

Environment

Classroom Study Material 2024

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ENVIRONMENT

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A Note for 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.

Environment Mains 365 Key Features



Concise and Objective

Brief, objective presentations of each topic, incorporating relevant examples and figures.



Enhanced Infographics

Designed for effective understanding of environmental phenomena as well as revision and engagement.



Topic at a Glance

This summarizes static topics and recurring important themes for quick review.



Previous Years Questions (PYQs)

Segregated list of previous years questions for efficient revision.



Appendix

Includes appendix of key data and facts which can be used to enrich your answers.



Weekly Focus

QR code-linked list of relevant weekly focus documents.

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. COP28

Why in the news?

Recently 28th Conference of the Parties (COP28) of the UNFCCC was held in Dubai, UAE and parties adopted final document called **UAE Consensus**.

Key outcomes of COP28

Pillars of COP28	Key outcomes
Fast-tracking a just, orderly, and equitable energy transition	<ul style="list-style-type: none"> • Launch of Global Renewables and Energy Efficiency Pledge (India not a signatory) • The Global Cooling Pledge for COP 28. • Oil and Gas Decarbonization Charter • Conclusion of First Global Stocktake of the Paris Agreement
Fixing climate finance	<ul style="list-style-type: none"> • Mobilization of \$83.9 billion to climate finance in the Green Climate Fund, Adaptation Fund, Least Developed Countries Fund, and Special Climate Change Fund. • Operationalization of loss and damage fund • Declaration on a Global Climate Finance Framework. • Global Green Credit Initiative (GGCI) by India.
Focusing on people, lives and livelihoods	<ul style="list-style-type: none"> • COP28 UAE Declarations on Agriculture, Food, & Climate, Climate and Health and Climate Relief, Recovery & Peace • Global Goal on Adaptation-UAE Framework for Global Climate Resilience adopted.
Underpinning everything with full inclusivity	<ul style="list-style-type: none"> • Launch of COP 28 Gender-Responsive Just Transitions and Climate Action Partnership. • Appointment of the Youth Climate Champion.

Issues persisting from COP 28

- **Failure to agree on rules for global carbon market.**
 - US tried to make regulations which were blocked by EU, African and Latin American.
- Current levels of climate finance are **insufficient to meet adaptation finance gap.**
- **Promotion of Marine geoengineering technologies** like Carbon Capture, Utilization, and Storage in COP28, ignores the harm they pose to marine environment.
- Concerns regarding **greenwashing and influence of oil-and-gas sector on negotiations** during the COP28.
- **India's concerns at COP28**
 - **Refrained from signing COP28 Declaration on Climate and Health** as it could hinder its ability to meet the growing demands for medical services.
 - **Emphasized need of "equity and justice"** in U.N. climate negotiations, with rich countries leading global climate action.
 - Reiterated that **cuts must be on all fossil fuel, not just Coal**, which it needs for thermal power. Hence, India has **refused to sign Green energy pledge.**

Way Forward

- Developed country need to **expeditiously deliver USD 100 billion/year goal** through to 2025, towards climate mitigation.

- **Need to adhere to Precautionary principle** while planning to implement geo-engineering technologies like Carbon Capture and Storage (CCS).
- Operating entities of the Financial Mechanism e.g. GEF, need to provide, **capacity-building support to attain and update INDCs**.

Emergence of climate change as an intergovernmental political issue

Environmental issues reach the global stage at the first international environmental summit in Stockholm, Sweden, but not specifically climate change.



1972

Climate change seen as a political issue at the **First World Climate Conference in 1979**, and the **Toronto Conference on the Changing Climate in 1988**.



1972-1988

First global agreement on → climate change - **UNFCCC, opened for signature** at the Earth Summit in Rio de Janeiro.



1992

A successor agreement to the Kyoto Protocol, the **'Paris Agreement'** is adopted.



2015



Late 1970s

Concerns regarding Climate change raised globally by the **World Meteorological Organization (WMO)**.



1988

Establishment of IPCC to investigate and report on scientific evidence on climate change and possible international responses.



2005

Kyoto Protocol enters into force.

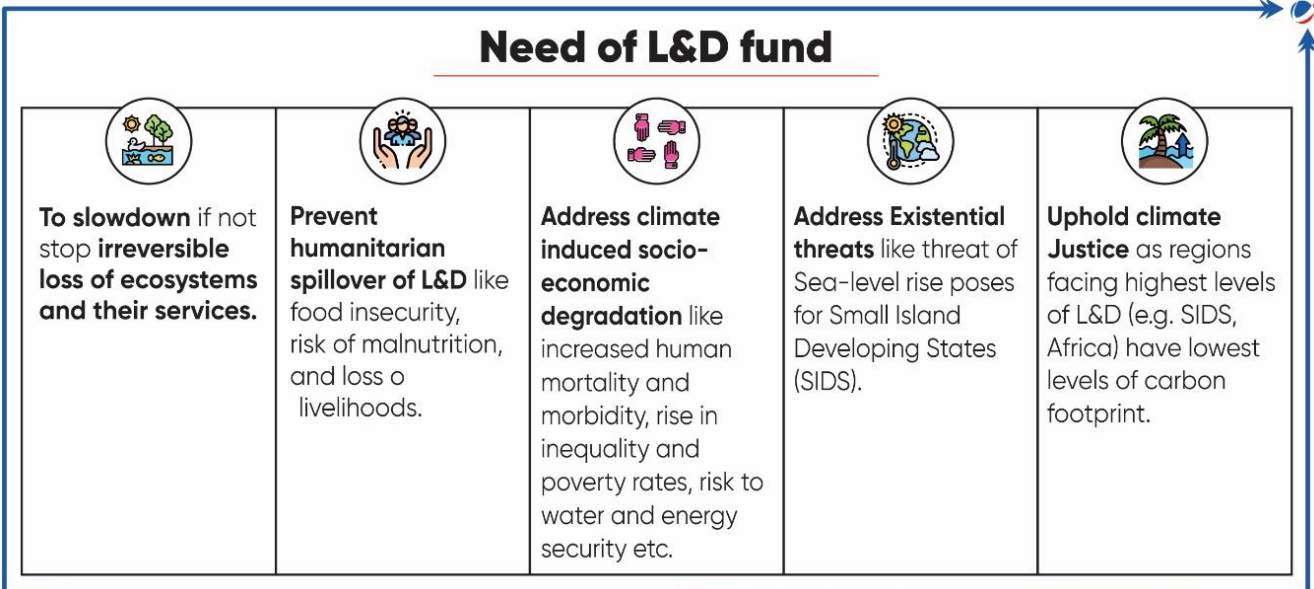
1.1.1.1. LOSS AND DAMAGE

Why in News?

COP28 climate conference in Dubai, **officially operationalized** the loss and damage fund to help vulnerable countries cope with the impact of climate change.

Loss and damage (L&D) fund

- It refers to the **compensation that rich industrialized nations, with historic role in climate change, must pay to poor nations**, whose carbon footprint is low but are facing the brunt of climate change.
 - **L&D are impacts of climate change that cannot be adapted to, and where losses are permanent.**
- It will be **based at the World Bank** but managed by an independent secretariat.
- L&D fund was **first announced during COP27 in Sharm el-Sheikh (Egypt)** in 2022.
 - **Warsaw International Mechanism (WIM)** for L&D was **established at COP19 in 2013 in Warsaw** (Poland) to address L&D associated with climate change in developing countries.
- **India's stand on fund:** Strong supporter of the fund and opening up L&D funds for developing nations and not limit it to small island and least developed nations.



Challenges in L&D fund

- **Absence of a mutually agreed upon definition** to categorize L&D activities.
- **Poor data availability and processes** for systematically collecting, recording, and reporting information on L&D.
- **Low pledges** (around \$700 million) in comparison to funding requirement estimated in the hundreds of billions annually.
- **Low technical capacity** especially in developing countries – to scientifically model L&D.
- **Difficulty in quantifying nontangible L&D** like Non-economic losses, like losing family members, the disappearance of cultures and ways of living etc.

Way Forward

- **Build upon the COP28 UAE consensus** to arrive at a mutually compatible definition of L&D.
- **Focus on building climate change resilience:** E.g. strengthening flood defences, Climate resilient Infrastructure, financial or social support, like, insurance protection etc.
- **Mitigation and adaptation actions** for both developing and developed countries, to avert and minimize the extent of L&D.
- **Incorporate concept of L&D** in national and international policy on climate action.

1.2. INDIA AND CLIMATE ACTION AT A GLANCE

India and climate Action



India's Climate targets

- Quantitative targets under Nationally Determined Contributions (NDCs) submitted to UNFCCC
 - To reduce Emissions Intensity of its GDP by **45%** by 2030, from 2005 level.
 - To **achieve about 50% cumulative electric power** installed capacity **from non-fossil fuel**-based energy resources by 2030.
 - To **create an additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent** through additional forest and tree cover by 2030.



Panchamrita targets announced at COP 26-Glasgow

- Achieve target of **net zero by 2070**.
- Increase **non fossil energy** capacity to **500 GW by 2030**.
- Meet 50% energy requirements from renewable sources by 2030.
- Reduce **carbon intensity** of economy by **less than 45% by 2030**.
- Reduce total projected carbon emissions by **one billion tonnes** in 2030.



Achievements/Progress

- **Reduced the emission intensity vis-à-vis its GDP by 33% between 2005 and 2019.** (India's National statement at UNFCCC COP 28)
- **Achieved 45.5% (203 GW)** of installed electricity capacity **from non-fossil fuel sources.** (June 2024, Ministry Of Power)



Challenges/Issues in achieving climate targets

- Overall rating of India's climate targets and action remains **"Highly insufficient"**. (Climate Action Tracker)
- **Low targets:** E.g., panchamrita target of Net zero was not included in NDCs.
- **Slow pace of decommissioning coal-based plants.**
- **High GHG emissions:** E.g., India is among the top 5 methane emitters in world.
- **Constraints in increasing share of renewable energy:** Intermittent supply, high dependence on import for components, high cost of storage, grid connectivity etc.
- **Institutional bottlenecks:** E.g. National Mission for Sustaining the Himalayan Ecosystem (NMSHE) faces challenges like manpower shortage, financial constraints, lack of coordination among research institutions and ministries etc.
- **Lack of sector specific mitigation obligations.**



Schemes/ Policies/initiatives

- **National Action plan on Climate Change (NAPCC)**, National Adaptation Fund on Climate Change and Climate Change Action Program (CCAP) etc.
- **Policies:** National Wind Solar hybrid policy, National biofuel Policy, National Offshore Wind Energy Policy, Green Hydrogen/ Green Ammonia policy etc.
- **Schemes:** PM-KUSUM, Solar rooftop programme, ultra-mega solar parks, Perform Achieve and Trade (PAT) scheme, Ujjwala, IJJALA, FAME India scheme, etc.
- **Tax concessions and incentives such as Production Linked Incentive scheme** for renewable sector.
- **Net Zero target by 2030 by Indian Railways.**
- **International:** International Solar Alliances (ISA), Coalition for Disaster Resilient Infrastructure (CORI), Green Grids Initiative—One Sun One World One Grid project, LiFE Mission etc.



Way Forward

- **Stop building new coal power capacity** and develop a sustainable and inclusive plan for the early retirement of its existing capacity.
- **Adopt stronger targets** that will drive higher emissions reductions to get onto a 1.5°C pathway.
- **Climate change knowledge management cells** in institutions for resolving the coordination blockages.

1.2.1. GREEN CREDIT PROGRAM

Why in the News?

Ministry of Environment, Forests and Climate Change (MoEFCC) notified rules for **Green Credit Program (GCP) 2023**.

About Green Credit (GC)

- A singular unit of an incentive provided for a specified activity, delivering a **positive impact on the environment**.
- These **credits can be traded on a dedicated exchange, similar to how carbon credits** are traded.

Green Credit	Carbon Credit
<ul style="list-style-type: none"> ● Under the Green Credit Program (GCP) operating under The Environment (Protection) Act, 1986. 	<ul style="list-style-type: none"> ● Under the Carbon Credit Trading Scheme operating under The Energy Conservation Act, 2001.
<ul style="list-style-type: none"> ● Provides advantages to individuals and communities. 	<ul style="list-style-type: none"> ● Primarily benefit industries and corporations.
<p>Green credit activities may qualify for carbon credits, leading to climate co-benefits like carbon emissions reduction, but not vice versa.</p>	

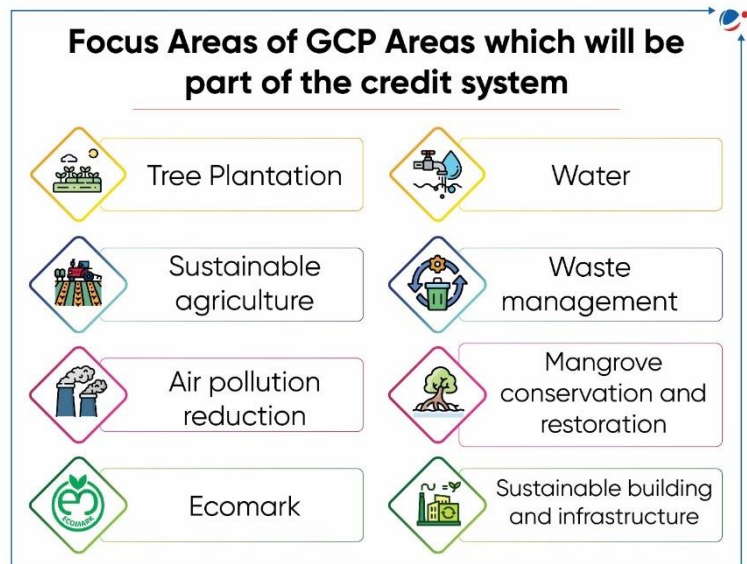
About Green Credit Program (GCP)

- A **market-based mechanism to incentivise environment positive actions by different stakeholders**.
 - The participation to the GCP **shall be based on voluntary participation**.

- **Aim:**
 - Aligned with the **'LiFE'-'Lifestyle for Environment'** initiative.
 - **Encourage industries, companies, and other entities** to meet their existing obligations or other obligations (voluntary).
- **Established under:** "The Environment (Protection) Act, 1986" with MoEFCC as Nodal Agency.
- **Governance Structure**
 - An **inter-ministerial Steering Committee**.
 - **The Indian Council of Forestry Research and Education (ICFRE)** serves as the **GCP Administrator**, responsible for program implementation, management, monitoring, and operation.
 - **Project Registration, Verification and Issuance of Green Credits** platforms are established by ICFRE.

Key Highlights of Green Credit Rules (amended)

- Forest Departments of all States and Union territories required to **identify degraded land parcels under their control to enhance green cover**.
 - Focus of work for plantation on degraded forest areas under the GCP to be on **eco-restoration of degraded forests**.
- **Number of trees to be planted** can depend upon site characteristics and may vary as per the site conditions.
- **Activities for eco-restoration not to be limited to the plantation of trees** and also include other activities like Plantation of shrubs, herbs, grasses, Soil and moisture conservation works, etc.
- ICFRE instructs **Forest Departments to conduct tree plantation within two years**.
- **Other rules:** Preference to indigenous species, Plantation of high-quality seedlings and Retention of Naturally growing seedlings.



Concerns related to the programme

- **Difficulties in calculating and standardizing measurable outcomes** for different focus areas for which the credit is generated.
- **Long-term feasibility of credits.** E.g., what happens to green credits in instances of high mortality rates of plantations.

1.2.2. CARBON CREDITS TRADING SCHEME (CCTS), 2023

Why in the news?

Ministry Of Power (MoP) announced reforms in **Carbon Credits Trading Scheme (CCTS)**.

More on the news

- The MoP had notified the CCTS in June 2023, to **develop the Indian Carbon Market framework**, under the **Energy Conservation Act, of 2001**.
- **Major reforms announced by MoP**
 - **The Bureau of Energy Efficiency (BEE)** to develop the **standards and register** the project under an **offset mechanism**.
 - BEE would **"validate" carbon credits**, as opposed to only **"verification"** in the **original framework**.
 - Allowed **'non-obligated entities' (Non-OEs)** (purchase the carbon credit certificates voluntarily) to also **register decarbonization projects and generate carbon credits**.



- **Significance of reforms:**
 - The inclusion of Non-OEs further **deepens the Indian carbon credit market.**
 - Indian entities won't have to go to **overseas standards agencies to validate** their carbon credits.
 - Foreign decarbonisation projects might choose **India for certification.**

About Carbon Credits Trading Scheme (CCTS), 2023

- **CCTS provides to set up a carbon credit trading market as the country aims at decarbonizing the economy.**
 - A carbon credit is a kind of **tradable permit** that **equals one tonne of carbon dioxide removed, reduced, or sequestered from the atmosphere.**
- **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.
 - **Institutional framework:**
 - ✓ **New National Steering Committee for Indian Carbon Market (NSCICM) for Governance of the Indian carbon market (ICM)** and monitoring
 - ✓ **Bureau of Energy Efficiency (BEE) as the administrator:** For identification and recommendation of sectors for inclusion in Indian carbon market to the Ministry of Power.
 - ✓ **Central Electricity Regulatory Commission (CERC):** To regulate matters relating to trading of CCC.
 - ✓ **Grid Controller of India Limited** as the **registry** of obligated or non-obligated entities.

Other Initiatives for carbon markets in India

- 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**
- **Global Hydrogen Trading Mechanism (GHTM):** Indian Gas Exchange or IGX (**India's only gas exchange**) and Gujarat State Petroleum Corporation (GSPC) signed a MoU to establish a **GHTM.**
- **Framework for Voluntary Carbon Market in Agriculture Sector:** Sector Launched by Ministry of Agriculture & Farmers Welfare (MoA&FW)

Challenges to CCTS

- **India's industry stakeholders do not have deep experience of the cap-and-trade market.**
- **Cumbersome and complex institutional framework** due to involvement of multiple agencies at different levels.
- **Difficulties in setting emission targets.**
 - Too lax targets in can increase supply of carbon credits and suppress the price of credits in the market.
 - Too stringent targets can lead to too few carbon credits and hence very high prices for credits.
- **Poor market transparency** leading to issues like double counting of GHG reductions, poor assessment of climate mitigation efforts and **concerns about greenwashing.**
- **Uncertainty about penalties under the proposed carbon market.**
- **Challenges in meeting obligations for designated consumers** due to shortage of renewable sources of power.

Way forward

- **Formulate Transparent, well-defined methodology to set emission intensity targets.**
 - **Present trade of various environmental instruments can be examined** to observe trading trends.
- **Developing a provision for fungibility of the unit trading** to emission reduction may attract voluntary buyers and lead to international participation in the market.
- **Streamline and strengthen institutional structure.**

1.3. CLIMATE EQUALITY AT A GLANCE

Climate equality



Types of inequalities

- **Carbon Inequality between Nations:** A small number of developed countries are responsible for substantially higher share of the CO₂ emitted globally.
- **Carbon Inequality within Nations:** Carbon emissions of higher income groups are significantly higher.



Current Situation (Emission gap report 2023)

- **Globally, richest 10% account for nearly half (48%)** of emissions.
- **Bottom 50% of households contribute 12% of the global total GHG emissions.**



Need to Address Inequality

- Accounts for historical responsibilities.
- Standard climate measures lead to social and economic inequity.
- Designing effective and targeted climate policies.
- Equity considerations can enhance efficiency of public climate investment, etc.



Measures Taken

- **Global**
 - **Geneva Pledge on Human Rights and Climate Action, 2015** for sharing of best practice and knowledge between human rights and climate experts.
 - **Others: Climate Promise Initiative by UNDP**
- **India**
 - **Protecting rights of Indigenous community:** Panchayats (Extension to Scheduled Areas) Act, 1996 (PESA); Forest Rights Act 2006 etc.
 - Supreme Court (**Case- M.K. Ranjitsinh and Others v. Union of India and Others**), recognized **Right to be free from adverse effects of climate change under Articles 14 and 21 of the Constitution.**
 - **Accessible Renewable Solar Alliance** etc.



Way Forward

- **Policy instruments disincentivizing investments in polluting** and fossil activities.
- **Scaling up public investments in low-carbon energy** production infrastructures, transport and energy efficiency etc.
- **Invest in production and collection of climate inequality** statistics for informed policy making.

1.4. INDIAN TRADITIONAL PRACTICES & CLIMATE CHANGE

Why in News?

The risks posed by climate change have led to a **growing recognition that traditional practices should be at forefront in climate change responses.**

Role of Indian Traditional practices in increasing climate change resilience

- **Agriculture**
 - **Natural Farming:** E.g. **Zero-Budget Natural Farming (ZBNF)** increases farmers' climate resilience by improving soil health and reducing water usage
 - **Adaptation to sea level rise:** E.g. **Kuttanad Kaliyanam farming** which involves below sea level paddy cultivation in Kerala.
 - **Water use efficiency:** E.g. **Meghalaya's bamboo drip irrigation system.**
 - **Architecture and housing:** Traditional architecture from extreme weather and disaster-prone regions. E.g. **Dhajji-Dewari and Taq system of Kashmir valley.**
- **Sacred Grooves in India:** Act as gene pools for traditional crop varieties and medicinal plants, safeguarding genetic resources for future generations.
- **Traditional Rainwater harvesting:** Helps mitigate the effects of drought. E.g., **Jhalaras of Rajasthan, Zabo of Nagaland.**

Issues with adoption of traditional practices

- **Threat to food security** due to risk of decline in agricultural productivity.
- **Lack of Scientific certainty** in some traditional practices, E.g. ZBNF farming.
- **Endangered Traditional practices** due to Homogenizing influence of modernization and lack of repository of traditional practices.
- **Misappropriation of India's traditional Knowledge and practices** by foreign entities. E.g. patent on healing properties of turmeric, neem etc.

Conclusion

There is need to Capturing India's Traditional Knowledge and practices through **community engagement, participatory mapping, ethnographic research and documenting and mapping.** Also, there is a need to integrate traditional knowledge into national climate change policies.

1.5. CLIMATE CHANGE IMPACTS

1.5.1. IMPACT ON VULNERABLE SECTIONS AT A GLANCE

1.5.1.1. IMPACT ON CHILDREN AT A GLANCE

Climate Change impact on Children



Impact ('Children Displaced in A Changing Climate' Report by UNICEF)

- ◆ **Displacement:** E.g., **6.7 million Children** are **displaced in India** alone between 2016 and 2021 due to weather-related events.
- ◆ **Water Stress:** E.g. Almost **1 billion children** are **exposed** to high or extremely **high-water stress**.
- ◆ **Gendered impact:** E.g. in Bangladesh, the number of marriages of girls ages 11 to 14 increased by 50% in years with heatwaves lasting longer than 30 Days.
- ◆ **Education:** E.g. In Ethiopia, around 20% of girls and 5% of boys miss time in school to fetch water in normal circumstances.
- ◆ **Disease:** E.g. More than 1,000 children under the age of five die each day from diseases arising from lack of water, sanitation and hygiene.



Factors behind Children's Vulnerability due to climate change

- ◆ **Limited Physical capabilities.**
- ◆ **Economic and social inequality**
- ◆ **Lack of access to key essential services** such as water, health, education etc.
- ◆ **Less Focus on children** in the Global climate change discourse and financing, children most of the time get ignored.
 - Only **2.4%** of climate finance from key multilateral climate funds support projects incorporating child-responsive activities.
- ◆ More prone to **mental health impacts like trauma** from extreme events.



Mitigation/Way Forward

- ◆ **3Ps i.e., Protect-Prepare-Prioritize approach suggested by** 'Children Displaced in A Changing Climate' Report by UNICEF
 - **Protect** Child-critical services to make them shock-responsive, portable, and inclusive.
 - **Prepare** children and young people to live in a climate changed world by improving their adaptive capacities, resilience and enabling their participation.
 - **Prioritize** children and young people in climate, humanitarian and development policy, action, and investments like under UNFCCC.

1.5.1.2. IMPACT ON WOMEN AT A GLANCE

Climate Change Impact on Women



Disproportionate Impacts of Climate Change

- **Girls are at higher risk of receiving less food than boys.**
- **Livelihood threatened by climate change.** E.g., **Women make up 43%** of the agricultural labor force in developing countries. (FAO)
- Only **2% of gender-tagged international adaptation finance** is gender-responsive. (*Adaptation Gap Report*)
- Societal norms and caregiving responsibilities **hinder women's mobility during disasters or migrations.**
 - Women and children are 14 times more likely than men to die during a disaster. (UNDP)
- **UN figures estimate that 80%** of people displaced by climate change are women.



Women's' Role in Climate Action

- **Utilising women's traditional knowledge and experience** related to natural resource management in climate action strategies.
- **Women act as first responders** and contribute to post recovery needs of families.
- **Climate investments** can be advanced through grassroots women's organizations.
- Research shows clear linkages between **women's political leadership and action to tackle climate change.** E.g., countries with higher proportions of women in parliament are more likely to have stricter climate policies.



Way Forward

- **Address Gender-Specific Impacts: Adaptation initiatives** should identify and **tackle gender-specific impacts** in areas like water, food security.
- **Dedicated Financing Mechanisms:** to Encourage active involvement of women at the local level.
- **Gender-Responsive Technology:** that consider women's priorities, needs, and roles.
- 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.

1.5.1.3. IMPACT ON ELDERLY POPULATION AT A GLANCE

Climate Change impact on Elderly population



Impact

- Face a higher susceptibility to **heat-related illnesses and mortality during heatwaves.**
 - Heat-related deaths among **those over 65** have **risen by 70%** in two decades. (WHO)
- Extreme **weather events resulting in migration of family members and displacement** can contribute to increased social isolation among the elderly.
- Extreme weather events can cause economic hardship and leading **to the loss of assets, pensions, disability aids, and other essential resources.**



Way Forward

- **Increase awareness of seniors vulnerabilities** through targeted educational programs and outreach efforts.
- Provide seniors with targeted resources such as **accessible infrastructure, transportation options, and healthcare services.**

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			PUNE: 5 JULY

1.5.1.4. IMPACT ON RURAL POOR AT A GLANCE

Impact of Climate Change on Rural Poor



Impact

- **Economic Impact:** In an average year, **poor households lose 5% of their total income due to heat stress** relative to better-off households.
- **Disproportionate Impact of Climate Hazards:** On low-income communities, causing property damage, livelihood loss, and economic setbacks.
- **Displacement and Migration:** In 2019, **Bangladesh, China, India and the Philippines each recorded more than 4 million disaster displacements (IPCC).**
- **Health Impacts:** Increases in healthcare costs, reduces earning potential, especially affecting low-income individuals and communities.



Mitigation

- **Mobilizing global funding mechanisms** such as the **Green Climate Fund** to support climate justice and equitable development in vulnerable regions.
- **WWF's community-based conservation strategies** for Empowering local communities to develop and implement climate-resilient initiatives.
- Implement UN's recommendations on **climate finance**, ensuring financial inclusion for marginalized groups.

फाउंडेशन कोर्स सामान्य अध्ययन

प्रारंभिक एवं मुख्य परीक्षा 2025

इनोवेटिव क्लासरूम प्रोग्राम

- प्रारंभिक परीक्षा, मुख्य परीक्षा और निबंध के लिए महत्वपूर्ण सभी टॉपिक का विस्तृत कवरेज
- मौलिक अवधारणाओं की समझ के विकास एवं विश्लेषणात्मक क्षमता निर्माण पर विशेष ध्यान
- एनीमेशन, पॉवर प्वाइंट, वीडियो जैसी तकनीकी सुविधाओं का प्रयोग
- अंतर - विषयक समझ विकसित करने का प्रयास
- योजनाबद्ध तैयारी हेतु करेंट ओरिएंटेड अप्रोच
- नियमित क्लास टेस्ट एवं व्यक्तिगत मूल्यांकन
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- सीसेट टेस्ट सीरीज
- निबंध लेखन - शैली की कक्षाएं
- करेंट अफेयर्स मैगजीन

नोट: ऑनलाइन छात्र हमारे पाठ्यक्रम की लाइव वीडियो कक्षाएं अपने घर पर ऑनलाइन प्लेटफॉर्म पर देख सकते हैं। छात्र लाइव चैट विकल्प के माध्यम से कक्षा के दौरान अपने संदेह और विषय संबंधी प्रश्न पूछ सकते हैं। वे अपने संदेह और प्रश्न नोट भी कर सकते हैं और दिल्ली केंद्र में हमारे कक्षा सलाहकार को बता सकते हैं और हम फोन/मेल के माध्यम से प्रश्नों का उत्तर देंगे।

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JODHPUR: 11 जुलाई



1.5.2. IMPACT ON HEALTH AT A GLANCE

Climate Change impact on Health



Impact

- **Global potential loss of income** from the reduction in labour capacity due to extreme heat was **\$863 billion in 2022. (Lancet Study)**
- **Rise in Pollution related morbidities** – About 9 million people die annually (Lancet report).
- **Exposure to extreme weather events** - 189 million people are exposed to extreme events e.g. Storms, etc.

Climate-sensitive health risks



Constraints

- **Financing gap for climate change impact of health.**
- **Low income countries are highly vulnerable as they have poor infrastructure etc.**
- **Underutilisation of climate information in health actors.**
- **Other issues; Research and knowledge gaps, lack of access to sufficient local meteorological observations; Insufficient human and institutional capacity, etc.**



Steps taken

Global

- COP28 UAE Declaration on Climate and Health Unveiled (**India yet to sign**)
- **World Health Summit (WHS)** held annually in Berlin, Germany.
- **The Alliance for Transformative Action on Climate and Health (ATACH)** a **World Health Organization (WHO)** initiative.

India

- **National Action Plan on Climate Change and Human Health.**
- Environmental health surveillance
- **National Health Mission funds**, funds are provided to States/UTs to implement Green/Low carbon emission measures.
- **Indian Public Health Standards (IPHS), 2022**, provides principles of Green & Climate Resilient Hospitals.



Way Forward

- **'One health approach'** which recognizes the interconnection between people, animals, plants, and their shared environment.
- Building climate-resilient, **low-carbon sustainable health systems**
Tailored climate information and services to support the health sector. This can be achieved through:
 - Developing **in-country capacities** to improve local knowledge.
 - **Policy mandates** for health and meteorological actors to collaborate.
 - **Raising awareness** about the importance of climate information.

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1.5.3. IMPACT ON INDIAN SUB-CONTINENT AT A GLANCE

Climate Change Impact on Indian Sub-continent



Impact

- India's average temperature has risen by around **0.7 deg. C** during 1901-2018.
- Frequency of daily precipitation extremes (>150 mm per day) increased by about **75%** during 1950-2015.
- Sea-level rise in North Indian Ocean occurred at a rate of **3.3 mm per year** (1993-2017).
- Extreme events:
 - Arabian sea saw a **52% increase** in cyclonic storms from **2001-2019** (IISER study)
 - Marine heatwaves expected to increase from 20 days per year to 220-250 days per year.
 - Frequency of extreme positive Indian Ocean Dipole events projected to increase by almost 3 times over the 21st century.



Way forward

- Investing in resilient infrastructure. E.g., through collaboration on platforms like Coalition for Disaster Resilient Infrastructure (CDRI)
- Enhancing forecasting capabilities. E.g., through hyper local weather forecasting.
- Promoting adaptive agriculture and other resilient practices like Climate smart agriculture for food security.

1.6. MITIGATION AND ADAPTATION

1.6.1. CLIMATE CHANGE MITIGATION AT A GLANCE

Climate Change Mitigation

Emission Trends



Global

- **Global average CO₂**: 417.9 ppm in 2022, (150% increase from pre-industrial levels). (**Greenhouse Gas Bulletin by WMO**)
- **Methane (CH₄)** and **Nitrous Oxide (N₂O)** concentrations increased by **264% and 124%** respectively from pre-industrial levels in 2022. (**GGB by WMO**)
- **Global warming is estimated to be limited to 3°C** if the current policies continue. (Emission Gap Report 2023)
- Global GHG **emissions increased by 1.2 % from 2021 to 2022**. (Emission Gap Report 2023)



India

- India to **date has only contributed 5% of warming** (Emission Gap Report-2023).
- 2022 share in global CO₂ emissions stood at **8%. (3rd highest globally)**.
- **Per capita carbon emissions are still very low** at 2 tonnes per person per year in 2021 (Global average 4.7 tonnes).



Challenges in Mitigation

- **Adaptation finance needs** are 10-18 times higher than current public flows. (**Adaptation Gap Report 2023**)
- **Negligible movement on NDCs** since COP 27.
 - If current policies are continued, global warming is estimated to be limited to 3°C.
- Low- and middle-income countries face **substantial economic and institutional challenges** in low-carbon energy transitions like lack of natural resources, debt-burdens etc.
- **Major countries plans and projections** would lead to an **increase in global coal production** until 2030, and in global oil and gas production until at least 2050. (Production Gap Report (PGR) 2023)
- Action plan on **loss and damage** has **overlooked non-economic losses like cultural heritage and indigenous knowledge**.



Initiatives

- **Global**: Global Methane Pledge, Powering Past Coal Alliance, Just Energy Transition Partnerships (JETPs), Mission Innovation, etc.
- **India**: Panchamrit Target declared in COP 26 (Aim to achieve **Net-Zero emissions by 2070**), Mission Lifestyle for Environment' (LIFE), National Action Plan on Climate Change (NAPCC), etc.



Recommendations

- **Developed countries should double their climate finance** by 2025.
- **Urgently accelerate economy-wide, low-carbon transformations** to achieve the long-term temperature goal of the Paris Agreement.
 - **Recommendations of IPCC AR6** to limit global warming to 1.5°C: Global GHG emissions peak before 2025; Global net zero CO2 emissions in the early 2050s.
- Ensuring a **just transition** for Low- and middle-income countries.
 - E.g., in Mauritius, UNDP has supported the government to install battery energy storage capacity with funding from the **Green Climate Fund**.

1.6.2. GREENWASHING

Why in the News?

Central Consumer Protection Authority (CCPA) has sought public comments on the proposed **Draft Guidelines on Prevention and Regulation of Greenwashing** issued under **Consumer Protection Act, 2019**.

More on the News

- Green washing involves **making a product or policy seem more environmentally friendly** or less damaging than it is in reality
- **Key highlights of the draft guidelines**
 - **Defines** and also **prohibit** greenwashing.
 - **Applies to all advertisements, service providers, advertisers, endorsers, etc.**
 - Prohibits selective presenting of data and calls for **fully disclosing environmental claims**.
 - **Verification of claims** through **credible certification, reliable scientific evidence, and independent third-party verification**.
 - **Futuristic environmental claims only when clear and actionable plans** have been **developed** for achievement of objectives.

Types of Greenwashing



Greenhushing: Companies **underreport or hide sustainable credentials** to avoid scrutiny.



Greenrinsing: When a company **regularly changes its ESG** (Environmental, Social, Governance) targets **before achieving them**.



Greenlabeling: The **labeling** of an essentially **unsustainable product as green or sustainable**.



Greenlighting: The **highlighting of a particularly green feature** of a business's products or activities to draw attention away from its environmentally harmful actions.



Greenshifting: When companies reduce the climate crisis to consumer behavior and **shift responsibility to individuals**.



Greencrowding: When a company **hides within a group and is slow to adopt sustainability** policies (e.g. the 20 largest single-use plastic waste producers are members of the Alliance to End Plastic Waste global alliance).

Need for regulating greenwashing

- **Erosion of Public Trust** due to deceptive marketing and false claims of sustainability.
 - Example, in 2015, the US Protection Agency exposed Volkswagen for using **software to manipulate emission tests in its Clean Diesel cars.**
- False environmental claims **delay the genuine solutions.**
- **Impact on Innovation** as it redirects resources towards the appearance of environmental friendliness

Initiatives taken to prevent Greenwashing

- **India**
 - **Bureau of Indian Standards (BIS):** Developed a standard for eco-labelling of products and services called **IS/ISO 14024:1999.**
 - **Consumer Protection Act, 2019: Central Consumer Protection Authority (CCPA)** regulates matters related to **violation of rights of consumers, and false or misleading advertisements.**
 - **Advertising Standards Council of India (ASCI):** The ASCI guidelines require that advertisements making environmental/green claims be specific, accurate, and not misleading.
 - **Security and Exchange Board of India (SEBI):** SEBI's **Business Responsibility and Sustainability Reporting (BRSR) norms.**
 - ✓ SEBI also issued **dos and don'ts relating to green bonds.**
- **Global**
 - **UN's High-Level Expert Group on Net-Zero Emissions Commitments of Non-State Entities**
 - **Greenwashing TechSprint**

Way-Forward

- Annual publication of each **organization's greenhouse gas emissions alongside baseline data** and **Third-Party certification.**
- **Harness new technologies** like AI, natural language processing, Machine Learning in **tackling greenwashing** while also **measuring impact of a project.**
- **Cross-border cooperation and collaboration** among **companies, governments, non-governmental organizations, and other stakeholders.**

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1.6.3. CLIMATE FINANCE AT A GLANCE

Climate Finance



Definition

- 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**.



Current Needs

- Global:** At least **USD 4–6 trillion per year** for global transformation to a low-carbon economy. (Emission Gap Report 2022)
- India:**
 - Up to **6–8 trillion USD** during 2015–2030 to implement the actions required to transform the current energy systems.
 - USD 10 trillion** to achieve **net-zero by 2070**.

Significance of Climate finance:



Major Constraints

- Adaptation made up only about 8%** of the total climate financing in 2019–2020.
- Nearly **94%** of existing climate investment is either **through either debt or equity** (return seeking).
- Regional imbalance:** between 2011 and 2020, **80%** of global climate finance was **focused in OECD countries and the East Asia Pacific region**.



Global Initiatives

- **Loss and Damage Fund.**
- **Green Climate Fund (GCF):** Established in COP 16, 2010, developed countries pledged to mobilise US\$ 100 billion per year by 2020.
- Parties to the UNFCCC have made new **submissions for the New Collective Quantified Goal on Climate Finance (NCQG) under Paris Agreement**
- **Other:** Adaptation Fund; Special Climate Change Fund (SCCF); Least Developed Countries Fund (LDCF); Global Environment Facility (GEF); Clean Technology Fund (CTF) etc.



Initiatives in India

- **National Adaptation Fund for Climate Change (NAFCC)** was established in August 2015.
- **Priority Sector lending to renewable energy projects.**
- **SIDBI's Avaana Sustainability Fund (ASF)** (Approved by GEF)
- **Union Budget 2022-23** announced **sovereign green bonds for green infrastructural investments.**



Recommendations: An Independent High-Level Expert Group on Climate Finance (IHLEG):

- Boost **tax revenues**, **eliminate harmful subsidies** and implement **carbon taxation.**
- **Increase Private Finance** by **more than 15 times** on current levels.
- **Multilateral Development Banks** should **Triple** the level of **support by 2030.**
- **Fivefold increase** in **Low-cost and debt-free finance** needed by 2030.

1.6.4. DECARBONISATION IN INDIA AT A GLANCE

Decarbonisation in India



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**.



Challenges in Decarbonization

- High dependence on **conventional fuel (contributes about 60%)**.
- **Technological limitations** in important fields like low-carbon technology, CCUS etc.
- **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.** E.g., shifting to electrical vehicles would require expansion of charging infrastructure.
- **Other challenges: Skill gap in labour force; Lack of policy measures and monitoring standards for tracking decarbonization of different sectors etc.**



Way Forward: Recommendations of Energy Transition Advisory Committee (ETAC)

- **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.
- **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.

1.6.4.1. SECTOR SPECIFIC DECARBONIZATION



Transport Sector

Emission from India's Transport Sector

- **14% share** in energy-related CO₂ emissions.
- **3rd most** greenhouse-gas-emitting sector in India.
- **Between 1990 and 2019, Indian Transport-sector emissions grew by 375%.** (Towards Decarbonising Transport 2023)

<p>Challenges in Decarbonisation</p> <ul style="list-style-type: none"> • Challenges in adoption of low carbon transportation like electric vehicles (EVs) <ul style="list-style-type: none"> ○ High cost: Involved in deployment of new technologies and charging infrastructure. ○ Hesitancy: Among consumers to adopt due to high cost, safety etc. ○ Low focus on fuel standards. ○ Fossil fuel's share is still high in India's power generation in India (43% of total installed capacity). • High levels of traffic congestion and air pollution. • Emerging issues: War in Ukraine, increased geopolitical tensions, supply chain disruptions, spiralling energy prices, and rising inflation.
<p>Initiatives taken by India to Decarbonise Transport Sector</p> <ul style="list-style-type: none"> • Targets: 45% mode share for rail freight until 2030; 30% EV market share by 2030 • Bharat Stage VI Emission Standards • Ethanol Blending in Petrol to reach 20% by 2025 • Forum for Decarbonizing Transport in India by NITI Aayog • FAME India (Part of National Electric Mobility Mission Plan) • PM-eBus Sewa Scheme for city e-buses on PPP model • National Green Hydrogen Mission
<p>Way forward</p> <ul style="list-style-type: none"> • Avoid, Shift and Improve Strategy: <ul style="list-style-type: none"> ○ Mobility transition - Transition to sustainable mobility will reduce energy consumption without limiting mobility. (Avoid) ○ Energy transition in transport - Transition to clean energy in the transport sector will cover remaining demand with carbon-neutral energy. (Shift) ○ Transport transformation - This large-scale transformation will ensure that transport is carbon neutral by 2050. (Improve) • Strategic investments and innovative financial solutions can kick-start an accelerated transition to 100% zero-emission motor vehicles (COP26 declaration).
<p>Agrifood systems</p>
<p>Emission from Agrifood systems</p> <ul style="list-style-type: none"> • Contributes to~ 1/3rd of global greenhouse gas emissions. (18 % in India's (2019)) • India among the top 3 emitters of agrifood emission.
<p>Challenges in decarbonisation</p> <ul style="list-style-type: none"> • Project-level financing for agrifood systems stands at only 4.3%. • High fossil fuel usage: At least 15% of global fossil fuels use annually (Global Alliance for the Future of Food report).
<p>Initiatives</p> <ul style="list-style-type: none"> • National Mission for Sustainable Agriculture (NMSA) • Paramparagat Krishi Vikas Yojana. • Gobardhan scheme.
<p>Recommendations for the Agrifood System Transformation</p> <ul style="list-style-type: none"> • Annual investments must increase to \$260 billion a year to halve agrifood emissions by 2030 and reach Net Zero emissions by 2050. • Repurposing harmful subsidies toward agrifood system mitigation technologies • Use Innovative mitigation technologies like chemical methane inhibitors, feed additives from red seaweed, indoor farming methods, precision machinery, etc.

Shipping Industry

Emission from Shipping Industry (UNCTAD's Review of Maritime Transport 2023 report)

- International Shipping emissions **increased by 20%** in the last decade.
- **Shipping industry** accounts for **nearly 3% of global GHG emissions.**

Challenges

- Only **1.2% of the global fleet** use alternative fuels like LNG, battery/hybrid, LPG, and methanol.
- **Cost of retrofitting existing fleet.**

Initiatives to Protect Environment from Shipping Emissions:

- **International Maritime Organization (IMO)** has set a target to achieve **net-zero GHG emissions by around 2050 (at least 5-10% use of zero or near-zero GHG fuels by 2030).**
- **IMO's Energy Efficiency Existing Ship Index (EEXI).**
- **The MARPOL Treaty** a legal instrument under the auspices of IMO.
- **Hong Kong International Convention** for the Safe and Environmentally Sound Recycling of Ships.
- **Harit Nauka Initiative in India**

Way Forward: Recommendations (UNCTAD's Review of Maritime Transport 2023 report)

- **Facilitate the fuel transition** and an equitable decarbonization process
- **The readiness and availability of alternative fuels** and vessel designs must be assessed.
- **Reform and invest** in port efficiency and performance

1.6.5. SHORT-LIVED CLIMATE POLLUTANTS (SLCPS)

Why in the News?

