Urban Waterbody Information System (UWaIS)** etc.

Sustainable Agriculture	▶ **Emissions from Agriculture sector**: Around **18% of GHG emissions** of India. ▶ **Extent of Natural farming:** More than **10 lakh ha. area is covered**. ▶ **Global position of India in Organic farming:** ○ **1st in** terms of **number of Organic producers.** ○ **4th in terms of certified organic area** globally. ▶ **Initiatives:** National Mission on Natural Farming, Paramparagat Krishi Vikas Yojana (PKVY), National Mission on Oilseeds and Oil Palm (NMOOP), etc.
Urban agriculture	▶ Urban and peri-urban areas worldwide are estimated to have **produced between 15 % to 20 % of all food.**
Sustainable lifestyles	▶ **Potential:** If **1 out of 8 billion people** worldwide adopt **environment-friendly behaviours** in their daily lives, global carbon emissions could drop up to **20%**. (UNEP)
Mission LiFE (Lifestyle for Environment)	▶ **Three Phases:** Change in demand, supply and policy. ▶ Within India, at least **80% of all villages** and **urban local bodies** aimed to become **environment-friendly** by **2028**.
Circular Economy (CE)	▶ **Status:** Only **7.2% of the global economy is circular** with a declining trend. (Circularity Gap Report 2023) ▶ **Expected benefit for India**: Creation of **additional value amounting to 30% of India's current GDP** and **44% reduction in GHG emissions** in 2050. (Ellen McArthur Foundation).
Plastic Waste	▶ **Trend: Per capita plastic waste generation** in India has **doubled** from 2017-2022. ▶ **Recycling**: Only **30% of** plastic waste is **recycled**. (Plastics: The Potential and Possibilities report 2023) ▶ **Progress: 2.26 million tonnes of plastic** packaging **covered under EPR** for year **2022-23.** ▶ **Initiatives:** Extended producer responsibility (EPR) and single use plastic ban under **Plastic Waste Management (PWM) Amendment Rules, 2021,** Swachh Bharat Mission 2.0 etc.
Solid Waste	▶ **Total quantity of Solid waste generated in India:** 1.6 lakh tonnes per day. ▶ **Processing efficiency**: Collection efficiency of waste is 95.4%, 50 % of waste is treated and **18.4% is landfilled**. ▶ **Initiatives:** Swachh Bharat Mission-Urban (SBM-U) 2.0, Solid Waste Management Rules 2016, etc.

Waste to Wealth	▶ **Potential in India:** Generating **3GW of electricity from waste by 2050.** ▶ **Initiatives:** Waste to Wealth Mission, Gobardhan Scheme, etc.
E-waste	▶ **Status:** India is the **world's third-largest e-waste generator**. (Global E-wate Monitor 2020) ▶ **Collection:** Only **22.7% of the total e-waste generated in 2019-20** in India was collected. ▶ **Initiatives: E-waste (Management) Rules 2023**
Fly Ash Utilization	▶ **Trend**: Fly ash utilization in India has **increased from 10% in 1996 to 92% in 2020-21.** ▶ Still over **17 million tonnes out of the 222 million tonnes fly ash generated still remain** un-utilised. ▶ **Initiatives:** ASH TRACK Mobile App, declared as a saleable commodity, etc.
Environmental, Social and Governance (ESG)	▶ **Initiatives:** RBI joined the Network for Greening of Financial System (NGFS), SEBI's framework on ESG, etc.
Sustainable Sand Mining	▶ **Exploitation:** Sand resources are the **2nd most exploited natural resource** in the world after water. (Sand and Sustainability Report, 2022) ▶ **Trend**: Use of **sand resources has tripled in the last two decades.** ▶ **Initiatives:** Sustainable Sand Mining Management Guidelines 2016, Sand Mining Framework, 2018, etc.

RENEWABLE ENERGY AND ALTERNATIVE ENERGY SOURCES

India's Targets	▶ **50% of energy requirement** will be met **from renewable energy by 2030. (Panchamrita)** ▶ **500 GW of non-fossil energy capacity** to be installed **by 2030. (Panchamrita)**
India's Renewable Energy capacity	▶ **India's global rank:** 4th in terms of installed RE capacity. ▶ **Installed capacity:** Energy from renewable energy sources (including Hydro) makes 41.4% of total installed capacity (April 2023). (Ministry of Power) ▶ **Initiatives**: National Hydropower programme, National Biogas and organic manure programme, etc.

