VISIONIAS
INSPIRING INNOVATION

ENVIRONMENT

Classroom Study Material 2022

(September 2021 to June 2022)

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ENVIRONMENT

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Previous Year Question

A reference sheet of syllabus-wise segregated previous year questions from 2014-2021 (for the Environment Section) has been provided. In conjunction with the document, it will help in understanding the demand of the exam and developing a thought process for writing good answers.

A NOTE FOR THE STUDENTS

Dear Students,

- Precision of content in good answer is no longer a dispensable luxury, but a simple necessity. And the preparation to write a precise answer starts well before one picks up a pen and starts to formulate the answer. A good understanding of the topic asked along-with a ready set of data and examples assists one in approaching the most difficult of the questions.
- This is further assisted by a good presentation style, which depicts the information in an easy-to-understand manner.

In this context, we made few changes to the Mains 365 documents last year, which included

Topic at glance:
which gave a comprehensive view of the topic, connecting the current and static aspects along-with providing necessary data and facts.

Infographics:
Designed in a manner that they can be readily used in the answers

Previous years questions:
A QR code linked syllabus wise segregated list of previous years questions was added.

Along-with these, this year we have made few more additions to help you revise the topics and approach answers in a precise manner, these include:

Data banks:
have been designed and added in the articles to help you identify and revise the important datasets of the topics.

Appendix:
An appendix of key data and facts has been added at the end of the document to facilitate quick revision.

Weekly focus document list:
A QR code linked list of relevant Weekly focus documents has been added in the end of the document to ensure easiness in approaching these topics.

We hope that these additions will help you not only developing a comprehensive understanding of the topics but also provide the necessary inputs to write effective and well-presented answers.

Knowing is not enough: we must apply. Willing is not enough: we must do.

-Johann Wolfgang von Goethe

All the best!
Team VisionIAS

1. CLIMATE CHANGE

1.1. INDIA AND CLIMATE ACTION

INDIA AND CLIMATE CHANGE AT A GLANCE

IMPACT OF CLIMATE CHANGE ON INDIA

- **0.7 degree rise** in average temperature (1901-2018).
- **1 degree rise in sea surface temperature (SST) of tropical Indian ocean** (1951-2015).
- **15% decline in glaciers in the Hindu Kush Himalayan Region (HKH)** since 1970s.
- **6% decline in summer monsoon** rainfall (1951 - 2015).
- **75% increase in frequency of localized heavy rain** events (1950-2015).
- **1.3% increase in area affected by drought** per decade (1951-2016).

INDIA'S TARGETS

INDC TARGETS UNDER PARIS AGREEMENT	PANCHAMRITA ANNOUNCED AT COP 26-GLASGOW
• **30-35% reduction in emission intensity from 2005 levels.** • **40% all electricity** to be generated by **non-fossil fuel energy by 2023.** • **Create additional carbon sink of 2.5-3 billion ton** of CO_2 equivalent by 2030 through tree & forest cover.	• 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 till 2030.**

ACHIEVEMENTS /PROGRESS

- Achieved **emission reduction of 28% over 2005 levels.**
- Achieved **40% of installed electricity capacity from non-fossil fuel sources.**
- Non fossil energy capacity stood at **166.7 GW** in May 2022.
- **Total forest and tree cover makes up 24.62%** of the total geographical area of India.

SCHEMES/POLICIES/INITIATIVES

- **National Action Plan on Climate Change (NAPCC), National Adaptation Fund on Climate Change and Climate Change Action Program (CCAP).**
- **National Wind Solar hybrid policy, National Biofuel Policy, National Offshore Wind Energy** Policy, Green Hydrogen/ Green Ammonia Policy etc.
- **Solar rooftop programme, ultra-mega solar parks, Perform Achieve and Trade (PAT) scheme,** Carbon tax, Ujjwala, UJALA, FAME India scheme, etc.
- **International:** International Solar Alliances (ISA) and Coalition for Disaster Resilient Infrastructure (CDRI).

CONSTRAINTS

- **Coal dependency** for energy production.
- **Delayed timeline for Net zero** (IPCC recommends net zero by 2050).
- Limited focus on **increasing consumption** of renewable installed capacity.
- **Absence of sectoral commitments.**
- **Financial constraints** (climate finance of $1 trillion needed by developed countries).
- **Issues in implementation of the climate missions:** like inter-ministerial coordination; lack of technical expertise and project clearance delays etc.

WAY FORWARD

- **Ensuring adequate support from developed countries** in the form of finance, technology and capacity building.
- **Need of net negative emission commitments from developed nations** to vacate the carbon space in 2050 for developing countries.
- **Phasing out coal by retiring the inefficient coal plants** and not building new ones.
- Developing a strategy for **net zero goals.**
- **Focusing on energy intensive sectors** for emission reduction.

1.2. CLIMATE CHANGE AND AGREEMENTS

CLIMATE CHANGE NEGOTIATIONS AT A GLANCE

EMERGENCE OF CLIMATE CHANGE AS AN INTERGOVERNMENTAL POLITICAL ISSUE

- **1972:** Environmental issues reach the global stage at the **first international environmental summit took place in Stockholm, Sweden,** but not specifically climate change.
- **Late 1970s:** Concerns regarding Climate change raised globally by the **World Meteorological Organization (WMO).**
- **1972-1988:** 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.**
- **1988: Establishment of IPCC** to investigate and report on scientific evidence on climate change and possible international responses.
- **1992:** First global agreement on climate change – **UNFCCC, opened for signature** at the Earth Summit in Rio de Janeiro.
- **2005: Kyoto Protocol** enters into force.
- **2015:** A successor agreement to the Kyoto Protocol, the **'Paris Agreement'** is adopted.

ONGOING DEBATES AND ISSUES (POST COP26 IN GLASGOW)

- **NDCs for 2030 remain totally inadequate** to fulfil the 1.5° pathway.
- **Climate Finance issues:** Inadequate contributions, **inordinate delays and difficulties** for developing nations in accessing funds, **shortage of Grants-based finance, global climate finances skewed towards mitigation activities** etc.
- **Fairness and equity issues:**
  - ★ Dilution of the principle of common but differentiated responsibilities.
  - ★ **Absence of dedicated funding mechanism for loss and damage.**
  - ★ **Action against fossil fuels may compromise developing countries' developmental needs etc.**
- **Carrying over of Carbon credits of Kyoto Protocol can disincentivize newer and stronger projects.**
- **Lack of focus on sectoral specific targets for emission reduction.**

WAY FORWARD

- **Countries need to scale up their ambitions by 2022,** accompanied by **strong and binding national legislations.**
- **Far-reaching transformations** across high emitting sectors required.
- **Immediate scale-up of technological carbon removal and climate finance.**
- **Establishment of dedicated Glasgow Loss and Damage Facility,** which can build up on the efforts of 2013 **Warsaw International Mechanism.**
- **Well-executed stocktake** to evaluate whether nations are fulfilling their commitments and guide decision-making on new emissions-reduction targets.
- **Countries can voluntarily avoid using credits from projects accredited under the Kyoto** regime.