The Climate and Clean Air Coalition's (CCAC) annual meeting, the Climate and Clean Air Conference, recently took place in Nairobi, Kenya.



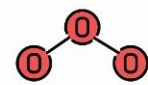
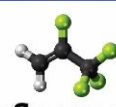
About CCAC

- It is the **only global alliance** dedicated **exclusively to the reduction of short-lived climate pollutants (SLCPS).**
- **India** joined in **2019.**
- **Key outcomes of the CCAC Conference 2024:** Launch of Clean Air Flagship, CCAC Technology and Economic Assessment Panel etc.

What are short-lived climate pollutants (SLCPS)?

They are powerful climate forcers that **remain in the atmosphere for a much shorter period of time** than carbon dioxide, yet their **potential to warm the atmosphere can be many times greater.**

Short-lived climate pollutants (SLCPs)

SUBSTANCE	ANTHROPOGENIC SOURCES	LIFETIME IN ATMOSPHERE
 Black carbon (soot)	Fossil Fuels, Industrial Production, Agricultural and Waste Burning	4-12 days
 Methane (CH₄)	Agriculture, Fossil fuels, landfills, open dumps, and wastewater	12 years
 Tropospheric (or ground-level) ozone (O₃)	Secondary pollutant formed by the interaction of sunlight with volatile organic compounds (VOCs) and nitrogen oxides (NO _x)	few hours to a few weeks
 Hydrofluorocarbons (HFCs)	Refrigeration, air-conditioning, insulating foams and aerosol propellants	15 years

Impact of SLCPs

- **2nd largest contributor** to human-caused climate warming after carbon dioxide, **contributing up to 45% of global warming to date.**
- **On Human Health:** E.g., Exposure to ground-level ozone can cause inflammation of the lungs, asthma and allergies.
- **On weather patterns:** E.g., Tropospheric ozone influences cloud formation.
- **Accelerated ice melt:** Due to deposition of black carbon on ice or snowfields.
- **On Agriculture:** E.g., Tropospheric ozone harms vegetation by damaging leaves, reducing photosynthesis, impairing plant reproduction and growth, etc.

Sector-wise solutions to reduce SLCPs

- **Agriculture:** Promote farm-scale anaerobic digestion; Eliminate open burning in agriculture etc.
- **Fossil fuels:** Carry out pre-mining de-gasification and recovery and oxidation of methane from ventilation air from coal mines.
- **Waste:** Separate and treat biodegradable municipal waste and turn it into compost or bioenergy to mitigate methane.
- **Household energy:** Replace traditional cooking with clean-burning modern fuel and cookstove technology, such as solar, biogas, electricity to reduce black carbon.

1.6.6. CLIMATE ENGINEERING

Why in the News?

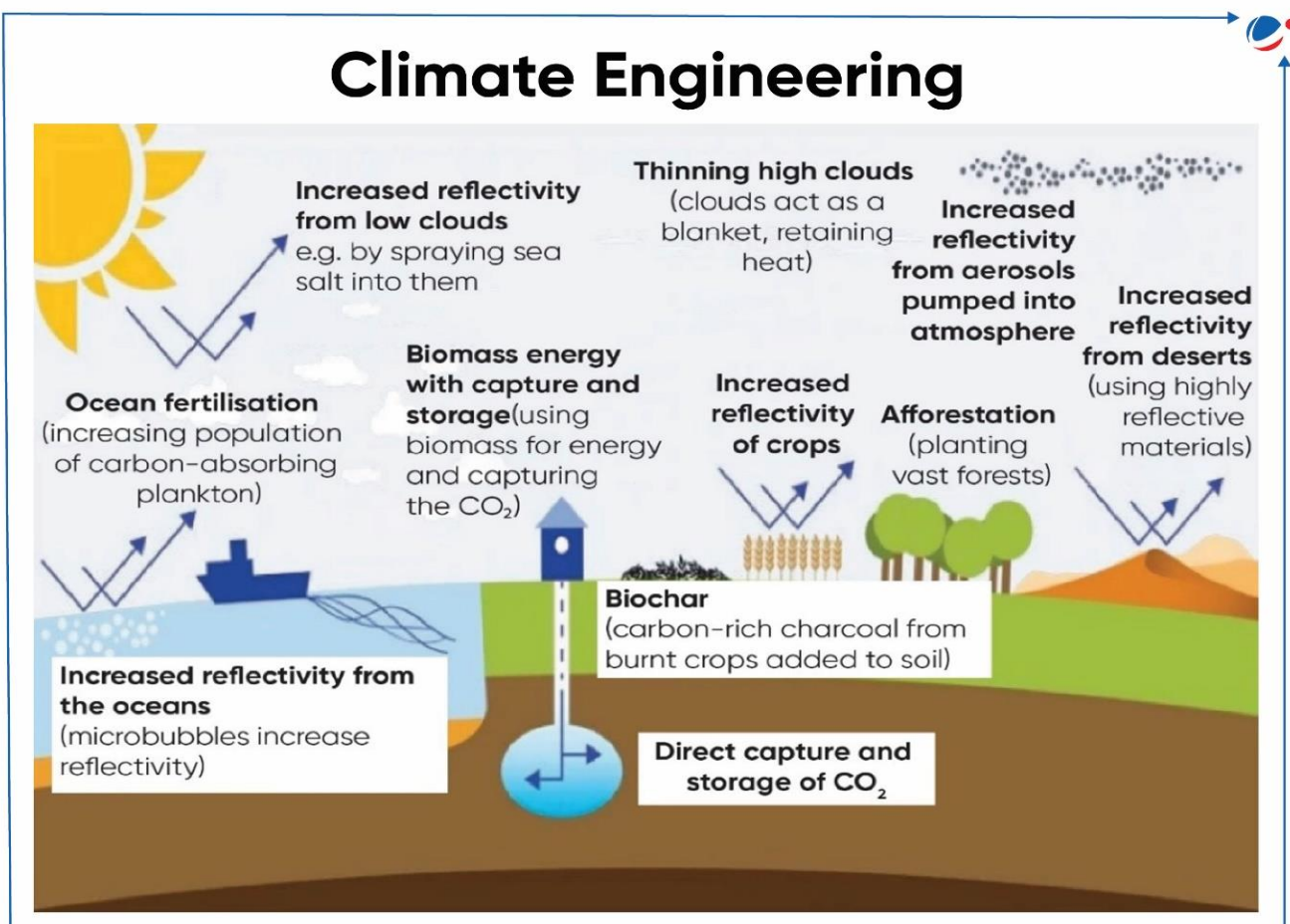
UNESCO released its **first report on the ethics of climate engineering**.

About Climate Engineering

- Aims to **address global warming** not by reducing GHG emissions but **by directly intervening in the climate system**.
- **Methods:** Carbon Dioxide Removal (CDR) and Solar Radiation Modification (SRM).
- **Significance of climate engineering:** Mimic natural processes; Reduces the urgency of reducing carbon emissions; Addressing climate policy gap etc.

Potential risks associated with climate engineering

- **Environmental Risks:**
 - May **impair the self-regulation capacity** of natural ecosystems in long run;
 - Can have adverse **impact** on ozone layer, rainfall, crop production and ocean acidification; and
 - **Technology dependency** for tackling climate.
- **Economic Risks:** High cost and can **exacerbate global inequalities**.
- **Ethical issues**
 - **Organized irresponsibility:** Due to the **uncertainties and synergistic effects** of environmental risks.
 - **Low transparency** of their progress, feasibility, risks, and benefits.
 - **Violates Distributive justice:** Due to difficulties in achieving ethical consensus for **proper recognition and compensation for risks**.
- **Moral hazard:** providing stakeholders with an excuse to **not reduce the use of fossil fuels**.



India's Initiative for climate engineering

- Department of Science and Technology (DST) is supporting an active climate modelling research program in geoengineering at the Indian Institute of Science (IISc).
- Major Research and Development Program (MRDP) was launched by DST to understand the implications of geoengineering.
- Indian Institute of Tropical Meteorology is developing Earth system model for performing solar geoengineering simulations.

Way ahead: UNESCO's recommendations

- Introduce legislation that regulates climate action to prevent harm and ban weaponization of climate engineering techniques.
- Participation and inclusiveness of Marginalised groups, women, youth, indigenous people et.
- Promote open collaboration and constant monitoring of climate actions to promote informed decision making.
- Strengthening institutional, technological and ethical capacities as regards climate action.

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BENGALURU: 12 & 18 JULY

BHOPAL: 18 JULY

CHANDIGARH: 18 JULY

HYDERABAD: 24 JULY

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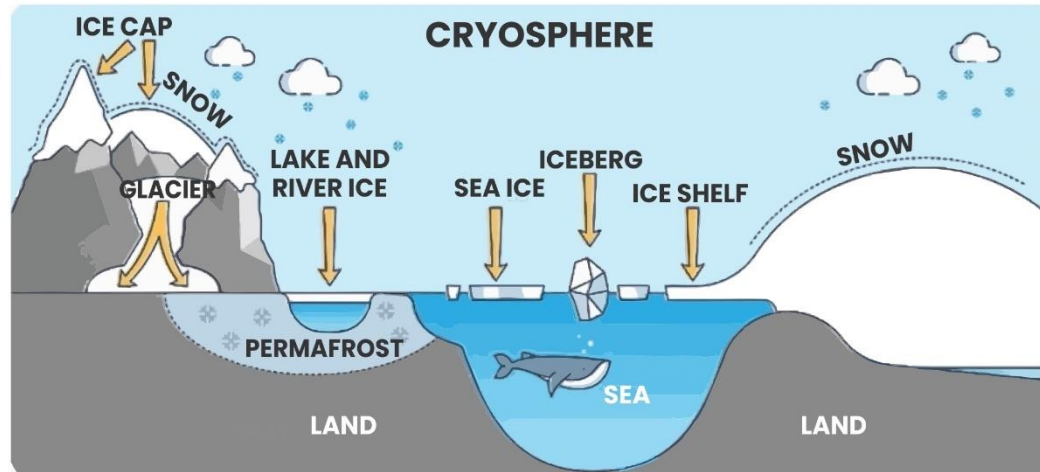
1.7. CRYOSPHERE AND CLIMATE CHANGE AT A GLANCE

Cryosphere and Climate Change



Definition

- Frozen part of the planet



Impact of Climate Change on Cryosphere

- Last decade has witnessed **the seven worst years of ice loss.**
- **In case of** temperature rises by 2°C.-
 - **Nearly all tropical glaciers, most mid-latitude glaciers, and Polar Regions** will disappear. E.g., **Venezuela may be the first nation to lose all its glaciers**
 - Himalayas expected to lose **50 % of today's ice by 2100.**



Impact of melting Cryosphere

- **Disturb Earth Energy Budget** maintained by its high Albedo.
- Releases of **Carbon stored** in Permafrost soil.
- Can **strengthen extreme weather events and rise sea levels.**
 - If all glaciers and ice sheets melted, global sea level would rise by more than 60 meters (NASA)
- Impact water availability as 80% of the world's fresh is in the form of glaciers, ice sheets, etc.
- Melting of polar ice mass due to climate change have **decelerated speeding up of Earth's rotation**, which may **delay the need of adding a negative leap second.**



Steps Taken to protect Glaciers

Global

- **Himalayan Monitoring Assessment Programmed (HIMAP)** launched by the Centre for Integrated Mountain Development (ICIMOD) etc.
- **UNESCO's World Glacier Monitoring Services**
- Year 2025 has been declared International Year of Glacier Preservation by the UN.

India

- **National Mission for Sustaining Himalayan Ecosystem:** part of National Action Plan on Climate Change (NAPCC) launched in 2008.
- Research Station 'Himansh' established in the Chandra basin (Himachal Pradesh) in 2016

1.7.1. INDIA'S INTEREST IN ARCTIC

Why in the news?

Ministry of Earth Sciences Launched India's 1st Winter Scientific Expedition to Arctic.

Significance for India

- **Environmental Protection:** Changes in the Arctic climate have global implications, including on the **Indian monsoon, global sea rise etc.**
- **Economic:** The Arctic holds an estimated **13% of the world's undiscovered conventional oil resources** and **30% of its undiscovered conventional natural gas resources**.
 - It also has **rich deposits of coal, gypsum and diamonds** and also **substantial reserves of zinc, lead, placer gold and quartz**.
- **Transportation and Connectivity:** Opening of new shipping route and possibilities of mineral extraction may lead to scramble for supremacy over Arctic region.
- **Science and Research:** Crucial for **understanding global climate** patterns and changes. For example, **linkage between Arctic-Himalaya**.

History of India's Arctic Research



Challenges Faced by Arctic Region

- **Plastic Crisis:** Toxic Threats to Health, Human Rights, and Indigenous Lands from the Petrochemical Industries.

- **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.
- **Changing chemistry of western region of the Arctic Ocean:** Acidity levels increasing three to four times faster than ocean waters elsewhere.
- **Governance:** Unlike Antarctica, which is governed by Antarctic Treaty, Arctic region belongs to various national jurisdictions.

Initiatives for Arctic Region

- **The Arctic Council** facilitates cooperation among Arctic states on environmental protection and sustainable development.
- **UN High Seas Treaty to mitigate impacts of climate change.**
- **India's Arctic Policy-** Aims to understand the impact of climate change in the Arctic on India's climate, and energy security.
- **Protection of the Arctic Marine Environment (PAME).**

Conclusion

Exploration in Arctic region **should be safe and sustainable** with minimum Intervention in Arctic ecosystem for resources exploitation. Also, **global cooperation can be promoted in implementing international commitments** such as Paris Climate deal.

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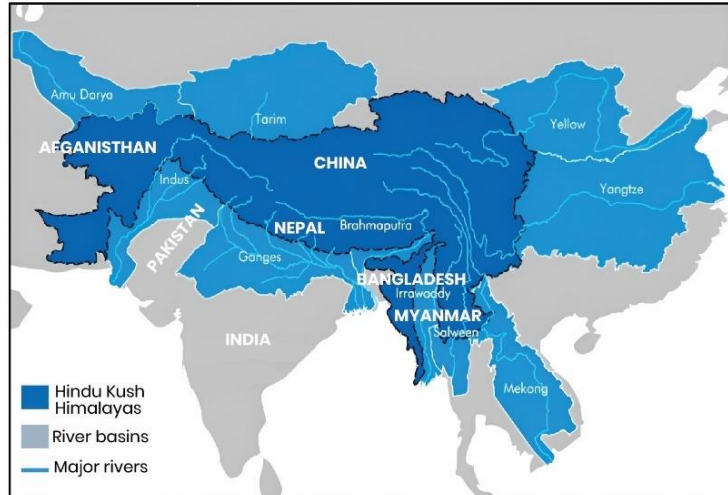
1.7.2. HINDU KUSH HIMALAYAS (HKH) AT A GLANCE

Hindu Kush Himalayas (HKH)



About HKH

- Spans an area of approximately 4.3 million square km (extends **about 3,500 km**) in **Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan.**



Significance of HKH region

- Home to the world's highest peaks such as Mount Everest and Kanchenjunga.
- Known as **the Third Pole or the Water Tower of Asia.**
 - Source of **10 major Asian** river systems.
- 4 Global Biodiversity Hotspots**
- High Biodiversity; **330 Important Bird and Biodiversity area.**
- 240 million** people depend on HKH for their lives and livelihood.



Climatic risks faced by the region

- Increased intensity and frequency of Climate change hazards:** Like- Glacial Lake outbursts, flash floods etc.
- Global warming:** a 3 °C temperature rise will melt up to 75% of glaciers in parts of the Himalayas by 2100. (**Asian Development Bank**)
- Economic losses:** in the region from disaster totalled \$45 billion from 1985 to 2014,.
- Loss of Biodiversity:** **70% of the original biodiversity** has been **lost over last century.**



Global initiatives for protecting Himalayan Ecosystem

- **Building Adaptation and Resilience in HKH Initiatives.**
- **International Centre for Integrated Mountain Development**
- **Hindu Kush Himalayan Monitoring and Assessment Programme (HIMAP)** coordinated by ICIMOD.
- **Himalayan Adaptation Network** by IUCN.
- **Living Himalayas Initiative** by the World Wide Fund for Nature (WWF).



India's Initiatives

- **National Mission on Sustaining the Himalayan Ecosystem**, launched by India as part of **National Action Plan on Climate Change**.
- **SECURE** (Securing livelihoods, conservation, sustainable use and restoration of high range Himalayan ecosystems) **Himalaya** by **MoEFCC and the UNDP**.



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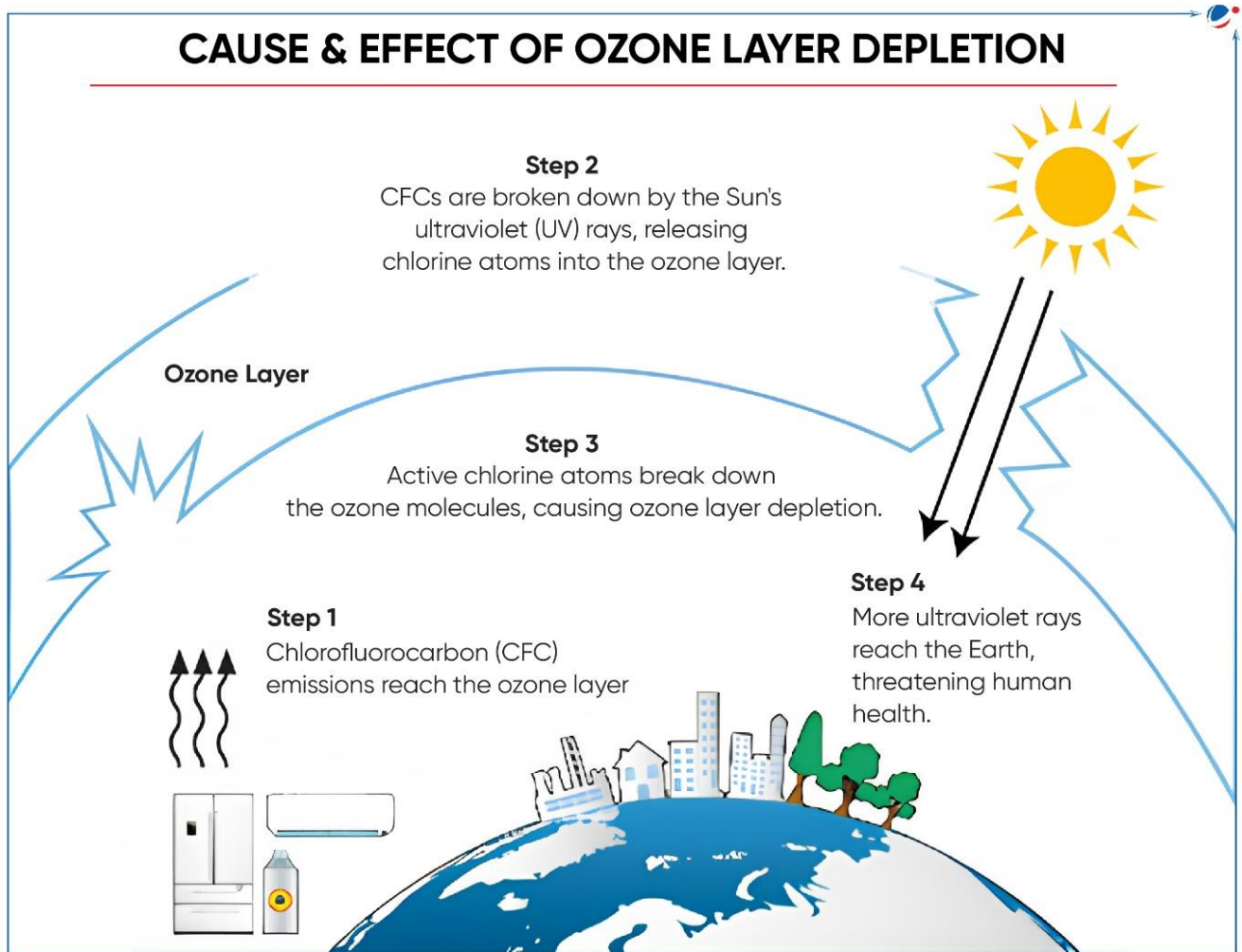
1.8. OZONE HOLE

Why in the news?

As per recent study, from 2020-22, ozone hole has grown larger and thinner over Antarctica. Since 2004, researchers saw a total reduction of 26% at the core of ozone hole.

About Ozone hole

- **Ozone hole: Exceptionally depleted ozone in the stratosphere** (between 10 KM and 40 KM above the Earth's surface) over Arctic/ Antarctic.
 - **Ozone layer** is a thin shield of gas in Earth's atmosphere that protects the Earth, **absorbing the sun's ultraviolet rays.**



MAINS 365 - ENVIRONMENT

Arctic Hole	Antarctic hole
<ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> ○ Occurs due to polar Arctic vortex. 	<ul style="list-style-type: none"> • First reported in 1985. • Develops in August and dissipates in late November • The frozen crystals that make up polar stratospheric clouds provide a surface for the reactions that free chlorine atoms in the Antarctic stratosphere.



Causes of Ozone Layer Depletion:

- **Natural:** Changes in Antarctic **polar vortex**; **Aerosols** from wildfires and volcanic eruptions; Changes in **solar cycle etc.**
- **Human-made: Human-made greenhouse gases** known as **Ozone-Depleting Substances (ODSs)**
 - **Major ODSs** includes chlorine, bromine, CFCs, carbon tetrachloride, halons etc.

Initiatives

- **Montreal Protocol:**
 - **It is a global environmental treaty** to eliminate the production and use of **ODS**.
 - It was implemented under the **Vienna Convention (adopted in 1985)**
- Later, **Kigali Amendment** to the **Montreal Protocol** was **adopted in 2016**; to phase **down the production** and consumption of **Hydrofluorocarbons (HFCs)**.
- According to UNEP, ozone layer is on track to **recover within four decades**.

India and Ozone Depletion

- India **exceeded the 35% HCFC** (Hydrochlorofluorocarbons) **phase-out goal**, achieving a 44% reduction from the **2020 baseline** and has also **eliminated HCFC 141b. (UNDP)**
- **India's initiative to address ozone depletion:**
 - **Ratification to Vienna convention and Montreal protocol.**
 - **Three-stage HCFC phase-out Management Plan.**
 - **India cooling Action Plan (ICAP)** to provide access to sustainable cooling.
 - **Ozone Cell** in MoEFCC.

1.9. OTHER CONCEPTS

1.9.1. CARBON FARMING

Why in the news?

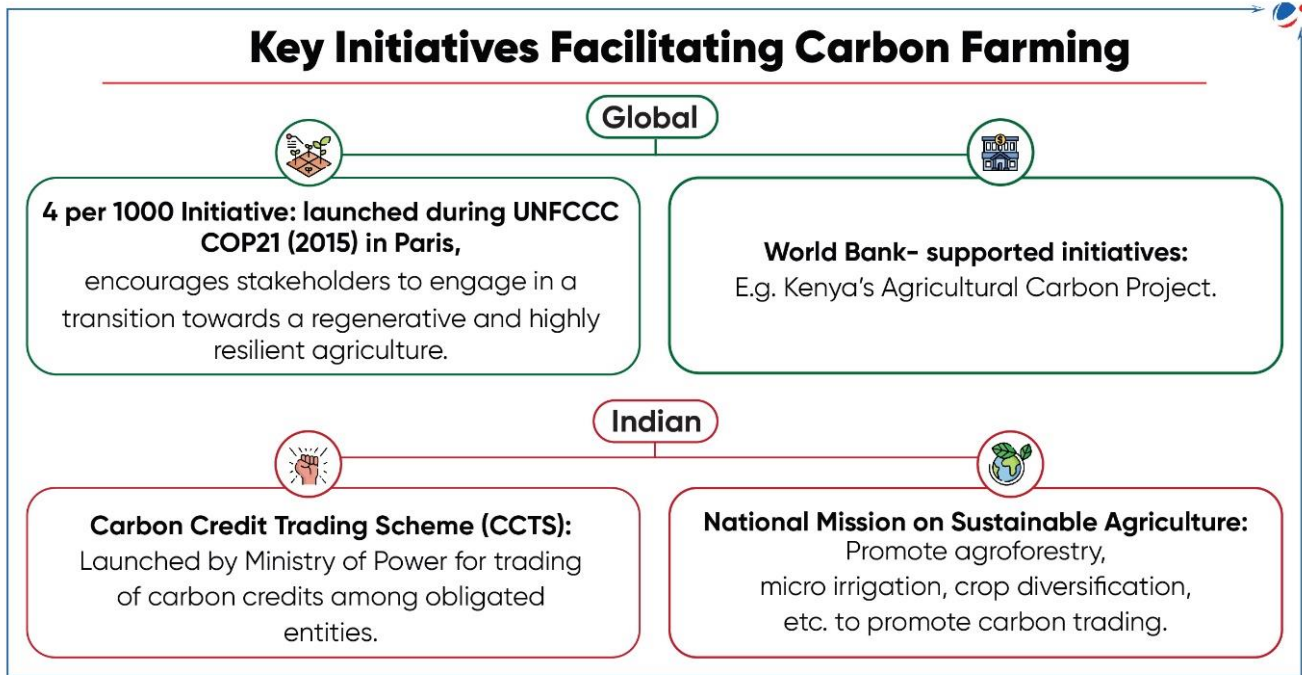
European Parliament and the European Council recently working to establish the first **EU-level Carbon Removal Certification Framework** to boost **carbon farming**.

About Carbon Farming

- Uses **regenerative agricultural practices** to improve agricultural productivity, restore ecosystems, and combat climate change by storing carbon and reducing emissions.
- **Common Methods:** Agroforestry, conservation farming (minimising soil disturbance), integrated nutrient management, Renewable Energy Production Grasslands Conservation, etc.

Potential Benefits:

- **Carbon Sequestration:** Agricultural soils can absorb 3-8 billion tonnes of CO₂-equivalent every year.
- **Promoting Farmers Income:** Carbon credit systems can incentivise farmers by providing additional income through environmental services.
- **Challenges:** Inadequate policy support, lack of resources to invest in sustainable land management practices by small land holding farmers etc.



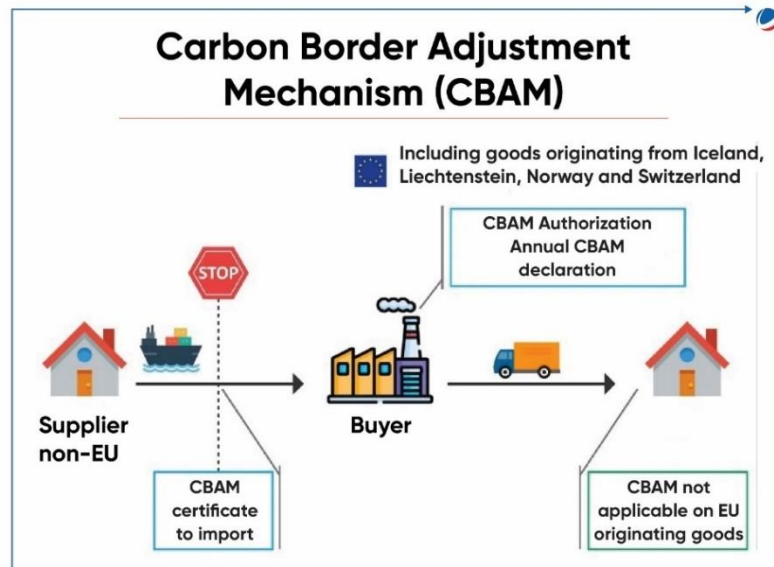
1.9.2. CARBON BORDER ADJUSTMENT MECHANISM

Why in the news?

Green energy to help industry deal with EU's Carbon Border Adjustment Mechanism (CBAM): Ministry of Commerce and Industry

About CBAM

- CBAM is a policy instrument to put a **fair price on the carbon emitted during the production of carbon-intensive goods** that are entering the EU and to encourage cleaner industrial production in non-EU countries.
 - Reporting under it will start from 1 October 2023. It becomes operational in its definitive phase on 1 January 2026.
 - The CBAM is **designed to be compatible with WTO rules.**
- CBAM is like a **non-tariff barrier (NTB)** for Indian exports.
 - An NTB is any measure, other than a customs tariff, that acts as a barrier to international trade.
- **Potential impact on India:** Can affect India's exports.
 - E.g., in 2022, India's 27% exports of iron, steel, and aluminium products of value USD 8.2 billion went to the EU.



India's Approach to deal with CBAM

- Adoption of **low-carbon emitting technologies** and production methods.
- Promoting **decarbonization** with the help of initiatives like **Green Hydrogen Mission, Solar Mission** etc.
- India is negotiating with the EU to **keep MSMEs out of the ambit.**

2. AIR POLLUTION

2.1. URBAN AIR POLLUTION IN INDIA AT A GLANCE





Urban Air Pollution in India



Extent of Urban Air pollution in India (2023 World Air Quality report, IQAir)

- **Ranked 3rd globally in air pollution**
- **Annual average PM2.5 concentrations:** 54.4 µg/m³ (>10 times of WHO recommended annual guideline level of 5 µg/m³)
- **9 out of 10 World's most polluted cities in India** (Begusarai, Guwahati, Delhi in Top 3)

Impacts of Urban Air Pollution

 Adverse health outcomes	 Acid rain	 Climate change	 Reduced Agricultural Productivity
Globally, air pollution accounted for 2nd largest risk factor of death (8.1 million deaths) in 2021 (State of Global Air Report, 2024).	Impacts buildings, forests, aquatic life etc.	Due to Short-lived climate pollutants like black carbon, ozone, methane, etc.	Due to Ground-level ozone and Particulate matter.



Regulatory Measures to Improve Air Quality

- **Acts:** Air (Prevention and Control of Pollution) Act, 1981
- **Statutory Bodies:** **Central Pollution Control Board** (Water Prevention and Control of Pollution Act, 1974), **Commission for Air Quality Management (CAQM)**, (CAQM in the National Capital Region and Adjoining Areas Act 2021).
- **For vehicular emissions:** BS-IV to BS-VI norms, Roadmap for Ethanol Blending in India 2020-25, Faster Adoption and Manufacturing of Electric Vehicles (FAME) -2 scheme, etc.
- **Flagship scheme: National Clean Air Programme (NCAP)** to attain **National Ambient Air Quality Standards** for PM 10 concentrations by 2025-26.
- **Monitoring:** SAMEER app, System of Air Quality and Weather Forecasting and Research (SAFAR), Swachh Vayu Sarvekshan 2023 etc.
- **Other Initiatives:** Graded Response Action Plan (GRAP), Wind Augmentation and Air Purifying Unit (WAYU) device, etc.



Way Forward

- **Implementing National Emissions Trading System** based on 'polluters pay' principle, e.g., EU Emission Trading System.
- **Direct procurement of crop residue** by large agro-waste management companies, etc.
- **Enhancing efficiency of power plants:**
 - Switching to **super-thermal/renewable-based ones.**
 - Ensuring **100% utilisation of fly ash** by Thermal Power Plants (MoEF&CC Notification in 2021).
- **Decarbonisation of the transport sector:** E.g., **Strict emissions standards on trucks and other heavy-polluting vehicles in Bogota, Columbia.**
- **Technological interventions:**
 - **Anti-smog gun** used in Delhi to absorb polluted particles.
 - **5G-enabled autonomous robots, South Korea** for scanning air quality in industrial areas.
 - **Space Based Interventions** like NASA's **Tropospheric Emissions Monitoring of Pollution (TEMPO)** satellite to monitor air pollution from space.

2.1.1. AIR POLLUTION IN MAJOR CITIES

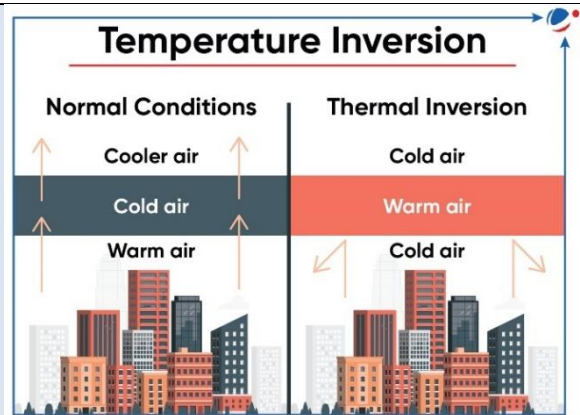
2.1.1.1. CASE OF DELHI

Reasons for rise in air pollution in Delhi every winter

- **Changes in wind direction** to Northwest after monsoon withdraws brings dust from Rajasthan, Pakistan and Afghanistan.
- **Dip in wind speeds** making them ineffective at dispersing pollutants.
- **Temperature Inversion** entraps pollution at lower levels.
- **Vehicle emissions** are responsible for **40% of PM2.5 emissions** in the nation's capital.
- **Stubble burning in NCR.**
 - E.g., **1 tonne of straw** being burnt releases **3kg of Particulate Matter** and 1460kg of Carbon dioxide.

Temperature Inversion

- As **temperature dips, inversion height**, which is layer beyond which pollutants cannot disperse into the upper layer of the atmosphere, **is lowered.**
- The concentration of pollutants in the air increases when this happens.



2.1.1.2. CASE OF MUMBAI

Reasons for rise in air pollution in Mumbai

- **Change in local wind pattern:** Cycle of wind patterns **between sea to land** and **land to sea** is disturbed which increases the Particulate Matter (PM).

- Dip in La Nina (**cooling of the ocean surface and change in wind patterns**)
- **Temperature gradient:** Between the city and nearby hills, draws winds and dust towards the city.
- **Generation of pollutants:** Road dust, construction sites, automobile exhaust, unclean fuel, etc.

2.1.2. CLOUD SEEDING

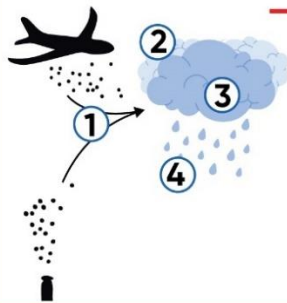
Why in the news?

Researchers discussed the possibility of **using cloud seeding to tackle Delhi's air pollution**.

About Cloud Seeding

- It is a **weather modification technique** to enhance precipitation by dispersing substances into air that help to saturate the clouds.
- **Chemicals used:** Salts of **silver iodide, potassium iodide, sodium chloride, or dry ice**, etc.
- **Conditions required for cloud seeding:**
 - **Deep enough clouds** with suitable temperature (between -10 and -12 degrees Celsius).
 - **Cloud covering** at least 50% of the target area.
 - **Relative humidity to be greater than 75%.**
 - **Cold enough clouds** to hold supercooled liquid water.

How Cloud Seeding Works



1. Silver iodide is released by a plane or ground-based generator
2. Silver iodide particles reach the targeted cloud
3. Silver iodide aids in the formation of ice crystals
4. Now too heavy to remain in the air, the ice crystals then fall, often melting on their way down to form rain

Methods of cloud seeding

- **Hygroscopic cloud seeding**, involving **dispersing salts through flares or explosives**. Yielded positive results in South Africa and Mexico.
- **Use of electrical charges** that work similar to silver iodide. Researchers directed **infrared** (that helped atmospheric gases to form particles, acting as seeds) to air in Berlin.

Applications of Artificial Rain (using Cloud Seeding)

- **Power generation:** Augmented the production of hydroelectricity (by enhancing rainfall in catchment areas) in Tasmania, Australia, during the last 40 years.
- **Increasing rainfall:** **Cloud Aerosol Interaction and Precipitation Enhancement Experiment (CAIPEEX phase-4)**, under the **Ministry of Earth Sciences** in 2018-19 was able to **achieve 18% relative enhancement** in rainfall over **100 sq km area**.
- **Fog dispersal and cyclone modification:** "Project Sky Water"(1962) of USA.
- **Abate Pollution:** **Clearing particulate matter and pollutants from atmosphere**, dispersal of smog and haze, reduction of airborne pollutants like dust, smoke, and chemicals.
- **Other applications:** Controlling Forest fires, aid research by better understanding of atmospheric processes, cloud physics, control of water pollution (maintaining Minimum River Flows), etc.

Issues with inducing Artificial Rains

- **Side-effects:** E.g., silver iodide could be toxic to aquatic life.



- **Ethical and Legal challenges:** Water rights, ethical considerations regarding human intervention in natural processes, etc.
- **Other issues:** Abnormal weather patterns, high cost due to use of aircraft/flare shots, etc.

Conclusion

Collaborative efforts between **scientists, policymakers, and the public** for **clear guidelines, ethical standards, and regulatory frameworks** on cloud seeding projects. **Dedicated research** to understand the **long-term impacts of Cloud Seeding on ecosystems, weather patterns, and human health, etc.**

2.1.3. 5 YEARS OF NATIONAL CLEAN AIR PROGRAMME (NCAP)

Why in the News?

Ministry of Environment, Forest and Climate Change (MoEFCC) launched NCAP in 2019 due to rising air pollution in the country.

About NCAP

- **Aim:** To improve air quality in 131 cities (non-attainment cities (NAC) and Million Plus Cities) in 24 States by engaging all stakeholders.
 - The cities which are exceeding the **National Ambient Air Quality Standards (NAAQS)** for 5 consecutive years are identified as NAC by **Central Pollution Control Board (CPCB)**.
- **Target:** Achieve reductions up to **40%** of PM10 and PM2.5 concentrations by **2025-26**, base year **2017**.
- **Implementation:** **CPCB** at the national level. Under it, **City Action Plan's (CAPs)** are implemented by state government and city level (Municipal bodies).
- **Swachh Vayu Survekshan** (by MoEF&CC) ranks cities on the basis of the implementation of activities approved under city action plan and air quality in 131 National Clean Air Programme cities.
 - **Criteria used:** Biomass and Municipal Solid Waste Burning, Road Dust, Dust from construction and Demolition Waste, Vehicular Emissions, Emissions from Industries, Improvement in PM 10 concentrations, Public awareness, other emissions.
- **PRANA** (Portal for Regulation of Air-pollution in NAC) was launched to monitor the implementation of NCAP.

Progress made by NCAP in last 5 years

- **27 out of 49 cities** showed improvement in **PM 2.5**.
- **24 out of 46 cities** showed improvement in **PM 10**.

Challenges in implementation of NCAP

- **Inadequate number of air quality** monitors (only 931 against the 1500 targeted by 2024).
- **Poor data capture** due to substandard monitoring stations.
- Less than **50% utilization of total funds** released under NCAP.
- **Other Challenges:** Lack of clear fiscal and funding strategy at the state level, dealing with trans-boundary emissions.

Way forward

- Adopt a **standardised method** for air quality monitoring with **investment in technological tools**.
- **Strong, coherent and coordinated fiscal response** by the government.
- Providing **legal mandate** to targets for ensuring compliance.
- **Catalyzing action by the private sector and improving stakeholder cooperation**.

3. WATER AND LAND DEGRADATION

3.1. THE WATER (PREVENTION AND CONTROL OF POLLUTION) AMENDMENT ACT, 2024

Why in the news?

The Parliament recently passed the **Water (Prevention and Control of Pollution) Amendment Act, 2024**.

More on News

- It amends the **Water (Prevention and Control of Pollution) Act 1974**.
- **Application: Himachal Pradesh, Rajasthan** (both passed resolution to amend the Act) **and the Union territories**.
- **Water is a state subject** and its optimal utilization and management lies predominantly within the domain of the States.
 - **However, Article 252 of Constitution** empowers Parliament to legislate on any matters with respect to which it lacks legislative power.

About Water (Prevention and Control of Pollution) Act 1974

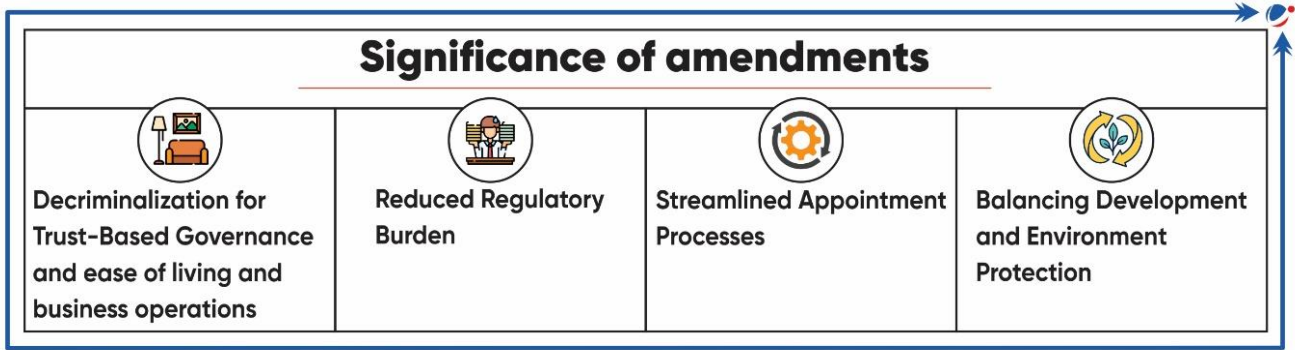
- The Act provides for the **prevention and control of water pollution, and for the maintaining or restoring of wholesomeness of water** in the country.
- The original Act is **applicable in 25 States**.
- **Regulatory bodies:** Creation of the **Central Pollution Control Boards (CPCB)** and **State Pollution Control Boards (SPCB)**
- **Approval:** Mandatory for industrial units to get **permission from their respective State boards** before setting up factories.

Key Amendments (Water Amendment Act, 2024)

Key Aspects	Water Act, 1974	Water Amendment Act, 2024
Chairman of SPCB	<ul style="list-style-type: none"> • Nominated by the State government. 	<ul style="list-style-type: none"> • Central government to prescribe manner of nomination, terms and conditions of service.
Consent exemptions for establishing industries	State Government may “exempt certain categories of industrial plants” and empowered to issue guidelines on matters relating to grant, establishment of any industry, etc.	<ul style="list-style-type: none"> • Central government, in consultation with the CPCB • Central government may issue guidelines
Penalty for offences	<ul style="list-style-type: none"> • Imprisonment of up to Six years for discharge of polluting matter. 	<ul style="list-style-type: none"> • Act decriminalises several violations, and instead imposes penalties of ₹10,000-₹15 lakh.
Offences by government departments	The head of a department will be deemed guilty for offences	Head of a department will be required to pay penalty equal to one month of their basic salary if the department violates any provision of the Act.

Other provisions of Amendment Act 2024:

- **Tampering with Monitoring Devices:** Penalty ranging from ₹10,000 to ₹15 lakh.
- **Adjudicating officers to be appointed by Central government** to determine penalties
- Penalties to be **credited to the Environment Protection Fund** established under the **Environment (Protection) Act, 1986**.
- **Appeal:** May be made before the **National Green Tribunal**, after depositing 10% of the penalty levied.



Criticism of the amendments

- **Ineffectiveness of Penalties:** E.g., enforcing penalties for littering at Ghats are challenging due to logistical and cultural reasons.
- **Other issues:**
 - **Ignoring the Climate and water Crisis**
 - **Detrimental Impact on Future Economy**
 - **Effect on Federalism** due to limited powers of the state to run the operation of SPCBs.

Conclusion

There is need for Stakeholder Engagement through consultations with environmental experts, industry representatives, and civil society organizations to refine the amendments and address concerns. Also, training and capacity-building programs for Pollution Control Boards can enhance effective enforcement of environmental regulations.



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Highlights of the Program

- Coverage of the entire UPSC Prelims and Mains Syllabus
- Highly experienced and qualified team of senior mentors
- Emphasis on themes for Prelims & Mains with High-Scoring Potential
- Focus on Current Affairs & CSAT preparation through rigorous practice
- Access to Lakshya Prelims Practice Tests (LPPT) and Lakshya Mains Practice Test (LMPT)
- Sandhan Personalised Test Series with an extensive collection of 15000+ questions
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Date	Duration	Medium	Mode
23rd JULY	15 Months	English & Hindi	Offline & Online

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3.2. EXTREME WATER STRESS AT A GLANCE

Extreme Water Stress



Definition

- A country facing “**extreme water stress**” means it is using at **least 80% of its available** supply, and “high water stress” means it is **withdrawing 40% of its supply**.