 Solar Energy	▶ **Potential in India**: 748 GW assuming 3% of the waste land area to be covered by Solar PV modules. (National Institute of Solar Energy) ▶ **India's global rank**: 4th in the world in terms of installed capacity. ▶ **Total installed capacity:** 67 GW in April 2023. (Ministry of Power) ▶ **Initiatives**: National Solar Mission, Grid-connected solar rooftop programme, International Solar Alliance, etc.
 Wind Energy	▶ **Potential in India**: **302 GW at 100 meters** and 695.50 GW at 120 meters above ground level. ▶ **India's global rank: 4th** in the world in terms of installed capacity. ▶ **Total installed capacity**: 43 GW in April 2023. (Ministry of Power) ▶ **Initiatives:** National Wind Solar Hybrid policy, 2018, Concessional custom duty exemption on certain components, Draft on National Repowering Policy, etc.
 Bio Energy	▶ **Potential in India**: Surplus biomass availability correspond to a potential of about **28 GW**. ▶ **Installed capacity:** 10 GW from Biomass Power/Cogeneration in May 2023. (Ministry of Power) ▶ **Initiatives:** National Bioenergy Programme, National Policy on Biofuels, 2018, Pradhan Mantri JI-VAN Yojana, Sustainable Alternative Towards Affordable Transportation (SATAT), etc.
 Ethanol Blending	▶ **Target**: 20% ethanol-blending in petrol by 2025. ▶ **Achievement**: Achieved 10% ethanol blending target in June 2022. ▶ **Initiatives**: Ethanol blending petrol (EBP) programme, GST on ethanol (from 18% to 5%), etc.
 Hydrogen Energy	▶ **Target:** Production of 5 million tonnes by 2030. ▶ **Initiatives:** National Green Hydrogen Mission, National Hydrogen Energy Roadmap, National Hydrology portal, etc.
 Other sources	▶ **Ocean Thermal Energy Conversion potential in India:** 180,000 MW ▶ **Geothermal Energy potential in India:** 10 gigawatts (GW).
 Electric Vehicle (EV)	▶ **Target:** Achieve target of EV sales penetration of 30% of private cars, 70% of commercial cars, 40% of buses and 80% of two and three-wheelers by 2030. ▶ **Trend:** EV sales grew more than 3x in FY21-22 from 20-21. ▶ **Initiatives:** FAME India Scheme, reduction of GST on electric vehicles (from 12% to 5%), etc.
 Energy storage system	▶ **Estimated 160 GW of** Energy storage system capacity required in India by **2030.** ▶ **Initiatives:** PLI Scheme National Programme on Advanced Chemistry Cell (ACC) Battery Storage; National Mission on Transformative Mobility and Battery Storage etc.

Vehicle Scrapping

- **Only 6 vehicle scrapping centres have been functional** under the Motor Vehicles (Registration and Functions of Vehicle Scrapping Facility) Rules, 2021.
- **No Automated Testing Stations (ATS) is functional** as per the Central Motor Vehicles (Twenty-first Amendment) Rules, 2021.

CONSERVATION EFFORTS

Forest

- **Targets**:
  - **NDC**: To create an additional **carbon sink of 2.5 to 3 billion tonnes** of CO_2 by 2050.
  - **National Forest Policy of India, 1988:** To have a **minimum of 1/3rd of the total geographical area** of the country under forest and tree cover
- **Total forest and tree cover**: 24.62% of the geographical area of India. (India State of Forest Report 2021)
- **Initiatives**: Forest (Conservation) Act of 1980, National Afforestation Programme (NAP) and National Mission for a Green India (GIM) , Compensatory Afforestation Fund (CAF) Act of 2016 etc.