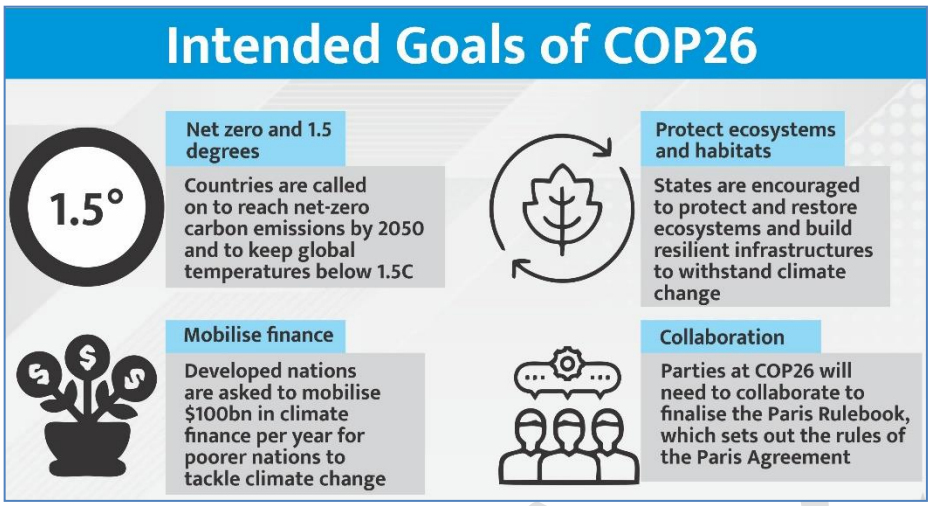
INDIA AND INTERNATIONAL CLIMATE CHANGE NEGOTIATIONS

- **Interests:** Early and ambitious global climate action with enough 'policy space' and 'carbon space' for domestic development.
- **Position:**
  - ★ Continued support to international negotiations and awareness about its responsibilities.
  - ★ Belief in foundational **principles of equity, and common but differentiated responsibilities and respective capabilities (CBDR/RC).**
- **Demands**
  - ★ Developed countries should **acknowledge IPCC's suggestions on the global carbon budget and equity** and undertake rapid reductions in emissions.
  - ★ $1 trillion in climate finance from developed countries.
- **Role in Shaping Climate Change Negotiations: India leads as a role model, represents interests of developing nations** and provides alternate channels to fight Climate Change.
- **Initiatives launched:** Climate Equity Monitor, Initiative for the Resilient Island States (IRIS) etc.
- **Current status:** India is **yet to submit updated 2030 NDC targets** to the UNFCCC and its current climate targets and policies as "Highly insufficient," with Paris Agreement's 1.5°C temperature limit.

1.2.1. UNFCCC COP 26

Why in News?

The 26th Conference of the Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC) in Glasgow, hosted by the UK, recently concluded.



More on the news

- The Conference also included the 16th session of the **Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP 16),** and the third session of the **Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA 3).**
- The conference ended with all 197 parties to the UNFCCC agreeing to **Glasgow Climate Pact (GCP)**, the global agreement which will accelerate action on climate this decade and completes the Paris Rulebook.
    - The pact aims to **limit global warming to 1.5 degree Celsius by 2030,** as agreed under the 2015 Paris Agreement and **cut Global greenhouse gas emissions by 45 per cent by 2030 and to zero overall by 2050.**

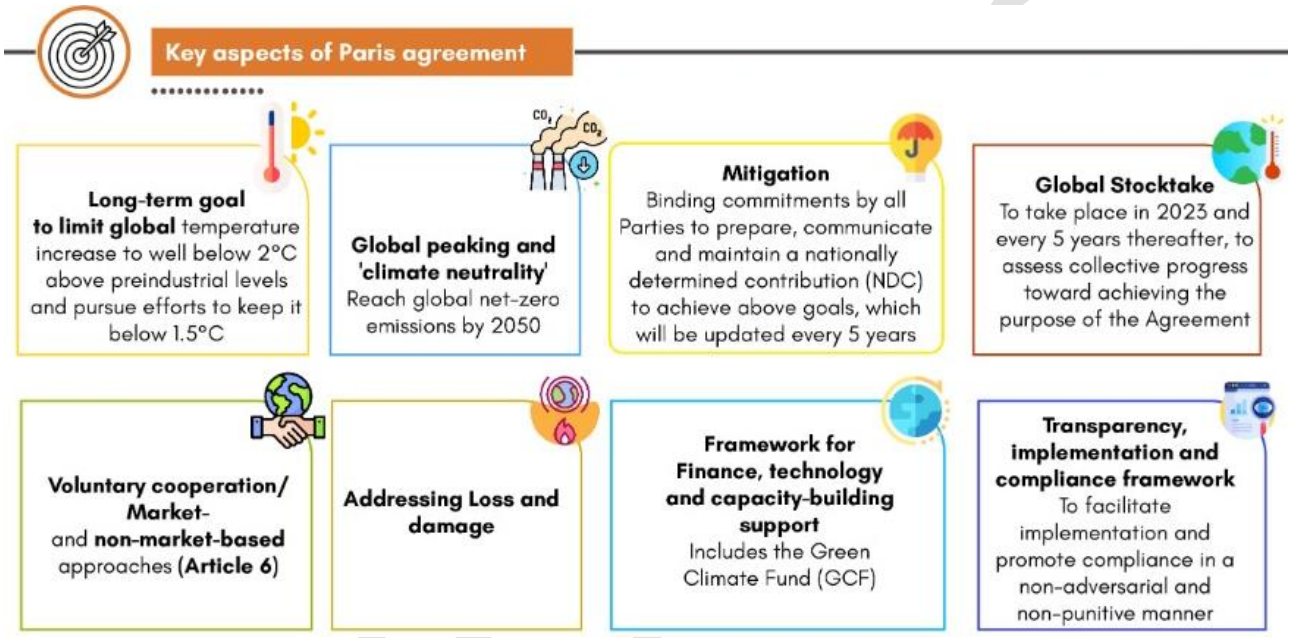
Key Outcomes of the COP26

Areas of discussion	Important Decisions and Developments
Ambition	• By the end, 153 countries submitted **new NDCs (nationally determined contributions)** to slash their emissions by 2030. • Countries requested to revisit and **strengthen their climate pledges by the end of 2022.**
Target action against fossil fuels	• **First-ever COP decision to explicitly target action against fossil fuels**, calling for a **"phasedown of unabated coal"** and **"phase-out" of inefficient fossil-fuel subsidies.**
Adaptation	• Countries have been urged to **at least double their collective provision of climate finance for adaptation from 2019 levels by 2025.** • **$352 million were pledged for the UN's Adaptation Fund,** the highest single mobilisation to the fund. ○ The fund has the advantage of being focused exclusively on adaptation projects and also being **100% grant-based.** • **Sharm el-Sheikh Work Programme on the Global Goal on Adaptation** to reduce vulnerability, strengthen resilience and increase the capacity of people and the planet to adapt to the impacts of climate change.