Current situation

- **25 countries, including India faces extremely high-water stress. (World Resources Institute (WRI))**
- 50% of world’s population live under **highly water-stressed conditions** for at least one month of the year. (WRI Data)



Impacts

- **31% of global GDP** will be exposed to **high water stress by 2050.** (WRI Data)
 - **India, Mexico, Egypt and Turkey will account for over half of exposed GDP** in 2050.
- **60% of world’s irrigated agriculture** faces extremely high-water stress. (WRI Data).

Causes of global extreme water stress



Overexploitation of water particularly for agriculture.



Unsustainable water use policies.



Climate change disrupts hydrological cycle and reduce water availability.



Lack of investment in water infrastructure.



Water pollution by human activities like use of fertilizers, microplastics, etc.



Initiatives taken in India

- **National Water Mission**
- **Water conservation initiatives** under schemes such as Atal Bhujal Yojana, etc.
- **Jal Shakti Abhiyan** - Catch the Rain.
- **Sahi Fasal** campaign



Way Forward: Recommendations given by World Resource Institute's Atlas

- Improve **water governance through nature-based solutions** and green infrastructure.
- **Consider programs like debt-for-nature swaps** for a commitment to invest in mangrove restoration or wetland conservation.
- **Crop diversification** for Resolving Water Crisis in Agriculture.
- Cities should develop **urban water resilience action plans**.

3.2.1. URBAN WATER CRISIS IN INDIA

Why in the news?

Bengaluru city witnessed its worst water crisis in decades, highlighting the issue of urban water crisis in India.

About Water crisis

- It refers to a situation where there is **inadequate access to clean and safe water**. Recently cities like Bengaluru and Chennai suffered water crisis.
- **Water resources becoming scarce** because of **drought** conditions as **aggravated by climate change** has been referred to as '**Day Zero**'.

Reasons behind the Urban Water Crisis

- **High demand:** By **2030 India's water demand would be double** due to rapid urbanization (UN Report).
- **Limited resource:** **18% of world's population** lives in India, but it has **only 4% of world's water resources**.
- **Poor groundwater recharge:** Due to **unplanned concretization** which prevents water from percolating into the soil and recharging the water table.
- **Pollution of water bodies:** For example, **Bellandur Lake (Bengaluru)**.
- **Over-extraction of groundwater:** **48% urban water supply comes from Groundwater** (report by the Centre for Science and Environment)
- **Poor water supply infrastructure:** Including **distribution networks, treatment plants, and storage facilities**.

Key Initiatives taken for tackling water crisis

- **National Water Mission (NWM):** For conservation Of water through integrated water development.
- **Project for Preparation of Urban River Management Plans (URMPs):** **Approved by NMCG for 60 cities** as a part of River-Cities Alliance (RCA) under Namami Gange.
- **Jal Diwali - "Women for Water, Water for Women Campaign"**
- **Jal Shakti Abhiyan - Catch the Rain Campaign:** to promote water conservation.

Way Forward

- **Nature-Based Solutions:** Promoting **green-blue infrastructure** and **restoration of wetlands**
- **Promotion of sustainable Water Management Techniques:** **Shallow Aquifer Management (SAM) model** was launched by Telangana to recharge ground water.
- **Community based solutions:** For e.g., **Orange County in California (US)** has employed a **community education campaign** to create **acceptance of the recycled water**.
- **City to City learning in water governance:** For example, the **LOTUS-HR** program is a collaborative project between the Netherlands and India to treat sewage water in **Delhi**.



- **Leveraging the private sector:** For e.g., **Tata Steel** had commissioned the creation of the **Dimna Lake** in Jamshedpur.

3.2.2. WATER FOR PROSPERITY AND PEACE

Why in the news?

The "UN World Water Development Report: Water for Prosperity and Peace" report was released by the UNESCO World Water Assessment Programme (WWAP) on behalf of the UN-Water.

Linkages between Water and Prosperity

- **Around 80% of jobs are water-dependent**, due to the dominance of agriculture.
- **Economic Returns of WASH** (Water, Sanitation and Hygiene) **outweigh the costs**, as it can improve health, productivity, environment, and social outcomes in a society.
- **Ensures gender equality in a society**, as water scarcity and droughts can lead to displacement and increase the risks of violence against women and girls, and rate of child marriages.

Linkages between Water and Peace

- **Peace and Social Stability of a society increases** with decrease in inequalities in allocation of water resources and access to water supply and sanitation.
- **Water is either a tool or a target or a victim of warfare** in most parts of the world.
 - E.g., **Israel was accused of using Water as a Weapon of War in Gaza.**
- **Human-Animal conflicts are exacerbated by reduced water resources availability.**

Challenges related to Water in Prosperity and Peace

- **Water-prosperity paradox**, where Water is needed by middle- and lower income countries to develop their economies, and economic growth needed in order to finance water requirement.
- **Water Pollution** only evolves and doesn't disappear with development of a country.
 - E.g., in lower-income countries, poor water quality is mainly due to **low levels of wastewater treatment**, whereas in higher-income countries, runoff from agriculture is a serious problem.
- **Lack of trans-boundary agreements and international basin establishment**
 - Only 32/153 countries with trans-boundary waters have an operational arrangement.
- **Increased water consumption with new age technologies:** E.g., it is estimated that **AI currently requires 500 ml of water to answer 10-50 queries.**

Recommendations

- **States to focus on responsible governance of water**, ensuring that secure and adequate access to water resources.
- **Leverage WASH** (Water, Sanitation and Hygiene) **as a 'politically neutral' service system**, to serve as a platform for **social cooperation and partnerships** between citizens and government.
- **Decouple water from industrial productivity** and encourage water reuse and zero discharge.
- **Trans-boundary water management**, through equitable agreements and joint operational bodies.
- **Moving away from mere volumetric water sharing** to sharing the outcomes of the resource.
- **Improve water resources development** and allocation by integrating **nature-based solutions and adopt water accounting method.**

3.3. GROUND WATER MANAGEMENT IN INDIA AT A GLANCE

Ground Water management in India



Current Situation

- India is world's largest user of groundwater (uses 25% of all global groundwater extracted every year)
- Indo-Gangetic basin in India has already passed the groundwater depletion tipping point. (Interconnected Disaster Risks Report 2023 by United Nations University)
- Water level in more than 60% of wells monitored by CGWB registered a declining trend in the last one decade.



Reasons for Overall decline in GW in India

- **Over-Extraction:** Over the last 50 years, number of borewells has grown from 1 million to 20 million.
- **Climatic factors:** A long-term decline in monsoonal rainfall, owing to climate change.
- **Policy related factors:** State sponsored free or heavily subsidized power (including solar pumps) for pumping groundwater for irrigated agriculture.
- **Other factors:** Demand due to rise in population, urbanisation and rise in industries etc. have surpassed the supply.

Impacts of decline of GW



Reduced Surface Water Supplies as groundwater and surface water are connected



Shrinking aquifers may lead to land subsidence



Impact on Food Security, livelihoods of farmers



Water Quality Concerns due to excessive pumping



Increased Costs as water will be pumped farther to reach the surface using more energy



Ground Water Assessment and Management Initiatives by Govt

- National Aquifer Mapping & Management Programme (NAQUIM)
- Jal Kranti Abhiyan
- Atal Bhujal Yojana (2020)
- Pradhan Mantri Krishi Sinchai Yojana (PMKSY)-Har Khet Ko Pani
- Jal Shakti Abhiyan
- "Master Plan for Artificial Recharge to Ground water in India 2020" by CGWB



Suggestions to improve GW management

- **Move away from water guzzling crops:** For instance, in Gujarat, from cotton and wheat to pomegranates and cumin.
- **Policy level measures:** Policies like separating agricultural electrical connections from household connections.
- **Restructuring governance:** Mihir Shah Committee recommended that CWC and CGWB should be restructured to form a new **National Water Commission**.
- **Demand side interventions:** Surface water harvesting through farm ponds and check-dams, installation of water-efficient irrigation systems (e.g. more efficient drips and sprinklers) etc.

3.4. NAMAMI GANGE PROGRAMME (NGP)

Why in the News?

Mission to clean the Ganga River remains a work in progress.

More on news

- The government launched the **NGP** to rejuvenate River Ganga and its tributaries in **June 2014** for a period up to **31st March 2021**.
 - The programme was subsequently extended up to 31st March 2026.

About NGP

- **Objective: Integrated Conservation Mission** to accomplish the twin objectives of **effective abatement of pollution, conservation, and rejuvenation of River Ganga**.
 - Also covers its tributaries under **one umbrella programme**.
- **Key features**
 - **Type:** Central Sector Scheme.
 - **Implementing Agency:** **National Mission for Clean Ganga (NMCG)** and its state counterparts—State Programme Management Groups.
- **Major States covered:** **Uttarakhand, Uttar Pradesh, Jharkhand, Bihar and West Bengal.**

Achievements

- Out of 1072 Grossly Polluting Industries (GPIs) 885 have been brought under **Central Pollution Control Board's Online Continuous Effluent Monitoring Stations (OCEMS)**.
- Median value of **Dissolved Oxygen** (indicator of river health) found to be within acceptable limits as per survey in 2022.

Challenges faced by NGP

- **Slow pace:** Out of a total of 409 projects, only 232 projects have been completed and made operational (till December 2022).
- **Low capacity of installed waste treatment plants:** Capable of treating just **20% of estimated sewage** in 5 major States that lie along the river.
- **Limited Targets:** Of the **11,765 MLD of sewage generated across the 5 major basin states**, centre is to set up STP capacity **only for 7000 MLD of sewage by 2026**.
- **Challenges in establishing Sewage Treatment Plant (STP):** high cost of installation and maintenance, outdated **infrastructure etc.**



- **Poor financial management:** Only about **14,745 cr of allocated funds have been released by NMCG** to State Governments, and other agencies till June 2023.
- **Multiple authorities at state and the national levels:** This cause duplication of effort.

Way forward

- **Existing and planned sewage treatment plants (STPs) need to be verified on efficiency, reliability and technology parameters** by independent agencies.
- **Evolve new and innovative ways to generate sufficient revenues** for operation and maintenance (O&M) of water and wastewater infrastructure through pricing and valuing water.
- **Restore local storages** (ponds, lakes, wetlands) as an integral part of river restoration and conservation strategy.
- **Mapping and updating of land records: Map the entire looped length of each and every tributary of the Ganga and correct the land records.**

3.5. WATER TRADING

Why in the news?

Recently, NITI Aayog released a document on **water trading mechanisms to promote the reuse of treated wastewater.**

About Water Trading Mechanism

- **Water Trading** is a **water market mechanism** that considers **water as a commodity rather than public good which can be traded.**
- **Mechanism: A Water company**, rather than creating its own water source, can **buy the water** from a **third party** and sell it to the users.

Need for reuse of treated wastewater through water trading

- **Tackling urban water pollution:** Only about **40% of urban wastewater is treated** in India.
- **Unequal spatial distribution:** E.g., India receives more than 80 % of the rainfall during four months of the year.
- **National Water Policy of 2002 & 2012:** Emphasised **public-private partnership** in water management.
- **Tackling water scarcity: Around 80% of people living under water stress lived in Asia**, in particular, northeast China and India. (UN World Water Report 2023)
- **Overuse of water in Indian agriculture:** India is a large **virtual net export of water** because of agricultural products export.

Challenges

- **Fixing appropriate price** of treated **wastewater**
- **Storage** of wastewater generated due to fluctuating **demand.**
- **Identification/creation of demand** to make water/treated wastewater a tradable commodity.
- **Disruption of supply** due to maintenance of plant, disruption in sewage network, quality problems in inlet sewage or treated sewage, disruption in the distribution network, etc.
- In India, water is neither considered a commodity **nor possesses any significant economic value.**

Way forward

- **Formation of Independent Regulatory Authority (IRAs)** with statutory powers to determine **water allocation** and **pricing of treated wastewater.**
 - **Today, 12 states in India have enacted Acts to form IRAs**, but they mostly have the power to **regulate water tariffs in the irrigation sector.**
- **Creating a trading platform and fixing the reuse target.**



- **Identification of Industrial Clusters, Municipal/Residential units, Agriculture lands,** and Environmental needs where the treated wastewater could be reused.
- **Preparation of site-specific plans for reuse** using GIS tools.

World's Best Practices in Water Trading

- **Australia:** Murray Darling Basin has proved that water trading is one of the best methods to use water in an efficient manner.
- **Spain:** Water market exchanges alleviated the conditions of those basins where water scarcity was most severe.
- **South Africa:** One of the most advanced water frameworks in the world. South Africa's system enables existing water rights to be reallocated.

3.6. MINAMATA CONVENTION

Why in the news?

Fifth meeting of Conference of Parties (COP 5) to Minamata Convention was held in Geneva.

Major Outcomes

- For the first time, **COP pushed to reduce mercury supply sources and trade** by strengthening capacities at national level and **developing study on global supply, trade, production and use of mercury** compounds.
- **Limit of 15 mg/kg concentration of mercury** is set as threshold for wastes contaminated with mercury.

About Minamata Convention on Mercury

- **First global legally binding treaty to protect human health and environment** from adverse effects of mercury.
- **Adopted in 2013 at Kumamoto (Japan)** and came into force **in 2017 (India ratified it in 2018)**.
 - Mercury may have **toxic effects on nervous system**, thyroid, kidneys, lungs, immune system, eyes, skin etc.
- **Purpose:** Ban on new mercury mines, phase-out of existing ones, phase-out and phase-down of mercury use in products and processes, Participation of Indigenous Peoples and local communities.
- Named after the city in Japan that became the epicentre of **Minamata disease**, caused by severe mercury poisoning.

Annexes of Convention

Annex A	Mercury-added products. Eg. Batteries, Compact fluorescent lamps, Pesticides, etc.
Annex B	Manufacturing processes in which mercury or mercury compounds are used. Eg. Production of polyurethane using mercury catalysts.
Annex C	Artisanal and small-scale gold mining.
Annex D	List of point sources of emissions of mercury and mercury compounds to atmosphere.
Annex E	Arbitration and conciliation procedures.

Success of Convention

- **Global ratification:** 148 countries ratified the convention. (As of July 10, 2024)
- **Significant reduction in Mercury Use** in industrial processes and products has been reported.
- **Many countries have implemented stringent regulations** to control mercury emissions from coal-fired power plants, industrial boilers, etc.
- **Establishment of comprehensive monitoring and reporting mechanisms** has improved the tracking of mercury levels. (**Reporting rate is 80%**).

Challenges

- Reducing mercury use in the **artisanal and small-scale gold mining(ASGM)** sector remains a significant challenge due to its economic importance in many communities.

- **Lack of Compliance and Enforcement** particularly in countries with limited resources and capacity.
- Providing adequate technological and financial resources to support developing countries in implementing the convention.

3.7. LAND DEGRADATION AT A GLANCE

Land Degradation

Definition

- Land degradation is the reduction in the capability of the land to produce benefits from a particular land use under a specified form of land management (FAO, 1999).

Current situation

- **India**
 - **Degraded land:** ~29.7 per cent (ISRO Atlas, 2021).
 - **Arable land suffers from acute soil acidity:** ~11 mha of (pH < 5.5).
 - **Yearly potential soil loss:** 21 tonnes/ha/yr. (IIT-Delhi Study)
 - **Areas of high degradation:** Rajasthan, Maharashtra, Jammu & Kashmir
- **World**
 - World's **cultivated soils have lost up to 75%** of their original carbon stock.
 - **50% of plane's topsoil lost via erosion** over last 150 years. (WWF report)

Targets

- **Global**
 - **Land Degradation Neutrality (LDN) target setting programme (LDN TSP):** Global voluntary commitments to restore degraded land reached one billion hectares by 2030.
 - **Global Land Initiative:** G20 members pledged to halve land degradation by 2040.
- **India**
 - **LDN target:** Committed to restore 26 million hectares by 2030.

Significance of conserving soil

<p>Supports Agriculture and Forestry</p>	<p>Highly efficient carbon sinks: After oceans, world's soils are the second largest carbon pool on Earth</p>	<p>Supports biodiversity: Plays host to some 25% of our planet's biodiversity</p>	<p>Contribute to water, nutrient and nitrogen cycling</p>	<p>Foundation of basic ecosystem functions and helps regulate Earth's temperature.</p>
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Constraints

- **Rapid land use change for developmental** activities like housing, hydroelectricity projects, etc
- **Illegal logging and encroachment of land and unregulated livestock** grazing and fodder collection.
 - **11% of fully grown trees** in 2010–2011 were no longer visible when reviewed in 2018–2022. (Analysis by researchers at the University of Copenhagen (Denmark))
- **Limited knowledge and High capital cost** of restoration program
- **Other:** Extreme weather conditions such as drought, Excessive Use of fertilizers and pesticides, etc.



Initiatives

- **Global:**
 - **United Nations Convention to Combat Desertification (UNCCD):** Legally binding international agreement. Flagship initiatives-
 - ◆ **LDN targets for 2030.**
 - ◆ **Land Degradation Neutrality Fund (LDN Fund) to catalyze private fund.**
 - **Bonn Challenge** aims to restore 150 million hectares of degraded and deforested land by 2020 and 350 million hectares by 2030.
 - **Other:** UN Decade on Ecosystem Restoration (2021–2030), "4 per 1000" Initiative; Global Soil Partnership (GSP); etc.
- **India:**
 - **National Action Plan on Climate Change (NAPCC)**
 - **Desertification and Land Degradation Atlas of India.**
 - **Integrated Watershed Management program**
 - **'Geospatial Modelling and Mapping of Soil Erosion in India'** study published by IIT-Delhi.
 - **Sustainable Land and Ecosystem Management Program**



Way Forward

- Enhancing restoration target to **1.5 billion hectares of global land by 2030** to achieve a **land-degradation-neutral (LND)** world. (UNCCD Dash Board)
- **Utilizing Local and indigenous knowledge** for addressing land degradation.
- **Promoting restorative agronomic practices** like natural farming, agroforestry etc.
- **Converting wastelands into productive agroforestry zones:** Wastelands constitute **16.96% of geographical area** of India in 2015–16.
- **Regulate soil pollution** in line with international agreements/standards like: **Stockholm Convention and Basel Convention** etc.

4. SUSTAINABLE DEVELOPMENT

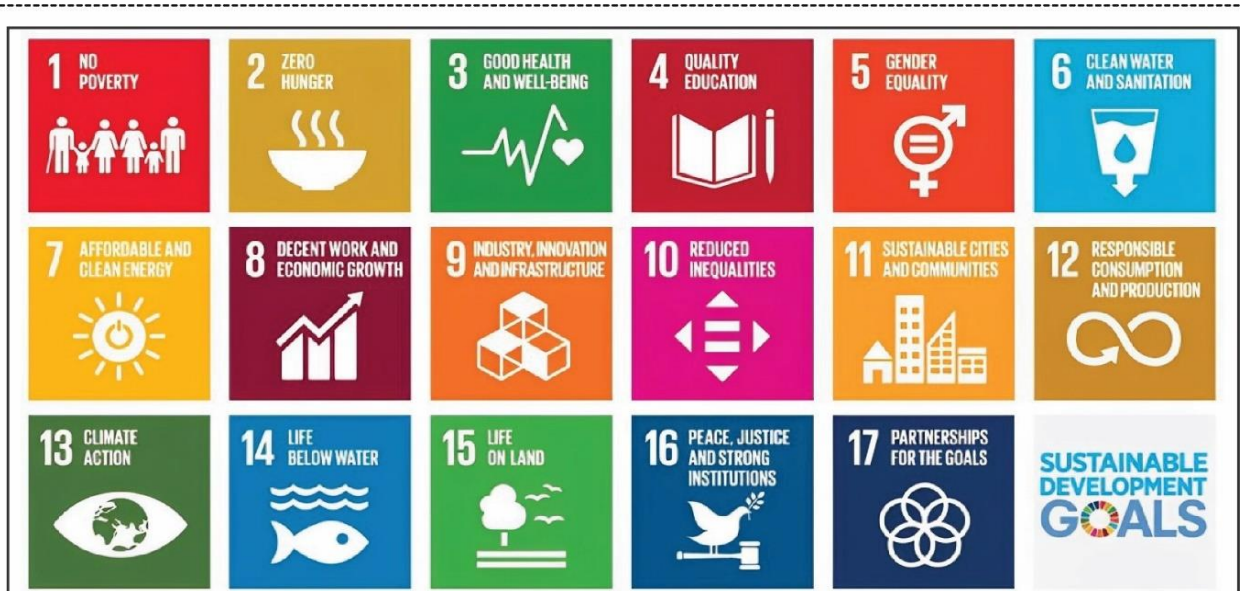
4.1. SUSTAINABLE DEVELOPMENT GOALS AT A GLANCE

Sustainable Development Goals



Concept

- Described by the **1987 Brundtland Commission Report** “as development that meets the needs of the present without compromising the ability of future generation to meet their own needs”.
- Adopted in **UN Sustainable Development Summit, 2015 as Transforming our world: the 2030 Agenda for Sustainable Development**



Challenges

- **Slow Progress:** Asia Pacific **would not achieve all 17 SDGs before 2062 (SDG Progress Report, 2024 by UNESCAP)**
- **Uneven and Inadequate Progress** with country divide, gender divide, urban-rural divide, etc.
- **India related challenges:**
 - **Structural:** Imbalance in economic development, rapid urbanisation, regional variance (More than 20 points variation in scores between Andhra Pradesh (77) and Punjab (54), SDG India Index, 2023-24 by NITI Aayog)
 - **Implementation:** Systemic weaknesses, lack of access to resources, poor participation by marginalised communities, etc.
 - **Monitoring:** defining indicators, monitoring outcomes, progress, etc.



Best Practices/ Initiatives

- **MYAC (One Million Youth Actions Challenge) by One UN Climate Change Learning Partnership** encourages youth to **promote 4 SDGs** including SDG 6, 12, 13 and 15.
- **Improving statistics on stateless people** through census inclusion and capacity-building is helping decision makers in **Central Asian countries**.



Way Forward

- **Integrate climate action (SDG 13) into national policies.**
- Efforts to **address inequalities that impact marginalized groups.**
- **Nature based Solutions (NbS) which includes** actions to protect, sustainably manage, and restore natural and modified ecosystems.
 - E.g., Reforestation and Afforestation, Wetland Restoration, Green Infrastructure, ENACT partnership (launched in CoP27) to environmental issues through Nature-based Solutions (NbS).
- **Other measures:** Investing in sustainable infrastructure, effective SDG data sharing, etc.

4.1.1. LOCALISATION OF SUSTAINABLE DEVELOPMENT GOALS

Why in the News?

UN-Habitat released “**Smart Cities Mission, India: Localising Sustainable Development Goals (SDGs)**” Report in collaboration with **Ministry of Housing and Urban Affairs**.

What is Localisation of SDGs?

It is the process of taking into account sub-national contexts in achievement of SDGs.

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 SDGs localisation

- Overall coordination for implementation of SDGs is handled by the **NITI Ayog** with twin mandate of:

Benefits of SDG Localisation



Cooperative and Competitive Federalism: healthy competition at sub-national level.



Localised Solutions: as opposed to one-size fits all.




Improved State Capacity: At all levels of Government.

- Overseeing the adoption and monitoring of the SDGs in the country, and
- Promote competitive and cooperative federalism among States and UTs.
- 'SDG India Index' launched by NITI Ayog to monitor the progress of SDGs in states and UTs.


Some Examples of SDG localisation	
Bihar	Viksit Bihar ke 7 Nischay , includes schemes on inclusion, entrepreneurship, women's reservation in jobs, provision of water, electricity, concrete streets, toilets and higher education.
Bhopal	India's first city-level Voluntary Local Review (VLR) of Sustainable Development Goals (SDGs) called 'Agenda for Action: Sustainable Urban Transformation in Bhopal'.
Andhra Pradesh	Navaratnalu , cluster of 9 flagship programmes for vulnerable communities.

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.




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4.2. SUSTAINABLE TOURISM AT A GLANCE

Sustainable Tourism



Definition

- **Tourism that takes full account of its current and future economic, social and environmental impacts**, addressing the needs of visitors, the industry, the environment and host communities (World Tourism Organization).

Basic principles of Sustainable Tourism



Environmental Sustainability

Optimal use of **environmental resources**, **conserve natural heritage and biodiversity.**



Socio-cultural Sustainability

- Respect the socio-cultural authenticity of host communities
- Conserve their **living cultural heritage and traditional values.**
- Contribute to intercultural understanding and tolerance.



Economic Sustainability

Viable, long-term economic operations. Providing fairly distributed socio-economic benefits to all stakeholders



Environmental Footprint of Tourism

- **8% of the world's carbon emissions** attributed to Tourism.
- **Transport-related CO2 emissions** from tourism will grow by **25% from 2016 by 2030** under current emission scenario.



Issues/Challenges in Ensuring Sustainable Tourism.

- **Narrow Understanding of the Concept of Sustainability**, being restricted to environmental perspective only.
- **Other Issues:** Over-tourism in many destinations; No specific agency for implementation of rules; Practice of Greenwashing; huge capital investment in transitioning to sustainable practices; etc.



Initiatives taken

- **India:**
 - National Strategy for Sustainable Tourism (NSST), 2022;
 - Draft National Tourism Policy 2022;
 - Travel for LiFE campaign;
 - Sustainable Tourism for India Criteria and Indicators (STCI); etc
- **Global:** Global Sustainable Tourism Council (GSTC) and Tourism for Tomorrow Awards; Global Code of Ethics for Tourism (by UNWTO); Green Key (global eco-label certification), etc.



Way Forward (National Strategy for Sustainable Tourism (NSST), 2022)

- **Formulating Sustainable Tourism Criteria of India (STCI) and Scheme for Certification** based on global practices adopted to the needs of the country.
- **Capacity building** of various stakeholders through National and State Resource Centres.
- **Education and Skill training** in aspects such as awareness of over tourism impacts, environmental impact and concept of carrying capacity, indigenous solutions etc.
- **Establish Vision Group on Sustainable Tourism** under the Union Minister for Tourism to include all the Stakeholder Ministries, States, Industry, NGO and Experts.
- **National Nodal Agency** to support the Ministry of Tourism in coordinating and evolving strategy and actionable plans and schemes.

4.2.1. UNREGULATED TOURISM IN THE INDIAN HIMALAYAN REGION (IHR)

Why in the news?

Recently, a Parliamentary Standing Committee has recommended the government to prepare a **practical action plan** with clear timelines to put a check on destructive activities in IHR.

Challenges of unregulated tourism in the IHR

- **Growing number of tourists:** IHR records about **100 million tourists every year** and the number is **expected to increase to 240 million by 2025**.
- **Waste generation:** According to Niti Aayog's report in 2018, tourism in IHR States generates about **8.395 million tonnes per year (MT/Y) of solid waste**.
- **Others:**
 - Loss of Forests and biodiversity due to infrastructure development
 - Changing landscape due to replacement of traditional eco-friendly and aesthetic infrastructure
 - Seasonality of tourism causing over-crowding, erosion of cultural and social fabrics, etc.

Way Forward

- **Planning, implementation, monitoring,** Multi-year strategy with local community partnerships.
- **Inter-departmental convergence** for active monitoring.
- **Designing climate-smart infrastructure** through strategic environmental assessment, climate risk disclosure, etc.
- **Use of Technology-** E.g., prepare tourism satellite accounts of IHR, multi-hazard zoning, etc.

- **Financial interventions** like 'Green Cess', Payment for Environmental Services, etc.
- **Others:** Environmental audit of tourism service providers, **common certification scheme** and **eco-labelling**, clear zoning of landscape, etc.

4.3. SUSTAINABLE FINANCE

Why in news?

'Sustainable finance: bridging the gap in Asia and the Pacific' report was launched by **United Nation Economic and Social Commission for Asia and the Pacific (ESCAP)**.

About Sustainable Finance

- Sustainable finance refers to the process of taking **environmental, social and governance (ESG) considerations** into account when making investment decisions in the financial sector.



Status of Sustainable Finance

- **Developing countries** face **high financing gap** between **\$2.5 trillion and \$4 trillion** annually (Financing for Sustainable Development Report 2024 by UNDESA)
- Need of **USD 3 trillion** over the next decade to **finance green growth** (Reshaping Global Finance Architecture for Sustainable Growth by NITI Ayog)

Reasons for high financing gaps

- **Rise in systemic risks**, rise in disaster frequency, COVID 19, etc.
- Average **GDP growth rates in developing countries fell** to just over 4% annually (between 2021 and 2025).
- Median **debt service burden** for Least Developed countries (LDCs) rose to 12% in 2023.
- **Other concerns:** Digitization induced risks, rising geopolitical tensions.

Measures Taken

- **Addis Ababa Action Agenda** for efficient use of financial flows for sustainable development. (SDG Summit 2023 by UNGA in 2030)
- **New Sustainability Reporting** requirements under **Business Responsibility and Sustainability Report (BRSR)** by SEBI.
- **Sovereign Green Bonds**: Announced in the Union budget 2022-23 to fund projects which help in accelerating India's transition to a low-carbon economy.
- **Sustainable Finance Group** set up under RBI.
- **Network for Greening of Financing System** joined by RBI
- **Task Force on Sustainable Finance** set up by Ministry of Finance.
- **Concept of Blue Bonds** by SEBI to support investments in healthy oceans and blue economy.
- **Others:** Instruments like Green Deposits, Sovereign Green bonds, Green and Social Impact Bonds, etc.

Recommendations

- **Local-currency financing of energy transition projects** as well as green technologies and other net-zero investments.
- **Concessional financing and risk-sharing** by multilateral development banks, bilateral development financial institutions, etc.
- **International Cooperation** e.g., new approach to blended finance for responsible business conduct.
- **Green and Inclusive financial systems**, ensuring just transition for vulnerable groups.
- **Other measures:** Policy coherence, addressing mismatches between capital and investment needs, building tax capacity, resilience funds, promoting circular economies,

4.4. SUSTAINABLE LIFESTYLE

4.4.1. MISSION LIFE

Why in the news?

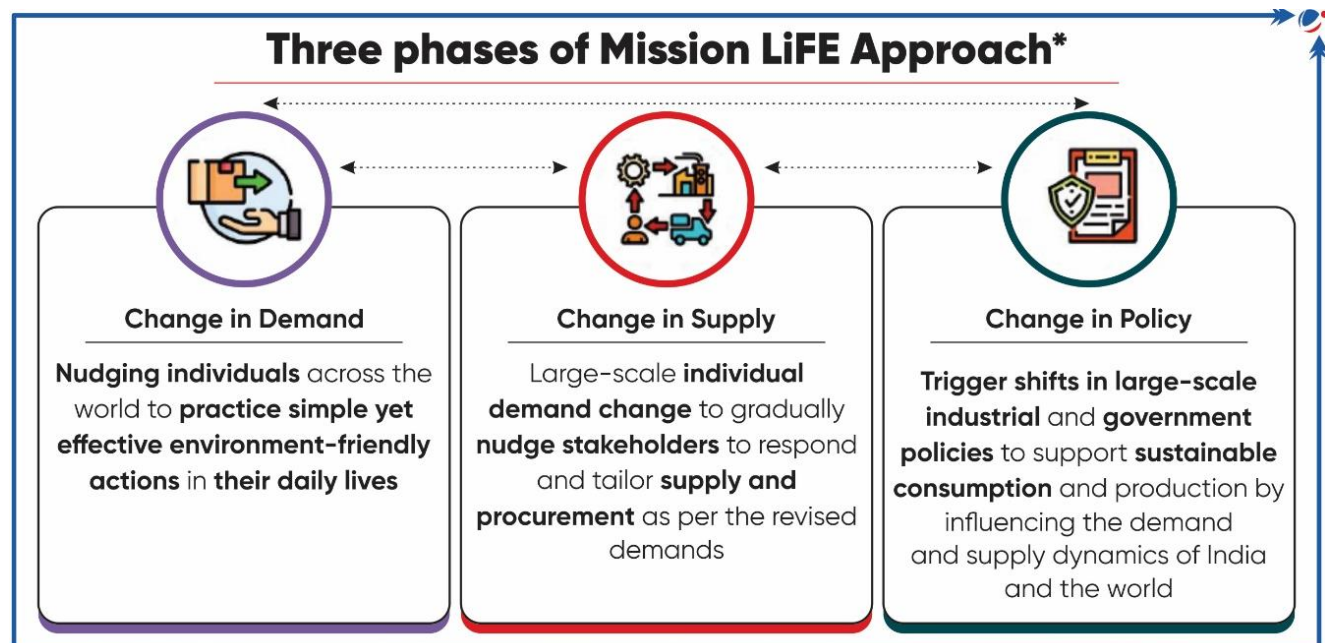
As part of Mission LiFE MoEF&CC conducted awareness activities.

About Mission LiFE ('Lifestyle for Environment')

- **India-led global mass movement** to nudge individual and community action to protect and preserve environment.
- It is aligned with SDGs and aims to ensure sustainable consumption and production patterns.
- **Launched by India at UN Climate Change Conference (UNFCCC COP26) in 2021**

Targets

- At least **one billion Indians and other global citizens** to take individual and collective action for environmental preservation in 2022 to 2027.
- At least **80% of all villages and urban local bodies** to become environment-friendly by 2028.



Challenges in Implementation

- **Capitalism** encourages individualism, competition and mindless consumption for economic growth.
- **Socio-economic inequity and challenge of choices**, e.g., natural fibres being more expensive than mass produced chemically synthesized fibres.

- **Infeasibility of one-size fits all approach of sustainable approaches**, e.g., stable and continuous electricity played a crucial role in successful shift from LPG to electricity based induction stoves in Himachal Pradesh.
- Lack of the **precise information necessary to take informed decisions**
- **Other issues: Practice of Greenwashing** by companies; Difficulty in **measuring sustainability**; **Lack of financial incentives** to invest in clean energy technologies, etc.

Expected Impacts of Implementing LiFE			
<p>Energy and emissions Reduce annual CO₂ emissions of 2 billion tonnes at the world level by 2030.</p>	<p>Air pollution Around 60% of the reduction in sulfur dioxide (SO₂) emissions from behavioural changes.</p>	<p>Job Creation Create around 17 million clean energy jobs globally by 2030</p>	<p>Investment Stimulate about USD 1.6 trillion in clean energy investments</p>

Way forward

- **Create Accurate and outcome-oriented indicators** related to impact of sustainable choices on the environment.
- **Green Nudging citizens** with information about importance of sustainable lifestyle and health and wellbeing.
- **Taking inspiration from cultural and traditional practices** like handwashing and sun-drying of clothes, handwashing and sun-drying of clothes etc.
- **Incentivising adoption of sustainable options** through tools like tax breaks, carbon pricing etc.
- **Knowledge about sustainable lifestyles** should be integrated into education programs.



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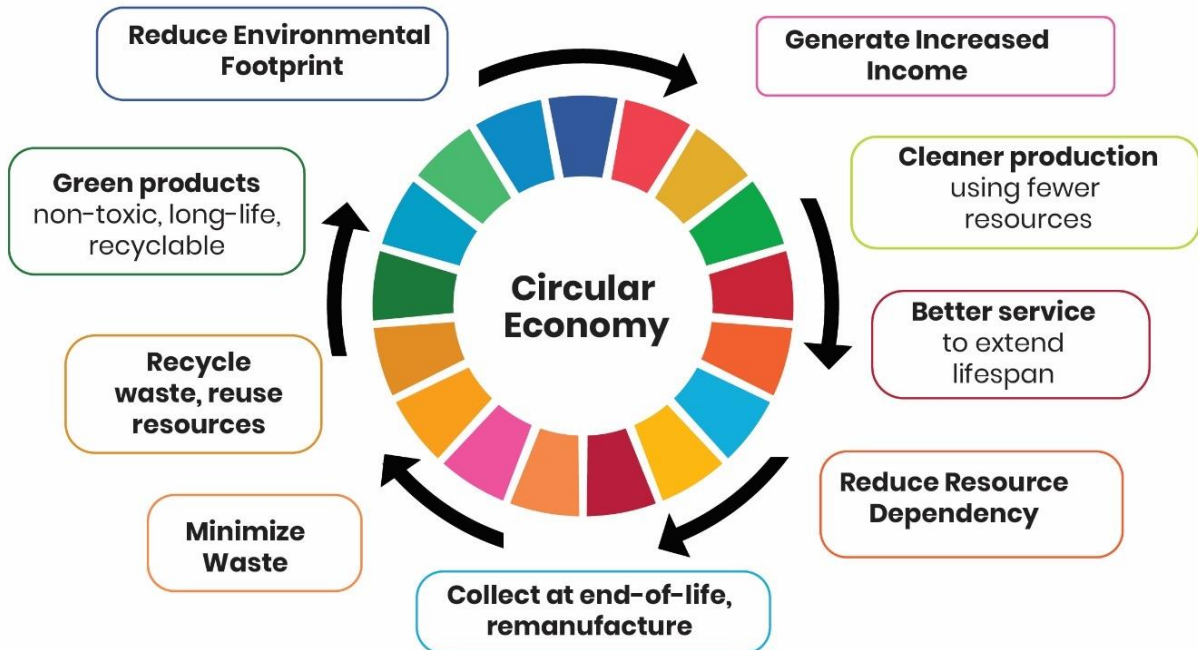
4.4.2. CIRCULAR ECONOMY AT A GLANCE

Circular Economy



About Circular Economy

- Involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible causing the **life cycle of products to be extended**.



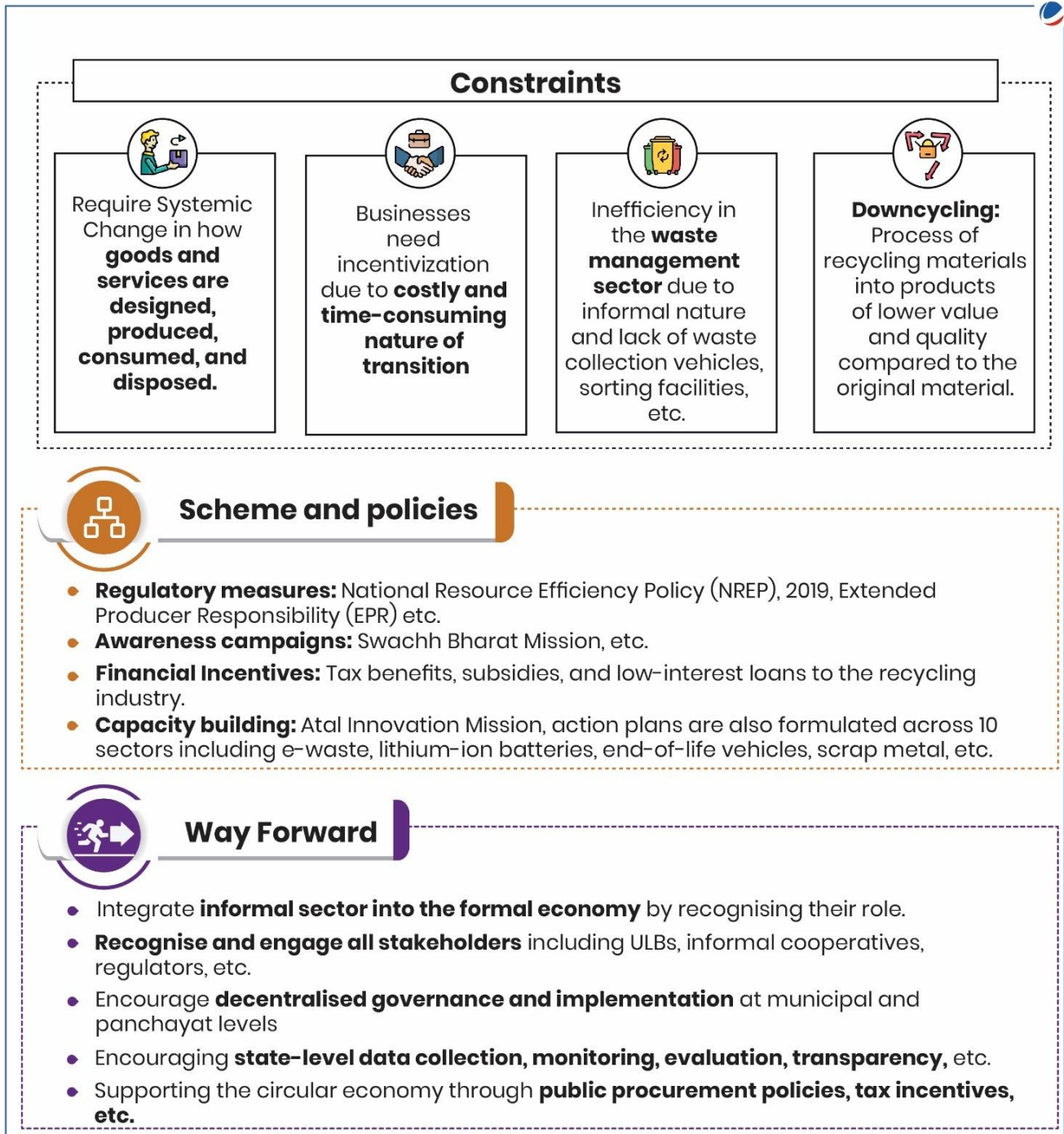
Current situation

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



Need of CE in India

- **Replacing Linear Economic Model:** From 1970 to 2015, India witnessed a six-fold increase in its annual material consumption.
- **Increase household disposable income** through lower costs for products and services.
- **Reduce dependency** on imported resources.
- **40 lakh crore annual value can be created in 2050**, amounting to 30 % of India's current GDP.



4.5. SUSTAINABLE AGRICULTURE IN INDIA

4.5.1. COASTAL AQUACULTURE AUTHORITY (AMENDMENT) ACT, 2023

Why in the news?

Recently, this **Coastal Aquaculture Authority (Amendment) Act, 2023**, was adopted, which amends the earlier 2005 Act.

About Coastal Aquaculture Authority (Amendment) Act, 2023

- **Broaden the definition of “coastal aquaculture”** removing the ambiguity existing between the farm and other verticals of coastal aquaculture.
- **Registration** granted under Coastal Aquaculture Authority Act shall prevail and be treated as **valid permission under Coastal Regulation Zone (CRZ) Notification**.
- **Additional role of Coastal Aquaculture Authority:**
 - **fix standards for inputs and discharge** of effluents from aquaculture units,
 - **prohibit the use of certain inputs** to prevent harm to the environment,
 - **monitor and regulate** units, inputs, and emissions.
- **Permitting certain aquaculture activities** in CRZ areas like hatcheries, nucleus breeding centres, and broodstock multiplication centres.
- **Prevent the use of antibiotics** and pharmacologically active substances.
- **Promote biosecurity** i.e. any measure adopted to analyse, manage and prevent the risk of introduction or spread of harmful organisms within the coastal aquaculture unit.

Significance of Amendments

- **Economic:** Ease of doing business; Employment Generation; Prohibiting the use of antibiotics will decrease non-tariff barriers; and Sustainable growth of Coastal areas.
- **Environmental:** Promoting new Environment-friendly coastal aquaculture and Genetically improved and disease-free broodstocks and seeds

Issues with the Act

- **Infective work by Coastal Aquaculture Authority:** Due to a deficiency in skilled manpower and infrastructure facilities in the Authority (as noted by the CAG report).
- **Promoting intensive coastal aquaculture:** which may have adverse impacts on the environment, such as salinisation of land/wells and obstruction of natural flood water drainage.