Forest Rights

- **38% of all claims over land** made under the **Forest Rights Act (FRA)** till November 2022, have been rejected. (Ministry of Tribal Affairs)

Wetlands

- **Loss**: India lost **2 out of 5 wetlands in the last 3 decades.** (Wetlands International)
- In India, there are **7 lakh wetlands** (covering 4.86% of the country's total geographic area) and 75 Ramsar Sites.
- **Initiatives:** Sustainable Aquaculture in Mangrove Ecosystem (SAIME) Initiative, MISHT (Mangrove Initiative for Shoreline Habitats & Tangible Incomes) scheme, Wetland (Conservation and Management) Rules 2017 etc.

Outcomes of Convention on Biological Diversity (CBD)

- Adopted **Kunming-Montreal Global Biodiversity Framework (GBF):** 4 long-term goals (2050 Vision for Biodiversity) and 23 action-oriented global targets for urgent action over the decade to 2030.
- **Dedicated and accessible GBF Fund.**
- **Effective mechanisms for planning, monitoring, reporting and review.**
- **Multilateral mechanism for benefit-sharing from the use of digital sequence information on genetic resources.**

Human-Wildlife Conflict

- **222 Elephants were electrocuted** and 45 were killed by trains, 29 tigers were killed by poachers (Between 2018-19 and 2020-21).
- **Initiatives**: 14 species-specific guidelines, Wildlife Protection Act 1972, etc.

Tiger Conservation	▶ **Trend**: **Increase in Estimated Tiger population** from 1,411 in 2006 to 3,167 in 2022. (5th cycle of All India Tiger Estimation) ▶ **Achievement in India:** Achieved the targets set under TX2 initiative in 2018 (4 years in advance). ▶ **Initiatives:** Project tiger, M-STrIPES (Monitoring System for Tigers Intensive-Protection & Ecological Status), **(CA|TS) framework, International Big Cats Alliance (IBCA)** etc.
Elephant	▶ India is home to more **than 60%** of all **wild Asian** elephants. ▶ **Initiatives:** Project Elephant, Gaj Yatra, Elephant Corridors, etc.
Project Cheetah	▶ **World's first inter-continental large wild carnivore translocation project.** ▶ **Future Plan:** To **introduce at least 50 cheetahs** into various national parks over the next five years.
Amendments to Wildlife (Protection) Act	▶ **New Chapter VB for implementation of CITES.** ▶ **Number of schedules reduced from 6 to 4.** ▶ **New section 42A for Surrender of captive animals.** ▶ **Exemptions for Transfer or transport of 'live elephant'.**
Environmental Clearances (EC)	▶ Tenure of EC extended for the following projects – ○ **River valley projects** to have **13-year validity.** ○ **Nuclear power projects** or those involving the processing of nuclear fuel to have **15 years** validity.
Antarctica	▶ Holds **90% of the Earth's total ice volume** and **70% of its fresh water.** ▶ **India's endeavours in Antarctica**: Indian Antarctic Bill, 2022, India's Research stations- Maitri and Bharati, **member of** Council of Managers of National Antarctic Programme **(COMNAP)**, Scientific Committee of Antarctica Research **(SCAR)** etc. ▶ **International Treaties**: Antarctic Treaty, Protocol on Environmental Protection to the Antarctic Treaty (1991) (Madrid Protocol) etc.

DISASTER MANAGEMENT

Earthquake	▶ **Prone region:** 59% of the Indian landmass, **11% fall in very high-risk zone V.** ▶ **Recent examples:** Turkey and Syria (2023), Afghanistan (2022), North India (2023), and Assam (2021) ▶ **Initiatives:** Earthquake Risk Assessment and Mapping, Indian Standard Code for seismic design and construction of structures, Earthquake Early Warning System (EEWS), etc.
Floods	▶ **Prone region**: More than 40 million ha area in India. ▶ **Recent examples:** 2021 Maharashtra floods, 2022 Assam floods. ▶ **Examples of Urban flooding:** Bengaluru (2022), Hyderabad (2020) etc. ▶ **Initiatives**: Flood Management Programme, National Water Policy, NDMA guidelines on flood, etc.

Drought

- **Prone region:** 16% of India's total area.
- **Recent examples: Bundelkhand (Uttar Pradesh) and Marathwada and Vidarbha (Maharashtra)** often face droughts.
- **Initiatives:** Integrated Watershed Management Development, Desertification and land degradation by ISRO etc.