International Carbon Markets under Article 6	• **Article 6,** which covers Market- and non-market-based mechanisms of the Paris Agreement, **was finalized.** Key decisions regarding the Article include-
	  ○ **Carbon credits generated under the Kyoto Protocol since 2013** (amounting to ~ 320m tonnes of CO_2 equivalent), **will be carried over** into the Paris mechanism but must be used by 2030.
	  ○ **5% of proceeds** under traditional market mechanisms (Article 6.4), **must mandatorily go toward funding adaptation.**
	  ○ Contributing funds toward adaptation under bilateral trading of credits between countries (Article 6.2) is voluntary.
	  ○ **Avoidance of double counting,** in which more than one country could claim the same emissions reductions as counting toward their own climate commitments.
	  ○ **Exclusion of the use of credits generated** historically, between 2015 and 2021, from reduced deforestation and forest degradation, **under the UN scheme known as REDD+.**

Loss and damage	• **Glasgow Dialogue** created on funding for loss and damage. • **Developed countries pledged to support the Santiago network,** a website set up by the UNFCCC, with links to organisations such as development banks that could support loss and damage.

Rules on transparency of climate action and support	• All countries agreed to submit information about their emissions and financial, technological and capacity-building support using a common and standardized set of formats and tables.
Common Time Frames	• Countries were encouraged to use common timeframes for their national climate commitments. ○ This means that new NDCs that countries put forward in 2025 should have an end-date of 2035, in 2030 they will put forward commitments with a 2040 end-date, and so on.
Voluntary Pledges, Declarations and Agendas	• India became a signatory of **Breakthrough Agenda** (for affordable and accessible clean technologies and sustainable solutions in emitting sectors) and **Declaration on "accelerating the transition to 100% zero-emission cars and vans"**. • **Other**- Global Methane Pledge, Glasgow Leaders' Declaration on Forests and Land Use, Sustainable Agriculture Policy Action Agenda Beyond Oil and Gas Alliance (BOGA) Forest, agriculture and commodity trade (FACT) statement etc.



Related Concept: Market- and non-market-based mechanisms under Article 6

- It contains three separate mechanisms for "voluntary cooperation" towards climate goals.
- Two of the mechanisms are based on markets-
  - **Article 6.2** governs bilateral cooperation via **"internationally traded mitigation outcomes" (ITMOs).**
  - **Article 6.4** will create a new international carbon market for the trade of emissions cuts known as the **"Sustainable Development Mechanism" (SDM).**
- **Article 6.8**, based on "non-market approach", offers a formal framework for climate cooperation between countries, **where no trade is involved**, such as development aid.

1.2.2. 50 YEARS OF STOCKHOLM CONFERENCE

Why in news?

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

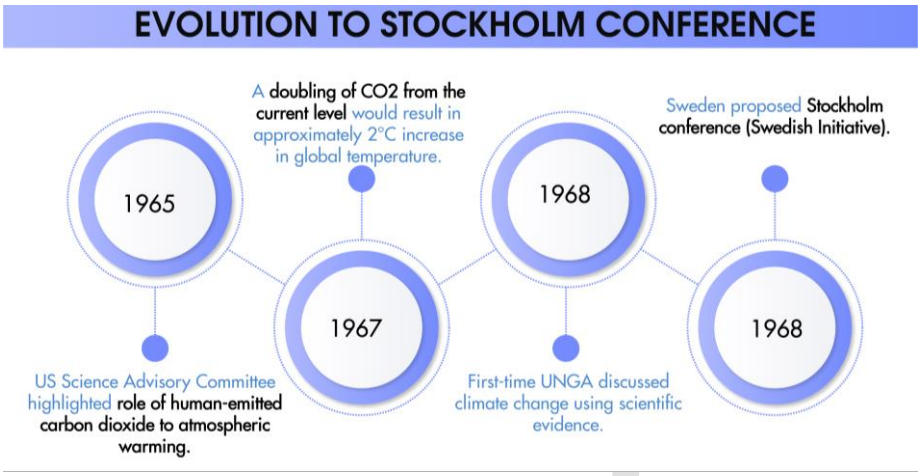
More about news

- **Stockholm+50 theme**: A healthy planet for the prosperity of all — our responsibility, our opportunity.
- **Stockholm+50 agenda:**
  - To share experiences and initiatives to protect the planet.
  - Sustainable recovery from the COVID -19 pandemic.