Conclusion

The **Coastal Aquaculture Authority (Amendment) Act of 2023** is the appropriate step toward reviving and modernising coastal aquaculture in the nation and making it a major seafood exporter worldwide.

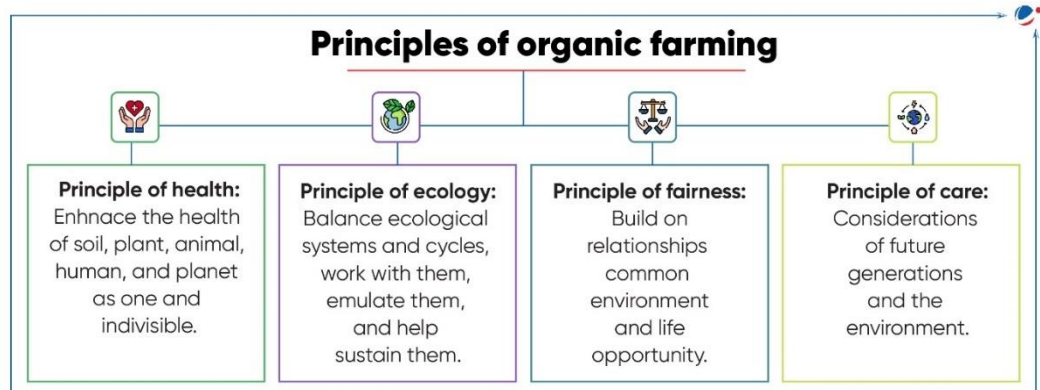
4.5.2. ORGANIC FARMING IN INDIA

Why in the news?

Agricultural and Processed Food Products Export Development Authority (APEDA) created **dedicated organic promotion division**.

About Organic Farming

- It is a unique production management system that **promotes and enhances agro-ecosystem health**, including biodiversity, biological cycle and soil biological activity.
- This is accomplished **by using on-farm agronomic, biological, and mechanical methods** in exclusion of all synthetic off-farm inputs.





Status of Organic Farming in India

- India has the **highest number of organic farmers** in the world (**44.3 lakhs**) [**Economic Survey 2022-23**]
- India ranks **6th in terms of** certified area globally. (The World of Organic Agriculture Statistics and Emerging Trends 2023).
- **Sikkim** became the world's first 100% organic state.

Benefits of Organic Farming

- **For the Environment:** Prohibits Use of Harmful Pesticides; Healthy Soil; carbon sequestration; Stimulates Biodiversity and micro-organisms; Ethical pasture-based systems.
- **For Farmers:** High growing segment of agri-market; Reduces the input cost; resilient to extreme weather events etc.
- **For Consumers:** Healthier; Higher nutritional quality etc.

Challenges for the Organic Farming

- **High input costs and low yields** (18% lower than conventional farming) in the initial years.
- **Inefficient supply chain** for marketing and distribution.
- **High price of produce** when compared with conventional farming.
- **Issues with certification process** such as lack of standardization, poor quality and lack of third party-accreditation agencies etc.
- **Other issues:** limited government support etc.

Initiatives taken

- **Certifications:** **National Programme for Organic Production (NPOP); Participatory Guarantee System of India (PSG-India); FSSAI Jaivik Bharat logo.**
- **Initiatives to promote Environmental Friendly Fertilizers (EFFs): PM PRANAM** (Programme for Restoration, Awareness, Nourishment, and Amelioration of Mother Earth) Scheme; **Nano Urea and Neem coated Urea; GOBARdhan** (Galvanizing Organic Bio-Agro Resources Dhan)
- **Other initiatives:** Pramparagat Krishi Vikas Yojana; National project on organic farming, Organic value chain development in Northeastern Region Scheme, etc.

Way Forward

- Supplementing organic farming with **other sustainable farming methods.**
- Strengthening **value chain and certification regime** of organic products.
- Enhancing the **number of third party accreditation agencies.**
- **Others:** production of organic inputs; strengthening value chain of organic products; improving monitoring of certification activities, etc.

4.5.3. CLIMATE RESILIENT FARMING

Why in the News?

Standing Committee on Agriculture, Animal husbandry and Food processing presented 'Promotion of Climate Resilient Farming' Report.

About Climate Resilient Farming

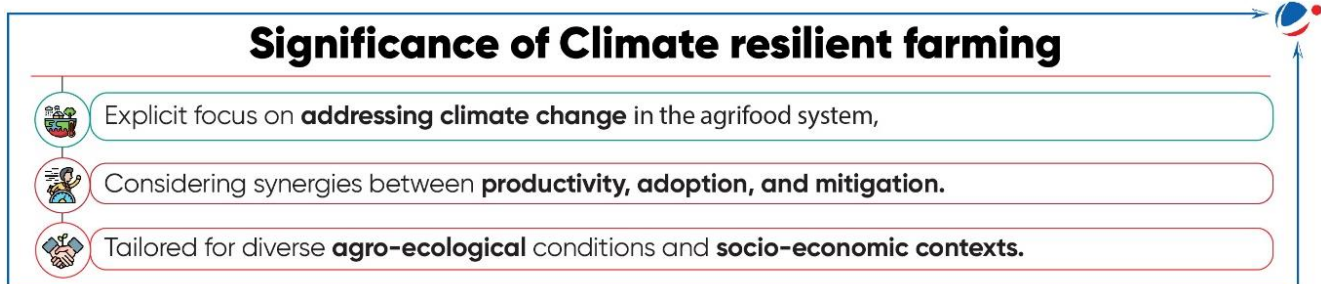
- It means the incorporation of **adaptation, mitigation and other practices** in agriculture which **increases the capacity of the system to respond to various climate** related disturbances by resisting damage and recovering quickly.

How does climate change and agriculture impact each other?

- **Impact of Climate change on Agriculture**
 - Projected decline in **yields of rainfed rice, wheat by 2050.**



- Beneficial for crops like cotton, chick pea, due to reduced frosts.
- **Shift in crop zones** like of Apple and other temperate crops.
- About **1.8-2 million tonnes of estimated annual milk loss** due to heat stress in cattle and buffalo.
- **Impact of Agriculture on Climate:** Agriculture sector emitted about **14% of GHG emissions of India**.
- Major share of GHG emissions due to **enteric fermentation (54.6%), rice cultivation (17.5%), and fertilizer applied to agricultural soils (19.1%), etc.**



Challenges in adopting CSA

- Requires **collaboration between diverse stakeholders** of varied backgrounds.
- **Policies like MSP** favouring monoculture, excessive groundwater extraction, etc.
- **Other issues: Skill gap in farmers, dependence on rainfall, fragmented land holdings, etc.**

Initiatives taken

- **National Innovations in Climate Resilient Agriculture' (NICRA)** by Indian Council of Agricultural Research (ICAR).
- **The National Mission for Sustainable Agriculture (NMSA)**
- **Paramparagat Krishi Vikas Yojana.**
- **An Investment forum for advancing Climate Resilient Agrifood systems** in India by NITI Aayog, Ministry of Agriculture and Farmers' Welfare, and FAO.

Way forward

- **Grassroot level participation:** Climate Resilient Villages (CRVs) models
- **Adoption of heat tolerant varieties:** for e.g., Adoption of HDCSW-18, DBW-187 (wheat varieties) etc. by Punjab farmers.
- **Better Livestock Feed management:** Some feeding methods include altering feeding time or frequency and modification of diet composition.
- **Technological interventions:** AI-driven analytics system like **Weather Information Network Data System (WINDS)**, etc.
- **Using Environmental Inhibitors:** like Methanogenesis (reducing methane emissions); Nitrogen inhibitors, to minimise the harmful effects of agrifood systems on environment (FAO Report).

4.5.4. ZERO BUDGET NATURAL FARMING AT A GLANCED

Zero Budget Natural Farming (ZBNF)



About

- Formulated by Subhash Palekar in India on the basis of four essential elements namely.

Elements of ZBNF



Beejamrit:

Involves seed treatment using cow dung and cow urine.



Jeevamrit:

applying inoculation made of local cow dung and cow urine.



Acchadana:

For ensuring favourable micro-climate in the soil



Waaphasa:

Soil aeration



Significance of ZBNF

- Improves:** farmers' income, soil health, environmental conservation, livestock sustainability, employment opportunities.
- Minimizes:** cost of production, use of chemical inputs like Endosulfan, etc.



Challenges with ZBNF

- Concept of Zero cost input** is debatable and difficult to achieve.
- Lack of evidence to support the **claims of higher yield in ZBNF.**
- Labour intensive** form of agriculture
- Variations in yield due to **dependence on natural factors, etc.**



Initiatives taken

- National Mission on Natural Farming.**
- Krishi Sakhis** (trained farmers and para-extension professional at grassroots) for the promotion of Natural Farming.
- Other initiatives:** National Mission on Natural Farming, National Mission on Sustainable Agriculture.



Way Forward

- **Long-term experimentation** before implementing as a national level agriculture practice.
- **Farming practice neutrality**, providing direct benefit transfers (DBT), makes the subsidy neutral towards specific farming practices.
- Resilient supply chain networks for farm inputs.
- **Emphasis on scientific studies, impetus to the indigenous cow breeds** (like Punganur Cow, Red Sindhi etc.) **through various government and cooperative initiatives, etc.**

4.5.5. AGROFORESTRY

Why in the news?

Recently, the Centre released a **fact sheet to promote agroforestry prepared by the Indian Council of Forestry Research and Education (ICFRE).**

About Agroforestry

- Combination of **practicing agriculture and forestry** together with emphasis on **interaction and interdependence on various elements of nature.**
- **Components of agroforestry:** Crops, trees, and livestock.
- **Agroforestry systems:** These are classified based on the type of component: Agri silviculture (crops + trees), Silvopastoral (pasture/livestock + trees); and Agrosilvopastoral (crops + pasture + trees).
- **Attributes of the Agroforestry system**
 - **Productivity:** Production of preferred goods and increasing productivity of land
 - **Sustainability:** Conserving the production potential
 - **Adoptability:** Acceptance of the prescribed practice
- **Status:** Agroforestry covers **8.65% of India's total geographical area.** (NITI Aayog GROW report)
- **Significance of the Agroforestry:** Profitability (due to combined output from trees, crops, and livestock); preservation of natural resources and biodiversity; decrease in input cost; food security; carbon sequestration, etc.

Challenges of Agroforestry



Insufficient research.



Insufficient research on agroforestry models suitable for the diverse agro-climatic regions.



Lack of market mechanism for tree growth.



Trees interfering with agricultural crop yields.

Initiatives taken

- **Sub-Mission on Agroforestry (Har Medh par Ped) Scheme** launched in 2016-17.
- **Mission for Integrated Development of Horticulture (MIDH)** since 2014-15.

- **National Agroforestry Policy, 2014**
- Exemption of many tree species from the **Felling and Transit rules**, and **removed bamboo from the category of forest produce** to enable large-scale cultivation.
- **Indian Council of Forestry Research and Education (ICFRE)** listed **36 species** that can be grown in different agro-climate zones to promote agroforestry.

Way forward for scaling agroforestry

- **Research and development** on ecological and social impacts on adoption of agroforestry.
- **Ensuring the availability of certified planting material** to the farmers and other users.
- **Development of new agroforestry models** for different agro-climatic zones.

4.5.6. ENVIRONMENTALLY FRIENDLY FERTILIZERS (EFFS)

Why in the news?

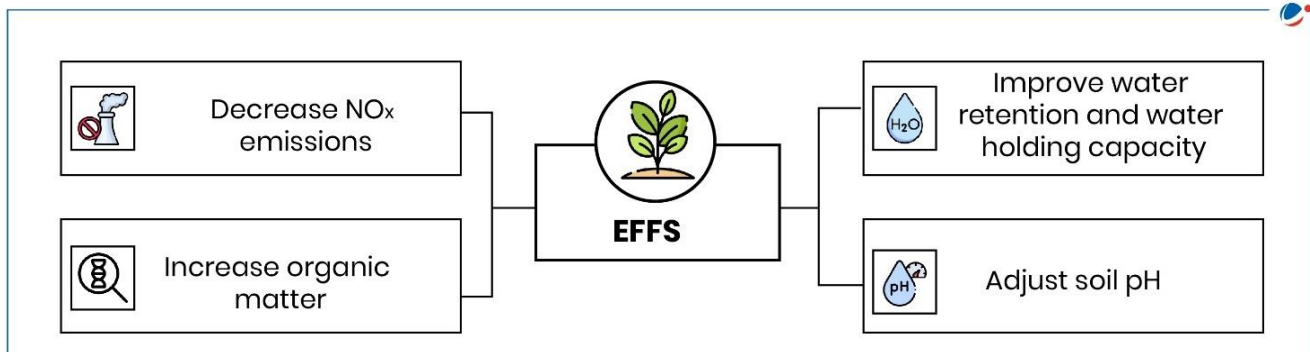
Cabinet Committee on Economic Affairs (CCEA) approves launch of Urea Gold, an Environmentally Friendly Fertilizer.

About Urea Gold (Sulphur-Coated Urea)

- It is a **non-organic slow-release fertilizer** and is generally prepared by **coating preheated urea granules** with molten sulphur.
- Sulphur coating ensures a more **gradual release of nitrogen**, prolonging urea action, **increasing efficiency** and reduce frequent application of fertilizer, thus enhancing soil health.
- As per Indian Council of Agricultural Research (ICAR) study, use of SCU leads to **reduction in urea consumption by 25%**.

Environmentally Friendly Fertilizers (EFFs)

- EFFs are fertilizers that can **reduce environmental pollution from nutrient loss** by retarding, or even controlling the release of nutrients into soil.
- EFFs also include **organic fertilizers** such as **Biocompost, Vermicompost, etc.**
- **Initiatives for EFFs in India:**
 - **PM PRANAM** (Programme for Restoration, Awareness, Nourishment, and Amelioration of Mother Earth) Scheme
 - **Development of Nano Urea and Neem Coated Urea**
 - **Pradhan Mantri Kisan Samruddhi Kendras (PMKSK)** will facilitate these fertilizers.
 - **GOBARdhan (Galvanizing Organic Bio-Agro Resources Dhan)**, helps in preparing organic manure.



4.6. WASTE MANAGEMENT

4.6.1. PLASTIC WASTE MANAGEMENT IN INDIA AT A GLANCE

Plastic waste management in India



Status of Plastic Pollution in India

- **4.12 Million Tonnes Per Annum** plastic waste is generated in India. (CPCB's annual report in 2020-21)
- Per capita plastic waste generation doubled over the last 5 years. (CPCB's annual report in 2020-21)
- **Ranked 3rd** globally in generation of **single-use plastic (SUP) waste** (Plastic Waste Makers Index 2019)



Challenges in PWM (Public Accounts Committee (PAC) report titled "Pollution caused by Plastic")

- **Absence of mechanism for assessment** of generation of plastic wastes.
- **Absence of action plan** for implementation of 'behavioural change, institutional strengthening, etc., through EPR.
- **Absence of Uniform Framework on EPR.**
- **Non-Compliance like** non-registration of plastic units, etc.
- **Units functioning without valid registration** due to lackadaisical approach of CPCB, SPCBs, etc.
- **Delay in elimination of Single Use Plastic** as many states did not ban it.



Initiatives

- **Plastic Waste Management Rules and its amendments.**
 - **Plastic Waste Management Amendment Rules, 2021** banned identified single use plastic item from 1st July, 2022.
- **Extended Producer Responsibility on Plastic Packaging, 2022.**
- **Swachh Bharat Mission 2.0.**
- **Clean and Green campaign of MoHUA.**
- India piloted a resolution in the **4th United Nations Environment Assembly** in 2019, on addressing **single-use plastic products pollution.**
- **Private sector collaborations:** India Plastics Pact (IPP), Un-Plastic Collective (UPC).



Recommendations

- Suggested methodology of **waste quantity and composition** outlined in **the Municipal Solid Waste (MSW) Management Manual by local bodies.**
- Encourage producers to **develop separate waste stream** for collection of plastic packaging waste and **issuance of EPR certification on achieving annual targets.**



- Assign **clear responsibilities** to stakeholders, establish **coordination mechanism, and Enforce strict compliance.**
- Include penalty ULBs which do not set up **PWM systems** and prevent creation of legacy waste dumpsite.
- **Incentivise producers and fund R&D for developing eco-friendly alternative to SUPs.**

4.6.1.1. PLASTIC WASTE MANAGEMENT (AMENDMENT) RULES, 2024 (PMW RULES 2024)

Why in the news?

Recently, the government notified the **Plastic Waste Management (Amendment) Rules, 2024 (PMW Rules 2024)** under the **powers conferred** under the **Environment (Protection) Act 1986.**

Key provisions of PWM Rules, 2024

- **Local body has been mandated to** undertake an annual **assessment of plastic waste generated**, including estimation of the **quantity of plastic waste to be generated** in following **five-year period.**
- **Centralised Portal for Registration:** for Producers, Importers, Brand-Owners and manufacturers of commodities made from compostable plastic or biodegradable plastic.
- **Elimination of Single Use Plastics (SUP): Local body shall take necessary measures** to prevent stocking, distribution, sale and usage of prohibited **SUP items** in their jurisdiction and submit annual report.
- **Expansion of scope of EPR: Producers, Importers and Brand Owners** who introduce any **plastic packaging** in the market shall be **responsible for collection of such plastic packaging**
 - **Also applies to** commodities made from **compostable or biodegradable plastics.**
- **Online Report Submission:** Annual report submission on implementation by ULBs to SPCB and PCC; from SPCB to CPCB and from there to Central Government.
- **Other provisions: Changes in Definitions of stakeholders** like importer, seller, producer, manufacturers; **Precise definition of Biodegradable plastics; Certificate from FSSAI in addition of CPCP** by manufactures of compostable or biodegradable plastics; etc.

4.6.2. E-WASTE MANAGEMENT IN INDIA AT A GLANCE

E-waste management in India



Definition of E-waste

- Includes electrical and electronic equipment, including solar photo-voltaic, **discarded as waste without the intent of reuse**, as well as rejects from manufacturing, refurbishment and repair processes.



Status of E-Waste in India

- 16.01 lakh tonnes** total e-waste generated (2021-22)
- Ranked 3rd largest e-waste generator** following only China and the USA. (**Global E-Waste Monitor 2024** report)
- 567 e-waste processing facilities** with a capacity of ~17.23 lakh tonnes annually.



Challenges associated with E-Waste in India

- Around 85% of e-waste is managed by the **unorganised sector**,
- Huge gap between **present recycling and collection facilities and the quantum of E-waste** that is being generated.
 - Approx 33% of total e-waste generated was collected and processed.
- 80% of E-waste in developed countries** meant for recycling is sent to developing countries such as India.
- Focus short product lifecycles** with limited repair options, etc.



E-waste Management framework in India

- Hazardous waste (Management and Handling) amendment rules, 2003:** First time covered the Hazardous materials in e-waste composition.
- E-waste (Management and Handling) Rules, 2011:** Introduced the concept of **Extended Producer Responsibility (EPR)**.
- E-Waste (Management) Rules, 2016:** Introduced concept of **Producer responsibility Organization**.
- E-Waste (Management) Rules, 2022, E-Waste (Management) Second Amendment Rules, 2023 and E-Waste (Management) Amendment Rules, 2024** streamlined EPR regime.

Need for proper e-Waste Management



Economic benefits of recovering valuable materials
like gold, silver, etc



Takes up **significant landfill space.**



Health hazards
(contains over 1,000 toxic materials)



Environmental Risks (non-biodegradable)



Social impact
(engagement of child labour).



Global initiatives

- **The Basel Convention:** to reduce the movement of hazardous waste between countries, including e-waste.
- **The Global E-waste Statistics Partnership (GESP)** between the United Nations University and the International Telecommunication Union.
- **E-waste Challenge** by World Economic Forum to create a circular economy for electronics.
- **E-waste Coalition 2018** by seven organisations from the United Nations system.







Way Forward

- Setting up efficient recycling facilities and collaborating with specialized companies. **E.g., Co-locating E-Waste Management Industrial Cluster** with Manufacturing Clusters.
- **Technological Development:** E.g., the Ministry of Electronics and Information Technology has developed indigenous technology for recovery of precious metals and plastics from e-waste
- **Other measures:** Stringent monitoring and enforcement of rules; Corporate Responsibility; Upgradation of skills of informal sector, etc.

4.6.2.1. BATTERY WASTE MANAGEMENT (AMENDMENT) RULES, 2024

Why in the News?

Recently, the Union Ministry of Environment, Forest, and Climate Change made revisions to the Battery Waste Management Rules, 2022.

Need for proper Battery Waste Management			
 <p>Growth in Battery Use due to electronics, electric vehicles (EVs), renewable energy systems etc.</p> <ul style="list-style-type: none"> • 933 Gwh, global annual demand for batteries (2021), expected to grow to 5,100 GWh by 2030. 	 <p>Large share of used Lead Acid Batteries (>90%) is recycled by informal recyclers.</p>	 <p>Environmental Protection from toxic substances such as lead, cadmium; promotion of Circular Economy.</p>	 <p>Impact on Human Health due to improper disposal like neurological damage, respiratory problems, etc.</p>

Current Governance framework of Battery Waste in India

- MoEF&CC published the **Battery Waste Management Rules, 2022**, for environmentally sound management of waste batteries **under the Environment (Protection) Act 1986.**
 - The rules **replaced the Batteries (Management and Handling) Rules, 2001**, amended in 2023 and recently in 2024.
- **Key Provisions of the Battery Waste Management Rules, 2022**
 - **Extended Producer Responsibility (EPR)**
 - **Centralized online portal** for exchange of EPR certificates between producers and recyclers/refurbishes.
 - **Mandatory recovery** of the minimum percentage of recovery of materials from waste batteries.
 - **Polluter Pays Principle:** Environmental compensation imposed for non-fulfilment of EPR target.

Key changes introduced by the New Rules

Particulars	Battery Waste Management Rules, 2022	Battery Waste Management (Amendment) Rules, 2024
Provision of Certificate for Waste Battery	<ul style="list-style-type: none"> • EPR certificates to be generated by CPCB through the centralised online portal based on the recycled or refurbished quantities. • Assigned certificates can be sold in exchange of waste batteries. 	<ul style="list-style-type: none"> • CPCB to fix the highest and the lowest price for EPR certificates (exchange price between registered entities to lie within this range)
Action on violations and imposition of Environmental Compensation	<ul style="list-style-type: none"> • Committee for Implementation constituted by CPCB to prepare and recommend guidelines (to be submitted to MoEF&CC) for imposition and collection of Environmental Compensation 	<ul style="list-style-type: none"> • CPCB (may consult the Committee for Implementation) to prepare and recommend guidelines (to be submitted to MoEF&CC).

Way Forward

- **Policy Support** like **licence for handling lithium-ion batteries** separate from electronic waste; **disposal of batteries in landfills** to be made **illegal** (NITI Ayog).
- **Incentivizing manufacturers**, such as **green taxes, to enforce extended producer responsibility.**
- **Deposit Refund System** to provide incentives to customers to return batteries; **Separate collection agency** for collection and recycling of batteries; **Financing for R&D.**

4.6.3. SEWAGE MANAGEMENT IN INDIA AT A GLANCE

Sewage Management in India

Current generation of Sewage Waste in India

- More than **33,000 Million Litres per Day (MLD)** is the estimated sewage generation from **Class I cities and Class II towns** in India with the current treatment capacity of STPs is just **18.6%**.



Institutional arrangement and initiatives for Sewage Treatment in India

- **Water is a 'State Subject' (7th Schedule, Article 246)**, therefore, it is the responsibility of the States/UTs to ensure the cleanliness of rivers.
 - **National Urban Sanitation Policy (2008)** made local governments responsible for 100% safe waste disposal.
- **74th Constitutional Amendment (1993)** decentralized **water supply and sanitation** services to the **Urban Local Bodies (ULB)**
- **Environment (Protection) Act, 1986** and the **Water (Prevention & Control of Pollution), Act 1974**, require **Industrial units and local bodies to install STPs** and Effluent treatment plants
- **Other initiatives:** Components of the **Atal Mission for Rejuvenation & Urban Transformation (AMRUT)**, **Smart Cities Mission**, **Namami Gange program** and **National River Conservation Plan**.



Challenges associated with STPs

- **Lack of Capacity in ULBs:** CAG audit (2016) in Jharkhand found that **none of the sampled ULBs had a sewage network** causing 175 MLD of untreated wastewater into open drains.
- **Lopsided implementation: 5 states** (Maharashtra, Gujarat, Uttar Pradesh, NCT of Delhi and Karnataka) **account for 60% of the total installed treatment capacity.**
- **Differences in discharge standards: Surface water body is regulated by 35 parameters** while **wastewater for land application is regulated by only 10 parameters.**
- **Low Compliance:** Only **23 %** of treatment capacity meets the consented parameters of SPCBs.
- **Other issues:** STPs are highly capital-intensive; No Specific policy at either the Central or state level.



Way forward

- **Setting up of underground STPs in land-scarce cities, e.g., case of China.**
- **Implementing Nature-based Solutions (Nbs)** like artificial wetlands, planted soil filters, etc.
- **Other measures:**
 - **Establishing multiple monitoring points**
 - **Utilization in Irrigation**, IARI, recommended an irrigation method for sewage-fed tree plantations
 - Utilization of treated sewage for **non-potable purposes** like horticulture, irrigation, etc.;
 - **Defining better and uniform water quality standards.**

4.6.4. WASTE TO WEALTH

Waste to Wealth



Waste to Wealth Techniques

- **Biological Processing:**
 - Composting biodegradable and organic waste to yield bio-fertilizer.
 - **Biomethanation** (anaerobic fermentation of biodegradable matter) to yield biogas, etc.
- **Thermal or Waste to Energy Processing:** 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, etc.



Significance of Waste to Wealth

- 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**.

Challenges



Informal and inefficient collection



Limited financial capacity of Local Bodies for processing



Lack of reliable data of waste inventory



Costly and complex technologies



Limited Private Participation



Initiatives taken

- **Waste to Wealth Mission** under **PM-STIAC** with components like-Swachhta Saarthi Fellowship, Su-Dhara, Community Engagement, Waste to Wealth portal, etc.
- Policies and guidelines for waste management like- **Solid Waste Management Rules, 2016; Plastic Waste Management Rules, 2022; Construction & demolition waste Management Rules, 2016 etc.**
- **500 new Waste to Wealth plants** under the **GOBARdhan** scheme (**Green Growth segment** of Union Budget 2023-24).
- Mandating use of **Plastic Waste in Road Construction**.



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.**

4.6.5. PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE (PGRFA)

Why in the News?

Global Symposium on Farmers' Rights (GSFR) organised by the Secretariat of **International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)** of **Food and Agriculture Organization (FAO)** adopted the Delhi Framework on Farmers' Rights.





Key highlights of Delhi Framework:

- Creating **functional synergy across different UN instruments** (like ITPGRFA, CBD, United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) etc.) for realization of farmers' rights.
- Establish **farmer-managed seed system for traditional varieties** and create self-sustaining production and marketing value chain.
- **Building farmer-centric partnership opportunities** including South-South, etc.

About Plant Genetic Resources for Food and Agriculture (PGRFA)

- Are the **raw material that form basis of all crop varieties** and **include seeds and all other plant genetic material.**
- 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.

Importance of PGRFA

 <p>Protecting natural resources</p>	 <p>Raw material for plant evolution and adaptation</p>	 <p>Critical for development of new varieties, ensures health and economic security</p>	 <p>Genetic material from food plants in one country can be helpful to other countries as well</p>
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Threats to PGRFA conservation and utilisation

- **Genetic vulnerability** and erosion due to mono-cropping
- **Imbalance between Intellectual Property Rights** provided to breeders of modern plant varieties and rights of farmers.
- **Other threats:** Pollution, climate change induced variations, population growth and urbanisation,



Way Forward

- Constructing a **comprehensive information retrieval system** for plant genetic resources, conducting efficient survey, etc.
- Using **in-vitro genebank, Field genebank (Ex-situ) and cryobank**, etc., on farm management and improvement of plant genetic resources.

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

- Also known as **seed treaty**, is a **legally binding agreement** adopted in 2001 (31st session of the FAO) **to conserve, use and manage PGRFA** around the world.
- It makes possible the sharing of **plant genetic resources across borders** through a unique **Multilateral System of Access and Benefit-sharing (MLS)**.
- Provided an **international legal framework** for the establishment of Svalbard Global Seed Vault in Norway.
- **India is a party and has enacted the Protection of Plant Varieties and Farmers' Rights Act 2001** to safeguard **interest of farmers** engaged in the **conservation and improvement of plant genetic resources**.
- **Indian Initiatives for seed sector:**
 - Seeds Act, 1966; National Seed Policy, 2002;
 - Protection of Plant Varieties and Farmer's Rights Act, 2001;
 - Seed Village Programme;
 - Sub-Mission for Seed and Planting Material (SMSP) under National Mission on Agricultural Extension and Technology;
 - Bharatiya Beej Sahkari Samiti Limited (Cooperative society focussing on production, testing, procurement, processing of seeds).

4.7. MISCELLANEOUS

4.7.1. GREEN BUILDINGS

Why in the news?

Indian Green Building Council (IGBC) has introduced new green rating tools as part of its Net Zero mission to accelerate the **uptake of green building projects** in country.

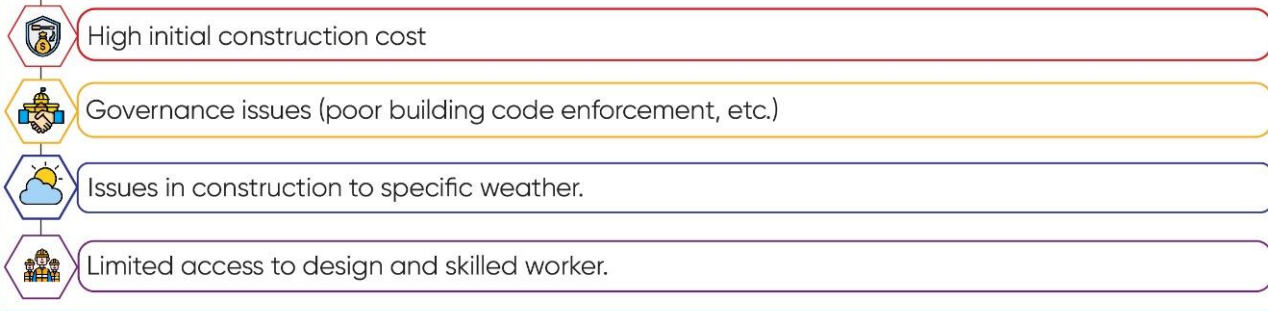
About Green Buildings

- Refers to the **use of environmentally friendly construction materials**, processes, operation, and maintenance to **reduce the cost of energy and waste management**.
 - E.g., **cool roofs, Agrocrite** (carbon-negative building material made of crop residues), **Carbon Craft Tile** (upcycled carbon by using recovered carbon waste as a resource).
- They are different from-
 - **Energy-efficient** (use less heat to heat, cool, and run appliances)
 - **Net zero carbon buildings** (achieve zero carbon emission by cutting energy consumption and using on-site/off-site renewable energy sources)

Advantages

- Green buildings **consume 25% less energy** than traditional buildings.
- **Building and construction sectors** contribute about **38% of the greenhouse gas (GHG) emissions**.
- **Health benefits due to non usage of harmful substance**. For e.g Not using volatile organic compounds (VOCs).
- **Economic: Global green building materials market** projected to grow from **\$422.27 billion in 2023 to \$951.15 billion by 2030**, at a CAGR of 12.3%
- **Other:** Low maintenance cost, Reduced Waste, Increased Building Durability, improved Water Efficiency etc.

Challenges in constructing green buildings



Initiatives taken:

- **Energy Conservation Building Code (ECBC)** (2007 revised in 2017) by Bureau of Energy Efficiency (BEE).
- **Eco-Niwas Samhita 2018** by Ministry of Power is **ECBC for Residential Buildings**.
- **Green Rating for Integrated Habitat Assessment (GRIHA)** by The Energy & Resources Institute (TERI) and Ministry of New and Renewable Energy (MNRE), uses a **five-star rating, valid for five years**.
- **Indian Green Building Council (IGBC)**, India's Premier Certification Body, established by **Confederation of Indian Industry in 2001**,
- **Leadership in Energy & Environmental Design (LEED)** by U.S. Green Building Council.
- **Star Rating of Commercial Buildings** launched by Ministry of Power.

Way Forward

- Finance Commissions & Local bodies should **encourage green buildings through tax incentives**.
- **Green projects** need long-term investment through the issuance of green bonds.
- **Retrofitting of existing buildings**; etc.

4.7.2. ENVIRONMENTAL MOVEMENTS IN INDIA

Why in the news?

2023 marked the 50th anniversary of the Chipko movement.

About Chipko movement

- The Chipko movement was a **nonviolent resistance against forest cutting** in the Reni village in Uttarakhand's Chamoli district.
- **Origin:** Dates back to the 18th century and was started by **Rajasthan's Bishnoi community**. Led by **Amrita Devi** against the orders of then King of Jodhpur.
- Resulted in passing of a royal decree that **banned cutting of trees in all Bishnoi villages**.
- **Movement's leaders/activists:** Primarily village women
- **Major leaders:** Sunderlal Bahuguna, Chandi Prasad Bhatt, Gaura Devi, etc.
- It is **renowned for its collective mobilization of women** to conserve forests, manifesting the philosophy of **Eco-feminism**.

About Eco-feminism

- It is a **philosophical and political movement** that examines **connections between ecological concerns and women**. It contends that our culture is dominated by a **capitalist patriarchal system**, where societal values and ethics are dictated by a **profit-driven, sexist, and male-centric society**.
- **Reasons behind emergence of Eco-feminism:**
 - **Interconnectedness of exploitation and degradation of the natural environment** and the **subjugation of women in patriarchal societies**.
 - **Significance of traditional knowledge** often held and transmitted by women

- **Women's lived experiences** where women have close and direct relationship with natural environment.
- **Contemporary relevance:** Critique of capitalist exploitation, valuing traditional ecological knowledge, recognition of Environmental Justice, etc.

Major environmental movements

- **Silent Valley Movement (1973)** against hydro-electric dam on Kundapuzha River, Kerala.
- **Appiko movement (1983)** led by **Panduranga Hegde** in Karnataka. Inspired by the Chipko movement and included **women in Karnataka's** Western Ghats.
- **Narmada Bachao Andolan (1985)** against large dam on Narmada.
- **Other important environmental movements:** Chilika Bachao Andolan, Against Bauxite Mining in Kashipur, Gandhamardan Environment Protection, etc.

Impacts of Environmental Movements in India

- **Leadership to women**, E.g., Gaura Devi.
- **Push to Environmental Policy and Legislation** such as Forest Right Act 2006,
- **Legacy of nonviolent protests** including Gandhian Concept of nonviolence and Satyagraha.
- **Sustainable development** E.g., Narmada Bachao Andolan.
- **Protecting cultural identity;** advocated the ideology of 'environmentalism of the poor'

Challenges faced by the Environmental Movement

- Lack of sufficient technical information and data.
- Weak decision making powers of local self-governments.
- Lack of dialogue and cooperation.
- Environmental laws that do not provide for public participation.
- Disappearance of traditional belief systems.

Way forward

- **Alternative people friendly development plans** for sustainable society.
- **Enhance public participant of development** by campaigning for laws
- **Technical and data related knowledge** should be incorporated in the movement
- **Link local and global issues** such as resource conservation and environmental protection
- **Promoting individual action along with movements. E.g., LiFEstyle for Environment (LiFE)**

Indian Customs and tradition for sustainable development

- **Compassionate capitalism:** Gandhiji's Sarvodaya, Indian tradition (uplifting and providing equal opportunities to all).
- **Circular economy; Energy Conservation** (utilizing local materials like bamboo, stones, etc.)
- **Sacred groves:** Patches of forests/natural vegetation dedicated to local folk deities (Example – Ayyanar and Amman) or tree spirits (Vanadevatais).
- **Conservation of Animals** (symbolically considered as vehicles of gods/goddesses/deities themselves).
- **Health through traditional medicinal systems**– Ayurveda, Siddha, Unani, Sowa-Rigpa, Homeopathy.

5. RENEWABLE ENERGY AND ALTERNATIVE ENERGY RESOURCES

5.1. RENEWABLE ENERGY IN INDIA AT A GLANCE

Renewable Energy (RE) in India



India's RE targets

- Achieve 50% cumulative electric power installed by 2030 from renewables. (INDC)
- Non-fossil fuel energy capacity of 500 GW by 2030. (Panchamrita targets)
- Aim for 500 GW of renewable energy installed capacity by 2030. (Panchamrita targets)



Current Status (Power Ministry, June 2024)

- Installed Capacity of Renewable energy source (Incl. Hydro): 195 GW (Power Ministry, June 2024) (43.7% in total)
- Share of different sources in total Installed Capacity:
 - Solar: 19.2% (85 GW)
 - Wind: 10.5% (46 GW)
 - Biomass cogeneration: 2.3% (10 GW)
 - Waste to Energy: 0.1% (0.5 GW)
- Installed Capacity of Non-Fossil Fuel in total installed capacity: 203 GW (45.5% in total)
- Global rankings: 4th globally in Renewable Energy Installed Capacity, 4th in Wind Power capacity and 5th in Solar Power capacity

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5.2. SOLAR ENERGY IN INDIA AT A GLANCE

Solar Energy in India

Status of solar energy in India

- **Installed solar energy capacity:** 85 GW (Power Ministry, June 2024)
- **Potential: 748 Giga Watt peak** (National Institute of Solar Energy).
- India ranks **5th in Solar Power Capacity globally.**
- **3rd largest solar power** generator (5.9% of global growth) and saw **4th largest surge** in solar generation in 2023 (Global Electricity Review, 2024 by Ember).

Challenges

- **Decline** in the **Solar photovoltaic Potential (SPV)** in stations of **IMD** due to increase in aerosol load from carbon emissions (**IMD Study**)
- **Gujarat and Rajasthan**, where India's largest solar parks are located are **also showing a decrease in SPV potential.**

Initiatives to Promote Solar Energy

- **Grid Connected Solar Rooftop Programme** by Ministry of New & Renewable Energy to **achieve a cumulative installed capacity of 40,000 Megawatt (MW) by March 2026.**
- **Production-linked incentive scheme under National Programme on high efficiency Solar PV Modules**, aim to reduce import dependence.
- **Solar Park Scheme**, hubs for solar energy generation, attracting investments.
- **Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM)**, aims to achieve solar power capacity addition of 34.8 GW by March 2026.
- **Pradhanmantri Suryodaya Yojana**, **provide electricity to low and middle-income individuals through solar rooftop** installations.
- **Cochin International Airport** is the world's **first solar-powered airport.**
- **PM Surya Ghar Muft Bijli Yojana** to provide subsidies to install solar panels on roofs.

MAINS 365 - ENVIRONMENT

5.2.1. SOLAR ROOFTOP POWER

Why in the news?

Recently, Union Cabinet has approved - **PM Surya Ghar Muft Bijli Yojana** for installing Rooftop Solar in one crore households nationwide.

About PM Surya Ghar Muft Bijli Yojana

- **Key Highlights of Scheme**
 - **Ministry:** Ministry of New & Renewable Energy.
 - **Aim:** To provide **free electricity up to 300 units every month for one crore households.**
 - **Subsidy structure:** Central Financial Assistance for Residential Rooftop Solar (RTS) up to:

Suitable Rooftop Solar Plant Capacity	Subsidy Support
1 – 2 kW	Rs 30,000 to Rs 60,000/-
2 – 3 kW	Rs 60,000 to Rs 78,000/-
Above 3 kW	Rs 78,000/-



- Collateral-free low-interest loan products of around 7% for installation of RTS systems up to 3 kW.
- **Other features of the scheme**
 - **Model Solar Village** to be developed in each district, to act as a role model for adoption of rooftop solar in rural areas.
 - **Others:** Incentives to Local Bodies; National Portal for households to apply for subsidies; Component for payment security for Renewable Energy Service Company (RESCO).
- **Significance of PM Surya Ghar Muft Bijli Yojana:**
 - **1 crore families** will save **Rs 15000 crore annually** through reduced electricity bills.
 - Households can earn income by **selling surplus power to electricity Distribution Companies (DISCOM)**.
 - **Addition of 30 GW of solar capacity** through RTS in residential sector.
 - Reduction of **nearly 720 million tonnes of CO2** equivalent emissions.
 - **Others:** more EV charging; create entrepreneurship; self-reliance in energy sector; etc.

About Solar Rooftop System

- Includes **photovoltaic panels installed on the roof of a building** which is connected to the **main power supply unit**. Captures energy from sunlight and convert it into usable electrical energy.
 - Consists of **solar modules, solar inverter(s) and other electrical components**.
- **India's Current Rooftop Solar Capacity**
 - Currently, India has **installed 11 GW of rooftop solar capacity**, of which **2.7 GW is in the residential sector**.
 - **Gujarat is the leader in Rooftop Solar installations (82%)**.

Challenges for scaling up Solar Rooftop System

- **Grid stability and energy storage due to variability and unpredictability of solar energy.**
- **High cost due to lack of Research & Development, increased imports of components.**
- **Low DISCOMs participation and low net metering** (delivering net surplus energy)

Conclusion

There is need for measures like time bound approval, third-party inspections, improving grid infrastructure, modification in net-metering policies and single window facility, etc.

5.2.2. INTERNATIONAL SOLAR ALLIANCE

Why in News?

India hosts the 6th Session of the International Solar Alliance (ISA) Assembly in New Delhi. Also, Spain became the 99th member of ISA

More on the News

Key Highlights of the 6th Assembly

- Increase in the **Viability Gap Funding (VGF) Cap for solar projects from 10% up to 35%** of the project cost.
- ISA announced that **Global Solar Facility (GSF)** is set to receive a **capital contribution of \$35 million dollars**.
 - In **2022**, the ISA Assembly approved the Global Solar Facility, to attract private capital to flow into off-grid solar projects, rooftop solar projects, and productive use solar projects.
 - GSF will provide: **Payment guarantee fund; Insurance fund** to mitigate project risks; **Investment fund** for Technical Assistance.
 - GSF is designed to **catalyze solar investments** in underserved segments and geographies across **Africa**. After Africa, aims to **expand to Asia, Latin America and the Middle East**.

About ISA

- A treaty-based **intergovernmental organization** that is an action-oriented, member-driven, collaborative platform for increased deployment of **solar energy technologies**.
- Jointly launched by India and France in 2015 on the sidelines of COP-21 of the United **Nations Framework Convention on Climate Change (UNFCCC)** in Paris. Headquartered in Gurugram.
- With the amendment of the **Framework Agreement** in 2020, all member states of the United Nations are eligible to join the ISA. Has observer status to UN.
- **Key Strategy:** Guided by the '**Towards 1000**' strategy. Under it, ISA aims to
 - Mobilise **USD 1,000 billion** of investments in solar energy solutions by 2030
 - Delivering **energy access to 1,000 million people**
 - **Installation of 1,000 GW** of solar energy capacity.
- **Significance of ISA:** Ensuring **Just energy transition** through **technology transfer, mobilising finance**, etc; asserts India's soft power along with other initiatives like Global Biofuels Alliance, CDRI, etc.
- **Challenges:** lack of finance and technologies, uneven global electricity landscape, lack of solar energy equipment manufacturing capability, etc.
- **Other Initiatives by ISA**
 - **One Sun One World One Grid (OSOWOG)**, aims to connect different regional grids through a common grid for transfer of renewable energy power (led by India and UK in collaboration with ISA and World Bank).
 - ✓ India has **established cross-border interconnections** with its neighbours through which **electricity is exported to Nepal, Bangladesh, and Myanmar** and **imported from Bhutan** along with an MoU with BIMSTEC.
 - **Solar Technology Application Resource Centre (STAR C)**, for capacity building.
 - **Large-scale Solar Power Projects** under Solar Park Concept in cluster/group of ISA member countries.