Landslides

- India is among the **top 4 countries with the highest landslide risk.**
- **Prone region:** 12.6% of India's land area, excluding snow-covered area. (Landslide Atlas of India, 2023)
- **Recent examples:** Chamoli landslide (2021), Kerala landslide (2019) etc.
- **Initiatives:** Landslide Early Warning System (LEWS) under LANDSLIP project, landslide susceptibility mapping, etc.

Heatwaves

- **Criteria:** At least 40° C or more for plain areas and 30° C or more for hilly regions.
- India in **2022 faced severe heatwaves.**
- **Initiatives:** IMD issues colour code impact-based heat warning, InfoCrop simulation model, India Cooling Action Plan (ICAP) etc.

Wild Fires/. Forest Fires

- **Prone region:** More than 36% of India's forest cover is prone to frequent forest fires. (India State of Forest Report 2021)
- **Recent examples:** Rajasthan's Sariska Tiger Reserve and Madhya Pradesh's Ladkui jungles etc.
- **Initiatives**: National Action Plan on Forest Fires (NAPFF), 2018, Initiatives by Forest Survey of India (FSI) such as Near Real-Time Forest Fire Monitoring and issuing alerts etc.

Other Disasters

- **Cyclone:** Biparjoy Cyclone (Western India 2023), Cyclone Mandous (Tamil Nadu, 2022) etc.
- **Volcano:** Mount Etna (Italy, 2023) and Mount Merapi (Indonesia, 2023)
- **Cloudburst:** Himachal Pradesh and Uttarakhand (2022)
- **Glacial Lake Outburst Floods (GLOF):** Uttarakhand (2021)

GEOGRAPHY

Joshimath Land Subsidence

- More than **80% of land subsidence** across the world is **caused due to excessive groundwater extraction.** (U.S. Geological Survey)
- **Initiatives:** Remote Sensing and GIS, regulating groundwater extraction by CGWA, recommendation of **Mahesh Chandra Mishra committee (1976),** etc.

Land Degradation in India

- **UNCCD** has set a target to **restore 26 million ha** of degraded land by 2030.
- **Area that underwent land degradation during 2018-19: ~30%** of the Total Geographic Area of India. (Desertification and Land Degradation Atlas of India)
- **Initiatives:** Signatory to United Nations Convention to Combat Desertification (UNCCD), National REDD+ Strategy, Green Highways Policy, 2015, Part of Bonn Challenge etc.

 Soil Degradation	▶ Over **6.74 million hectares** of land in India is **estimated to be salt affected** and **11 mha of arable land** suffers from **acute soil acidity**. ▶ **Initiatives:** Soil Health Card (SHC), Soil Health Management (SHM), UNCCD's Land Degradation Neutrality (LDN), Paramparagat Krishi Vikas Yojana etc.
 Soil Organic Carbon	▶ After oceans, **soils are the 2nd largest carbon pool** on Earth. ▶ Black soils have the potential to provide 10% **of the total SOC sequestration globally.** ▶ **World's cultivated soils** have **lost up to 75% of their original carbon stock**.
 Large Dams in India	▶ Around **3,700 dams in India will lose 26% of their total storage by 2050** due to the accumulation of sediments. (United Nations) ▶ **Initiatives**: Dam Safety Act, 2021, Dam Rehabilitation and Improvement Project (DRIP) of World Bank, Dam Health and Rehabilitation Monitoring Application (DHARMA) etc.
 Deep Ocean exploration	▶ **Mineral deposits found for commercial exploitation**: Polymetallic nodules (PMN), Polymetallic sulphides and Cobalt crusts. ▶ India has been allotted a site of 75,000 sq. km in **Central Indian Ocean Basin (CIOB)** by **International Sea Bed Authority** for the exploitation of PMN. ▶ **Initiatives: Samudrayaan Mission** part of **Deep Ocean Mission**.