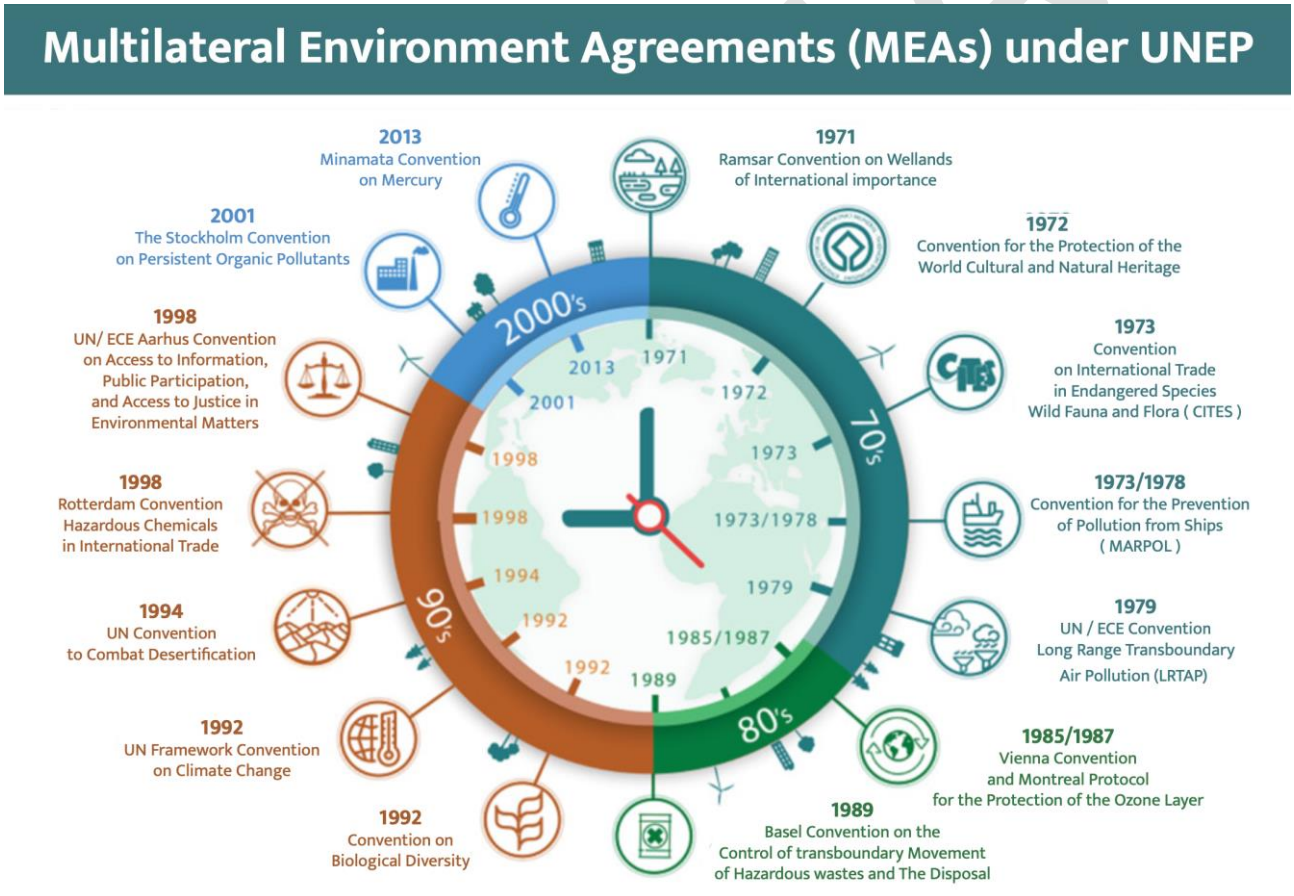
About Stockholm conference

- It was the **UN's first major conference on international environmental issues,** and marked a turning point in the development of international environmental politics.

- It was **organized in 1972** to coordinate global efforts to promote sustainability and safeguard the natural environment with the **theme 'Only One Earth'.**
  - **122 countries adopted the Stockholm Declaration** on to **26 principles and an action plan.**



- **The three dimensions of this conference were:**
  - **Countries agreeing not to harm each other's environment** or the areas beyond national jurisdiction;
  - Action plan to **study the threat to Earth's environment;** and
  - **Establishment of an international body called the UN Environment Programme (UNEP)** to bring in cooperation among countries.



Outcome & success of Stockholm Conference

- **Establishment of UNEP**: UNEP is the global authority that sets the **environmental agenda, promotes the coherent implementation of the environmental dimension of sustainable development** within UN system, and serves as an authoritative advocate for the global environment.
- **Beginning of the contemporary "environmental era":** It made multilateral governance of planetary concerns mainstream which led to **more than 500 multilateral environmental agreements being adopted in the last 50 years.**
  - Most of the conventions related to planetary crises **like the United Nations Framework Convention on Climate Change (UNFCCC), the Convention to Combat Desertification (UNCCD), and the Convention on Biological Diversity (CBD) etc. have their origin in the Stockholm Declaration.**

- **Identification of a theme of sustainable development,** that has been at the center of international environmental discourse.
  - 20 years later, the **1992 UN Conference on Environment and Development – the Earth Summit – in Rio de Janeiro** provided an answer by embracing sustainable development – development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Stockholm 50+ Recommendations for actionable agenda
- **Placing human well-being at the center** of a healthy planet and prosperity for all.
- **Recognizing and implementing the right to a clean,** healthy and sustainable environment.
- **Adopting system wide changes** in our current economic system.
- **Accelerate transformations** of high impact sectors.
- **Help developing countries** tackle environmental challenges by providing access and support for digital and technological solutions.

- **Establishing Key Principles**
  - **Precautionary principle:** The Vienna Convention for **the Protection of the Ozone Layer** was the first multilateral environmental agreement that codified precautionary measures in 1985.
  - **Polluter-pays principle (PPP):** It mandates that those producing pollution should bear the costs of managing it to prevent damage to human health and the environment.
- **Multi stakeholder approach**: It opened the door to **broader participation in sustainable development arena, by welcoming non-governmental organizations (NGOs)**, Indigenous Peoples, the scientific community, and the private sector and established the Environmental Forum.
- **Start of Environmental diplomacy** and **establishment of national environmental ministries**:Until 1972, no country had an environmental ministry. In India, Ministry of environment and forest was set up in 1985.

1.3. CLIMATE EQUITY

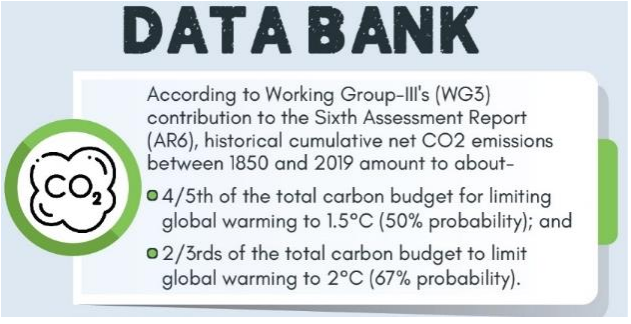
Why in news?

India made an intervention during the closing plenary of the Bonn Climate Conference stating that equity is being overlooked in climate negotiations.

What is carbon budget?
- The carbon budget is the **maximum amount of cumulative net global anthropogenic CO_2 emissions** that would result in limiting global warming to a given level with a given likelihood.
- The carbon budget is important because **stock of greenhouse gases in the atmosphere has a long life.**
  - For instance, India contributes 6 per cent to the annual global emissions but is only responsible for 3 per cent of the stock.
  - While the developed countries are responsible for historically exhausting around 70 per cent of the stock.

About the Bonn Climate Change Conference

- The Bonn Climate Change Conference has been **the first opportunity for all Parties to the UNFCCC to meet since the** adoption of the Glasgow Climate Pact at COP26 last year (2021).
  - In Glasgow, governments agreed a package of decisions that pave the way for full implementation of the Paris Agreement.
- The UN **Climate Change Conference COP27 will take place in Sharm el-Sheikh, Egypt**, in November 2022.
- **Major outcomes of the conference:**
  - **First technical dialogue of the Global Stocktake**, designed to review collective progress towards achieving the Paris Agreement's goal to limit global warming to 1.5 degrees Celsius.
    - ✓ But the **talks ended without the Glasgow Dialogue being added to the formal negotiating agenda**.
  - **Draft of a "global goal on adaptation" (GGA),** which aims to reduce vulnerability, strengthen resilience and increase the capacity of people and the planet to adapt to the impacts of climate change, was discussed.
  - **Negotiations around the Adaptation Fund and to get international carbon markets up and running** under Article 6 of the Paris Agreement.
  - **Additional work streams included those focusing on the gender action plan,** the Carolivia joint work on agriculture and Action for Climate Empowerment, which focuses on public involvement in climate action.