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5.3. HYDROGEN ENERGY IN INDIA AT A GLANCE

Hydrogen Energy in India

- **Hydrogen Fuel Cell** uses the **chemical** energy of hydrogen to produce electricity. Clean **form of energy with electricity, heat and water** being the only by/products
- **Green Hydrogen (GH₂): produced by splitting water into hydrogen and oxygen using renewable electricity** like solar or wind-powered photo-catalysis and electro-catalysis of water, etc.



Targets

- Development of green hydrogen production capacity of at least **5 MMT (Million Metric Tonne) per annum** (National Green Hydrogen Mission)



Status

- Currently, India **produces 6.5 million metric tonnes per annum (MMTPA) of hydrogen**, predominantly for use in **crude-oil refineries and fertilizer production**. (WEF)



Benefits of Hydrogen as a fuel

- Blend of H₂ and Natural gas can be used to generate **heat with lower emissions** than using natural gas alone.
- **Decarbonize sectors** like transportation, shipping, and steel, etc. and **achieve net zero emission** by 2070.
- Abundance and Extraction; Environmental Friendliness
- Power and Efficiency (3 times as powerful as gasoline)



Concerns

- **High production costs** of Green Hydrogen (roughly **\$4-5 per kg**)
- Substantial energy and cost in extraction and **non-economical battery storage**
- Requires huge investment to establish robust supply chains
- Storage and safety concerns like inflammable
- High logistics costs; etc.



Steps taken for utilizing Hydrogen as a fuel

- **National Green Hydrogen Mission**
- Ministry of Steel inaugurated **India's 1st Green Hydrogen Plant in the Stainless-Steel Sector**.
- GAIL has **initiated blending 2% hydrogen in CNG networks and 5% in PNG networks** in Indore.
- **NTPC** has introduced **Hydrogen-based Fuel-Cell Electric Vehicle (FCEV) buses** in Leh.
- **Indian Oil Corporation** launched India's **1st Green Hydrogen Fuel Cell Bus**.
- **Indian scientist** with support from the **Science and Engineering Research Board (SERB)** has developed new process to produce **hydrogen from methanol**.

5.4. ETHANOL BLENDING IN INDIA AT A GLANCE

About Ethanol



About Ethanol and its blending

- **Ethanol:** A **principal-biofuel**, naturally produced by the **fermentation of sugars by yeasts** or via **petrochemical processes such as ethylene hydration**.
- **Ethanol Blending:** Involves a **blended motor fuel containing ethyl alcohol** that is at least 99% pure, derived from agricultural products
- **Potential of biomass energy in India:** 28 GW through Surplus biomass availability in India.



Key Targets

- **Targets of 20% ethanol blending in petrol by 2025** (Updated) **and 5% biodiesel** blending in diesel by 2030. (National Policy on Biofuels, 2018)



India's achievements

- **10% ethanol blending** in Petrol by June 2022.

Significance

Reduce Pollution: Use of E20 leads to reduction of carbon monoxide emissions by **about 50 per cent** in two-wheelers and **about 30 per cent** in four-wheelers compared to petrol.

Reduce Import: help in lowering India's energy import dependency

Boost farmer income and help in **achieving international commitment** of the government.



Challenges

- **Impact on Food and water security**, due to demand of water intensive sugarcane crop.
 - Recently, government banned using 'sugarcane juice and sugar syrup' for ethanol production as per **Sugar (Control) Order 1966 for the 2023-24**.
- **Others:** Non-uniform availability of ethanol across various states, modification in vehicles increasing the cost; high prices of ethanol; high implementation cost; etc.



Initiatives

- **National Policy on Biofuels - 2018** enables the availability of biofuels in the market.
- **Ethanol blending Program (EBP)** with the target of **20% ethanol blending in petrol** by 2025.
 - **Reduced GST (from 18 to 5%)** on ethanol under EBP.
- **PM JI-VAN YOJANA** for setting up **second-generation (2G) ethanol projects**.
- **Flexi-fuel engines** and components included under PLI scheme.
- **Amendment of Industries (Development & Regulation) Act, 1951** to ensure free movement of ethanol in the country.



Way forward

- Ensure **uniform availability of ethanol blends** across India.
- Augmenting **infrastructure of Oil marketing companies**.
- Focus on **sustainability of supplies**.
- **Providing tax incentive** to absorb R&D cost on E20 compatible design, etc.

5.4.1. SUSTAINABLE ALTERNATIVE TOWARDS AFFORDABLE TRANSPORTATION (SATAT)

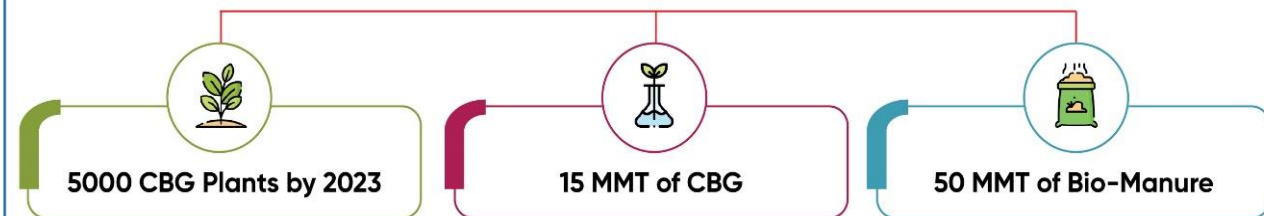
Why in the news?

Parliamentary Standing Committee on Petroleum and Natural Gas submitted an action taken report on its earlier recommendations on the subject '**Review of Implementation of CBG (SATAT)**'.

About Sustainable Alternative Towards Affordable Transportation (SATAT)

- **Launch: 2018.**
- **Objective:** To set up **Compressed Bio-Gas (CBG) production plants** and make available CBG in the market for use in automotive fuels.
 - CBG is obtained after **purification and compression of bio-gas**, which has a high **methane content (>90%)** and **higher calorific value (47-52 MJ/kg)**.
 - Other components of CBG include – **CO₂ (<4%)**, **Hydrogen Sulphide (<16 ppm)**, **Nitrogen (<0.5%)**, **Oxygen (<0.5%)**, and **Moisture (<5mg/m³)**.
- **Nodal Ministry:** Ministry of Petroleum and Natural Gas (MoPNG).

Targets under SATAT



Fulfills all 4 pillars of our vision of India's energy future -energy access, energy efficiency, energy sustainability and energy security.

Challenges in Implementation

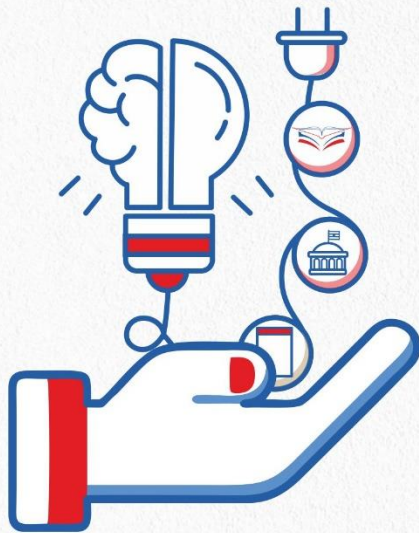
- **Governance-related issues:**
 - **Multiple regulatory approvals** and involvement of various ministries, including MoEFCC, MoPNG, MoNRE, etc., hinder entrepreneurs.
 - **Discontinuation of Central Financial Assistance (CFA)** since April 2021 for extending support to new and renewable energy projects.
 - **Lack of interest among Oil PSUs** in setting up CBG projects
- **Unregulated bio-mass supply chain:** Limited timeframe of 30–40 days for gathering agricultural feedstock and the unpredictability of feedstock prices.
- **The differential tax structure** of Compressed Natural Gas and CBG.

- **Market:** No buyers for fermented organic manure on which CBG companies base 15-20% of their revenue. Compressed Bio-Gas (CBG) projects are **not being implemented at a desired rate** (only about 40 CBG plants have been set up.)

Way Forward

- Convene meetings of the **National Bio-fuel Coordination Committee (NBCC)** regularly to sort implementation issues.
- **Generation Based Incentive (GBI)** instead of Capex-based subsidy for CBG plants.
 - Setting up a **financial institution in consultation with Oil and Gas PSUs** for all bio-fuel and clean energy projects.
 - Setting up a **Bio Fuel Infrastructure Fund** and **Credit Guarantee Fund** to expedite the development of the CBG sector.
 - Provide **fiscal support** for the development of **pipeline infrastructure for connecting CBG projects with the CGD network.**
- **Governance reforms**
 - **Simplify and digitise regulatory approvals** by creating **single window clearance**
 - **Capacity building of Urban Local Bodies** and involving the **PPP model**
 - **Restricting or regulating the export of agricultural biomass**
- **Technology:** Use of AI-based sensors to analyse the quality of feedstock, enable vehicle tracking, etc., to establish a sound biomass supply chain.

OPTIONAL SUBJECT CLASSES



- » Geography » Sociology
- » Political Science and International Relations

Starts: **16 JULY, 5 PM**

- » Public Administration
- » Anthropology » Hindi Literature

STARTING SOON

5.5. TIDAL ENERGY

Tidal Energy



Potential in India (Parliamentary Standing Committee on Energy)

- **Estimated potential** of tidal and wave energy in India are **12455 MW** and **41300 MW**, respectively.
- **Potential areas with low/medium tidal wave strength in India:** Gulf of Khambat, Gulf of Kutch, Palk Bay, Hoogly river, South Haldia & Sunderbans.

Significance of Tidal Energy



Energy security and diversification as it is more steady, predictable and reliable.



It is **more efficient than wind energy** due to higher relative density of water.



Harnessing India's **long coastline**



Reduce dependency on fossil fuels and diversify energy mix.



Climate mitigation and adaptation by reducing carbon footprint.



Aligns with the India's **'Panchamrit' pledge (COP26 of the UNFCCC)**.



Challenges

- **Tech hurdle:** corrosion and complex design required for harsh marine settings.
- **Sediment shift:** changes in water flow disrupt sediment pattern, affecting coastlines.
- **Navigation issues:** installation can obstruct marine routes, causing conflicts.
- **Ecological issues:** Turbines and barrages risk harm to marine animals and ecosystems.



Way forward

- **Reassessment of various forms of ocean energy:** To explore the practically exploitable potential.
- **Set up demonstration/ pilot projects:** To showcase proof-of-concept and commercial viability.
- **Non-solar Renewable Purchase Obligations (RPOs):** In 2019, government clarified that various forms of ocean energy shall be eligible for meeting non-solar RPOs.
- **Environmental Impact Assessment:** Pragmatic assessment of environmental impact and ecological sustainability of ocean energy projects.
 - **Evaluation of global experience** (particularly, **two projects from France and South Korea**, which constitutes about 90% of installed tidal power in the world).
- **De-risking financing options:** Issuance of tax free bonds by renewable financing institutions like IREDA, improvement in soft loans scheme for refinance, etc.

5.6. ENERGY TRANSITION IN INDIA AT A GLANCE

Energy Transition in India



Energy Transition

- Refers to **shifting energy production away from sources that release a lot of greenhouse gases**, such as fossil fuels, to those that release little to no greenhouse gases.



India's Status of Clean Energy Transition

- India's rank:** 63rd (up from 67 in 2023) (WEF Fostering Effective Energy Transition Report, 2024).
- Installed RE Capacity** increased from **76.37 GW in 2014 to 195 GW (including hydro)** in (June 2024).



Challenges

- Achieving all national climate and energy goals will require **adding or replacing 80 million kilometers of power lines by 2040**.
- Clean energy technologies, such as advanced batteries for energy storage or next-generation nuclear reactors, are still in the development or early deployment stages.
- Investment Disparities:** Almost 90% of the growth in Clean energy infrastructure investments since 2021 has been in advanced economies and China.
- Other issues:**
 - Uncertainties in Subsidies and Supply Chains.**
 - Geopolitical Tensions and Trade Protectionism.**
 - Energy Storage limitations.**
 - Capital-intensive, and high upfront costs of renewable energy projects than traditional fossil fuel-based projects.



Global Initiatives to facilitate Energy Transition

- International Solar Alliance (2015)**
- Clean Energy Transition Programme** of International Energy Agency
- Panel on Critical Energy Transition Minerals (India is its member).**
- Just Energy Transition Partnerships** by the International Energy Agency & WEF.
- Carbon Border Adjustment Mechanism (CBAM)** by EU
- Global Renewables and Energy Efficiency Pledge** at COP 28 (UAE), calls for tripling the rate of renewables capacity by 2030.
- Energy Charter Treaty**, provides a **multilateral framework for energy cooperation** to promote energy security through operation of more open and competitive energy markets.



Indian Initiatives to facilitate Energy Transition

- **National Solar Mission (2010)**
- **National Electric Mobility Mission Plan (2013)**
- **Green Energy Corridor Project:** Supported by the World Bank,
- **National Biofuel Policy (2018)**
- **Renewable Purchase Obligation (RPO)**
- **National Green Hydrogen Mission (2023)**



Way forward

- **Taking steps to manage energy demand** can cut energy consumption by as much as **31%**, resulting in **annual savings of up to \$2 trillion (WEF)**
- **Supportive policy environment, Like India's UJALA program**, reduced the initial cost per LED bulb to as low as \$0.8 (WEF).
- **Increased grid investment**, nearly doubling by 2030 to over USD 600 billion per year.
- **Others:** Strong political commitments and regulations to advance decarbonization; Deliver energy equity for vulnerable households; Drive R&D and adoption of new technologies; Make renewable energy technology a global public good; Level the Playing Field for RE Technologies

5.6.1. CRITICAL ENERGY TRANSITION MINERALS

Why in News?

United Nations appoints panel on Critical Energy Transition Minerals.

About Critical Energy Transition Mineral

Essential components in many of **today's rapidly growing clean energy technologies**, from wind turbines and solar panels to electric vehicles. **E.g. copper, lithium, nickel, cobalt etc.**

Challenges/Issues:

- **Geographical concentration:** Few countries have major reserves; E.g. **Lithium triangle**- consists of Argentina, Chile and Bolivia
- **Unsustainable Mining and processing:** lead to water pollution, destruction of ecosystems, and human rights issues (such as child labour).
- **Growing Demand:** Mismatch in demand and supply. According to the **International Energy Agency**, demand of critical mineral is set to grow by three and a half times by 2030.

Other Key Initiatives

- **Global**
 - **Mineral Security Partnership (MSP)** to bolster critical minerals supply chains. India is also a part.
 - **Critical Minerals Mapping Initiative**
 - **UN Framework on Just Transitions for Critical Energy Transition Minerals** (Expected to be launched by the end of 2024)
- **India**
 - **Identification of 30 critical minerals** crucial for self-reliance add example
 - **Partnership with Australia** for lithium and cobalt and with **Argentina** for lithium.

- **Khanij Bidesh India Limited (KABIL)**, formed to identify, acquire, process and make commercial use of strategic minerals in overseas locations for supply in India.

Way Forward

First IEA Critical Minerals and Clean Energy Summit outlines six key actions identified for reliable supplies of critical minerals

- **Accelerate progress** towards diversified minerals supplies
- **Unlock power of technology and recycling** to alleviate potential strains on supply.
- **Promote transparency** in markets.
- Enhance **availability of reliable information**.
- **Create incentives** for sustainable and responsible practices like rewarding environmental, social and governance efforts.
- Foster **international collaboration**.

The advertisement features the Vision IAS logo at the top left, with the tagline 'INSPIRING INNOVATION'. The main title 'SANDHAN' is written in large, bold, blue and red letters. Below it, a red banner contains the text 'A VisionIAS Personalised Test Series'. Underneath the banner, a subtitle reads '(An All India GS Prelims Test Series feature for Smart Revision, Practice and Holistic Preparation for UPSC Prelims)'. On the left side, there are four bullet points with red arrowheads, describing the features of the test series. On the right side, there is a box with the text 'Starts: 21 July' and a QR code with the text 'Scan to know more'.

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Scan to know more

5.7. ELECTRIC VEHICLES AT A GLANCE

Electric Vehicles

- Propelled by an **electric motor**, powered by **rechargeable battery packs**.
 - Contrary to this an **Internal Combustion Engine (ICE)** generates power by burning a **mix of fuel and gases**.

Types of EVs

			
Battery EVs/ All EVs: Run entirely on a battery-powered electric drive train .	Hybrid EVs (HEVs): Involving both the engine and electric motor , the transmission rotates concurrently driven by both power sources.	Plug-in HEVs: Encompasses both an engine and a motor but its battery pack is much larger when compared to other HEVs.	Fuel Cell Electric Vehicles: Referred to as Zero-Emission Vehicles , these vehicles utilize 'fuel cell technology' to generate electricity for propulsion.



Contribution of EVs in reducing Carbon Emissions

- Zero tailpipe emissions** (1% increase in the sale of EVs in a city can reduce CO2 emissions locally by 0.096% and by 0.087% in a nearby city).



Benefits of EVs over traditional combustion engines

- Superior energy efficiency** compared to internal combustion engine vehicles.
- Electric motors **boast high-energy conversion rates**, typically exceeding 90%.
- Running cost of an electric vehicle is much lower than** an equivalent petrol or diesel vehicle.
- Low maintenance costs** as they don't have many moving parts
- Registration fees and road tax** on purchasing electric vehicles are lesser.



Key issues

- Frequent changes in EV policies** create uncertainties in the market.
- Lowering targets** under the **FAME-II** due to budgetary constraints.
 - FAME-II (under Ministry of Heavy Industries) focuses on **supporting electrification of public & shared transportation**.
- Exemptions and rebates** for road tax are currently available in only **19 states/UTs**.
- Lack of charging infrastructure** and the overall **time required to charge** such batteries.



Government initiatives for EV adoption

- **Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME India) Scheme**
- **Production Linked Incentive (PLI) Scheme for the Automotive Sector**
- Capped the **maximum tariff for EV public charging.**
- **GST on EVs** has been reduced from 12% to 5%.
- Waiver on **road tax on EVs.**
- Central Electricity Authority (CEA) proposed battery standardization to boost EV-to-grid charging.



Way forward

- Formulation of a stable **national policy on Electric Mobility.**
- Enhancement of **budgetary allocation** for e-Buses under FAME-II and **extend it for at least 3 more years** (current tenure 2019-2024).
- **Incentivize installation of charging stations** for individual investors.
 - **Women SHGs and Cooperative Societies** may be assisted to open and operate charging Stations.
- Establish **dedicated Manufacturing Hubs and Industrial Parks**
- Conduct a study regarding the **feasibility of battery standardisation.**
- **Introducing a Standard Charger to create an open ecosystem with interoperability, etc.**



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Performance and Progress Analysis

6. CONSERVATION EFFORTS

6.1. FOREST CONSERVATION IN INDIA AT A GLANCE

Forest Conservation in India



Targets

- **INDC:** To create an additional carbon sink of 2.5 to 3 billion tonnes of CO₂ 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



Status of Forests in India

- **Total forest and tree cover: 24.62%** of total geographic area (**increase** of 0.28% from 2019), (India State of Forest Report 2021)
- **17 states have more than 33%** of their area under forest cover.



Importance of Forests

- **Carbon sink** of about **24,000 mt of CO₂** has a worth of **\$120 billion**, indicating financial wealth of forest.
- **Shields against extreme weather conditions**, such as storms and floods, e.g., Mangroves and coastal forests.
- **Invaluable resources and protection for communities** that rely on them for their livelihoods and security e.g., food and fuel, etc.
- **Habitat for large number** of flora and fauna species.

Threats to Forests



Deforestation
India Lost 3.3% of tree cover due to deforestation from 2001 to 2022. (Global Forest Watch)



Plantations vs forests
Lakshadweep has largest relative plantation area at 76%.



Climate Change
Fuels extreme heat thereby increase in wildfires and loss of tree cover.



Natural and Human induced disasters
like forest fires, etc.



Initiatives Taken by India

- **Forest Conservation (Amendment) Act, 2023 or Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980**
- **India's initiatives to improve Tree cover**
 - **Green India Mission to increase Forest/Tree Cover by 5 mha** and **improve** its quality on another **5 mha of forest/non-forest lands**.
 - **Nagar Van Yojana** to enhance green cover in urban and peri-urban areas.
 - **Accredited Compensatory Afforestation**.
- **Indian Forest & Wood Certification Scheme (IFWCS)** by MoEFCC, is a market incentive to **promote Sustainable Management of Forest and Trees outside Forests (TOF)** in country.
- **SC Judgement: State of Telangana Vs Mohd. Abdul Qasim, 2024:** Forests are a national asset and there is a need to promote Green accounting.



Best Practices

- **Forest Environment Tax** by Japan
- **Model Forest Act Initiative (MoFAI)** by UNEP and ADB
- **Congo Basin Forest Partnership**



Way forward

- Balancing **ecological conservation with economic imperatives**.
- Use of **disruptive technological solutions** like smart sensors, based on Internet of Things (IoT).
- **Strengthening community-based initiatives** like community forestry and joint forest management
- Adopting **rights-based approaches** to environmental protection and sustainable development thereby protecting the communities dependent on them.

6.1.1. DEFINITION OF FOREST

Why in the news?

The Supreme Court (SC) recently directed the Government to follow the definition of "forest" as laid down in the 1996 judgment in **T. N. Godavarman Thirumalpad v. Union of India**.

Background of Definition of Forest

- **T.N Godavarman Thirumalpad v. Union of India (1996):** Definition of "forest" **was expanded to include:**
 - All areas recorded as "forest" in any government (Union and State) record, irrespective of ownership, recognition, and classification.
 - All areas that conformed to the "dictionary" meaning of forest.
 - Areas that are identified as "forest" by expert committees set up by the State governments following the 1996 order.
- **Forest Conservation (Amendment) (FCA) Act, 2023:** Specified forest land as-
 - **Land declared/notified as a forest under the Indian Forest Act, 1927** or other laws.
 - **Land recorded in Government as forest**, as on or after 1980.
 - ✓ This does not include land which has been officially changed from forest use to use for non-forest purposes on or before 1996.

- **Van (Sanrakshan Evam Samvardhan) Rules, 2023:** As per rule 16, State Governments/UT Administrations, within a period of one year, have to prepare a consolidated record of such lands on which the provisions of the Forest Conservation (Amendment) (FCA) Act, 2023, apply.
 - This includes forest-like **areas identified by the Expert Committee constituted for this purpose**, unclassified forest lands or community forest lands.

Directions of the Supreme Court

- **Continuation of principles of TN Godavarman judgment** until the exercise by State Governments and Union Territories administrations is completed under **rule 16 of Van (Sanrakshan Evam Samvardhan) Rules, 2023.**
- **Broader meaning of forest**
- **Other Key directions:**
 - **Database creation:** State/UTs should **submit a “consolidated record” of all the lands recorded as ‘forest’** by the expert committees (constituted as per the TN Godavarman judgment) to the Central Government.
 - **Safeguard in zoo creation:** Prior approval of the court is needed before giving final approval for the establishment of zoos or safari by any government or authority.
 - ✓ FCA Act 2023 **excluded the establishment of zoos or safaris** in forest areas other than protected areas **from the definition of non-forest purposes.**

Implications of SC judgment

- **Protection of forest land** as narrowing the definition could have left nearly 1.99 lakh square kilometres of forest land from the ambit of 'forest'
- **Consistent with the spirit of FCA, 1980**
- Establishes **consensus about the definition of a forest** and **encourages sustainable development.**

Other Key provision of the Forest Conservation Amendment Act (2023)

- **New name:** ‘Van (Sanrakshan Evam Samvardhan) Adhiniyam’ (Forest (Conservation and Augmentation) Act), 1980.
- **Addition of Preamble:** It encompasses India’s Nationality Determined Contribution and other National targets.
- **Activities excluded from the definition of non-forest purposes:**
 - Establishment of **zoos and safaris under the Wild Life (Protection) Act, 1972**, in forest areas other than protected areas;
 - **Eco-tourism facilities** included in plans of the area;
 - **Silvicultural operations**, including regeneration operations; and
 - Any other purposes specified **by the Central Government.**
- **Specifies exempted Categories of Land** such as connectivity to a habitation, or to a rail, Projects of national importance and concerning national security
- State governments require **prior approval of the central government before assigning of forest land by way of lease or otherwise** to government entities (earlier needed for only private entities).

6.1.2. COMMUNITY FOREST GOVERNANCE

Why in news?

The study titled ‘Community Forest Governance and Synergies among Carbon, Biodiversity and Livelihoods’ by Nature Climate Change Journal, finds that empowered local governance is the key for forest restoration and management.

Community Forest Governance or Community Forestry

- Situation in which communities have the right to manage the forest resources upon which they depend, with a view to improving their living conditions.



Benefits:

- **Resource:** for livelihood, nutrition, and employment of rural communities and indigenous people.
- **Biodiversity Conservation by using unique knowledge of** Indigenous people about the flora and fauna.
- **Traditional Knowledge of the** Indigenous communities about the local ecosystem, including sustainable harvesting practices, medicinal plant use, and natural resource management, etc.
- **Customary Laws of** indigenous communities effective in maintaining ecological balance and resolving conflicts.
- **Focus on Forest Regeneration** before devising appropriate management and benefit-sharing mechanisms.

Steps taken by India to involve Local communities in forest management

- **National Forest Policy (1988)** through Joint Forest Management Programme (JFMP).
- **The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, (FRA)** provides a legal framework for communities to own, use, and manage their traditional lands.
- **‘Van Panchayats’ in Uttarakhand**
- **Eco-Development Committee (EDC)** for villages in Protected Areas and their buffer zones.
- **Biodiversity Conservation and Rural Livelihood Improvement Project (BCRLIP)**

Challenges Faced

- **Lack of priority and policy support** to ensure the participation of local communities (consultative role played by Gram Panchayats)
- Implementation of JFM is **expensive**.
- **Prioritizing measurable targets** of tree planting by forest bureaucracies
- **Commercial interests** (proposed bauxite mining project in the Niyamgiri hills by Vedanta).

Way forward

- **Telangana model:** It amended the Panchayat and municipal acts for environmental concerns and created a provision for a Green Fund, **Telangana Haritha Nidhi**, for tree planting and related activities.
Recognition to CFR: After Odisha in 2016, Chhattisgarh became the second state to acknowledge Community Forest Resource (CFR) rights within Kanger Ghati National Park in 2022.
- **Others:** Financial and institutional support to local communities; inclusive approach, etc.

6.1.3. SUSTAINABLE FOREST MANAGEMENT (SFM)

Why in the news?

India hosted a **Country-Led Initiative (CLI)** event as part of the United Nations Forum on Forests (UNFF) in Dehradun, Uttarakhand focused on the themes of **forest certification and Sustainable Forest Management (SFM)**.

Sustainable Forest Management (SFM)

- It is the stewardship and **use of forests and forests lands** in a way that maintains their biodiversity, regeneration capacity; potential for fulfil economic and social functions, and not cause damage to other ecosystems (FAO).
- **Seven Elements of SFM:** Extent of Forest Resources; Biological Diversity; Forest Health and Vitality; Productive and Protective functions of forest resources; socio-economic functions; legal, policy, and institutional framework.
- **Need for sustainable forest management: Management of Forest fires; Biodiversity Conservation; tackling climate change** including carbon sequestration; **community development; preserving traditional knowledge**, etc.

Measures taken by India for SFM

India

- **Legislative Framework:** Forest Conservation Act (FCA) 1980 (allows government to declare reserved or protected forest areas), the Indian Forest Act 1927, and Wildlife Protection Act 1972 etc.
- **Joint Forest Management (JFM)** involving forest authorities and local communities.
- **Afforestation and Reforestation Programs:** National Afforestation Program (NAP), Compensatory Afforestation Fund Management and Planning Authority (CAMPA), Green Highways Programme etc.
- **Use of technology**, such as Geographic Information System (GIS) mapping, etc.
- **Development of standards:** Through **Bhopal-India Process**, India developed its national set of 8 criteria and 37 indicators.
- **Community Forest Rights:** Through the Forest Rights Act, 2006.

Global

- **UN Strategic Plan for Forest (2017-30)** for sustainable management of all types of forests.
 - **6 Global Forest Goals and 26 associated targets** (Voluntary and Universal) to be achieved by 2030.
 - Target to **increase forest area by 3% worldwide by 2030**, signifying an increase of 120 million hectares, an area over twice the size of France.
 - **Global Forest Goals Report** of UN tracks progress on six Global Forest Goals.

Way Forward

- **India’s proposal: Gandhinagar Implementation Roadmap and Gandhinagar Information Platform** that emanated from the G20 deliberations, to tackle restoration of forest fire and mining degraded lands.
- **Others:** Setting Global standards; international cooperation; using Global Fire Management Hub for sharing best practices, etc.

The banner features the text 'CSAT क्लासेस 2025' in large, stylized fonts. It includes a toggle for 'ऑफलाइन' (Offline) and 'ऑनलाइन' (Online) with a play button icon. A central illustration shows a student at a desk surrounded by various educational icons like a clock, calculator, and books. At the bottom, it specifies 'ENGLISH MEDIUM 7 JUNE, 5 PM' and 'हिन्दी माध्यम 13 जून, 5 PM'. A QR code is provided with the text 'Scan QR code for instant personalized mentoring'.

6.2. WILDLIFE CONSERVATION AND PROTECTION

6.2.1. Wildlife Conservation in India at a Glance

Wildlife Conservation in India



Framework in India

- **Constitutional Provisions:** **Article 48A** under DPSP; **Article 51(g)** under Fundamental Duties; Under **Concurrent List (7th Schedule)**.
- **Legislative Measures:**
 - **Wild Life (Protection) Act, 1972**, includes penalties for violation.
 - **Network of Protected Areas** i.e., National Parks, Sanctuaries, Conservation Reserves and Community Reserves.
 - **Forest Conservation Act, 1980**
 - **Environmental Protection Act, 1986**
- **Implementation:** Primarily the responsibility of the respective States/UTs. **Wildlife Crime Control Bureau** to gather intelligence on hunting and poaching, etc.
- **Species specific Conservation Efforts:** Species Recovery Programme; Project Tiger; Project Cheetah; etc.



Challenges

- **Human Wildlife Conflict (1,510 deaths/injuries)** recorded in the country due to animal attacks, Crime in India, 2022 by NCRB).
- **Habitat loss (10 million hectares)** of forests are destroyed annually as per WWF)
- **Wildlife Crime** (Rhinoceros, Pangolins worst affected, World Wildlife Crime Report, 2024 by UNODC).
- **Others:** Construction near wildlife habitats; Natural causes (like unpredictable rainfall, spread of diseases, etc.), Illegal trading, hunting, and poaching; Global warming and climate change, over exploitation of resources; challenges in effective implementation of laws, etc.



Way forward

- Recognizing the **role of NGO** (e.g., Wildlife Protection Society of India, Wildlife Trust of India, etc.)
- **Increasing resilience** of nature reserves by minimizing tourism, creating more effective buffer zones, etc;
- **Effective enforcement** of wildlife protection laws, etc.

6.2.2. 50 YEARS OF PROJECT TIGER

Why in the News?

The Indian government officially marked 2023 as the 50th year of 'Project Tiger'.

About Project Tiger

- **A Centrally Sponsored Scheme** of the Ministry of Environment, Forests and Climate Change (MoEFCC), launched in 1973.



- It 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: National Tiger Conservation Authority (NTCA).**
- **Project Tiger and Project Elephant were merged** as Project Tiger & Elephant.

Achievements

- **Number of tigers increased to 3,682**, from 2967 in 2018. (**Status of Tigers, co-predators and Prey in India-2022 report**)
 - India achieved the targets set under TX2 initiative in 2018 (4 years in advance)
- **Number of tiger reserves increased to 55 in 2024**, from 9 in 1973.
- **23 tiger reserves** of India have received Conservation Assured' Tiger Standards (CA|TS) accreditation.

Activities undertaken under Project Tiger which improved conservation

- **Establishment and development of Tiger Reserves.**
- **Core-buffer strategy to manage tigers:** Core areas have **legal status** of a **national park or a sanctuary**.
- **Technological advancements:**
 - e-Bird **project** uses Unmanned Aerial Vehicles (UAV) for Surveillance and Monitoring.
 - **NTCA conducts assessment using the application M-STRIPES** (Monitoring System for Tigers Intensive Protection & Ecological Status).
- **Special Tiger Protection Force (STPF):** Deployed in several TRs for focused **anti-poaching operations**.

Global initiatives

- **International Big Cat Alliance (IBCA)**
- **Sustainable Finance for Tiger Landscapes Conference (SFTLC)**
- **TRAFFIC** to facilitate improvements in India's **anti-poaching efforts**.
- **Global Tiger Recovery Program (GTRP):** It is an effort of 13 countries to double tiger numbers in wild by 2022.
- **IUCN's Integrated Tiger Habitat Conservation Programme (ITHCP) or Tiger Program.**

Persisting challenges in Tiger conservation

- **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.

Conclusion

India needs to **expand and improve the quality of occupied habitats**. Further we need to create **safe connectivity among habitats** through structural measures and non-structural measures. Also, human-tiger conflicts can be minimized through practices like building outreach systems, compensation policies to cover the financial cost of losing livestock or crops, etc.

6.2.3. THE WILDLIFE (PROTECTION) AMENDMENT ACT, 2022

Why in the News?

Recently, several news rules were notified under the Wildlife (Protection) Amendment Act, 2022.



New Rules under the Amendment

<p>Captive Elephant (Transfer or Transport) Rules, 2024: Specifies rules for transfer of captive elephants</p> <ul style="list-style-type: none">• Key highlights of rules<ul style="list-style-type: none">○ Application to Deputy Conservator of Forests (DCF) having jurisdiction over area where elephant is registered.○ Terms and conditions for transfer: Owner is no longer able to maintain elephant; No transfer unless genetic profile of animal has been entered in electronic monitoring application of MoEFCC; etc.
<ul style="list-style-type: none">• Wildlife (Protection) Licensing (Additional Matters for Consideration) Rules, 2024: For grant of licensing for scheduled species• Key Highlights<ul style="list-style-type: none">○ No such licence shall be granted if it relates to any wild animal specified in Schedule I to the Act, except with previous consultation of Central Government.○ Chief Wildlife Warden or an Authorised Officer issues the licence based on parameters like existing licences and implications of licence on hunting or trade of wild animals concerned etc.
<p>Living Animal Species (Reporting and Registration) Rules, 2024: For registration of possession, transfer, and birth and reporting of death of living scheduled animal species which are listed in Appendices of CITES or Schedule IV of WPA, 1972</p>

Key amendments in WPA, 2022

- **Removes the present schedule for vermin species** and inserts a **new schedule for specimens listed for extinction under CITES.**
- **Reduces number of schedules from 6 to 4:**
 - **Schedule I** (Animal species that will enjoy the highest level)
 - **Schedule II** (Animal species that will be subject to a lesser degree of protection)
 - **Schedule III** (Protected Plant species)
 - **Schedule IV** (Specimens listed in the Appendices under CITES (scheduled specimens))
- **Seeks to empower the Centre to regulate plant or animal species** not native to India - invasive alien species.
- **Permitted the use of elephants for 'religious or any other purposes'.**
- Central Government to form a **Managing Authority and a Scientific Authority** to regulate the import and export of specimens of species.
- **Entrusts the Chief Wildlife Warden** to control, manage, and maintain all sanctuaries in a state.
- Apart from states, the Centre too can notify a conservation reserve — an area adjacent to national parks and sanctuaries.

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.**
- 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.

6.2.4. HUMAN-WILDLIFE CONFLICT AT A GLANCE

Human-Wildlife Conflict

- Man-animal conflict when **encountered between humans and wildlife leads to negative results**, such as loss of property, livelihoods, and even life (World Wide Fund for Nature).
- **Some Examples of Human-Wildlife Conflict (HWC):**
 - Predation on livestock or domestic animals by wildlife
 - Damage to crops and fences.
 - Intrusion of wildlife into residential areas
 - Squirrels or bats in home attics
 - Birds nesting in undesirable residential locations
 - Vehicle/wildlife collisions



Key Facts

- **1,510 deaths** recorded in the country due to animal attacks in 2022 (Accidental Deaths & Suicides in India 2022)
- **10085 Animal/Reptiles/Insects Bite** recorded in 2022 (Accidental Deaths & Suicides in India 2022)



Causes of Man-Animal Conflict

- **Numerous wildlife species** demonstrated the ability to adjust to the evolving landscape. E.g., elephants raiding crops.
- **Habitat fragmentation:** E.g., nearly one in every three tigers in India lives outside reserves (Status of Tigers, Co-predators and Prey in India – 2018)
- **Conservation efforts e.g.,** Density of tigers in the Sunderbans may have reached the carrying capacity, leading to frequent dispersals and a surge in human-wildlife conflict.
- **Others:** Climate change; Competition for natural resources; development activities; eco-tourism; livestock grazing; etc.

Impact of man-animal conflict



Psychological Impact on Communities due to fear/anxiety and Loss of life and property



Rising zoonotic diseases like Nipah



Growing antipathy towards animals



Retaliatory killing of predators Predation of livestock causing economic hardships for pastoral communities.



Laws and Policy to tackle man-animal conflict

- Forest and wildlife are subjects listed in **the Concurrent List of the Constitution**.
- **The Wildlife Protection Act of 1972** provides the statutory framework for protecting wild animals, plants, and their habitats.
- Network of 1022 Protected Areas which cover around 5.43% of the geographical area.
- **Standard Operating Procedures (SOPs)/guidelines:** Issued by Central government to manage Human-Tiger/Human-Leopard /Human-Elephant conflicts.
- **Advisory for management of man-animal conflict**
- **Species specific guidelines:** Released for mitigation of Human-Elephant conflict, etc.



Way forward as given in the National wildlife Action Plan (2017-2035)

- **Science-based plans** for species-specific and region-specific conflict-mitigation programs
- **Others:** Creation of database; **Participation of local community** involving dissemination of **Indigenous Traditional Knowledge; Create a Centre of Excellence (CoE)** under the aegis of the MoEFCC; creating awareness and training, etc.

6.2.5. WILDLIFE CRIME

Why in the news?

United Nations Office on Drugs and Crime (UNODC) released World Wildlife Crime Report 2024.

Wildlife Crimes

- Taking, possession, trade or movement, consumption of wild animals and plants or their derivatives in contravention of any international, regional, or national legislation(s).

Factors driving wildlife crime

- **Demand for medicine, pets, bushmeat, ornamental plants** etc.
- **Convergence of wildlife crime (Poaching, trade in protected species) with other forms of organized crime.** Example, trade of elephant ivory including cash in transit heist, murders, etc. (**Wildlife Justice Commission (WJC)** Report).
- **Huge profits earned** by illegal traders by selling exotic animals, plants, and their parts. Eg. Rhinoceros horn, etc.
- **Corruption undermines government restrictions** on wildlife harvest, trade and use, thus enabling wildlife crime.

Impact of Wildlife Crime

- **Environmental:** Out of all seized fauna, **40% were either threatened or near-threatened on red list.**
- **Economical:** Money-laundering and illegal cross-border financial flows.
- **Social: Risks of disease transmission; Degradation of services** like food, medicines, energy, etc.
- **Governance Harms:** Undermining the role of governments; Loss of government revenues; Enforcement costs etc.



Steps taken to combat Wildlife Crime

- **Global**
 - **UNODC's Global Programme for Combating Wildlife and Forest Crime, 2014**
 - ✓ UNODC established in 1997 in Vienna (Austria), to fight against illicit drugs and organised crime.
 - **South Asia Wildlife Enforcement Network (SAWEN)**, regional co-operation for curbing illegal wildlife trade in South Asia
 - **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973** (Monitor international trade of threatened species)
 - **TRAFFIC**, established by WWF and IUCN
- **India**
 - **Wildlife Crime Initiative:** It is a strategic partnership between TRAFFIC, wildlife trade monitoring network and World Wildlife Fund.
 - **Wildlife (Protection) Act, 1972** provides for forfeiture of any equipment, vehicle or weapon that is used for committing wildlife offence(s).
 - **Wildlife Crime Control Bureau** was established under Ministry of Environment and Forests to combat organized wildlife crime in the country.

6.2.6. COP 14 TO THE CONSERVATION OF MIGRATORY SPECIES OF WILD ANIMALS

Why in the News?

The **Fourteenth Meeting of the Conference of the Parties to the Convention on the Conservation of Migratory Species of Wild Animals (CMS COP 14)** held in Samarkand, Uzbekistan.

About CMS

- **Intergovernmental treaty** under the **United Nations Environment Programme (UNEP)** enforced in **1983**.
- Serves as a **global platform** for the **conservation and sustainable use of migratory animals** and their habitats.
- **Membership: 133 India is its member** (since **1983**).
- **CMS Appendices:**
 - **Appendix I:** lists migratory species that are considered **endangered** (facing a very high risk of extinction in the wild in the near future).
 - **Appendix II:** lists migratory species which have an **unfavourable conservation status** and require **international agreements** for their conservation and management.
- **Conference of Parties (COP)** is the **principal decision-making body** of the Convention, meets every 3 years and sets budgets and priorities for following three years.

India and CMS

- Signed a **non-legally binding** Memorandum of Understanding (MoU) with CMS on conservation and management of **Siberian Cranes** (1998), **Marine Turtles** (2007), **Dugongs** (2008), and **Raptors** (2016).
- India hosted **COP-13 of CMS** in 2020 at Gandhinagar (Gujrat).
- India is part of 2 of the Special Species Initiatives of CMS- **Central Asian Flyway and Central Asian Mammals Initiative**.
- **Zoological Survey of India (ZSI)** for the first time compiled the **list of migratory species** of India under the CMS before the Conference of Parties (**COP 13**).

Key-outcomes

- **Addition of 14 species** to CMS **Appendices** including Eurasian Lynx, Pallas's Cat etc.
- **New Concerted Actions:** For **six** species, including Chimpanzee, Straw-colored Fruit Bat, etc.
- **Single Species Action Plans (SSAPs):** for aquatic species, such as the Atlantic Humpback Dolphin, the Hawksbill Turtle and the Angelshark.

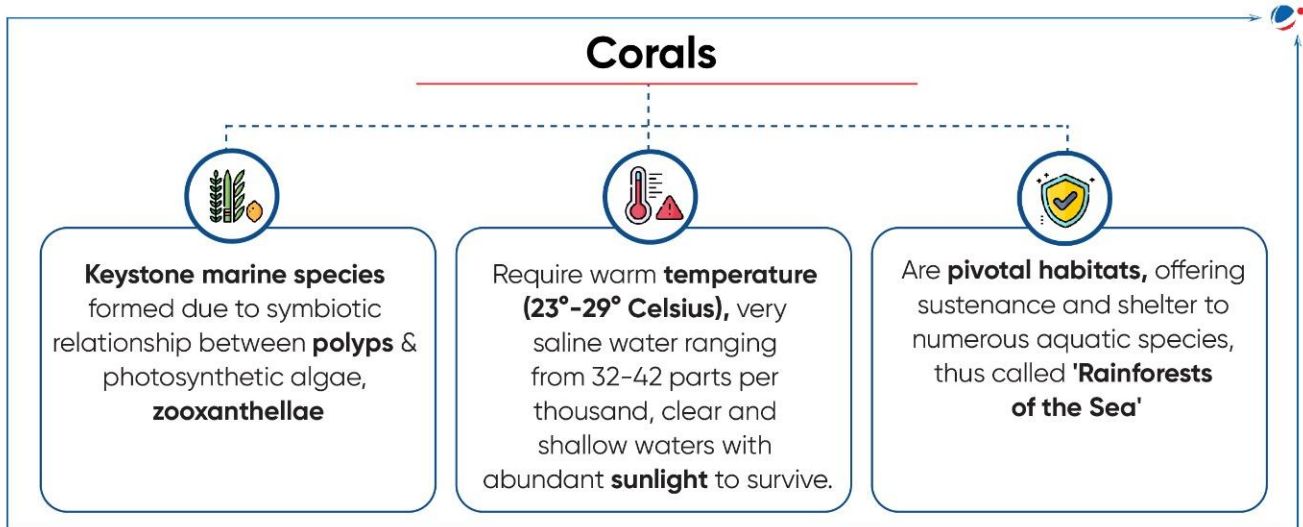
- **Agreement on Central Asian Flyway (CAF):** Spanning 30 Range States of migratory birds. It includes the establishment of a **coordinating unit** in India.
- **Global Partnership on Ecological Connectivity (GPEC)** was launched.