WEEKLY FOCUS- ENVIRONMENT

S.No.	Topic	Learn More
1.	Climate Change and its impact on Indian Region	
2.	Climate Change Negotiations	
3.	Transitioning to a Sustainable Energy Ecosystem	
4.	Conserving the Forests: Save Today, Survive Tomorrow	
5.	Sustainable Development Goals: The Pathway to the Future	

S.No.	Topic	Learn More
6.	Nature-positive Cities: Rejuvenating Cities relationship with nature	
7.	Sustainable Agriculture Part 1_Understanding the concept and practices	
8.	Sustainable Agriculture Part II_Transforming India's Food Systems	
9.	Future of Food: Food Sustainability for 8 Billion Populace	
10.	Lifestyle for Environment From Mindless Consumer to Mindful Citizen	

Lakshya Mains Mentoring Program 2023

Lakshya Mains Mentoring Program 2023 is a targeted revision, practice, and enrichment Program that aids students in achieving excellence in the UPSC Mains Examination 2023. The Program adopts a strategic approach by providing smart preparation strategies, developing critical thinking and analytical skills, and advanced answer-writing abilities.

Scan the QR code to Register

Features of the Program

Dedicated Senior Mentor

A Senior Mentor is assigned to each student to provide personalized guidance in each aspect of the Mains examination preparation and assist students in consolidating their strengths maximizing their performance by identifying and improving upon student weaknesses.

Emphasis on High-Scoring Potential Subjects

The Program lays special emphasis on subjects like Ethics and Essay and provides ample opportunity for students to inculcate the learnings and effect their implementation in the answer writing.

Regular Group Sessions

Aspirants engage in interactive sessions conducted by experienced mentors which provide subject-specific strategies, insights from toppers, advanced-level answer-writing skills, etc.

Answer Enrichment

Aspirants gain insights from institutional experience and the answer scripts of previous toppers to enhance the content and presentation of their answers, making them impactful and effective.

Live Practice Sessions

Through these practice sessions, aspirants can implement session learnings and receive immediate feedback from their mentors to refine their approach and boost their confidence.

Lakshya Mains Practice Test (LMPT)

Aspirants can undertake the scheduled LMPTs in online/Offline modes to put their knowledge and skills to the test and validate their preparation strategies.

Expert Evaluation

The LMPT is evaluated by the expert team at VisionIAS through an Innovative Assessment System to provide detailed feedback for further improvement.

Feedback Session with Assigned Mentor

In this session, students can discuss the feedback received on their LMPT performance and their Answer Scripts to address any doubts or concerns in a personalized setting with their Mentor.

Peer Interaction and Motivation

Aspirants participate in constructive discussions, share their experiences, insights, and motivation with fellow aspirants facilitating co-learning and development.

Multi-platform Support

Aspirants can benefit from a comprehensive support system in the form of online/offline Groups and One-to-One sessions, telephonic support, and a dedicated Telegram platform for immediate assistance whenever needed.

With its intelligent design, effective implementation, dedication from Senior Mentors, and active participation of Students, the Program has achieved tremendous success in a short period of time with **Waseem Ahmad Bhat** securing an impressive All India Rank (AIR) of 7, **Siddharth Shukla AIR 18,** and **Anoushka Sharma** securing AIR 20.

Heartiest Congratulations
to all Successful Candidates

39 in Top 50 Selection in CSE 2022


1 AIR
ISHITA KISHORE


2 AIR
GARIMA LOHIA


3 AIR
UMA HARATHI N

हिंदी माध्यम में 40+ चयन CSE 2022 में

= हिंदी माध्यम टॉपर =


66 AIR
KRITIKA MISHRA


85 AIR
BHARAT JAI PRAKASH MEENA


105 AIR
DIVYA


120 AIR
GAGAN SINGH MEENA


173 AIR
ANKIT KUMAR JAIN

8 in Top 10 Selection in CSE 2021


2 AIR
ANKITA AGARWAL


3 AIR
GAMINI SINGLA


4 AIR
AISHWARYA VERMA


5 AIR
UTKARSH DWIVEDI


6 AIR
YAKSH CHAUDHARY


7 AIR
SAMYAK S JAIN


8 AIR
ISHITA RATHI


9 AIR
PREETAM KUMAR


1 AIR
SHUBHAM KUMAR
CIVIL SERVICES EXIMINATION 2020

DELHI

HEAD OFFICE
Apsara Arcade, 1/8-B, 1 Floor,
Near Gate 6, Karol Bagh
Metro Station

Mukherjee Nagar Centre
635, Opp. Signature View
Apartments, Banda Bahadur Marg,
Mukherjee Nagar

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