What is Climate Equity?

- Climate equity **ensures the just distribution of the benefits of climate protection efforts** and alleviates unequal burdens created by climate change.
- It ensures that **the climate goals are achieved in a sustainable manner**, without unjust burden or fallouts on certain sections.
- The principle of equity has been interpreted synonymously with the principle of **common but differentiated responsibilities and respective capabilities (CBDR/RC)** which acknowledges the different capabilities and differing responsibilities of individual countries in addressing climate change.
    - According to the principle, **higher responsibility of climate action,** including contribution in climate finance, emission reduction targets etc., is to be **placed upon developed countries since they have been historically responsible for large share of GHG emissions,** exhausting the carbon budget.
    - Also, **developmental and economic benefits of past emissions, have made developed nations more capable** to undertake this responsibility and further aid climate mitigation and adaptation efforts across the globe.

About Loss and Damage (L&D)

- It refers to **impacts of climate change that cannot be adapted to, and where losses are permanent**.
- It covers both **slow-onset processes like sea-level and temperature rise,** and extreme events such as floods, hurricanes and tropical cyclones.
- **Financing for L&D is seen as climate reparations**, paid by historical emitters, in accordance with the 'polluter pays' principle.
- Loss and damage impacts **are felt disproportionately by small island nations** who have had negligible emissions with estimated costs of L&D by 2030 ranging from $290-580 billion.

- Further, the **concept of climate equity also applies to individual level**, where climate change is expected to disproportionally affect vulnerable and marginalised communities who are least responsible for climate change emissions.

What is the significance of addressing climate equity in Climate Change negotiations?

India has **stressed that countries should acknowledge Intergovernmental Panel on Climate Change (IPCC)'s suggestions** on the global carbon budget and equity, given its importance in-

- **Social and economic transformation required for climate mitigation.**
- **Enabling just transition towards low-emissions development** through transfer of technology and finances, concentrated in developed nations.
- **Ensuring sustainable development** in Developing countries.
- **Facilitating international co-operation on climate change**, especially with respect to funding of Loss and damage.
- **Other benefits:**
    - **Ensures accountability & responsibilit**y for those benefiting from the root causes that drive climate change.
    - **Manages the negative consequences of climate mitigation on vulnerable populations**.

Does Paris climate agreement ensure climate equity?

Several enabling decisions were taken during COP 26 in Glasgow for ensuring climate equity, including establishment Glasgow Dialogue on funding for loss and damage, Global goal on adaptation, institutionalising the functions of the Santiago Network on loss and damage, etc.

But the negotiations saw several setbacks as well:

- **Undermining historic responsibility**: All countries have been requested to revisit and strengthen their climate pledges by the end of 2022 with no differentiation and no concrete targets.
- **Targeted action against fossil fuels**, will **disproportionately impact developing countries** in their efforts to provide accessible and affordable energy to their citizens.
- **Absence of financial mechanism for addressing loss and damage:** Discussion have been restricted to technical assistance and insurance based interventions and does not address liability and compensation from developed nations.
- **Allowing Carbon credits generated under the Kyoto Protocol to be carried over into the Paris mechanism** would make limiting global warming to 1.5°C more difficult leading to higher impacts on vulnerable nations.

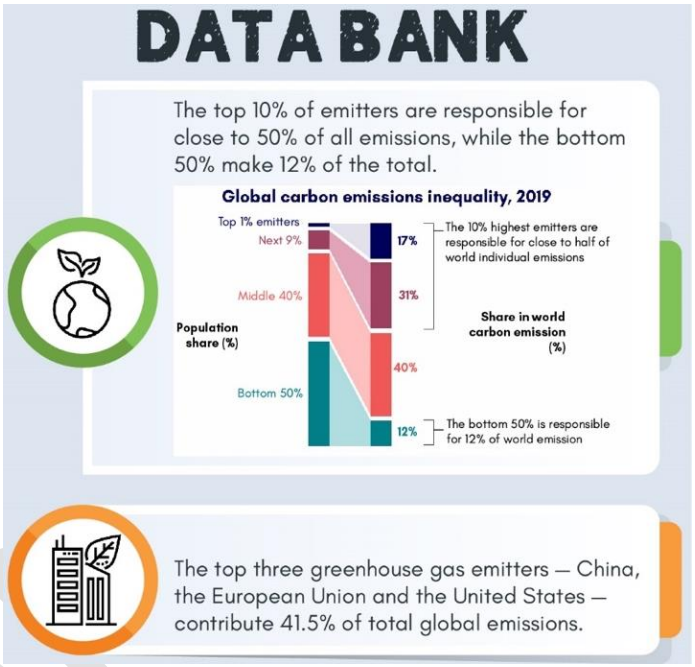
Way Forward

- **Establishment of a Glasgow Loss and Damage Facility** as a grant-based financial mechanism in addition to other funds to respond to current climate damage can help vulnerable nations.
- **Developed countries should enhance their emission reduction targets** to give developing countries' tier fair share in the carbon budget.
- **Creating mechanisms for technological and financial transfers** to aid countries in transitioning towards low emission pathways.
- **Enhancing accessibility of adaptation fund for vulnerable communities.**

1.3.1. CARBON INEQUALITY

Why in news?

A study has found that **Wealthy people have disproportionately large carbon footprints** and the percentage of the world's emissions they are responsible for is growing.



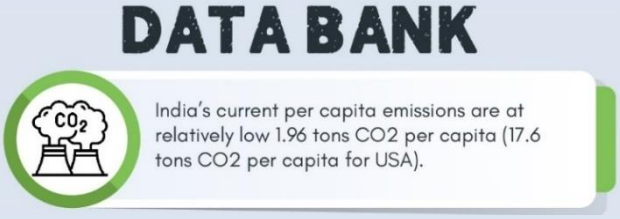
About Carbon inequality

- It refers to the phenomena of the **highly unequal distribution of carbon emissions throughout the world.**
- Types of inequalities:
  - **Carbon Inequality Between Nations:** A small number of developed countries are responsible for substantially higher share of the CO_2 emitted globally.
  - **Carbon Inequality within Nations:** Carbon emissions of higher income groups are significantly higher.
- **Significance of addressing Climate Inequality:**
  - Accounts for historical responsibilities; standard climate measures lead to social and economic inequity.
  - Designing effective and targeted climate policies are unjust in unequal societies.
  - Making productive use of public investment etc.
- **Ways to address carbon inequality**
  - **Proper tracking of individual emissions** within countries.
  - **Policy instruments targeting investments** in polluting and fossil activities.
  - **Scaling up public investments in low-carbon energy** production infrastructures, transport and energy efficiency etc.