6.2.7. CORAL BLEACHING

Why in the News?

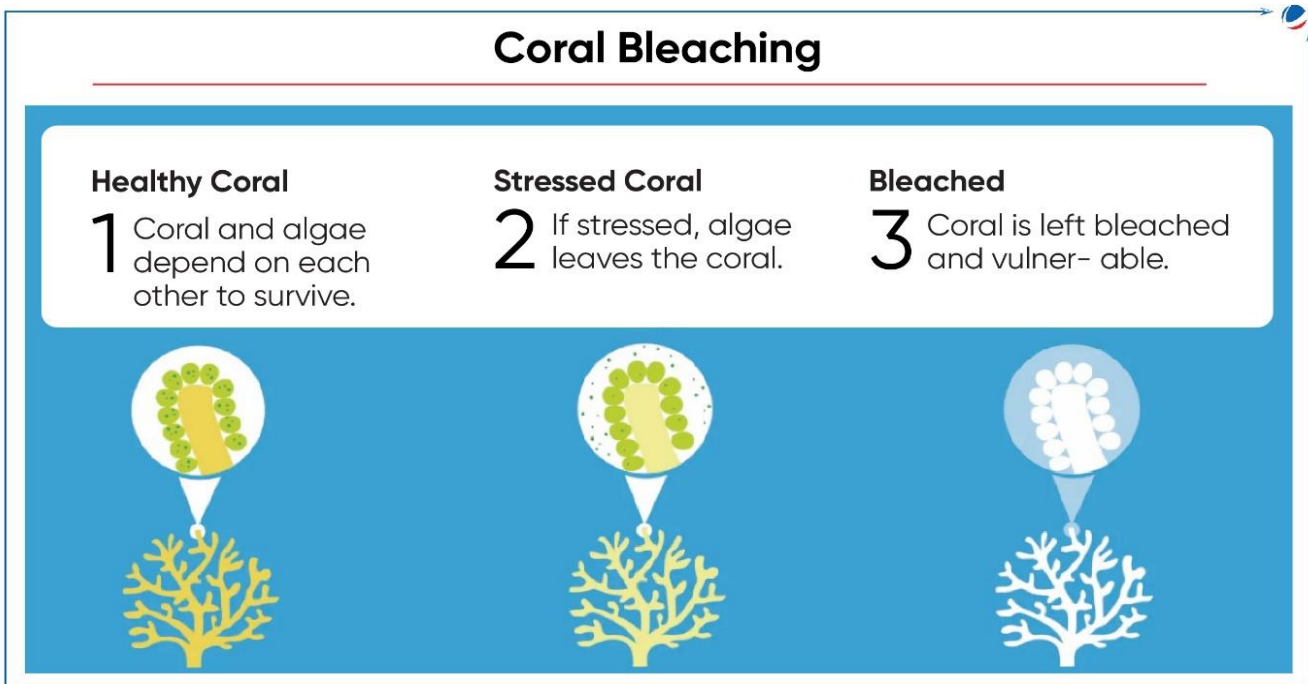
Recently, widespread coral bleaching has been seen along the Indian coast largely affecting Lakshadweep, Gulf of Munnar, Palk Bay and Andaman and Nicobar Islands.

About Corals



About Coral Bleaching

- Sustained increase in **Sea Surface Temperature (SST)** causes zooxanthellae (which provide pigmentation and 90% of the corals' nutritional needs) to leave their hosts, causing whitening, known as '**coral bleaching**'.





Status of coral bleaching

- **2023-2024** is being named as the **fourth global mass coral bleaching event**. (**United States National Oceanic and Atmospheric Administration**)
 - Global mass coral bleaching events reported in **1998, 2010, 2014-2017**.
- About **30% of world's coral reefs are severely damaged**, remaining 60% may be lost by 2030.
- **Bleaching in India:**
 - **Palk Bay:** Average coral cover dropped to 18.7% by 2019 from 30.8% in 2007.
 - **Gulf of Mannar:** Decreased from live coral cover 37% to 27.3% between 2005 and 2021.

Reasons for coral bleaching

- **Increasing SST in tropical regions** by ~1°C over past 100 years, currently rising at a rate of 1-2°C.
- **Marine heatwaves:** E.g., caused 85% of corals to bleach in **Gulf of Mannar**, Tamil Nadu in 2020.
- **Biological invasion** by Invasive species like **seaweeds, crown of thorns starfish (Great Barrier Reef)**.
- **Exposure to elevated concentrations** of various **chemical contaminants**, like Copper.
- **Epizootics** or **Pathogen-induced bleaching** causing patchy or whole colony death, etc.
- **Others:** El Nino, shifting ocean currents, ocean acidification, bottom trawling, etc.

Initiatives taken for coral conservation in India

- **Coastal Regulation Zone (CRZ) Notification of 1991** under **Environment Protection Act, 1986**
- **Eco-development activities by Gulf of Mannar Biosphere Reserve Trust**
- **Coral Reef Recovery Project-Mithapur (Gulf of Kachchh and Gujarat's Marine National Park)**.
- **Pradhan Mantri Matsya Sampada Yojana (PMMSY)** promotes artificial reef as a sub-activity under "Integrated Modern Coastal Fishing Villages."
- **Zoological Survey of India (ZSI)** with the **Gujarat Forest Department** successfully restored branching coral species (**staghorn corals**) that got extinct about 10,000 in the **Gulf of Kachchh**.

Multilateral cooperation in policymaking

- **International Coral Reef Initiative (ICRI)** at the 1st CoP of the CBD in 1992 (India: member).
- **Coral Reef Breakthrough by ICRI: Target of target 30by30 - save 30% of degraded reefs by 2030.**

Way forward

- **Biorock technology**, innovative **mineral accretion technology** to produce natural building materials in the sea which aids in coral restoration. E.g., used in the Gulf of Kachchh Coral restoration.
- **Super corals:** Ex-situ breeding of high temperature-resistant corals using '**human-assisted evolution**'.
- **Others:** Incorporating sustainability, reducing carbon footprint, marine pollution; building resilient coastal communities, etc.

6.2.8. UNESCO WORLD HERITAGE SITES

Why in news?

A new research by UNESCO and IUCN, the **World Heritage Sites (WHS's)** make up **less than 1 % of the Earth's surface**, but they **harbour more than 20 % of the planet's biodiversity**.

More on News

- WHS are estimated to protect over 20,000 endangered species.
- **Act as last line of defense against extinction:** Played key role in protection of **Javan Rhinos, Vaquitas** (the world's smallest cetacean) and **Pink Iguanas; Sumatran Rhinos, Sumatran Orangutans and Mountain Gorillas**.



About World Heritage Sites (WHS) and Convention

- It is any of the areas or objects inscribed on the **UNESCO World Heritage List**.
- Designated as having **outstanding universal value** under the **World Heritage Convention of 1972**.
- There are total 1199 heritage sites under the Convention (as of 27th Sept, 2023).
- Sites are selected under three categories i.e. **cultural, natural, and mixed**.
 - There are 42 **World Heritage Sites** in India. Out of these, 34 are cultural, 7 are natural, and one is of mixed type.
- **World Heritage Convention**
 - It has been adopted as **Convention Concerning the Protection of the World Cultural and Natural Heritage**.
 - **Parties and Implementing Agency:** 195 State parties including India and World Heritage Committee.
 - **Strategic Objectives (Five Cs):** Credibility, Conservation, Capacity-building, Communication and Communities.

Why World Heritage Sites are unique in conserving biodiversity?

- **Covers wide Horizon** including natural, cultural and mixed heritage sites. E.g., Khangchendzonga National Park, India.
- **Parties are encouraged to integrate the protection** of the sites into **Regional Planning Programme**. E.g., National Biodiversity Strategies and Action Plans (NBSAPs).
- **World Heritage Fund** to fulfil the needs during disasters or natural calamities.
- Obligation on Parties to report regularly to the **World Heritage Committee (WHC)** on the state of conservation of their World Heritage properties.
 - E.g., In Kaziranga National Park (India) and Chitwan National Park (Nepal), the population of Greater one-horned Rhinos has been doubled since their inscription on the UNESCO World Heritage List.
- **Others: Encourages Public Participation;** dialogue between **policymakers and World Heritage actors;** **Balance between Nature and Culture**, etc.

Challenges faced by World Heritage Sites

- **Decline in the population of the endangered species**. E.g. Tropical Rainforest Heritage of Sumatra;
- **Human activities** like construction of reservoirs, industrial and agricultural development, human encroachments, E.g. Lake Turkana National Parks in Kenya.
- **Climate Change** (every **1°C increase in global temperature** could **double the number of species threatened** by dangerous climate conditions)
- **Others:** Lack of funds; armed conflicts, etc.

Conclusion

More protection and priority to be given to WHS as they play key role in achieving the target of **Kunming-Montreal Global Biodiversity Framework**.

6.3. WETLAND CONSERVATION IN INDIA AT A GLANCE

Wetland Conservation in India

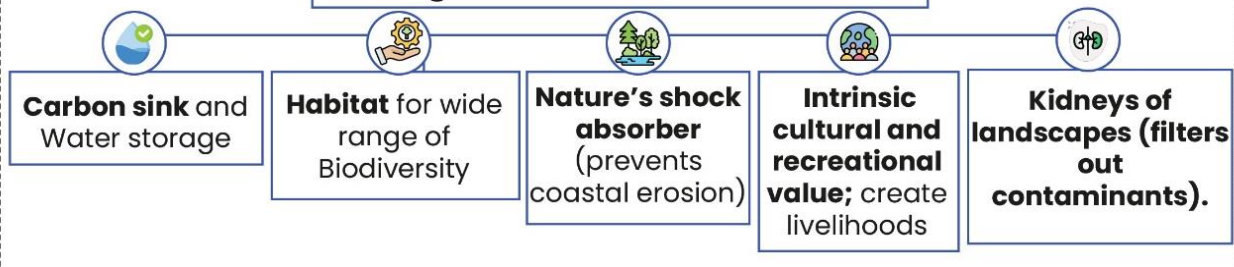
Any land area that **is saturated or flooded** with water, either seasonally or permanently. Includes marsh, fen, peatland, marine water the depth of which at low tides **does not exceed six meters etc.**



Current situation in India

- **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



Schemes/Policies/Initiatives in India

- **Wetland (Conservation and Management) Rules 2017.**
- Establishment of **Centre for Wetland Conservation and Management (CWCM).**
- **National Plan for Conservation of Aquatic Eco-systems (NPCA).**
- **National Mission for Clean Ganga (NMCG)**
- **Party to Ramsar Convention**
 - Ramsar sites in India: 82, E.g., Yashwant Sagar (Madhya Pradesh), Tampara Lake (Odisha), Pichavaram Mangrove (Tamil Nadu), **Thane Creek (Maharashtra) etc**
- **Blue Flag Certification** (India has 12 Blue Flag Beaches)



Constraints

- Alteration of **natural hydrological** regimes due to 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, **Harmful Algal Bloom (HAB), etc.**



Way Forward

- **Holistic and standardized protocol** for monitoring
- **Restoration of degraded wetlands.**
- **Strict implementation of pollution norms.**
- **Proper treatment and disposal of wastes.**
- **Optimal and sustained water flow to wetlands.**
- **Participatory conservation by involving local communities.**



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6.3.1. MANGROVES CONSERVATION AT A GLANCE

Mangroves Conservation



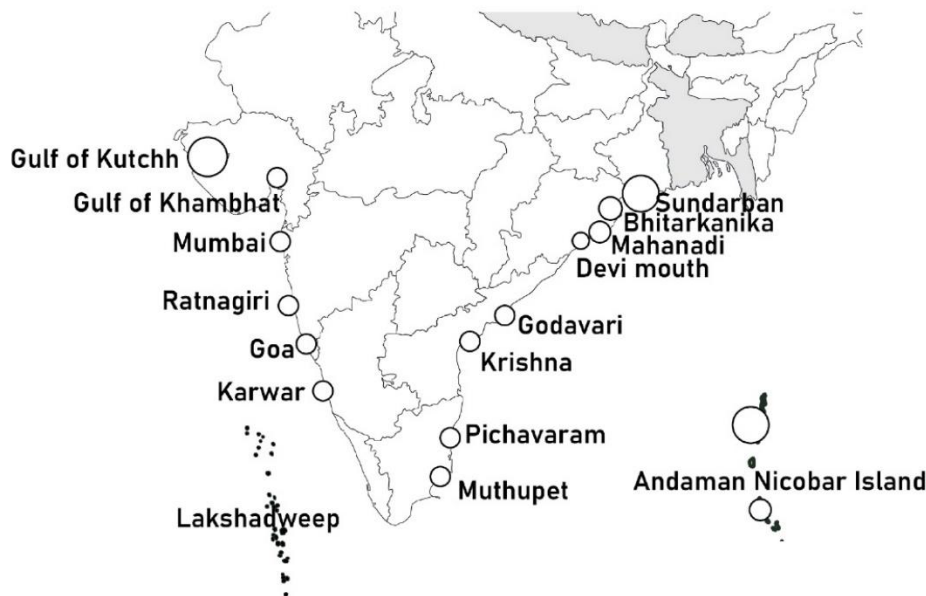
About Mangroves

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



Extent in India

- **Total Mangrove Cover in India:** 4,992 sq Km (ISFR, 2021).



Ecosystem services provided by Mangroves



Carbon sequestration: Store almost three times the amount carbon stored by tropical forests of the same size.



Protection from coastal calamities



Livelihood to coastal communities.



Biodiversity conservation: Over 1,500 species of fauna that depend on mangroves



Threats to Mangroves

- **Threat of extinction: 50% of the mangrove ecosystems** examined were **classified as vulnerable, endangered, or critically endangered** (IUCN Red List of Mangroves Ecosystems)
- **Climate change** increases **frequency of severe storms and sea-level rise.**
- **Development-related activities: E.g.,** Deforestation for dam construction and urban development.
- **Pollution and contaminants from coastal regions: E.g.- black carbon** from Kolkata and the Indo-Gangetic plain along with **biomass burning.**
- **Unsustainable fishing**



Initiatives for Mangrove Conservation in India

- **India State of Forest Report (ISFR) 2023** by the Forest Survey of India (FSI).
- **MISHTI (Mangrove Initiative for Shoreline Habitats & Tangible Incomes)** by MoEFCC.
- **Sustainable Aquaculture In Mangrove Ecosystem (SAIME)**
- **Magical Mangroves** campaign
- **National Coastal Mission Programme on 'Conservation and Management of Mangroves and Coral Reefs'**



Way Forward

- Strengthening of **existing laws** like the **Indian Forest Act,1927, Environmental Impact Assessment (EIA),1986 and Forest Conservation Act,1980.**
- **Ecological conservation including connecting the mangrove forest with the terrestrial forest** to improve conservation efforts. E.g., **Sundarban** mangroves connected to the Sundarban National Park.
- **R&D:** Important mangrove patches can be declared as **'Mangrove Germplasm Preservation Centres'** .
- **International cooperation** in line with the **UN Decade for Ecosystem Restoration 2021-2030.**

7. DISASTER MANAGEMENT

7.1. DISASTER MANAGEMENT IN INDIA AT A GLANCE

Disaster Management in India



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.



Vision as per NDMP, 2016

- **Make India disaster resilient** across all sectors;
- **Achieve substantial and inclusive disaster risk reduction** by building local capacities;
- **Significantly decrease the loss of lives, livelihoods, and assets; enhancing the ability to cope with disasters.**



Constraints

- **World is moving closer to Risk tipping points:** occurs when a socio-ecological system loses its ability to buffer risk.
 - **Six interconnected risk tipping points** (Accelerating extinctions; Groundwater depletion; Mountain glaciers melting; Space debris; Unbearable heat Uninsurable future)
- **Asymmetric impact of disasters on vulnerable sections** like poor, migrants, elderly etc.
- **Climate change** is expected to increase disaster frequency.
- **Lack of fundamental infrastructure** (early warning system, search and rescue facilities etc.),
- Absence of **specific goals and targets** in NDMP;
- **Difficulties in large scale mobilisation of finance;**



Government Initiatives/ Schemes/Policies/Acts

- **National Disaster Management Act 2005 and National Disaster Management Plan, 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**



Way Forward

- **Build Back Better: post-disaster recovery approach** to reduce future vulnerability and **improve community resilience.**
- **Setting specific goals and targets aligned** with the Sendai framework.
- **Equipping existing infrastructure** like common Service Centres (CSC) for early warning, relief and rescue etc.
- **Expanding financial resources** through international collaborations, public-private partnership, etc.

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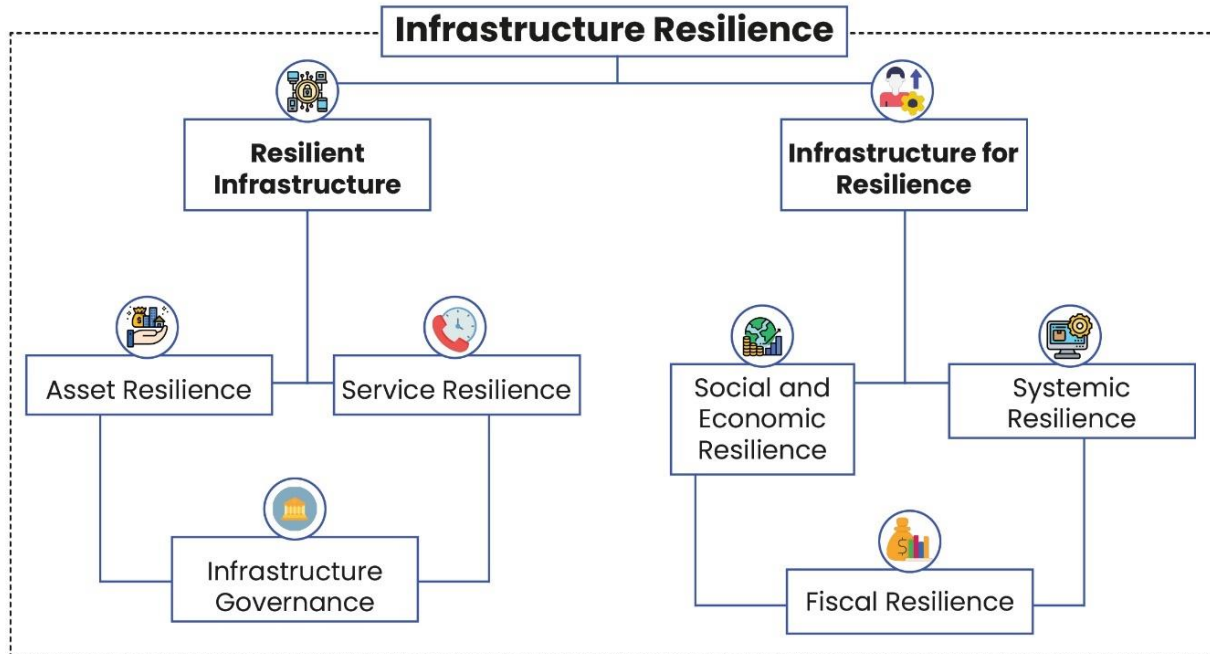
- Detailed topic-wise up-to-date contextual understanding of all current issues.
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7.2. INFRASTRUCTURE RESILIENCE AT A GLANCE

Infrastructure Resilience

- **Resilient infrastructure:** Infrastructure that can absorb, respond to, and recover from hazard events and shocks.
- **Infrastructure for resilience:** Infrastructure that supports broader social and economic or systemic resilience without generating or accumulating new systemic risk



Need of Infrastructure Resilience

- **Climate change may lead to an estimated global average annual loss (AAL)** in infrastructure sectors of about 14 % of GDP.
 - **Half of this contingent liability is held by** low- and middle-income countries (LMIC).
- **India's central and state governments currently finance over 75% of urban infrastructure** with very low private participation.
- **The Global Infrastructure Risk Model and Resilience Index (GIRI)** is used to estimate risk for infrastructure assets with respect to most major geological and climate-related hazards.



Need for Infrastructure resilience

- **Obsolescence of infrastructure:** E.g., old bridge collapses in India.
- **Weak infrastructure governance:** Deficient planning and design, inadequate standards, ineffective regulation and compliance and low levels of investment.
- **Systemic risks:** such as climate change and biodiversity loss.
- **Developmental benefits:** Quality and dependable essential services, reduced damage to infrastructure assets, lowered systemic risk, and sustainable development goals.
- **Disproportionate impact:** in Low- and Middle-Income Countries (LMICs).
- **Infrastructure finance:** Annual investment required to address infrastructure deficits, achieve the SDGs, and achieve net zero by 2050, amount to **\$9.2 trillion**.



Challenges to Mobilizing Finance for Resilient Infrastructure

- Higher upfront costs.
- No common agreed way to measure resilience.



Way forward

- **Private capital investment** in infrastructure should be increased.
- **Standardization and certifications** of resilient infrastructure.
- **Integrating Nature-based Infrastructure Solutions** into national and local planning.
 - **In India, the** integration of NbIS can be targeted through the State Action Plan for Climate Change (SAPCC).

7.2.1. NATURE-BASED INFRASTRUCTURE SOLUTIONS (NBIS)

Why in the news?

A report released by the Coalition for Disaster Resilient Infrastructure (CDRI) stressed on the need for **Nature-based Infrastructure Solutions (NbIS) for building infrastructure resilience**.

Nature-based Infrastructure Solutions (NbIS)

NbIS refers to practices that **concurrently protect and provide infrastructure, adapt to climate change, promote environmental integrity and biodiversity, and provide social well-being**.

Role in strengthening resilience

- **Safeguarding traditional infrastructure:** Can complement, substitute or safeguard traditional 'grey' infrastructure.
- **Low-cost:** NbIS cost, on average, only 51% of grey infrastructure projects.
- **Reducing carbon emissions:** Across infrastructure lifecycles, enabling avoiding land use change and extending infrastructure lifespans.
- **Socio-economic outcomes:**
 - Increased opportunities for women's involvement in decision-making and governance, particularly in rural areas.
 - Potential to create an **estimated 59 million jobs by 2030**.

Challenges for integrating NbIS

- Require **new interdisciplinary knowledge and skill sets** that traditional engineers and architects do not necessarily possess.
- **Lack of research** that quantifies ecosystem services, integrates nature-based values into modelling and cost-benefit accounting.
- **Lack of credible and robust risk identification process.**
- **Politically unattractive** as it reduces opportunities for privatized profits.
- **High Gestation period.**

Integrating NbIS

- **Research:** Need of **national centres of excellence** in NbIS.
- **Linking NbIS monitoring to the achievement of the SDG** and the global common goals.
- **Effective legislation to protect and enhance ecosystems** for greater investment in NbIS.
- **Rating systems:** For example, **GRIHA** (Green Rating for Integrated Habitat Assessment) in India.
- **Prescriptive global standards for NbIS** could provide a pathway for greater project financing.

Conclusion

The long design lifecycles of many infrastructure assets will be key to making investments resilient and configure development trajectories in the decades to come. At the same time, strengthening infrastructure resilience is critical to address existential risks associated with catastrophic climate change and biodiversity loss.

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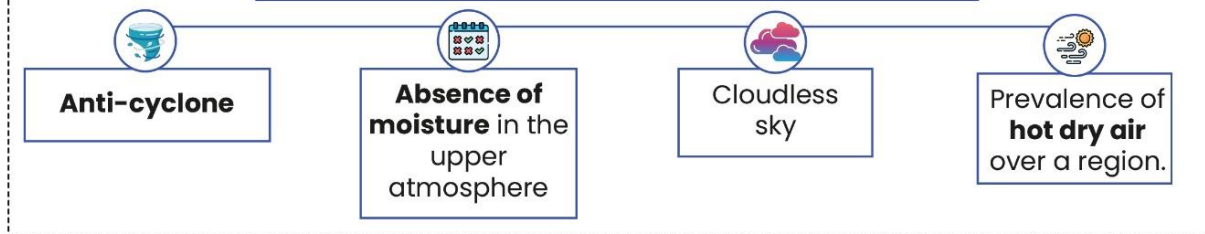
7.3. HEATWAVE MANAGEMENT IN INDIA AT A GLANCE

Heatwave Management in India

IMD criteria for Heat waves: Maximum temperature of **40 deg. C (Plains)** and **30 deg. C (hills)**.

- **Declaration of Heat waves:**
 - **Based on actual temperature:** Recorded maximum temperature of **45 deg. C or above** for all locations and **40 deg. C or below for coastal locations**.
 - **Based on departure from normal:** **Heat wave** when departure is 4 deg. C to 5 deg. C and **severe heat wave** when 6 deg. C.
- **Vulnerability:** **13% of the districts and 15% of the population** are moderate to very highly vulnerable
 - **4% of the districts and 7% of the population** are highly vulnerable.

Conditions favorable for Heat waves



Effect of Heatwaves

- **Human Health:** **over 10,000** people lost their lives due heat waves between 2000-2020 (IMD).
- **Environment:** Increasing energy demand due to usage of cooling; wildfires and droughts; worsens air quality, pollution; depletion of soil moisture.
- **Loss of productivity:** India expected to lose around **5.8% of daily working hours during to rising temperatures by 2030** (UNESCAP)
- **Economic and Social Impacts:** Increased migration; affects crop and livestock productivity impacting food security.



Initiatives taken

- **Action taken by IMD- Color code impact based heat wave warning.** E.g., Green (Normal day); Yellow (Heat Alert); Orange (Severe Heat Alert); Red (Extreme Heat Alert)
- **Heat Action Plans** by IMD in collaboration with NDMA and local health departments.
- **Rescheduling Working hours** for workers and labourers



Way forward (NDMA Guidelines)

- **A national level strategy and plan** to combat heat wave should be developed.
- Examine the local cause of **disproportionate rise in temperature** and **identity vulnerable hotspot**.
- **New heatwave criteria must be evolved** based on gridded data with maximum and minimum temperature.
- **Integrate climate variability mitigation and adaptation** efforts in heat plan.
- **Up gradation of forecast system** to provide heatwave alerts minimum 2-3 weeks prior.

7.4. EARTHQUAKE MANAGEMENT IN INDIA AT A GLANCE

Earthquake Management in India

Definition

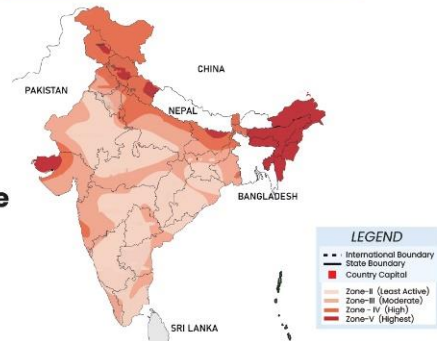
Sudden, rapid shaking of the earth caused by **release of accumulated stress of the moving lithosphere or crustal plates.**



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.
- **Causes: Tectonic Plate Movements; Fault Slippage** (Build-up of stress along the fault line overcomes the friction between rocks); Volcanic and anthropogenic activities, etc.

Seismic Zones in India



Recent Earthquakes and their reasons

- **Morocco (Epicentre- Atlas Mountains):** Northward convergence of African plate with Eurasian plate along a complex plate boundary.
- **Taiwan:** Reverse Faulting (split between 2 sections of rock in Earth's crust caused by compressional forces);
- **Afghanistan: Subduction of Arabian and Indian Plates** under the Eurasian plate.
- **Turkey:** located on the anatolian plate, squeezed westward by the northward collision of two tectonic plates- **the Arabian and Eurasian.**

Challenges

Difficult to predict

Lack of earthquake-resistant infrastructure

Movement of Indian and Eurasian plate towards each other

Central Himalaya, considered a prominent 'seismic gap'

High cost of retrofitting, etc.

Initiatives

- **Earthquake Risk Assessment and Mapping** by the Geological Survey of India (GSI)
- **Indian Standard Code for seismic design and construction of structures (IS 1893)** by BIS.
- **National Disaster Management Authority's (NDMA) guidelines**
- **Others:** Earthquake Early Warning System (EEWS), National Earthquake Risk Mitigation Project (NERMP), Mobile application 'India Quake', etc.

Way forward (NDMA Guidelines)

- Ensure **incorporation of Earthquake resistant design features.**
- **Facilitate selective strengthening and seismic retrofitting** of existing priority structures.
- **Others:** Improve the compliance regime; capacity development interventions; strengthen emergency response capability, etc.

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7.5. GLACIAL LAKE OUTBURST FLOOD (GLOF) AT A GLANCE

Glacial Lake Outburst Flood (GLOF)

- **Definition**

It is the **sudden release** of significant amount of water retained in a glacier irrespective



GLOF Vulnerability in India

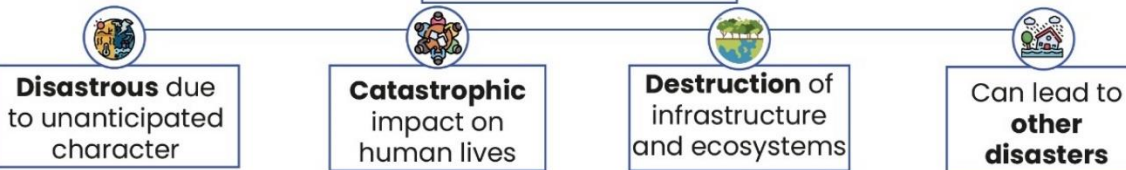
- **More than nine million people in High Mountain Asia (HMA) are vulnerable to GLOF. Glaciers are set to lose 30–50% of their volume** compared with 2015 by 2100 due to
- global warming. (ICIMOD's Hindu Kush Himalaya assessment report).



Occurrences

- **Kedarnath (2013), Chamoli (2021) and Sikkim (2023).**

Effects of GLOFs



GLOF Flood Mitigation measures

- **National Disaster Management Authority (NDMA) guidelines on management of GLOFs** in 2020.
- **Structural Measures like** Creation of reservoir, depressions, embankments, etc.
- **Early Warning System:** NDMA has planned to install early warning systems for real-time alerts at most of 56 at-risk glacial lakes in India.
- **Guidelines for Hydro projects** by Central Electricity Authority (CEA) for **slope stability**.



Way forward (NDMA Guidelines)

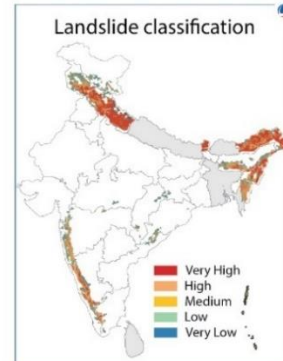
- Monitoring systems prior to, during, and after construction of infrastructure and settlements in the downstream area.
- Any existing and potential source of a larger snow and ice avalanche, slide, or rock fall around the lake area, has to be studied in detail.
- Reduce the volume of water in the lake in order to reduce the peak surge discharge by methods like controlled breaching, construction of an outlet control structure, etc.

7.6. LANDSLIDE MANAGEMENT AN INDIA AT A GLANCE

Landslide Management in India

Definition

Occurs when **gravity forces on hill slope material exceed the frictional forces** holding the material in place, causing **slope failure**.



India's Landscape Susceptibility to Landslides (Indian Landslide Susceptibility Map (ILSM))

- **3.17% of India's geographical area.**
- **4.75% of the area** is categorized as "**very highly susceptible.**"



Causes of Landslides

- **In Himalayas:**
 - **Geological Factors:** Steep slopes and rapid rivers causing toe erosion, rockfalls, and intense water saturation from snowmelt or heavy rains weakening rocks.
 - **Other reasons:** Slope cutting and blasting activity for construction, lack of comprehensive land use policy, and excessive tourism.
- **In Western Ghats:** Basalt rocks, high gradient.
 - **Western Ghats require less rainfall** to trigger landslides compared to Himalayas due to greater water retention and increased pore water pressure.



Recent Occurrences

- **Joshimath (Uttarakhand):** Caused by Location in the **high-risk seismic 'Zone-V'** (ancient landslide residue); on a slope over morainic deposits or loose sediments; absence of a system for proper disposal of water coming from the upper reaches.
- **Silkyara-Barkot tunnel, Uttarakhand:** Caused by built in area comprising limestone and other soft rocks having a tendency to collapse.



Initiatives Taken by India

- **National Landslide Susceptibility Mapping (NLSM) Programme** by **Geological Survey of India.**
- **Landslide Atlas of India** by **National Remote Sensing Centre of ISRO .**
- Provisions **made in the MNREGA scheme for structural mitigation of landslides** in hill areas.
- **National Institute of Disaster Management (NIDM), statutory organisation** under the NDMA, 2005 (under MHA), [recently got **global recognition as 'centre of excellence' on landslide disaster reduction for the period 2023-2026**].



Way forward (NDMA Guidelines)

- No construction in the areas having **slopes above 30 degrees or areas falling on the spring lines and first-order streams.**
- Perform **load-bearing tests**, use of **hazard zonation**, and **slope and land-use maps in urban planning.**
- Fast-growing **trees and useful grasses to be grown.**
- Provisions can be **made in the MNREGA scheme for structural mitigation of landslides** in hill areas.

7.7. CROWD DISASTER MANAGEMENT IN INDIA AT A GLANCE

Crowd Disaster Management in India

Definition

When the density of a group of gathered people is **critical** and governed by **involuntary forces** can lead to a situation of crowd disaster or stampede.

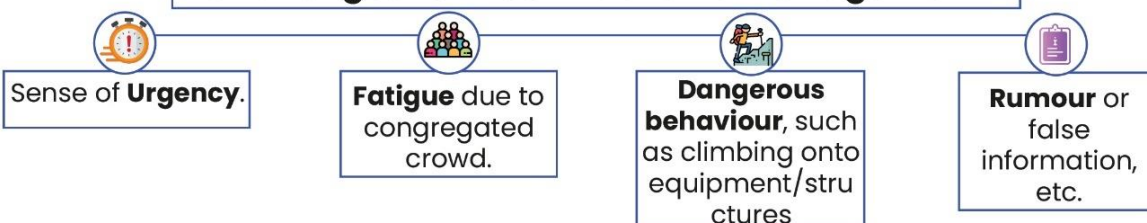
- Majority of the crowd disasters in India have occurred at **religious places, venues of music concerts, night clubs and shopping malls.**



Factors that may prompt crowd disasters

- Collapse of structures:** E.g., **Morbi Bridge Collapse** across Machchhu River in Gujarat; collapse of a platform at Delhi's Kalkaji Temple.
- Fire/Electricity:** E.g., **Uphaar Cinema Fire in 1997** that happened due to fire code violations.
- Sudden changes in Crowd Behaviour:** E.g., **stampede at the Mahakumbh Mela in 1954.**
- Poor management by security agencies:** E.g., **Seoul crowd tragedy (2022)**
- Other:** Lack of coordination among stakeholders; Administrative or Managerial Measures etc.

Challenges to Effective Crowd Management



Constitutional and Legal Provisions regarding Crowd Management

- Article 19:** Article 19 (1) (b) provides citizens **right to assemble peacefully and without arms.** However, **under Article 19(3)** the Government can impose reasonable restrictions on such right.
- Police Act of 1861:** Lays down **conditions** that may be **imposed for regulating lawful processions** and assemblies to prevent public inconvenience.
- Disaster Management Act 2005:** Deals with vehicular and human traffic, and other areas **related to crowd management.**



Way Forward

- **National Institute of Disaster Management (NIDM) NIDM's Crowd Management Strategies and arrangement**
 - Knowing **crowd type** (age, gender, region, etc.), **Motives of visitors** (social, entertainment),
 - **Capacity Planning** involving **infrastructure development, staging points or queue complexes and multiple** routes for vulnerable groups like women.
 - **Understanding Crowd Behaviour**
 - **Risk analysis and preparedness** through mock drills to identify gaps, etc.
 - **Other measures: Timely Information Management and Dissemination among stakeholders; Safety and security measures like** CCTV monitoring of entire crowd; etc

7.8. FIRE SAFETY REGULATIONS IN INDIA

Why in the news?

Recent fire accidents in a **gaming zone in Rajkot** (Gujarat), a **firecracker factory in Harda** (Madhya Pradesh) and a **private hospital in Delhi** have raised concerns over fire safety in India.

Fire Accidents in India

- **7,435 people were killed** in over 7,500 fire accidents in India in 2022 (NCRB).
 - **~800 factory fires** were recorded in the last two years in Delhi alone.

Existing Fire Safety Standards and regulations in India

- **Constitution:** Fire service is a **State subject** and included in the **12th Schedule of the Constitution of India**.
- **National Building Code (NBC)** by **Bureau of Indian Standards (BIS)** acts as the **central standard for fire safety in India**.
 - **Mandatory requirement for State governments to incorporate the NBC recommendations** on minimum fire safety into their local bylaws.
- **Others:** Model Building Bye Laws 2016 by Ministry of Housing and Urban Affairs; Model Bill to Provide for the Maintenance of Fire and Emergency Service for the State, 2019; Fire and Life Safety guidelines by Ministry of Health.

Challenges in maintaining Fire Safety Standards

- **Absence of uniform safety legislation across states**
- **NBC provisions, including 'Fire and Life Safety' audits, are recommendatory in nature**
- **Shortage of staff and proper firefighting equipment:** In 2019, there was a **shortage of 5,191 fire stations and 5,03,365 personnel**.
- **Urbanization-related challenges: High population density, Poor Urban Planning** having narrow congested lanes, E.g., **Kamala mills fire in Mumbai 2017**.

Reasons behind Major fire incidents in India	
Major Fire Incidents	Non-compliance of Fire safety standards and protocols
Coaching centres in Mukherjee Nagar and Kalu Sarai (Delhi)	Narrow staircases, Lack of emergency exits, Lack of sprinkler system
Kumbakonam School fire (Tamil Nadu, 2004)	Usage of highly flammable materials (thatched roof) in building, lack of safe fire exits
AMRI Hospital fire in Kolkata (2011)	Inactive fire alarms and sprinklers, Lack of adequate training, Unsafe storage of flammable material

Way forward

- **NDMA Guidelines**
 - **Enactment of a Fire Act** at state level for mandatory clearance from the fire department for certain buildings and premises.
 - **Improve the outreach of the Fire Services** to the block and the Gram Panchayat level.
 - **Professional Head of fire services at the state level and district level** (chief fire officer)
 - **Research & Development of indigenous**, less water-consuming fire extinguishing technologies.
- **13th Finance Commission Recommendations:**
 - Municipal Corporations with populations **over one million** must develop fire hazard response and mitigation plans.

PHILOSOPHY/ दर्शनशास्त्र

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7.9. FOREST FIRES IN INDIA AT A GLANCE

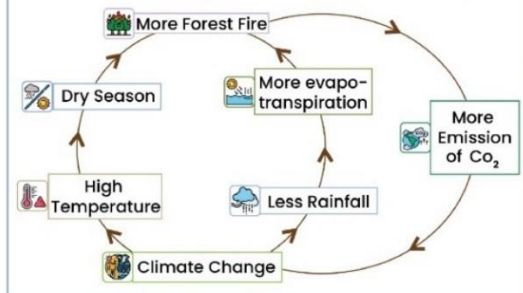
Forest Fires in India



Reasons for Forest Fires

- **Natural Causes:** Lightning; volcanic eruptions; high summer temperatures, abundance of chir pine trees which are flammable in hilly areas, etc.
 - **Anthropogenic causes (90% of forest fires globally are man-made- IUCN):** Slash and burn shifting cultivation; negligence in camp fires; accidental fires etc.
- Climate change (refer to infographic)**

Climate Change and Forest Fire Cycle



Forest Fires in India

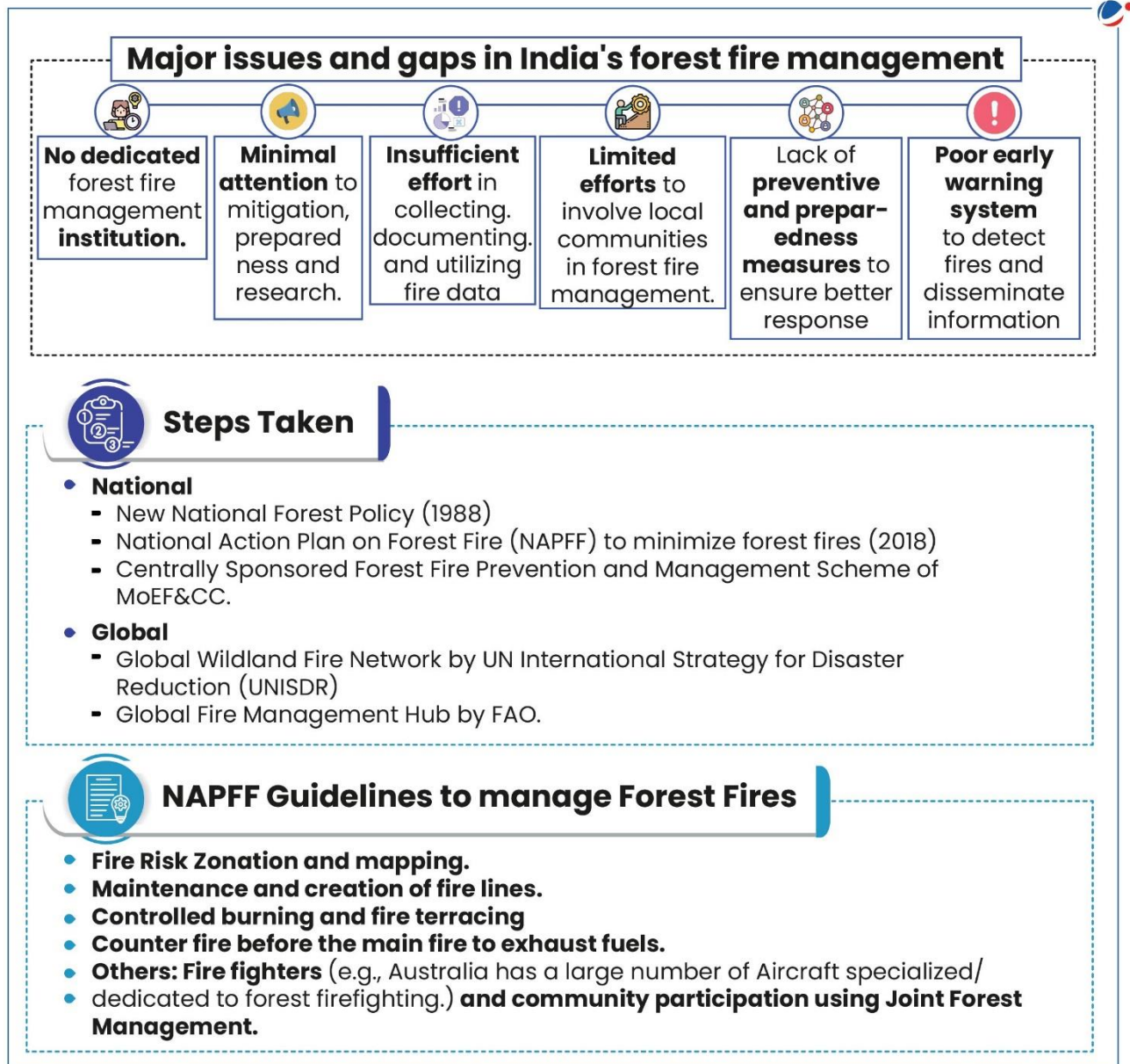
- **13,000 thousand fire alerts** reported between 2023-24.
- **22% area** falls under highly and extremely fire prone category.
- **Impact: 1.6% tree cover lost** between 2001 and 2023 (Odisha witnessed the highest loss).