Case Study: Examples of climate policies that effectively address inequality across the world.

- **Canada:** A tax was implemented along with a significant package of transfers to low- and middle-income households, which ensured the social viability of the reform.
- **Indonesia:** Energy subsidies reforms were coupled with substantial investments in the public health system, largely financed by increased revenues from energy taxes.

Related Information
Right to burn Fossil Fuels



- The Like-Minded Developing Countries — a group of developing countries which have a similar stand in the United Nations climate negotiations — has demanded that Developed countries must ensure net-zero emissions by 2030 **to provide carbon space to the developing countries to burn fossil fuels like coal for their growth.**
- **Reasons for demand of 'Right to burn Fossil Fuels': Low historical and current share** of developing countries (including India) in global emissions; Carbon space needed for **fulfilment of developmental imperatives** like eradication of poverty, accessible an affordable energy for all, etc.; **Developed countries have technological and financial capacity** to fulfil early targets etc.

- **Arguments against giving such right : Urgent need to mitigate** ongoing climate impacts; **Coal is no longer reliable** or cost-effective source for energy security; **Expected rise in future emissions** of Developing countries; **Doesn't address climate injustice within nations**; Investment in sectors such as renewable energy, electric mobility etc. can address the issues of employment, technology, energy poverty etc.
- **Way Forward**
  - **Focus on providing adequate resources**, both financial and technology transfer, to facilitate the developing countries to transition to a low carbon growth pathway.
  - **South-South collaborations** can help developing countries like India to advance technologically and financially towards a greener economy.

1.4. CLIMATE CHANGE IMPACTS

IMPACT OF CLIMATE CHANGE AT A GLANCE

Climate and Environment

Global warming

- Human-caused global surface temperature increase from 1850-1900 to 2010-2019 **is estimated to be 1.07°C,** with larger increases over land than over the ocean.

Cryosphere

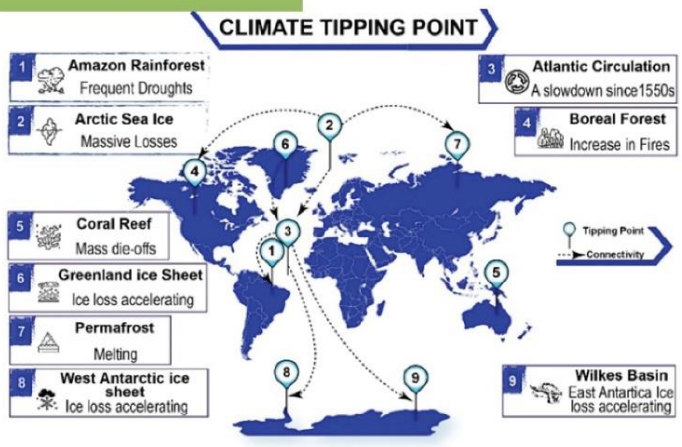
- **Arctic Sea ice area has decreased about 10%** (in March) to **40%** (in September) in between 1979-1988 and 2010-2019.
- Global retreat of glacier since the 1950s is unprecedented in the last 2000 years.

Oceans

- Global **mean sea level increased by 0.20 m between 1901 and 2018.**

Threat of Irreversible changes: Nine tipping points

- Tipping points are thresholds **where a tiny change could push a system into a completely new state.**
- **Globally, there are nine "tipping points"** where a changing climate could push parts of the Earth system into abrupt or irreversible change.



Impact on Biodiversity

- **Increases in disease and mass mortality events** of plants and animals.
- **Poleward shift of species.**
- Climate-caused local population **extinctions.**

Impact on Humans

- **Reduced food and water security.**
- **Adverse impact on physical and mental health.** E.g., heat related illness, water-borne and vector-borne diseases etc.
- **Economic loss** due to destruction from extreme events and impact on climate exposed on sectors like agriculture, forestry, tourism etc., outdoor labour productivity, agricultural productivity, etc.
- **Increase in Humanitarian crises** like displacement, etc.

1.4.1. IMPACT OF CLIMATE CHANGE ON VULNERABLE SECTIONS

1.4.1.1. WOMEN

IMPACTS AT A GLANCE: WOMEN

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

DISPROPORTIONATE IMPACTS OF CLIMATE CHANGE

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

ROLE IN CLIMATE ACTION

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

WAY FORWARD

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

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

1.4.1.2. CHILDREN

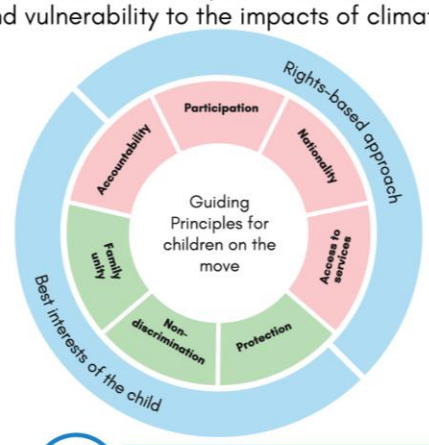
IMPACTS AT A GLANCE: CHILDREN

CURRENT SITUATION

- Estimated 1 in 7 children globally **(330 million children)** are exposed to at least 5 **major climate and environmental hazards, shocks and stresses.**
- **In 2020, nearly 10 million children were displaced** due to weather-related events.
- **Around 1 billion children living in 33 countries classified as at high risk** of the impacts of climate change.
- **India** is among four South Asian countries **where children are at extremely high risk of the impacts of the climate crisis.**

INTERNATIONAL INITIATIVES

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



DISPROPORTIONATE IMPACTS OF CLIMATE CHANGE

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

WAY FORWARD

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

1.4.1.3. INDIGENOUS PEOPLE

IMPACTS AT A GLANCE: INDIGENOUS PEOPLE

IMPACT OF CLIMATE CHANGE

- **Climate related displacement** with direct impacts on mental health, social capital, food security, water supply etc.
- **Climate change related damage to land, water, and life negatively affecting traditional knowledge.**
- **Increased vulnerability to impacts from climate change due to systemic discrimination.**
- **Issues related to climate action and policies:**
  - **Lack of additional financial resources and the transfer of technological capacity for adaptation.**
  - **Undesirable direct and indirect impacts of climate Mitigation measures may have consequences** for indigenous communities.
  - **Lack of dedicated research.**

WAY FORWARD

- **Integrating adaptation and mitigation efforts with other strategies crucial for indigenous communities** such as disaster preparation, land-use planning, environmental conservation etc.
- **Promoting participation of Indigenous peoples in decision-making spaces.**
- **A rights-based approach in conservation** to ensure full recognition land and resource rights.
- **Expand funding and create capacity building mechanisms for adaptation** among indigenous communities.

1.4.1.4. REFUGEES AND MIGRANTS

IMPACTS AT A GLANCE: REFUGEES/MIGRANTS

Climate crisis could **displace 1.2 billion people by 2050.** (Institute for Economics and Peace)

International Conventions on Environmental Migrants

- **Nansen Initiative Protection Agenda for Cross-Border Displaced Persons (2015)**
- **New York Declaration for Refugees and Migrants, UNHCR (2016)**

Climate change impacts driving migration

- **Slow inset impacts** like water scarcity, lower crop productivity, sea level rise and storm surge etc.
- **Certain regions becoming less liveable** due to heat stress, extreme events, land loss etc.

Constraints in dealing with climate refugee issue

- **Lack of recognition in international conventions** like the 1951 Refugee Convention.
- **Climate migration is mainly internal.**
- **Harder to identify the victims of slower onset impacts of climate change.**
- **Isolating environment/climatic reasons is difficult and may lead to the exclusion of categories of migrants who need protection.**
- **Growing xenophobic tendencies across the globe.**

Way Forward

- **Integrate climate migration developmental and climate planning.**
- **Developing a conceptual framework** on how to identify and support climate refugees.
- **Invest in understanding the drivers of climate migration** through evidence-based research, models & consultations etc.
- **Encourage the full use of all already existing humanitarian bodies of laws and instruments.**

1.4.1.5. SMALL ISLAND DEVELOPING STATES

IMPACTS AT A GLANCE: SMALL ISLAND DEVELOPING STATES (SIDS)

SIDS are a **distinct group of 39 developing island countries** classified by the UN.

Geographically SIDS are mostly located in the **Caribbean, the Pacific, and the Atlantic, Indian Ocean and South China Sea.**

Current Situation

- SIDS combined account for **around 1% of global CO2 emissions.**
- SIDS **received less than 5% of the total climate finance** in 2019.

Initiatives for SIDS

- Specific challenges of SIDS to Climate Change were **first recognised in the Rio Declaration,** issued by the 1992 UN Conference on Environment and Development.
- **Infrastructure for Resilient Island States (IRIS) launched by India, along with Australia, UK and SIDS.**
- 'Small Island Developing States Accelerated Modalities of Action' – **SAMOA Pathway.**
- **Alliance of Small Island States (AOSIS) coalition for collectively negotiating in UNFCCC.**

Factors exacerbating Vulnerability of SIDS

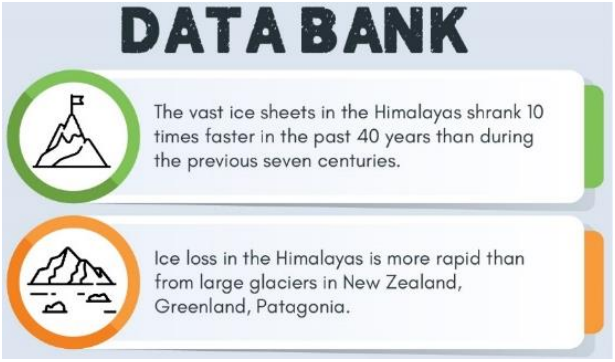
- **Small land** areas, **geographic isolation,** high proportion of the population living in low lying coastal regions, **susceptibility to many hydro-meteorological hazards,** etc.
- **Fragile economies** characterized by **high levels of public debt,** a narrow revenue base dependent on highly vulnerable sectors such as fisheries, tourism etc. and **dependency on aid.**
- **Challenges in accessing Climate Finance** like eligibility criteria, complex requirements, low focus on adaptation, institutional and policy constraints etc.
- **Unique challenges:** Limited freshwater, scarce Human resources, dependence on imports for energy and food security etc.

Way forward

- **Investing in disaster risk reduction programs** such as early warning systems.
- **Drive diversification of sectors and create low carbon jobs** to make economy more resilient to climate change.
- **Building natural marine resources like coral reefs to protect** the coasts.
- **Addressing loss and damages** faced by SIDS through Paris agreement.
- **Innovative financing instruments,** such as blue and green bonds, and blended financing, debt for nature swaps etc.

1.4.2. IMPACT ON CRYOSPHERE

The cryosphere refers to **frozen components of the Earth system** that are at or below the land and ocean surface. These include snow, glaciers, ice sheets, ice shelves, icebergs, sea ice, lake ice, river ice, permafrost and seasonally frozen ground.



1.4.2.1. HINDU KUSH HIMALAYA (HKH)

Why in news?

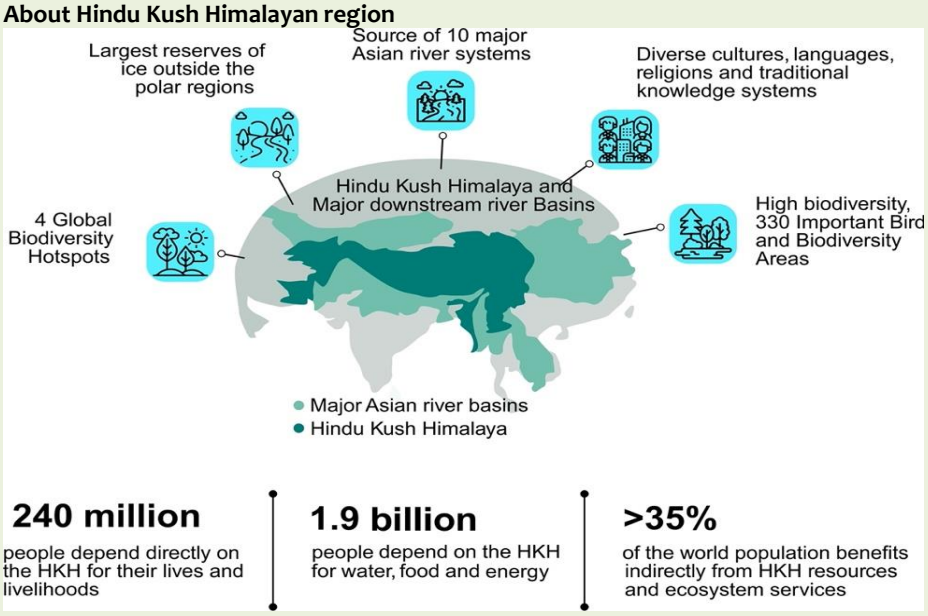
According to a recent finding, published in the journal Scientific Reports, glaciers across Himalayas are melting at an extraordinary rate.