Recent Occurrence

- **Forest fire in Uttarakhand (2024); Australian bushfire (2019).**

- **Benefits of Forest Fires:** Regeneration of certain forests; reduce fuel loads; removes undergrowth; removal of exotic, non-native species; addition of nutrients through ashes, etc.



7.10. INDUSTRIAL SAFETY AT A GLANCE

Industrial Safety

Definition

- Industrial Safety is a **multi-disciplinary** approach to ensuring compliance with regulatory agencies, safe working practices, and maintaining the health and well-being of those employed in a particular occupation or workplace.



Occurrences

- Chennai ammonia gas leak (2024); Vishakapatnam gas leak (2020); Chasnala Mining Disaster (1975); Bhopal Gas Tragedy (1984)**



Regulatory Mechanism in India

- Mines Act, 1952** to regulate the objectives of safety and health of workers in mines.
- Civil Liability for Nuclear Damage (CLND) Act 2010** and **prompt compensation to the victims** of a nuclear incident.
- National Green Tribunal (NGT)** deals with cases related to **industrial accidents**.
- Occupational Safety, Health and Working Conditions (OSH) Code, 2020**
- Public Liability Insurance Act (PLIA), 1991.**
- National Policy on Safety, Health and Environment at Workplace (NPSHEW)** to establish a preventive safety and health culture in the country.



International Regulations Regarding Industrial Safety

- ILO Convention No. 155 (Occupational Safety and Health Convention, 1981)**, not ratified by India.
- ILO Convention No. 187** (Promotional Framework for Occupational Safety and Health Convention, 2006), not ratified by India.
- International Organization for Standardization (ISO):** Example **ISO 45001:** Occupational health and safety management systems.
- United Nations Sendai Framework for Disaster Risk Reduction (2015–2030)**
- United Nations Sustainable Development Goals (SDGs)** Goal 8, "Decent Work and Economic Growth,"



Issues with Industrial Safety Management

- **Informal Economy** employing a significant portion of India's Population, where safety regulations may not be strictly adhered to.
- **Others:**
 - Lack of reporting and national-level database.
 - Inadequate safety regulations and enforcement.



Way Ahead

- **Integrating technology and innovation:** E.g., using **real-time data, sensors, cameras, and artificial intelligence** to monitor and detect hazards.
- **Improving the training and awareness of workers and employers.**
- **Strengthening Regulatory Enforcement:** E.g. Implement penalties for non-compliance to serve as a deterrent.
- **International Collaboration for the exchange of experiences and learning,** may be explored.

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AIR

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मोहन लाल

AIR

7



ANMOL RATHORE

AIR

9



NAUSHEEN

AIR

10



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7.11. OIL SPILLS AT A GLANCE

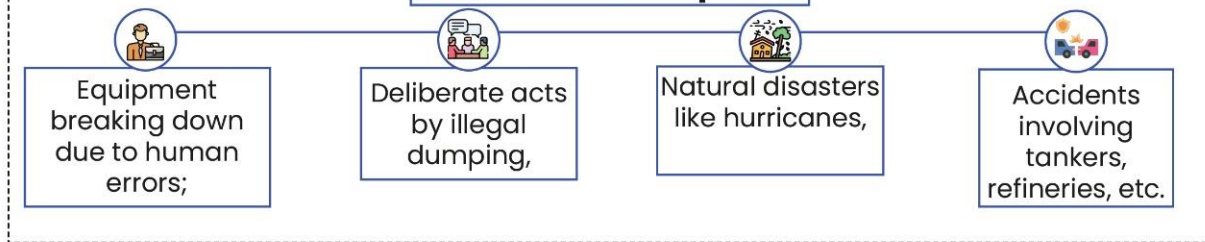
Oil Spills

Definition

- Release of a **liquid petroleum hydrocarbon** into environment, especially marine areas

- Recent occurrence: **Ennore Oil Spill, Tamil Nadu; Nagapattinam Oil Spill, Tamil Nadu**

Causes of Oil Spills:



Impacts of oil spill

- Destroys **insulating ability of fur on mammals and impacts water repelling qualities** of a bird's feathers.
- Impacts **immune system and reproduction of dolphins and whales** by oil inhalation.
- Obstruct passage of sunlight into sea**, thereby destroying photosynthesising phytoplankton.
- Impacts **mangrove forests** as they can **no longer shield coastlines**.



Initiatives taken

- National**
 - National Oil Spill Disaster Contingency Plan (1996)**: The Indian Coast Guard is the nodal agency for the Plan
 - Merchant Shipping Act, 1958** has provision of prevention and containment of Pollution of Sea by Oil.
- International**
 - International Convention on Civil Liability for Bunker Oil Pollution Damage (2001)**: India ratified the convention in 2015
 - International Convention for the Prevention of Pollution from Ships or MARPOL Convention** (India is a signatory)
 - International Convention on Oil Pollution Preparedness Response and Cooperation (OPRC) 1990** (India is a signatory)
 - International Convention for Safety of Life at Sea (SOLAS)**



Technological Solutions

- **Bioremediation: Oilzapper** (developed by TERI), using the bacteria to get rid of oil sludges and oil- spill and **Oilivorous-S** (jointly developed by TERI and Indian Oil Corporation Ltd) against sludge and crude oil with high-sulphur content.
 - **Floating booms:** Temporary **floating barriers** to contain marine spills.
 - **Different sorbents** like straw, volcanic ash etc.

7.12. VOLCANIC ERUPTIONS AT A GLANCE

Volcanic Eruptions

- Volcanoes are **openings, or vents** where lava, tephra (small rocks), and steam erupt onto the Earth's surface. They can be on **land and in the ocean**.
- **Ring of Fire, also referred to as the Circum-Pacific Belt**, is a string of sites along the **Pacific Ocean** characterized by active volcanoes and frequent earthquakes.

- **Different types of volcanic eruptive events:** Pyroclastic explosions, which is fast-moving hot gas and volcanic matter; Hot ash releases; Lava flows; Gas emissions; Glowing avalanches, when gas and ashes release.


- **Major Volcanic eruptions in recent time :** **Mount Etna Volcano** (Sicily); **Mount Vesuvius** (Italy); **Hunga Tonga** (Tonga Island).



Impacts of Volcanic Eruption

- **Acute and chronic respiratory diseases**, burns and traumatic injuries etc.
- **Concentration of sulfur dioxide (SO₂)**, ash, and other aerosols.
- Volcanic ash can mix with water and create lahars (**fast-moving mudflows**)
- Detrimental effects on **agriculture, infrastructure, and other economic activities**.

Measures to Mitigate Impacts


Monitoring (using seismometers, gas sensors, satellites, etc.)


Measuring ground deformation


Thermal imaging


Effective response system; etc.

7.13. MISCELLANEOUS

7.13.1. DAM SAFETY IN INDIA AT A GLANCE

Dam Safety in India



Dams in India

- **India is the 3rd largest** dam owing nation after USA and China.
- Around 5,700 dams in the country.
- **Maharashtra (1845)** has the highest number of large dams followed by Madhya Pradesh.
- **Madhya Pradesh** has the largest number of dams (63) more than **100 years old**.

Major Dam Failures across the globe include

1975:	1979	2023	2023
Banqiao dam failure in China.	Machchhu Dam failure in Morbi, Gujarat claimed over 2,000 lives.	Derna dam collapse in Libya claimed over 3,800 lives.	Damage to Chungthang Dam in Sikkim due to floods.



Concerns associated with Dams

- **Ageing dams: 80% of dams** in India are over 25 years old.
- **Seismic vulnerability:** For example, the earthquake in **Bhuj** (Gujarat) in 2001.
- **Abrasive sediments damage hydroelectric turbines** and other dam components **reducing the storage capacity**.
 - Around 3700 dams in India will lose **26% of the total storage by 2050** due to the accumulation of sediments (United Nations).
- **Non-compliance with legislative mandates** as highlighted by the CAG audit report.



Initiatives for dam safety

- **National:**
 - **National Register of Large Dams (NRLD)** compiled and maintained by CWC.
 - **Dam Rehabilitation and Improvement Project (DRIP): The 2nd and 3rd Phase of DRIP** envisages comprehensive **rehabilitation of 736 dams** across 19 States.
 - **Dam Health and Rehabilitation Monitoring Application (DHARMA)** involves application of **Artificial Intelligence (AI)** in dam safety.
 - **Dam Safety Act, 2021:** Having a **4-tiered Institutional Mechanism**
- **Global:**
 - **World Commission on Dams:** Established by the World Bank and IUCN.
 - **International Commission on Large Dams (ICOLD),** for exchange of knowledge in dam engineering.



Way Forward

- **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.

7.13.2. ENVIRONMENTAL COST OF WAR

Why in the news?

Experts have raised concerns with respect to environmental impact and associated costs of Russia-Ukraine war and the Israel-Palestine conflict.

About Environmental costs of war

- According to Institute for Economics and Peace, **only a few countries** globally are **conflict-free**, despite this being considered the most peaceful century. Even in comparatively **peaceful nations, security forces consume extensive resources.**
 - **During war**, the environment experiences neglect, exploitation, and deliberate abuse on a **significant scale.**

Stage	Associated environmental cost
Preparation (before war)	<ul style="list-style-type: none"> • Exploitation of Resources while building military forces • Energy requirements of military mostly derived from fossil fuels. <ul style="list-style-type: none"> ○ E.g., British military activity is responsible for approximately 50% of all UK government emissions.
War	<ul style="list-style-type: none"> • Deforestation for white phosphorous, bombing of protected areas, etc. E.g., During Vietnam War US military cleared rainforests in Vietnam. • Others: Air and soil pollution from debris from explosive weapons; wrecked ships leading to oil spills; destruction to ecosystems creating potential for invasive species.
After war	<ul style="list-style-type: none"> • Radiation from Nuclear-weapons, like, Hiroshima and Nagasaki after World War 2. • Others: increasing hunting/poaching; budget cut for environmental projects; irreversible loss to biodiversity and soil nutrients, forced human displacement, exploitation of resources, etc.

Key Initiatives

- **Geneva Convention** imposes restrictions on warfare methods damaging environment.
- **Brundtland Report (1987)** emphasizes that **Armed conflict pose significant barriers to sustainable development.**
- **Stockholm Conference (1972):** Prohibits the use of all weapons of mass destruction.
- **Rome Statutes - Article 12** establishes responsibility of states.
- **UN Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (ENMOD)**

Challenges associated with environmental cost of war

- **Armaments and the military** are not included in the Paris Climate Agreement.
 - Militaries account for **5.5 percent of global greenhouse gas emissions**.
- **Immediate reconstruction efforts** after war prioritize housing, infrastructure, etc. over environmental considerations.
- **Vicious Circle**, Climate change (a hidden cost of war on environment) makes resources scarcer and increases vulnerabilities.
- **Other causes:** limited knowledge; difficulty in quantifying environmental damage, etc.

Way ahead to mitigate war's impact on the environment

- **UN Framework on Climate Change:** Hold responsible parties accountable based on the "**polluter pays**" principle.
- **Green Post-Conflict Recovery** prioritizes green and sustainable recovery post-conflict,
- Educate Armed Forces members on emission reduction and environmental preservation.
- **Decarbonizing Military** like replacing petroleum-fuelled vehicles with hybrid and electric cars, installing solar arrays, etc.
 - UK's Ministry of Defence has developed a **Climate Change and Sustainability Strategy**

UPSC सिविल सेवा परीक्षा 2023 में चयनित सभी उम्मीदवारों को हार्दिक बधाई

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53 AIR		136 AIR		238 AIR		257 AIR		313 AIR		517 AIR		541 AIR		551 AIR		555 AIR	
मोहन लाल		अर्पित कुमार		विपिन दुबे		मनीषा धार्वे		मयंक दुबे		देवेश पाराशर		शिवम अग्रवाल		मोहन मंगवा		ईश्वर लाल गुर्जर	
556 AIR		563 AIR		596 AIR		616 AIR		619 AIR		633 AIR		642 AIR		697 AIR		747 AIR	
शुमम रघुवंशी		अजित सिंह खदा		के परीक्षित		रवि गंगवार		मानु प्रताप सिंह		मैत्रेय कुमार शुक्ला		शशांक चौहान		प्रीतेश सिंह राजपूत		नीरज घाकड़	
758 AIR		776 AIR		793 AIR		798 AIR		816 AIR		850 AIR		854 AIR		856 AIR		885 AIR	
सोफिया सिद्दीकी		पटेल दीप राजेशकुमार		अशोक सोनी		विनोद कुमार मीणा		पवन कुमार		भारती साहू		सचिन गुर्जर		रजनीश पटेल		पूरन प्रकाश	
913 AIR		916 AIR		929 AIR		941 AIR		952 AIR		954 AIR		961 AIR		962 AIR		964 AIR	
पायल ग्वालवंशी		नीलेश		प्रेम सिंह मीणा		प्रद्युमन कुमार		संदीप कुमार मीणा		कर्मवीर नरवदिया		अभिषेक मीणा		सचिन कुमार		नीरज साँगरा	



8. GEOGRAPHY

8.1. INDIA METEOROLOGICAL DEPARTMENT (IMD)

Why in the News?

India Meteorological Department (IMD) celebrated the **150th Year of its establishment** and **service** to India which was established in 1875.

About IMD

- **Ministry:** Ministry of Earth Sciences (MoES).
- **National Meteorological Service** of the country and the **principal government agency** in all matters relating to meteorology and allied subjects.
- **Mandate**
 - **Provide meteorological information for weather-sensitive activities** such as agriculture, irrigation, shipping, aviation, and offshore oil explorations.
 - **Warn against severe weather phenomena** like tropical cyclones, norwesters, duststorms, heavy rains and snow, cold and heat waves, etc.
 - **Research in meteorology and allied disciplines.**

Achievements of IMD

- **Observations**
 - **In 2023, WMO recognised three IMD observatories**, viz., **Dwarka & Veraval** (Gujarat) and **Cuttack** (Odisha) as long-term observing stations for more than **100 years of hydrological observations**.
 - **39 Doppler Weather Radars (DWRs)** across the country to monitor severe weather events (**till 2023**).
 - **Aviation Weather monitoring and forecasting** for all 117 Airports to support **Gati Shakti and Udaan Scheme**.
- **Improvement in Forecast Accuracy**
 - **Significant improvement in forecast accuracy** of severe weather events by **40-50%** (last 5 years).
 - **Air Quality Early Warning System (AQEWS) integrated with a Decision Support System (DSS)**, showing an accuracy of 88% for predicting extreme pollution events.
 - Introduced a **new Multimodal ensemble technique** for the forecast of tropical cyclones
- **Appreciation from the United Nations** for early warning services provided by IMD during **Super Cyclone Amphan in 2020 and Cyclone MOCHA in 2023**.

Challenges Faced by IMD in Accurate Weather Prediction

- **Limited Weather Models** to make predictions
- **Data Misinterpretation** while **analyzing multiple satellite images, radar data** leading to **forecast errors**.
- **Localized Extreme Weather Events** challenges in predicting **cloudbursts, lightning events, and other localized extreme weather phenomena**.
- **India's tropical climate and complex monsoon season** makes it **difficult to predict weather** accurately.
- **Challenges in recruitment, training, and retention of qualified personnel** in meteorology.

Way Ahead

- Invest in advanced **technologies and infrastructure** including **satellite observations**, ground-based measurements, and **ocean monitoring**.
- **Global Collaboration** in **sharing data, technologies, and expertise** to address regional variations and global climate challenges collectively.
- **Predictive Analytics and Artificial Intelligence** to enhance the **precision of climate predictions and identify patterns** in complex climate systems.

- **Develop Early Warning Systems** to effectively communicate and mitigate the impact of extreme weather events, especially in vulnerable regions.
- **Strengthen the capacity of meteorological agencies and institutions** through **training programs**, knowledge sharing, and **skill development**.

8.2. EL-NINO - MONSOON LINK

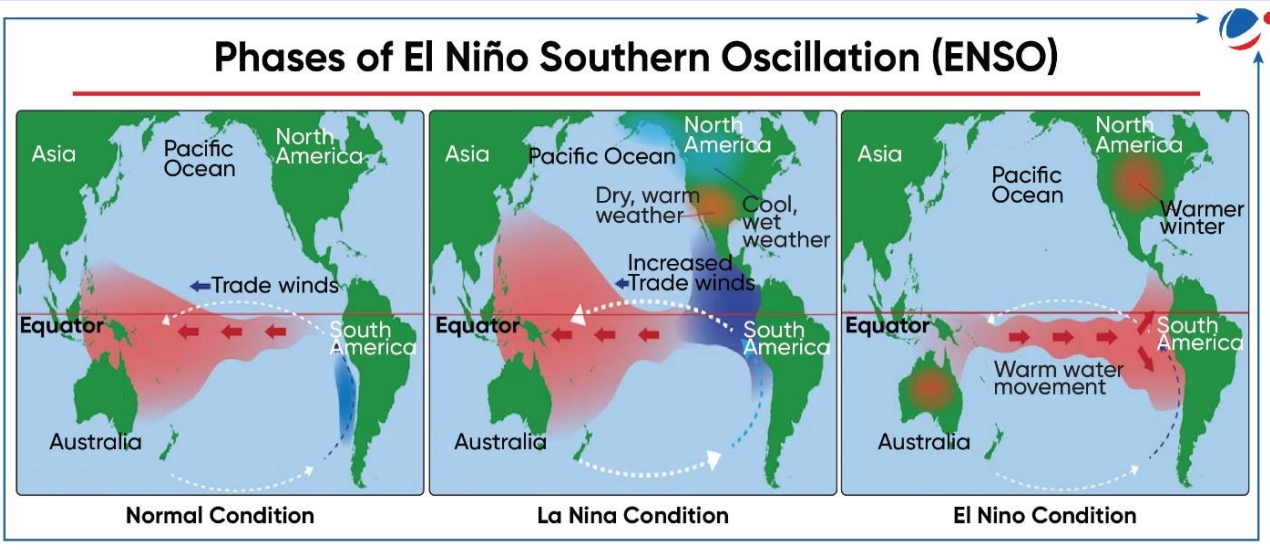
Why in the news?

Recently, a paper published in Nature’s Scientific Report revealed the regional and temporal variability of Indian summer monsoon rainfall in relation to El Niño southern oscillation (ENSO).

About El Niño Southern Oscillation (ENSO)

- A climatic phenomenon involving **fluctuating ocean temperatures** in the **central and eastern equatorial Pacific (referred as El Niño and La Niña)**, coupled with **changes** in the overlying **atmosphere (referred to as Southern Oscillation)**.
- Study showed that the El Niño-monsoon relationship **diminished in Central India**, and became **stronger in North India** and there is **no considerable variation over South India**.

3 phases of El Niño Southern Oscillation (ENSO)



Phase	Characterized by
La Niña	A cooling of the ocean surface with below-average sea surface temperatures (SST) , in the central and eastern tropical Pacific Ocean
El Niño	Reverse of La Niña , a warming of the ocean surface with above-average SST , in the central and eastern tropical Pacific Ocean.
Neutral	Neither El Niño or La Niña. Often tropical Pacific SSTs are generally close to average .

El Niño-monsoon relationship

- **ENSO is one of the most prominent tropical modulator of the Indian monsoon** and represents the largest interannual climate signal in the tropics.
 - **Other phenomena that affect Indian summer monsoon rainfall (ISMR):** Indian Ocean Dipole (IOD); Pacific Decadal Oscillation (PDO); Atlantic Meridional Oscillation (AMO); Atlantic Zonal Mode (AZM) etc.
- There exists an **inverse relationship between ENSO and Indian monsoon rainfall**.
 - **El Niño tends to suppress monsoon rainfall.**
 - **La Niña generally enhances monsoon rainfall.**



How El Nino impacts Monsoon

- Causes the **weakening of walker circulation**, which disrupts the normal flow of air and moisture.
- Shift in **Jet Stream** that **influences the movement of weather systems** and moisture transport.
- **Weakening of the pressure gradient** between the **Indian Ocean and the Pacific Ocean** and changes in wind patterns.
- **Leads to atmospheric stability** that **inhibits the vertical movement** of air and suppresses the development of **convective clouds**.
- **Other impacts of El Nino: Impact marine fisheries worldwide.** Localized threats to food security, **drought situation, rise in the general price level, etc.**

8.3. TRIPLE DIP LA-NINA

Why in the News?

A recent study has revealed that the recent **triple-dip La Niña conditions (2020–2023)** had peculiar impact on air quality in peninsular as well as North India.

Observed impacts

- **Poor Air quality in peninsular India** due to dominance of higher northerly wind forces influx and relatively slower winds near the surface, increasing PM2.5 concentration.
- **Improved Air quality in North India** due weaker western disturbances, with the absence of rain and clouds and faster ventilation.

About Triple dip La Niña

- A **rare event** that occurs when the **La Niña effect lasts three years in a row.**
 - **ENSO cycles** typically last **9-12 months** and reappear intermittently every 2-7 years.
- Earlier occurrences of triple-dip La Niñas: **1998-2001, 1973-1976, and 1954-1956.**
- The 2020–2023 triple-dip La Niña was **distinct as it did not follow a strong El Niño.**

Possible explanation for 2020-23 Triple dip La Niña

- ENSO may be **more susceptible to inter-basin interactions** involving the **Indian and Atlantic Oceans** (previously thought to be driven by processes primarily occurring within the tropical Pacific Ocean basin).
- **Influences from the North and South Pacific Ocean** may promote prolonged La Niña events.
- **Smoke from the extensive Australian bushfires in 2019–2020** may have helped to trigger the recent La Niña.
- **Changing conditions** in the tropical Pacific Ocean and atmosphere, **possibly due to climate change**, could be altering the character of **El Niño and La Niña events.**

Conclusion

The 2020–2023 triple-dip La Niña and recent studies on it underscore the idea that **there may be significant sources of ENSO variability** originating outside the tropical Pacific Ocean and that we need a more global approach for understanding and predicting ENSO cycle variations.

8.4. PACIFIC DECADAL OSCILLATION (PDO)

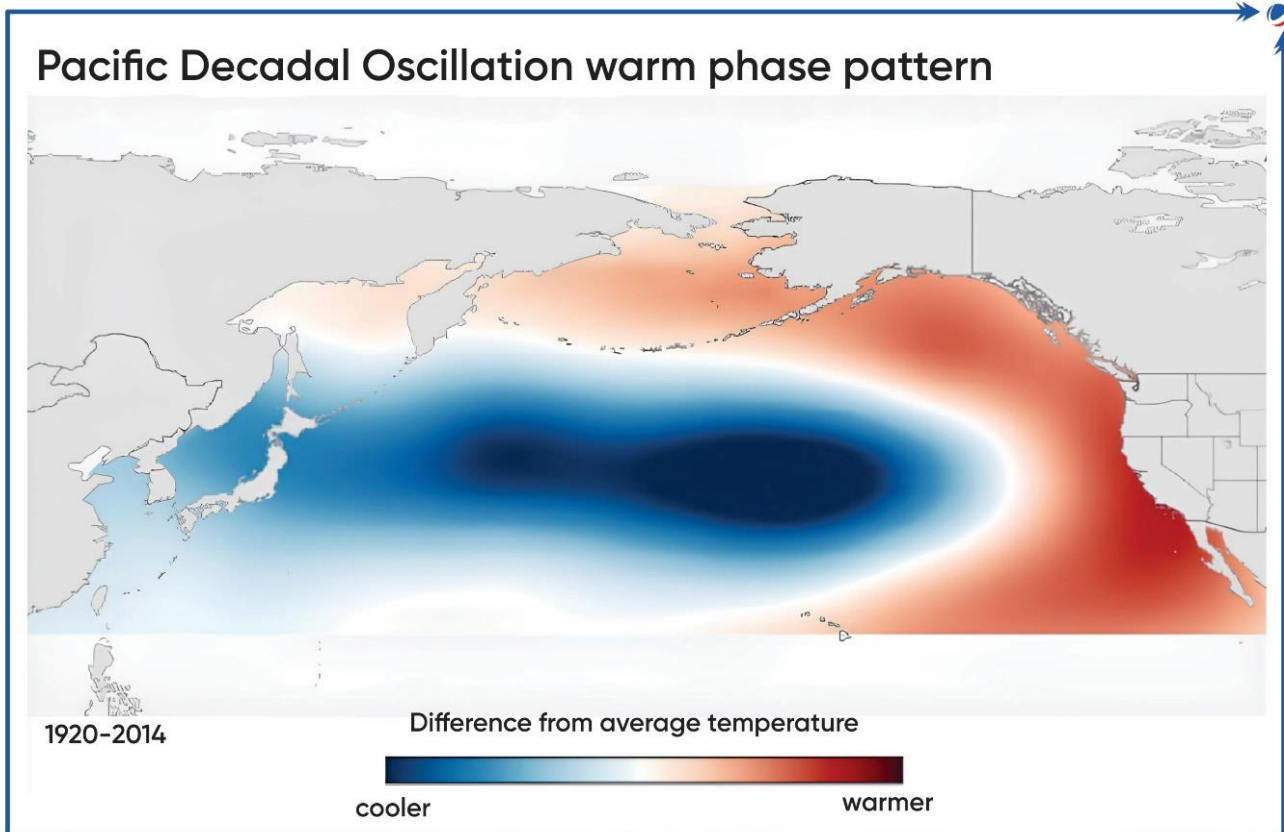
Why in the news?

According to a recent study, a combination of global warming and the Pacific Decadal Oscillation (PDO) could make cyclones more frequent in the coming years.

About PDO

- It is a long-term ocean **fluctuation** in the **Pacific Ocean.**
- It has **two phases:**
 - **Cool or Negative Phase:** Characterized by a **cool wedge** of lower than normal **sea-surface heights/ocean temperatures** in the **eastern equatorial Pacific.**

- ✓ And a warm **horseshoe pattern** of higher than **normal sea-surface heights** connecting the **north, west and southern Pacific (refer to image)**.
- **Warm or positive phase:** It is reverse of cool phase. In it, **West Pacific Ocean** becomes cool and the wedge in the **east warms**.
- It waxes and wanes approximately every 20 to 30 years. However, in the **recent time**, the ‘**warm**’ and ‘**cold**’ phases have been much shorter.
- Both PDO and **El Nino Southern Oscillation (ENSO)** impact each other-
 - **Climate impacts** experienced during a **PDO** event can go **hand-in-hand** with **impacts of ENSO**.
 - ✓ If **both phenomena** are in the **same phase**, their associated **impacts can be amplified**.
 - **Impact on Indian Monsoon: ENSO** (El Niño phase) with a **positive PDO** is generally **not good for the Indian monsoon**.
 - When **ENSO** (in La Nina phase) is linked with a **negative PDO**, it intensifies monsoon in India.
- **Linkage of PDO and global warming:**
 - Negative phases could be linked to times of **slower warming** as **cold or negative phases** of the **PDO** tend to increase **mixing of colder, deep ocean waters with warmer surface waters**.
 - ✓ This temporarily reduces the rate of **global warming** caused by **increasing greenhouse gas emissions**.
 - Positive phases of PDO have the opposite effect i.e. **increases the global warming**.



Why PDO enhances the frequency of Cyclones?

- **Negative PDO** along with **La Nina phase** creates **suitable condition** for the tropical cyclones.
- In 2019, the PDO entered a **cooler or negative phase**. If it remains so, it could mean **more tropical cyclones** in the **post-monsoon months** that originate near the equator.
 - The number of **equatorial-origin cyclones** was 43% fewer in 1981-2010 compared with 1951-1980, and this was because the **PDO was in a ‘warmer’ or positive phase**.
- When waters are warm, Cyclones can **gain more moisture and rise in intensity**.
 - It’s usually rare for cyclones to form near the Equator (due to the absence of Coriolis force).

8.5. OTHER CONCEPTS IN NEWS

8.5.1. ATLANTIC MERIDIONAL OVERTURNING CIRCULATION (AMOC)

Why in the news?

Researchers developed an **early warning indicator for the breakdown of the AMOC.**

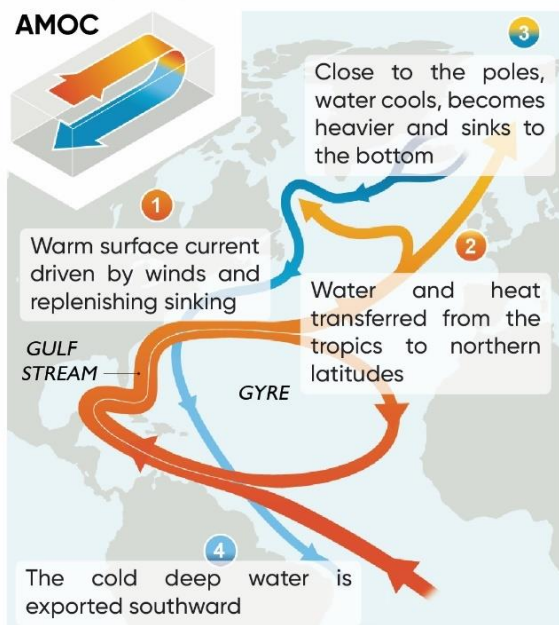
About AMOC

- The **AMOC circulates water from north to south** and back in a long cycle within the Atlantic Ocean.
- This circulation brings warmth to various parts of the globe and also carries nutrients necessary to sustain ocean life.
- It is driven by **differences in temperature and salt content.**
- AMOC has been labeled as **one of the tipping elements** in the climate system.
- It is **being eroded** by faster than expected melt-off of Greenland’s glaciers and Arctic ice sheets.
- **Implications of AMOC collapse:** Rise in Atlantic Sea levels; Flipping of wet and dry seasons in the Amazon; More erratic fluctuations in temperatures; warmer southern hemisphere.

Changes in Atlantic Meridional Overturning Circulation (AMOC)

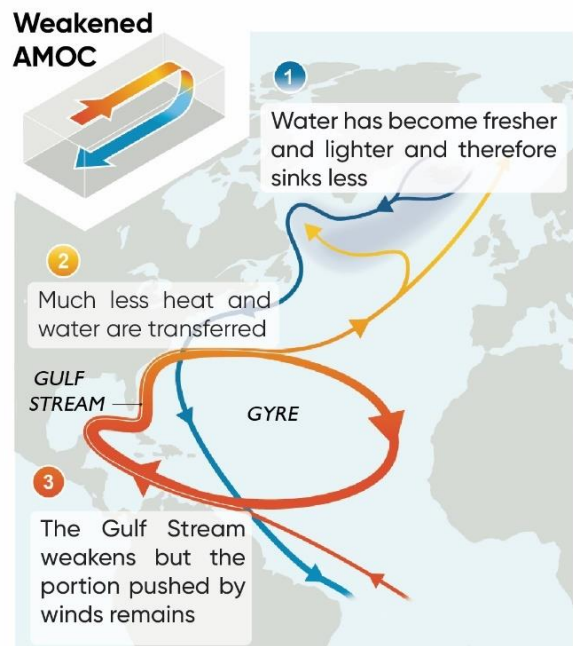
Today

The Gulf Stream is part of both the horizontal, subtropical gyre and the vertical, Atlantic Meridional Overturning Circulation (AMOC)



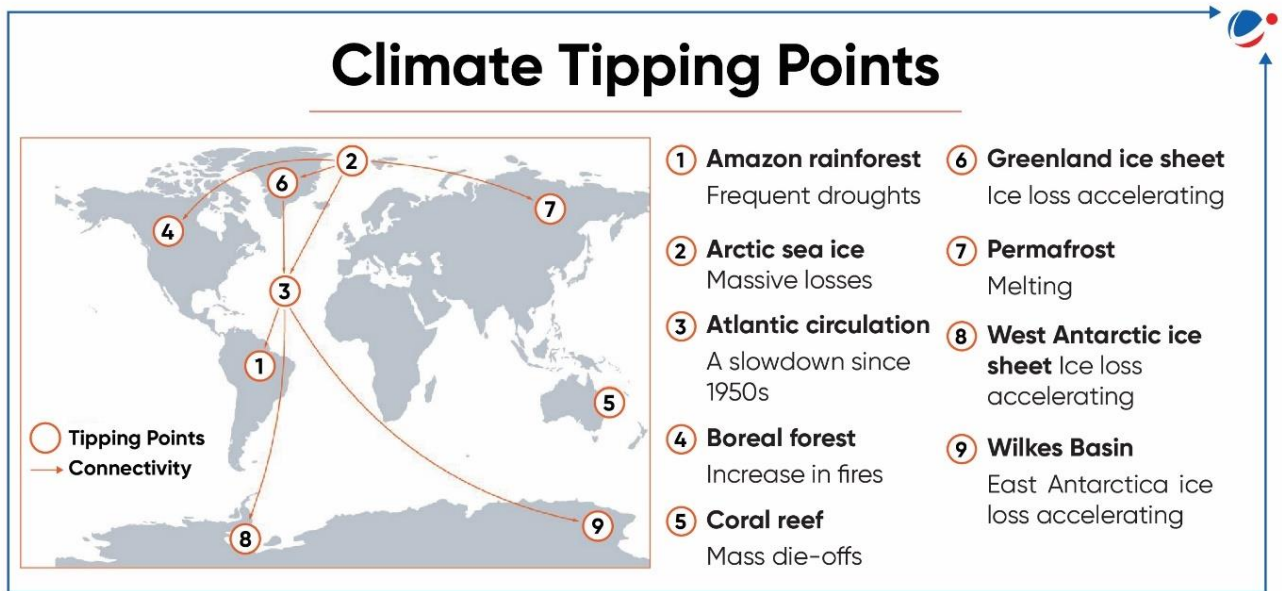
In a warmer world

Climate change weakens the AMOC, which slows the Gulf Stream down



Related concept: 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).



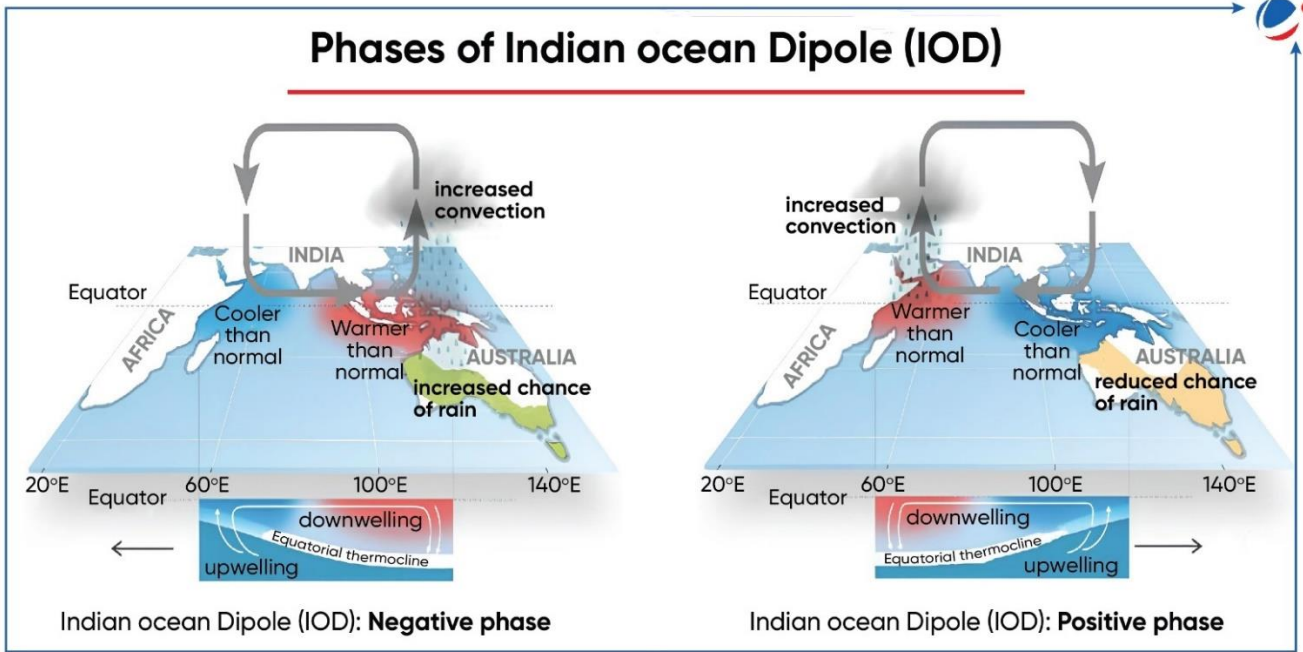
8.5.2. INDIAN OCEAN DIPOLE (IOD)

Why in the news?

Indian Ocean Dipole (IOD) turns positive.

About IOD (aka Indian Nino)

- Defined by the **difference in sea surface temperature** between eastern and western sides of Indian Ocean.
- **IOD has three phases:**
 - **Positive IOD:** Western side of Indian Ocean, near the Somalia coast, **becomes warmer** than the eastern Indian Ocean.
 - ✓ **Helps rainfall along Indian subcontinent and African coast** while **suppressing rainfall over Indonesia, Southeast Asia and Australia.**
 - **Negative IOD:** Cooler western part and warmer eastern part.
 - ✓ Results in **greater precipitation in Australia and drier conditions in East Africa.**
 - **Neutral IOD** when **temperatures are close to normal** across the Indian Ocean.
- IOD has a **link with El Nino Southern Oscillations (ENSO)** through an **extension of the Walker Circulation (air flow in equatorial Pacific)** to the west and associated warm water flow from Pacific to Indian Ocean.
- Positive IOD event is **often associated with El Nino** (abnormal warming of equatorial Pacific Ocean) while a **negative IOD is associated with La Nina** (abnormal cooling).
- Compared to ENSO events, the impacts of IODs are much weaker.





9. ENVIRONMENT PREVIOUS YEAR QUESTIONS 2013-2023 (SYLLABUS-WISE)

General Studies-I: Indian Heritage and Culture, History and Geography of the World and Society.

General Studies-III: Technology, Economic Development, Bio diversity, Environment, Security and Disaster Management

Climate Change

- The Intergovernmental Panel on Climate Change (IPCC) has predicted a global sea level rise of about one metre by AD 2100. What would be its impact in India and the other countries in the Indian Ocean region? **(GS-III 2023, 15 marks)**
- Discuss the consequences of climate change on the food security in tropical countries. **(GS-I 2023, 10 marks)**
- Discuss global warming and mention its effects on the global climate. Explain the control measures to bring down the level of greenhouse gases which cause global warming, in the light of the Kyoto Protocol, 1997. **(GS-III 2022, 15 Marks)**
- How do the melting of the Arctic ice and glaciers of the Antarctic differently affect the weather patterns and human activities on the Earth? Explain. **(GS-I 2021, 10 Marks)**
- Describe the major outcomes of the 26th session of the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC). What are the commitments made by India in this conference? **(GS-III 2021, 15 Marks)**
- Explain the purpose of the Green Grid Initiative launched at World Leaders Summit of the COP26 UN Climate Change Conference in Glasgow in November, 2021. When was this idea first floated in the International Solar Alliance (ISA)? **(GS-III 2021, 10 Marks)**
- Examine the status of forest resources of India and its resultant impact on climate change. **(GS-I 2020, 15 Marks)**
- Assess the impact of global warming on the coral life system with examples. **(GS-I 2019, 10 Marks)**
- How does the cryosphere affect global climate? **(GS-I 2017, 10 Marks)**
- 'Climate Change' is a global problem. How India will be affected by climate change? How Himalayan and coastal states of India will be affected by climate change? **(GS-III 2017, 15 Marks)**
- Bring out the relationship between the shrinking Himalayan glaciers and the symptoms of climate change in the Indian sub-continent. **(GS-I 2014, 10 Marks)**
- Should the pursuit of carbon credits and clean development mechanisms set up under UNFCCC be maintained even though there has been a massive slide in the value of a carbon credit? Discuss with respect to India's energy needs for economic growth. **(GS-III 2014 12.5, Marks)**

Air Pollution

- Discuss in detail the photochemical smog emphasizing its formation, effects and mitigation. Explain the 1999 Gothenburg Protocol. **(GS-III 2022, 10 Marks)**
- Describe the key points of the revised Global Air Quality Guidelines (AQGs) recently released by the World Health Organisation (WHO). How are these different from its last update in 2005? What changes in India's National Clean Air Programme are required to achieve these revised standards? **(GS-III 2021, 10 Marks)**
- What are the key features of the National Clean Air Programme (NCAP) initiated by the Government of India? **(GS-III 2020, 15 Marks)**
- Mumbai, Delhi and Kolkata are the three Mega cities of the country but the air pollution is much more serious problem in Delhi as compared to the other two. Why is this so? **(GS-I 2015, 12.5 Marks)**
- Environmental Impact Assessment studies are increasingly undertaken before a project is cleared by the Government. Discuss the environmental impacts of coal-fired thermal plants located at coal pitheads. **(GS-III 2014, 12.5 Marks)**



Water

- Comment on the National Wetland Conservation Programme initiated by the Government of India and name a few India's wetlands of international importance included in the Ramsar Sites. **(GS-III 2023, 15 marks)**
- What is oil pollution? What are its impacts on the marine ecosystem? In what way is oil pollution particularly harmful for a country like India? **(GS-III 2023, 10 marks)**
- Why is the world today confronted with a crisis of availability of and access to freshwater resources? **(GS-I 2023, 10 marks)**
- What are the environmental implications of the reclamation of the water bodies into urban land use? Explain with examples. **(GS-I 2021, 10 Marks)**
- How will the melting of Himalayan glaciers have a far-reaching impact on the water resources of India? **(GS-I 2020, 10 Marks)**
- What are the salient features of the Jal Shakti Abhiyan launched by the Government of India for water conservation and water security? **(GS-III 2020, 10 Marks)**
- Suggest measures to improve water storage and irrigation system to make its judicious use under depleting scenario. **(GS-III 2020, 15 Marks)**
- What is water stress? How and why does it differ regionally in India? **(GS-I 2019, 15 Marks)**
- Elaborate the impact of National Watershed Project in increasing agricultural production from water-stressed areas. **(GS-III 2019, 10 Marks)**
- What are the consequences of spreading of 'Dead Zones' on marine ecosystem? **(GS-I 2018, 10 Marks)**
- "The ideal solution of depleting ground water resources in India is water harvesting system." How can it be made effective in urban areas? **(GS-I 2018, 15 Marks)**
- Defining blue revolution, explain the problems and strategies for pisciculture development in India. **(GS-I 2018, 15 Marks)**
- In what way micro-watershed development projects help in water conservation in drought-prone and semi-arid regions of India? **(GS-I 2016, 12.5 Marks)**
- India is well endowed with fresh water resources. Critically examine why it still suffers from water scarcity. **(GS-I 2015, 12.5 Marks)**
- Discuss the Namami Gange and National Mission for Clean Ganga (NMCG) programmes and causes of mixed results from the previous schemes. What quantum leaps can help preserve the river Ganga better than incremental inputs? **(GS-III 2015, 12.5 Marks)**
- Enumerate the National Water Policy of India. Taking river Ganges as an example, discuss the strategies which may be adopted for river water pollution control and management. What are the legal provisions of management and handling of hazardous wastes in India? **(GS-III 2013, 10 Marks)**

Land Degradation

- The process of desertification does not have climatic boundaries. Justify with examples. **(GS-I 2020, 10 Marks)**

Sustainable Development

- The adoption of electric vehicles is rapidly growing worldwide. How do electric vehicles contribute to reducing carbon emissions and what are the key benefits they offer compared to traditional combustion engine vehicles? **(GS-III 2023, 15 marks)**
- What is Integrated Farming System? How is it helpful to small and marginal farmers in India? **(GS-III 2022, 15 Marks)**
- How and to what extent would micro-irrigation help in solving India's water crisis? **(GS-III 2021, 10 Marks)**
- How does the draft Environmental Impact Assessment (EIA) Notification, 2020 differ from the existing EIA Notification, 2006? **(GS-III 2020, 10 Marks)**
- Coastal sand mining, whether legal or illegal, poses one of the biggest threats to our environment. Analyse the impact of sand mining along the Indian coasts, citing specific examples. **(GS-III 2019, 10 Marks)**



- How far is Integrated Farming System (IFS) helpful in sustaining agricultural production? **(GS-III 2019, 10 Marks)**
- Define the concept of carrying capacity of an ecosystem as relevant to an environment. Explain how understanding this concept is vital while planning for sustainable development of a region. **(GS-III 2019, 15 Marks)**
- What are the impediments in disposing the huge quantities of discarded solid wastes which are continuously being generated? How do we remove safely the toxic wastes that have been accumulating in our habitable environment? **(GS-III 2018, 10 Marks)**
- Sikkim is the first 'Organic State' in India. What are the ecological and economical benefits of Organic State? **(GS-III 2018, 10 Marks)**
- "In spite of adverse environmental impact, coal mining is still inevitable for development." Discuss. **(GS-I 2017, 10 Marks)**
- Mention the advantages of the cultivation of pulses because of which the year 2016 was declared as the International Year of Pulses by the United Nations. **(GS-I 2017, 10 Marks)**
- In what way can floods be converted into a sustainable source of irrigation and all-weather inland navigation in India? **(GS-I 2017, 15 Marks)**
- The effective management of land and water resources will drastically reduce the human miseries. Explain. **(GS-I 2016, 12.5 Marks)**
- The states of Jammu and Kashmir, Himachal Pradesh and Uttarakhand are reaching the limits of ecological carrying capacity due to tourism. Critically evaluate. **(GS-I 2015, 12.5 Marks)**
- What are the consequences of illegal mining? Discuss the Ministry of Environment and Forest's concept of GO AND NO GO zones for coal mining sector. **(GS-III 2013, 10 Marks)**

Renewable energy and Alternative Energy Resources

- Discuss several ways in which microorganisms can help in meeting the current fuel shortage. **(GS-III 2023, 10 marks)**
- Examine the potential of wind energy in India and explain the reasons for their limited spatial spread. **(GS-I 2022, 10 Marks)**
- Do you think India will meet 50 percent of its energy needs from renewable energy by 2030? Justify your answer. How will the shift of subsidies from fossil fuels to renewables help achieve the above objective? Explain. **(GS-III 2022, 15 Marks)**
- India has immense potential of solar energy though there are regional variations in its development. Elaborate. **(GS-I 2020, 15 Marks)**
- Describe the benefits of deriving electric energy from sunlight in contrast to the conventional energy generation. What are the initiatives offered by our Government for this purpose? **(GS-III 2020, 15 Marks)**
- Give an account of the current status and the targets to be achieved pertaining to renewable energy sources in the country. Discuss in brief the importance of National Programme on Light Emitting Diodes (LEDs). **(GS-III 2016, 12.5 Marks)**
- It is said that India has substantial reserves of shale oil and gas, which can feed the needs of the country for quarter century. However, tapping of the resource does not appear to be high on the agenda. Discuss critically the availability and issues involved. **(GS-I 2013, 10 Marks)**
- With growing scarcity of fossil fuels, the atomic energy is gaining more and more significance in India. Discuss the availability of raw material required for the generation of atomic energy in India and in the world. **(GS-I 2013, 10 Marks)**

Conservation

- Identify and discuss the factors responsible for diversity of natural vegetation in India. Assess the significance of wildlife sanctuaries in rain forest regions of India. **(GS-I 2023, 15 marks)**
- Explain the causes and effects of coastal erosion in India. What are the available coastal management techniques for combating the hazard? **(GS-III 2022, 15 Marks)**



- Discuss the causes of depletion of mangroves and explain their importance in maintaining coastal ecology. **(GS-I 2019, 10 Marks)**
- How can the mountain ecosystem be restored from the negative impact of development initiatives and tourism? **(GS-I 2019, 15 Marks)**
- How is the government of India protecting traditional knowledge of medicine from patenting by pharmaceutical companies? **(GS-III 2019, 15 Marks)**
- What is wetland? Explain the Ramsar concept of 'wise use' in the context of wetland conservation. Cite two examples of Ramsar sites from India. **(GS-III 2018, 10 Marks)**
- How does biodiversity vary in India? How is the Biological Diversity Act, 2002 helpful in conservation of flora and fauna? **(GS-III 2018, 15 Marks)**
- Rehabilitation of human settlements is one of the important environmental impacts which always attracts controversy while planning major projects. Discuss the measures suggested for mitigation of this impact while proposing major developmental projects. **(GS-III 2016, 12.5 Marks)**
- Environmental Impact Assessment studies are increasingly undertaken before a project is cleared by the Government. Discuss the environmental impacts of coal-fired thermal plants located at coal pitheads. **(GS-III 2014, 12.5 Marks)**

Disaster Management

- Dam failures are always catastrophic, especially on the downstream side, resulting in a colossal loss of life and property. Analyze the various causes of dam failures. Give two examples of large dam failures. **(GS-III 2023, 10 marks)**
- Comment on the resource potentials of the long coastline of India and highlight the status of natural hazard preparedness in these areas. **(GS-I 2023, 15 marks)**
- Discuss the meaning of colour-coded weather warnings for cyclone prone areas given by India Meteorological department. **(GS-I 2022, 10 Marks)**
- Explain the mechanism and occurrence of cloudburst in the context of the Indian subcontinent. Discuss two recent examples. **(GS-III 2022, 10 Marks)**
- Discuss about the vulnerability of India to earthquake related hazards. Give examples including the salient features of major disasters caused by earthquakes in different parts of India during the last three decades. **(GS-III 2021, 10 Marks)**
- Describe the various causes and the effects of landslides. Mention the important components of the National Landslide Risk Management Strategy. **(GS-III 2021, 15 Marks)**
- Account for the huge flooding of million cities in India including the smart ones like Hyderabad and Pune. Suggest lasting remedial measures. **(GS-I 2020, 15 Marks)**
- Discuss the recent measures initiated in disaster management by the Government of India departing from the earlier reactive approach. **(GS-III 2020, 15 Marks)**
- Vulnerability is an essential element for defining disaster impacts and its threat to people. How and in what ways can vulnerability to disasters be characterized? Discuss different types of vulnerability with reference to disasters. **(GS-III 2019, 10 Marks)**
- Disaster preparedness is the first step in any disaster management process. Explain how hazard zonation mapping will help in disaster mitigation in the case of landslides. **(GS-III 2019, 15 Marks)**
- Describe various measures taken in India for Disaster Risk Reduction (DRR) before and after signing 'Sendai Framework for DRR (2015-2030)'. How is this framework different from 'Hyogo Framework for Action, 2005'? **(GS-III 2018, 15 Marks)**
- On December 2004, tsunami brought havoc on 14 countries including India. Discuss the factors responsible for occurrence of Tsunami and its effects on life and economy. In the light of guidelines of NDMA (2010) describe the mechanisms for preparedness to reduce the risk during such events. **(GS-III 2017, 15 Marks)**
- "The Himalayas are highly prone to landslides." Discuss the causes and suggest suitable measures of mitigation. **(GS-I 2016, 12.5 Marks)**
- Major cities of India are becoming vulnerable to flood conditions. Discuss. **(GS-I 2016, 12.5 Marks)**



- The frequency of urban floods due to high intensity rainfall is increasing over the years. Discussing the reasons for urban floods, highlight the mechanisms for preparedness to reduce the risk during such events. **(GS-III 2016, 12.5 Marks)**
- With reference to National Disaster Management Authority (NDMA) guidelines, discuss the measures to be adopted to mitigate the impact of recent incidents of cloudbursts in many places of Uttarakhand. **(GS-III 2016, 12.5 Marks)**
- The frequency of earthquakes appears to have increased in the Indian subcontinent. However, India's preparedness for mitigating their impact has significant gaps. Discuss various aspects. **(GS-III 2015, 12.5 Marks)**
- Drought has been recognized as a disaster in view of its spatial expanse, temporal duration, slow onset and lasting effects on vulnerable sections. With a focus on the September 2010 guidelines from the National Disaster Management Authority (NDMA), discuss the mechanisms for preparedness to deal with likely El Nino and La Nina fallouts in India. **(GS-III 2014, 12.5 Marks)**
- The recent cyclone on the east coast of India was called 'Phailin'. How are the tropical cyclones named across the world? Elaborate. **(GS-I 2013, 5 Marks)**
- How important are vulnerability and risk assessment for pre-disaster management? As an administrator, what are key areas that you would focus on in a Disaster Management System? **(GS-III 2013, 10 Marks)**

Miscellaneous/Geography

- How are the fjords formed? Why do they constitute some of the most picturesque area of the world? **(GS-I 2023, 10 marks)**
- What are the forces that influence ocean currents? Describe their role in fishing industry of the world. **(GS-I 2022, 15 Marks)**
- Describing the distribution of rubber producing countries, indicate the major environmental issues faced by them. **(GS-I 2022, 15 Marks)**
- Troposphere is a very significant atmospheric layer that determines weather processes. How? **(GS-I 2022, 15 Marks)**
- Differentiate the causes of landslides in the Himalayan region and Western Ghats. **(GS-I 2021, 10 Marks)**
- Mention the global occurrence of volcanic eruptions in 2021 and their impact on regional environment. **(GS-I 2021, 10 Marks)**
- Briefly mention the alignment of major mountain ranges of the world and explain their impact on local weather conditions, with examples. **(GS-I 2021, 15 Marks)**
- Discuss the geophysical characteristics of Circum-Pacific Zone. **(GS-I 2020, 10 Marks)**
- Account for the present location of iron and steel industries away from the source of raw material, by giving examples. **(GS-I 2020 10, Marks)**
- The interlinking of rivers can provide viable solutions to the multi-dimensional inter-related problems of droughts, floods and interrupted navigation. Critically examine. **(GS-I 2020, 15 Marks)**
- Discuss the factors for localisation of agro-based food processing industries of North-West India. **(GS-I 2019, 10 Marks)**
- How do ocean currents and water masses differ in their impacts on marine life and coastal environment? **(GS-I 2019, 15 Marks)**
- Why is India taking keen interest in resources of Arctic region? **(GS-I 2018, 10 Marks)**
- Define mantle plume and explain its role in plate tectonics. **(GS-I 2018, 10 Marks)**
- Account for variations in oceanic salinity and discuss its multi-dimensional effects. **(GS-I 2017, 15 Marks)**
- Petroleum refineries are not necessarily located nearer to crude oil producing areas, particularly in many of the developing countries. Explain its implications. **(GS-I 2017, 15 Marks)**
- What characteristics can be assigned to monsoon climate that succeeds in feeding more than 50 percent of the world population residing in Monsoon Asia? **(GS-I 2017, 15 Marks)**
- Not many years ago, river linking was a concept but it is becoming reality in the country. Discuss the advantages of river linking and its possible impact on the environment. **(GS-III 2017, 10 Marks)**

- One of the intended objectives of Union Budget 2017-18 is to ‘transform, energize and clean India’. Analyse the measures proposed in the Budget 2017-18 to achieve the objective. **(GS-III 2017, 15 Marks)**
- Discuss the concept of air mass and explain its role in macro-climatic changes. **(GS-I 2016, 12.5 Marks)**
- Explain the factors responsible for the origin of ocean currents. How do they influence regional climates, fishing and navigation? **(GS-I 2015, 12.5 Marks)**
- What are the economic significances of discovery of oil in Arctic Sea and its possible environmental consequences? **(GS-I 2015, 12.5 Marks)**
- How far do you agree that the behaviour of the Indian monsoon has been changing due to humanizing landscape? Discuss. **(GS-I 2015, 12.5 Marks)**
- Most of the unusual climatic happenings are explained as an outcome of the El-Nino effect. Do you agree? **(GS-I 2014, 10 Marks)**
- Why are the world’s fold mountain systems located along the margins of continents? Bring out the association between the global distribution of fold mountains and the earthquakes and volcanoes. **(GS-I 2014, 10 Marks)**
- Explain the formation of thousands of islands in Indonesian and Philippines archipelagos. **(GS-I 2014, 10 Marks)**
- Tropical cyclones are largely confined to South China Sea, Bay of Bengal and Gulf of Mexico. Why? **(GS-I 2014, 10 Marks)**
- Whereas the British planters had developed tea gardens all along the Shivaliks and Lesser Himalayas from Assam to Himachal Pradesh, in effect they did not succeed beyond the Darjeeling area. Explain. **(GS-I 2014, 10 Marks)**
- Why did the Green Revolution in India virtually by-pass the eastern region despite fertile soil and good availability of water? **(GS-I 2014, 10 Marks)**
- Account for the change in the spatial pattern of the Iron and Steel industry in the world. **(GS-I 2014, 10 Marks)**
- Critically evaluate the various resources of the oceans which can be harnessed to meet the resource crisis in the world. **(GS-I 2014, 10 Marks)**
- How does India see its place in the economic space of rising natural resources rich Africa? **(GS-I 2014, 10 Marks)**
- What do you understand by the theory of continental drift? Discuss the prominent evidences in its support. **(GS-I 2013, 5 Marks)**
- Bring out the causes for the formation of heat islands in the urban habitat of the world. **(GS-I 2013, 5 Marks)**
- What do you understand by the phenomenon of ‘temperature inversion’ in meteorology? How does it affect weather and the habitants of the place? **(GS-I 2013, 5 Marks)**
- Major hot deserts in northern hemisphere are located between 20-30 deg N latitudes and on the western sides of the continents. Why? **(GS-I 2013, 10 Marks)**
- Bring out the causes for more frequent occurrence of landslides in the Himalayas than in the Western Ghats. **(GS-I 2013, 5 Marks)**
- There is no formation of deltas by rivers on the Western Ghats. Why? **(GS-I 2013, 5 Marks)**
- Do you agree that there is a growing trend of opening new sugar mills in southern states of India? Discuss with justification. **(GS-I 2013, 5 Marks)**
- Analyze the factors for the highly decentralized cotton textile industry. **(GS-I 2013, 5 Marks)**



Scan the QR code to download the soft copy of syllabus-wise segregated PYQs from 2013-2023 (Environment).



10. APPENDIX

APPENDIX: KEY DATA AND FACTS

Climate Change




Key outcomes of CoP 28

- ▶ Mobilization of **\$83.9 billion** in climate finance.
- ▶ **Global Green Credit Initiative (GGCI)** by India.
- ▶ **Adoption of First Global Stocktake of the Paris Agreement**
- ▶ **Global Goal on Adaptation-UAE Framework** for Global Climate Resilience.
- ▶ **Officially operationalized the Loss and Damage Fund**




Loss and Damage (L&D) fund

- ▶ Fund 1st **announced during COP27 in Sharm el-Sheikh (Egypt) in 2022.**
- ▶ Based with World Bank
- ▶ India is a **strong supporter.**




India and Climate Action

- ▶ **Targets under NDCs submitted to UNFCCC:**
 - **Reduce Emissions Intensity of its GDP by 45%** by 2030, from 2005 level.
 - **Achieve about 50% cumulative electric power** installed capacity from non-fossil fuel-based energy resources by 2030.
- ▶ **Achievements/Progress:**
 - **Reduced the emission intensity vis-à-vis it's GDP by 33% between 2005 and 2019.** (India's National statement at UNFCC COP 28)
 - **Achieved 45.5% of installed electricity capacity from non-fossil fuel sources.** (June 2024, Ministry of Power)
- ▶ **Recent Initiatives:** Green Credit Program, Carbon Credit Trading Scheme.




Climate Equality

- ▶ Globally, richest **10% account for nearly half (48%) of emissions.** (Emission gap report 2023)
- ▶ **M.K. Ranjitsinh and Others v. Union of India and Others:** Recognized right to be free from adverse effects of climate change under Articles 14 and 21.



Impact of Climate Change on Vulnerable Sections

- ▶ **Children: 6.7 million Children displaced in India** alone (2016-2021) due to weather-related events. (UNICEF)
- ▶ **Women: Only 2% of gender-tagged international adaptation finance** is gender-responsive. (Adaptation Gap Report).
- ▶ **Elderly: Heat-related deaths** among those over 65 risen by 70% in 2 decades. (WHO)
- ▶ **Rural Poor: Poor households lose 5% of their total income due to heat stress** relative to better-off in an average year.



Impact of Climate Change on Health

- ▶ **Exposure to extreme weather events: 189 million people.**

MAINS 365 – ENVIRONMENT

Impact of Climate Change on Indian subcontinent

- ▶ **Rise in average temperature in India: 0.7°C** (1901–2018)
- ▶ **Increase in Frequency of daily precipitation extremes** (>150 mm per day): 75% (1950–2015)
- ▶ **Sea-level rise in North Indian Ocean:** 3.3 mm per year (1993–2017).

Emission trends

- ▶ **Global (Emission Gap Report 2023):**
 - **Increase in Global GHG emissions: 1.2 % from 2021 to 2022.**
 - **Global warming estimated to be limited to 3°C** if current policies continue.
- ▶ **India:**
 - **Only contributed 5% of warming to date** (Emission Gap Report–2023).
 - **2022 share in global CO2 emissions: 8%. (3rd highest globally).**
 - **Per capita carbon emissions:** Still very low at 2 tonnes per person per year in 2021 (Global average 4.7 tonnes).
- ▶ **Initiatives**
 - **Global:** Global Methane Pledge, Powering Past Coal Alliance, Just Energy Transition Partnerships (JETPs), Mission Innovation, etc.
 - **Indian:** Panchamrit Target declared in COP 26 (Net-Zero emissions by 2070), National Action Plan on Climate Change (NAPCC), etc.

Greenwashing







- ▶ **Making a product or policy seem more environmentally friendly** or less damaging than it is in reality.
- ▶ **Types:** Greenhushing, Greenrinsing, Greenlabeling, Greenlighting etc.
- ▶ **Example:** In 2015, Volkswagen used **software to manipulate emission tests in its Clean Diesel cars.**
- ▶ **Initiatives in India:** Standard for eco-labelling of products and services by BIS; Consumer Protection Act, 2019; SEBI's BRSR norms.

Climate Finance

- ▶ **Current Needs**
- ▶ **Global: At least USD 4–6 trillion per year** for global transformation to a low-carbon economy. (Emission Gap Report 2022)
- ▶ **India:**
 - Up to **6–8 trillion USD** during 2015–2030 to implement the actions required to transform the current energy systems.
 - **~USD 10 trillion to achieve net-zero by 2070.**


Sector Specific Decarbonisation in India

- ▶ **Transport Sector**
 - **14% share** in energy-related CO2 emissions.
 - **3rd** most greenhouse-gas-emitting sector in India.
 - **Initiatives:** Bharat Stage VI Emission Standards; Ethanol Blending in Petrol to reach 20% by 2025; FAME; National Green Hydrogen Mission.
- ▶ **Agrifood systems**
 - Contributes to **18 % GHG emissions in India's (2019)**
 - **India among top 3 emitters** of agrifood emission.


	<ul style="list-style-type: none"> - Initiatives: National Mission for Sustainable Agriculture (NMSA); Gobardhan scheme etc. ▶ Shipping Industry <ul style="list-style-type: none"> - Accounts for nearly 3% of global GHG emissions. (UNCTAD's Review of Maritime Transport 2023 report) - Initiatives: IMO's Energy Efficiency Existing Ship Index (EEXI); The MARPOL Treaty; Hong Kong International Convention; Harit Nauka Initiative
 <p>Short Lived Pollutants (SLPs)</p>	<ul style="list-style-type: none"> ▶ Substances: Black Carbon, Methane, Tropospheric Ozone, Hydrofluorocarbons, etc. ▶ Impact: 2nd largest contributor to human-caused climate warming after CO₂, contributing up to 45% of global warming. ▶ Initiative: Climate and Clean Air Coalition's (CCAC), only global alliance to reduce SLPs.
 <p>Climate Engineering</p>	<ul style="list-style-type: none"> ▶ Methods: Carbon Dioxide Removal (CDR) and Solar Radiation Modification (SRM). ▶ Initiatives: Climate modelling research program in geoengineering at IISc; Major Research and Development Program (MRDP) by DST.
 <p>Climate Change and Cryosphere</p>	<ul style="list-style-type: none"> ▶ Significance: <ul style="list-style-type: none"> - Estimated 30% of world's undiscovered conventional natural gas resources. - 80% of the world's fresh is in the form of glaciers, ice sheets, etc. ▶ Impact of climate change: <ul style="list-style-type: none"> - In case by 2°C rise, Himalayas expected to lose 50 % of today's ice. - Arctic heating up more than 2 times as fast as rest of world. ▶ Initiatives: Himalayan Monitoring Assessment Programmed (HIMAP); National Mission for Sustaining Himalayan Ecosystem.
 <p>Ozone hole</p>	<ul style="list-style-type: none"> ▶ Ozone holes grew larger and thinner over Antarctica. (2020-22) ▶ Initiatives: Vienna Convention; Montreal Protocol; Kigali Amendment; India cooling Action Plan (ICAP); Ozone cell in MoEFCC. ▶ India's achievements (Montreal Protocol): Exceeded 35% HCFC (Hydrochlorofluorocarbons) phase-out goal and eliminated HCFC 141b. (UNDP).
 <p>Carbon Farming</p>	<ul style="list-style-type: none"> ▶ Potential: Agricultural soils can absorb 3-8 billion tonnes of CO₂-equivalent every year.
 <p>Carbon Border Adjustment Mechanism (EU)</p>	<ul style="list-style-type: none"> ▶ Fair price on the carbon emitted during the production of carbon-intensive goods entering EU. ▶ Impact on India: In 2022, India's 27% exports of iron, steel, and aluminium products went to EU.


Air Pollution


 Urban Air Pollution in India	<ul style="list-style-type: none"> ▶ Air pollution in India (2023 World Air Quality report, IQAir) <ul style="list-style-type: none"> - Ranked 3rd globally in air pollution - Annual average PM2.5 concentrations: 54.4 µg/m³ (>10 times of WHO recommended annual guideline level of 5 µg/m³) - 9 out of 10 World's most polluted cities in India (Begusarai, Guwahati, Delhi in Top 3)
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 National Clean Air Programme	<ul style="list-style-type: none"> ▶ Target: Achieve reductions up to 40% of PM10 and PM2.5 concentrations by 2025-26, base year 2017. ▶ Progress made by NCAP in last 5 years <ul style="list-style-type: none"> - 27 out of 49 cities showed improvement in PM 2.5. - 24 out of 46 cities showed improvement in PM 10.
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Water and Land Degradation


 Water (Prevention and control of Pollution) Act, 1974	<ul style="list-style-type: none"> ▶ Key Amendments <ul style="list-style-type: none"> - Central government to prescribe manner of nomination, terms and conditions of service of Chairperson, State Pollution Control Board. - Decriminalises several violations, and instead imposes penalties. - Adjudicating officers to determine penalties, appointed by Centre. - Penalties collected in Environment Protection Fund under EPA, 1986.
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 Water for Prosperity and Peace	<ul style="list-style-type: none"> ▶ Around 80% of jobs are water-dependent. ▶ Society's Peace and Social Stability increases with decrease in inequalities in allocation of water resources and access to water supply and sanitation.
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 Extreme Water Stress	<ul style="list-style-type: none"> ▶ Current Situation <ul style="list-style-type: none"> - 25 countries, including India, faces extremely high-water stress. [World Resources Institute (WRI)] ▶ Impacts (WRI Data) <ul style="list-style-type: none"> - 31% of global GDP will be exposed to high water stress by 2050. - 60% of world's irrigated agriculture faces extremely high-water stress.
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 Urban Water Crisis in India	<ul style="list-style-type: none"> ▶ By 2030 India's water demand would double due to rapid urbanization (UN Report). ▶ India has 18% of world's population, but only 4% of world's water resources.
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 Ground Water in India	<ul style="list-style-type: none"> ▶ India is world's largest user of groundwater (uses 25% of all groundwater extracted every year globally) ▶ Indo-Gangetic basin in India has already passed the groundwater depletion tipping point. (Interconnected Disaster Risks Report 2023) ▶ Initiatives: National Aquifer Mapping & Management Programme (NAQUIM); Jal Kranti Abhiyan; Atal Bhujal Yojana (2020)
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 Namami Gange	<p>► Challenge:</p> <ul style="list-style-type: none"> - Only 232 projects (out of 409 projects) made operational (till Dec. 2022). - Installed waste treatment plants capable of treating only 20% of estimated sewage in 5 major States along the river <p>► Achievement: Out of 1072 Grossly Polluting Industries (GPIs) 885 brought under CPCB's Online Continuous Effluent Monitoring Stations (OCEMS).</p>
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 Water Trading for reuse for treated waste water	<p>► Only about 40% of urban wastewater is treated in India.</p> <p>► India is a large virtual net export of water</p>
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 Outcomes COP 5 Minamata Convention	<p>► Limit of 15 mg/kg concentration of mercury set as threshold for wastes contaminated with mercury.</p>
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 Land Degradation	<p>► Current Situation</p> <ul style="list-style-type: none"> - India: Degraded land: ~29.7 per cent. (ISRO Atlas, 2021) - World: 50% of plane's topsoil lost via erosion over last 150 years. (WWF report) <p>► Targets</p> <ul style="list-style-type: none"> - Global: Voluntary commitments to restore degraded land reached one billion hectares by 2030 (Land Degradation Neutrality Target Setting Programme) - India: Restore 26 million hectares by 2030 (LDN target)
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Sustainable Development







 Progress in Sustainable Development Goals	<p>► Challenges</p> <ul style="list-style-type: none"> - Asia Pacific would not achieve all 17 SDGs before 2062. (SDG Progress Report, 2024) - Regional variation: More than 20 points variation in scores between Andhra Pradesh and Punjab. (SDG India Index, 2023-24) <p>► Best Practices</p> <ul style="list-style-type: none"> - MYAC (One Million Youth Actions Challenge) by One UN Climate Change Learning Partnership; - ENACT partnership (launched in CoP27) to environmental issues through Nature-based Solutions (Nbs).
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 Localisation of SDGs	<p>► Examples of Best Practices</p> <ul style="list-style-type: none"> - Bihar: Viksit Bihar ke 7 Nischay - Bhopal: India's first city-level Voluntary Local Review (VLR) of SDG
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 <p>Sustainable Tourism</p>	<ul style="list-style-type: none"> ▶ Tourism sector's Share in World's Carbon Emissions: 8% ▶ Over- Tourism in Indian Himalayan Region: 100 million tourists every year ▶ Initiatives: National Strategy for Sustainable Tourism (NSST), 2022; Global Sustainable Tourism Council (GSTC)
 <p>Sustainable Finance</p>	<ul style="list-style-type: none"> ▶ Global need of USD 3 trillion over next decade to finance green growth (NITI Ayog report) ▶ Initiatives: Addis Ababa Action Agenda (SDG Summit 2023 by UNGA in 2030); Sovereign Green Bonds.
 <p>Mission LIFE</p>	<ul style="list-style-type: none"> ▶ Launched by India at UNFCCC COP26 in 2021. ▶ Targets: <ul style="list-style-type: none"> - Atleast one billion Indians and other global citizens to take individual and collective action for environmental preservation in 2022 to 2027. - Atleast 80% of all villages and urban local bodies to become environment-friendly by 2028.
 <p>Circular Economy</p>	<ul style="list-style-type: none"> ▶ Current Situation: Only 7.2 % of the global economy is circular with a declining trend (Circularity Gap report 2023) ▶ Initiatives: National Resource Efficiency Policy (NREP), 2019, Extended Producer Responsibility (EPR); Swachh Bharat Mission, etc.
 <p>Coastal Aquaculture Authority (Amendment) Act, 2023</p>	<ul style="list-style-type: none"> ▶ Broaden the definition of "coastal aquaculture". ▶ Registration granted under the Act to prevail as valid permission under CRZ Notification. ▶ Permitting certain aquaculture activities in CRZ areas like hatcheries. ▶ Prevent use of antibiotics.
 <p>Organic Farming</p>	<ul style="list-style-type: none"> ▶ India has world's highest number of organic farmers (Economic Survey 2022-23) ▶ Sikkim became the world's 1st 100% organic state. ▶ Initiatives: FSSAI Jaivik Bharat logo; PM PRANAM; Pramparagat Krishi Vikas Yojana etc.
 <p>Climate Resilient Farming</p>	<ul style="list-style-type: none"> ▶ Impact of Climate change on Agriculture: Projected decline in yields of rainfed rice, wheat by 2050 and shift in crop zones like of Apple. ▶ Agriculture sector emissions in India: 14% ▶ Major share of GHG emissions: Enteric fermentation (54.6%), rice cultivation (17.5%), and fertilizer in agricultural soils (19.1%), etc.
 <p>Agroforestry</p>	<ul style="list-style-type: none"> ▶ Extent in India: 8.65% of total geographical area. (NITI Aayog GROW report) ▶ Initiatives: Sub-Mission on Agroforestry (Har Medh par Ped) Scheme launched in 2016-17; National Agroforestry Policy, 2014 etc.


<p>Plastic Waste Management in India</p>	<p>▶ Plastic waste in India</p> <ul style="list-style-type: none"> - Per capita plastic waste generation doubled over the last 5 years. (CPCB's annual report in 2020-21) - Ranked 3rd globally in generation of single-use plastic (SUP) waste (Plastic Waste Makers Index 2019)
<p>Plastic Waste Management (Amendment) Rules, 2024</p>	<p>▶ Key amendments</p> <ul style="list-style-type: none"> - Local body mandated to undertake an annual assessment of plastic waste generated. - Centralised Portal for Registration. - Expansion of scope of EPR to Producers, Importers and Brand Owners who introduce any plastic packaging.
<p>E-waste management in India</p>	<ul style="list-style-type: none"> ▶ Status: 16.01 lakh tonnes total e-waste generated (2021-22) ▶ Global rank: 3rd largest e-waste generator (Global E-Waste Monitor 2024 report) ▶ Challenge: Only ~33% of total e-waste generated, collected and processed.
<p>Sewage Management in India</p>	<ul style="list-style-type: none"> ▶ Estimated sewage generation from Class I cities and Class II towns: > 33,000 Million Litres per Day (MLD) ▶ Challenges: Only 23 % of treatment capacity meets the consented parameters of SPCBs.
<p>Green Buildings</p>	<ul style="list-style-type: none"> ▶ Consume 25% less energy than traditional buildings ▶ Initiatives: Energy Conservation Building Code (ECBC) (2007 revised in 2017); Eco-Niwas Samhita 2018 by Ministry of Power; GRIHA by TERI.
<p>Examples Environmental Movements in India</p>	<ul style="list-style-type: none"> ▶ Chipko movement (1973), Uttarakhand ▶ Silent Valley Movement (1973), Kerala ▶ Appiko movement (1983), Karnataka
<p>Renewable Energy and Alternative Energy Resources</p>	
<p>Renewable Energy in India</p>	<ul style="list-style-type: none"> ▶ Targets <ul style="list-style-type: none"> - Achieve 50% cumulative electric power installed by 2030 from renewables. (INDC) - Non-fossil fuel energy capacity of 500 GW by 2030. (Panchamrita) ▶ Progress: Installed Capacity (Power Ministry, June 2024)- <ul style="list-style-type: none"> - Renewable energy source (Incl. Hydro): 195 GW (43.7% in total) - Non-Fossil Fuel: 203 GW (45.5% in total)


 <p>Solar Energy in India</p>	<ul style="list-style-type: none"> ▶ Installed solar energy capacity: 85 GW (Power Ministry, June 2024) ▶ Potential: 748 Giga Watt peak (National Institute of Solar Energy). ▶ Global rank in Solar Power capacity: 5th ▶ Initiatives: Grid Connected Solar Rooftop Programme; Solar Park Scheme; PM Surya Ghar Muft Bijli Yojana; International Solar Alliance (ISA) etc.
 <p>International Solar Alliance</p>	<ul style="list-style-type: none"> ▶ Aim <ul style="list-style-type: none"> - Mobilise USD 1,000 billion of investments in solar energy solutions - by 2030. - Delivering energy access to 1,000 million people. ▶ Installation of 1,000 GW of solar energy capacity.
 <p>Hydrogen Energy in India</p>	<ul style="list-style-type: none"> ▶ Targets: Green hydrogen production capacity of at least 5 MMT (Million Metric Tonne) per annum. (National Green Hydrogen Mission) ▶ Steps taken: National Green Hydrogen Mission; Hydrogen-based Fuel-Cell Electric Vehicle (FCEV) buses in Leh.
 <p>Tidal Energy</p>	<ul style="list-style-type: none"> ▶ Estimated potential of tidal and wave energy in India: 12455 MW and 41300 MW, respectively
 <p>Biofuels</p>	<ul style="list-style-type: none"> ▶ Potential: 28 GW through Surplus biomass availability in India. ▶ Current Installed capacity of Biomass cogeneration: 10 GW (Power Ministry, June 2024) ▶ Initiatives: Sustainable Alternative Towards Affordable Transportation (SATAT), National Bioenergy Programme, GOBAR-Dhan Scheme etc.
 <p>Energy Transition in India</p>	<ul style="list-style-type: none"> ▶ Achievements: Installed RE Capacity increased from 76.37 GW in 2014 to 195 GW (including hydro) in (June 2024)
 <p>Electric Vehicles</p>	<ul style="list-style-type: none"> ▶ Benefits over conventional vehicles: Zero tailpipe emissions; High-energy conversion rates of electric motors boast, exceeding 90%. ▶ Initiatives: FAME India Scheme; GST on EVs has been reduced from 12% to 5% etc.

Conservation Efforts	
 <p>Forest Conservation in India</p>	<ul style="list-style-type: none"> ▶ Targets: <ul style="list-style-type: none"> - INDC: To create an additional carbon sink of 2.5 to 3 billion tonnes of CO₂ 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 in India: 24.62% of total geographic area (increased of 0.28% from 2019) (India State of Forest Report 2021) ▶ Loss: India lost 3.3% of tree cover due to deforestation from 2001 to 2022. (Global Forest Watch) ▶ Initiatives: Forest Conservation (Amendment) Act, 2023; Nagar Van Yojana; Green India Mission etc.
 <p>Wildlife Conservation in India</p>	<ul style="list-style-type: none"> ▶ Constitutional framework: Article 48A under DPSP; Article 51(g) under Fundamental Duties; Under Concurrent List (7th Schedule). ▶ Legislative Measures: Wild Life (Protection) Act, 1972, Forest Conservation Act, 1980 ▶ Initiatives: Species Recovery Programme; Project Tiger; Project Cheetah; etc.
 <p>Coral Bleaching</p>	<ul style="list-style-type: none"> ▶ 2023-2024 had the fourth global mass coral bleaching event. (US National Oceanic and Atmospheric Administration) ▶ Bleaching in India: Live coral in Gulf of Mannar Decreased from cover 37% to 27.3%. (2005- 2021) ▶ Initiatives: Biorock technology; Coastal Zone Regulation Notifications; International Coral Reef Initiative (ICRI); etc.
 <p>Project Tiger</p>	<ul style="list-style-type: none"> ▶ Achievements <ul style="list-style-type: none"> - Increase in Number of tigers: 3,682, from 2967 in 2018. (Status of Tigers, co-predators and Prey in India-2022 report) - Increase in Number of tiger reserves: 55 in 2024, from 9 in 1973 ▶ 23 CAITS accredited tiger reserves in India
 <p>Human Wildlife Conflict</p>	<ul style="list-style-type: none"> ▶ Key Fact: 1,510 deaths recorded in the country due to animal attacks in 2022 (Accidental Deaths & Suicides in India 2022) ▶ Initiatives: Advisory for management of man-animal conflict; Species specific guidelines; National wildlife Action Plan (2017-2035)
 <p>Wetland conservation</p>	<ul style="list-style-type: none"> ▶ Extent in India: 7 lakh wetlands covering 4.86% of total geographic area ▶ Loss: 2 out of 5 wetlands lost in India in last 3 decades. (Wetlands International) ▶ Initiatives in India: Wetland (Conservation and Management) Rules 2017; Centre for Wetland Conservation and Management (CWCM); Party to Ramsar Convention; 12 Blue Flag Beaches in India etc.

 Mangroves Conservation	<ul style="list-style-type: none"> ▶ Total Mangrove Cover in India: 4,992 sq Km (ISFR, 2021) ▶ Threat of extinction: 50% of the mangrove ecosystems examined classified as vulnerable, endangered, or critically endangered (IUCN Red List of Mangroves Ecosystems) ▶ Initiatives: MISHTI (Mangrove Initiative for Shoreline Habitats & Tangible Incomes); Sustainable Aquaculture In Mangrove Ecosystem (SAIME) etc.
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Disaster Management


 Infrastructure Resilience	<ul style="list-style-type: none"> ▶ Potential impact of climate change: Global average annual loss (AAL) in infrastructure sectors of about 14 % of GDP. ▶ Initiatives: Nature-based Infrastructure Solutions; Global Infrastructure Risk Model and Resilience Index (GIRI).
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 Heatwaves	<ul style="list-style-type: none"> ▶ Vulnerability: 4% of districts and 7% of population are highly vulnerable. ▶ Impact: Over 10,000 people lost their lives due to heatwaves between 2000-2020 (IMD). ▶ Initiatives: Color code impact-based heat wave warning; Heat Action Plans (IMD).
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 Earthquake	<ul style="list-style-type: none"> ▶ Vulnerability: 59% of Indian landmass classified as earthquake-prone ▶ Examples: Morocco, Taiwan, Afghanistan ▶ Initiatives: Earthquake Risk Assessment and Mapping; Earthquake Early Warning System (EWS)
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 Glacial Lakes Outburst Floods	<ul style="list-style-type: none"> ▶ Vulnerability: >9 million people in High Mountain Asia (HMA) are vulnerable. ▶ Examples: Kedarnath (2013), Chamoli (2021) and Sikkim (2023)
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 Landslides	<ul style="list-style-type: none"> ▶ Vulnerability: 13.17% of India's geographical area ▶ Examples: Joshimath, Silkyara-Barkot tunnel, Uttarakhand ▶ Initiatives: National Landslide Susceptibility Mapping (NLSM) Programme; Landslide Atlas of India by National Remote Sensing Centre of ISRO.
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 Crowd Disaster Management	<ul style="list-style-type: none"> ▶ Examples: Collapse of a platform at Delhi's Kalkaji Temple (2024); Morbi Bridge Collapse (2022); Seoul crowd tragedy (2022) ▶ Initiatives: Police Act of 1861; Disaster Management Act, 2005; NIDM's Crowd Management Strategies and arrangement.
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 <p>Fire Safety</p>	<ul style="list-style-type: none"> ▶ Fire accidents: 7,435 people killed in over 7,500 fire accidents in India in 2022. (NCRB) ▶ Recent Examples: Gaming zone in Rajkot (Gujarat); Firecracker factory in Harda (Madhya Pradesh) and a private hospital in Delhi ▶ Existing Regulation: Fire service is a State subject; National Building Code; Model Building Bye Laws 2016 etc.
 <p>Forest Fires</p>	<ul style="list-style-type: none"> ▶ Vulnerability: 22% area falls under highly and extremely fire prone category. ▶ Examples: Uttarakhand (2024); Australian bushfire (2019). ▶ Initiatives: New National Forest Policy (1988); National Action Plan on Forest Fire (NAPFF)
 <p>Industrial Safety</p>	<ul style="list-style-type: none"> ▶ Example: Chennai ammonia gas leak (2024); Chasnala Mining Disaster (1975); Bhopal Gas Tragedy (1984) ▶ Initiatives in India: Civil Liability for Nuclear Damage Act 2010, OSH Code, 2020, PLIA, 1991, National Policy on Safety, Health and Environment at Workplace.
 <p>Oil Spills</p>	<ul style="list-style-type: none"> ▶ Examples: Ennore Oil Spill, Tamil Nadu; Nagapattinam Oil Spill, Tamil Nadu ▶ Initiatives: National: National Oil Spill Disaster Contingency Plan (1996), Merchant Shipping Act, 1958 ▶ International: International Convention on Civil Liability for Bunker Oil Pollution Damage (2001), International Convention for the Prevention of Pollution from Ships or MARPOL (India is a signatory)
 <p>Dam Safety</p>	<ul style="list-style-type: none"> ▶ Vulnerability: <ul style="list-style-type: none"> - India is the 3rd largest dam owing nation after USA and China. ▶ 80% of dams in India are over 25 years old. ▶ Examples of dam failure: Banqiao dam China; Machchhu Dam, Gujarat; Derna dam, Libya; Chungthang Dam, Sikkim. ▶ Initiatives in India: National Register of Large Dams (NRLD). DRIP, DHARMA, Dam Safety Act, 2021
 <p>Environmental cost of War</p>	<ul style="list-style-type: none"> ▶ Measures <ul style="list-style-type: none"> - Geneva Convention imposes restrictions on warfare methods damaging environment. - Stockholm Conference (1972): Prohibits the use of all weapons of mass destruction. - Rome Statutes – Article 12 establishes responsibility of states - UN Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (ENMOD)

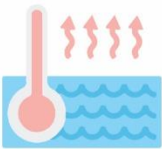
Geography



India Meteorological Department (IMD)

► Achievements

- **39 Doppler Weather Radars (DWRs)** in India to monitor severe weather events (**till 2023**).
- **Appreciation from the United Nations** for early warning services
- **Significant improvement in forecast accuracy** of severe weather events by **40-50% (last 5 years)**.



El-Nino - Monsoon Link

► El Niño Southern Oscillation (ENSO) & Indian monsoon:

- El Niño suppresses monsoon rainfall.
- La Niña enhances monsoon rainfall.

► El Nino impact on Monsoon

- Causes **weakening of walker circulation**
- **Weakening of the pressure gradient** between Indian Ocean and Pacific Ocean
- Shift in **Jet Stream influences the movement of weather systems**.

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WEEKLY FOCUS- ENVIRONMENT

S. No.	Topic	Lean More
1.	Climate Change and its impact on Indian Region	
2.	Climate Change Negotiations	
3.	Transitioning to a Sustainable Ecosystem Energy	
4.	Conserving the Forests: Save Today, Survive Tomorrow	
5.	Sustainable Development Goals: The Pathway to the Future	
6.	Nature-positive Cities: Rejuvenating Cities relationship with nature	

S. No.	Topic	Lean More
7.	Sustainable Agriculture Part I_ 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	
11.	Financing Global Energy Transition	
12.	Climate Change Negotiations (CCNs): From Rio (1992) to Dubai (2023)	

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- Performance Improvement:** Receive personalised recommendations identifying focus areas for further improvement, based on performance analysis.
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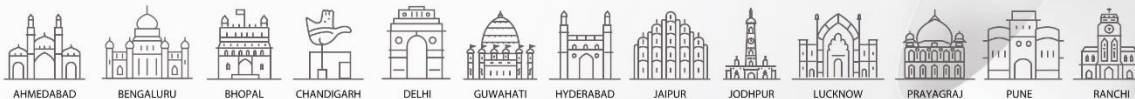
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1
AIR

Aditya Srivastava

79

in TOP 100 Selections in CSE 2023

from various programs of Vision IAS



2
AIR

**Animesh
Pradhan**



5
AIR

Ruhani



6
AIR

**Srishti
Dabas**



7
AIR

**Anmol
Rathore**



9
AIR

Nausheen



10
AIR

**Aishwaryam
Prajapati**

39
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in TOP 50

in CSE 2022



1
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**Ishita
Kishore**



2
AIR

**Garima
Lohia**



3
AIR

**Uma
Harathi N**

1
AIR



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