Impact of climate change in the HKH

- **Increased intensity and frequency of Climate change hazards** like- Glacial Lake outbursts, flash floods etc. posing significant risk to mountain habitants.

- **Declining snow cover and accelerated melting of glaciers** resulting in **drying rivers, impact on hydropower energy** and **degradation of water quality.**
- **Impact on livelihoods of mountain inhabitants in the short term and river basins in the long run.**
- **Adverse impact on mountain dwelling species,** some of which are expected to decline in numbers.

About Hindu Kush Himalayan region



Way ahead

- **Improved understanding of cryospheric change and its drivers.**
- **Adopting integrated and transboundary ecosystem approach** at the landscape scale for conservation and sustainable development.
- **Investments in mountain ecosystems** for enhancing resilience conserve biodiversity, alleviate poverty, and enhance sustainable livelihoods.
- Increasing budgetary allocations for **reviving and protecting springs, increasing water harvesting, and diversifying water sources.**

Initiatives for protecting Himalayan Ecosystem

- **SECURE (Securing livelihoods, conservation, sustainable use and restoration of high range Himalayan ecosystems) Himalaya** by MoEFCC as a part of "Global Partnership on Wildlife Conservation and Crime Prevention for Sustainable Development".
- **National Mission for Sustaining the Himalayan Eco-system (NMSHE)** launched under the National Action Plan on Climate Change (NAPCC) to develop in a time bound manner a sustainable **National capacity** to continuously **assess the health status of the Himalayan Ecosystem.**

Related Concepts:

Third Pole

- According to a recent study by NASA, **two lakes (Chibzhang Co and Dorsoidong Co) in the third pole region grew larger** between 1987 and 2021.
- **This happened as the mountain glaciers shrunk** due to rising temperatures, accelerating ice loss and meltwater runoff.
- Third Pole **encompasses Tibetan Plateau, Himalayas, Hindu Kush, Pamirs and Tien Shan Mountains**.
- Melt-water from Third Pole **feeds many of Asia's large lakes and rivers, including Indus, Brahmaputra, Ganges,** Yellow and Yangtze.

Karakoram Anomaly

- **Karakoram anomaly** is termed as **stability or anomalous growth of glaciers in the central Karakoram range,** in contrast to retreat of glaciers in other nearby mountainous ranges of Himalayas and other mountainous ranges of the world.
- A recent study conducted by researchers has postulated new theory to explain the reasons of **glaciers in Karakoram Range are resisting glacial melt due to global warming**.
  - While previous studies highlighted **role of temperature** in establishing and sustaining anomaly, it is for the **first-time highlighted impact of precipitation from western disturbances in feeding the anomaly** .

1.4.3. IMPACT ON OCEANS

IMPACTS OF CLIMATE CHANGE ON OCEAN AT A GLANCE

The global ocean – comprising the Arctic, Pacific, Atlantic, Indian, and Southern oceans, as well as their marginal seas – covers **71% of the Earth surface.**

It contains about **97% of the Earth's water,** supplies **99% of the Earth's biologically-habitable** space, and provides roughly **half of the primary production on Earth.**

Global surface temperature over the ocean is **0.88°C higher** in 2011-2020 than 1850-1900.

IMPACTS OF CLIMATE CHANGE

- **Ocean warming and thermal expansion of oceans** due to oceans absorbing more than 90% of the excess heat in the climate system.
- **Ocean Acidification:** Ocean has taken up between 20-30% of total anthropogenic CO2 emissions since the 1980s
- **Deoxygenation** (decrease in dissolved oxygen concentrations) for most ocean regions mostly due to temperature-driven solubility decrease.
- **Changes in Ocean circulations,** such as weakening of Atlantic Meridional Overturning Circulation.
- **Ocean Stratification** (vertical separation of layers of water) due to surface warming and surge in freshwater runoff entering the top layer of the oceans.
- **Increase in frequency and intensity of Marine heatwaves, precipitation, storms and hurricanes.**

IMPLICATIONS

- **Enhanced risk to food security, coastal infrastructure and livelihood.**
- **Increase risk of regional and global extinctions of marine species,** like coral reefs.
- **Accelerated melting of Sea ice.**
- **Changes in regional climate** due to potential collapse of present ocean circulations.
- **Potential for transboundary conflicts.**
- **Reduction in upper ocean nutrient levels** due to stratification.
- **Expansion of oxygen-depleted zones.**
- **Expansion of the range of certain bacteria and harmful algal blooms.**

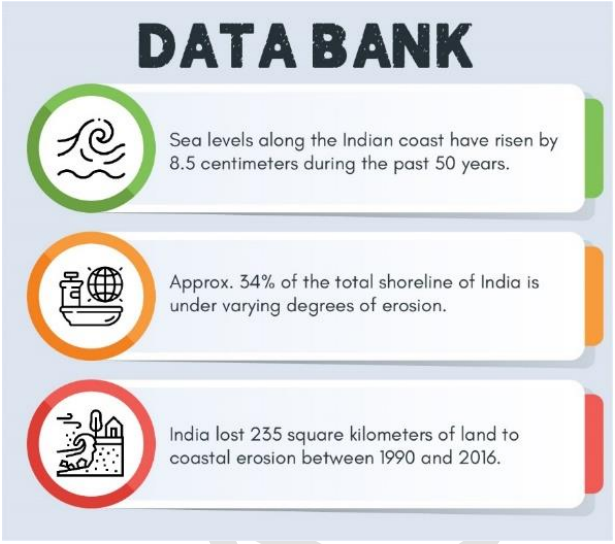
WAY FORWARD

- Reaching **net-zero carbon emissions** at the earliest.
- **Building climate resilient infrastructure in coastal areas.**
- **Establishing networks of marine protected areas.**
- **Enhancing ecosystem-based adaptation** through marine habitat restoration, etc.
- **Integrating multidisciplinary observation systems** for improved monitoring of significant changes in physical and biogeochemical properties of oceans.

1.4.4. IMPACT ON COASTAL REGIONS

Why in news?

Recently, the Indian National Centre for Ocean Information Services (INCOIS) prepared Coastal Vulnerability Index (CVI) for Indian coasts.



More on news

- INCOIS has carried out **coastal vulnerability assessment for entire Indian coast at states level** to bring out an **Atlas.**
- Maps determine the **coastal risks due to future sea-level rise based on the physical and geological parameters** for the Indian coast.
- CVI uses the parameters like **tidal range, wave height, coastal slope, coastal elevation, shoreline change rate, geomorphology,** and **historical rate of relative sea-level change.**
- Also, a **Coastal Multi-Hazard Vulnerability Mapping (MHVM)** was carried out to **derive composite hazard zones that can be inundated along the coastal areas** due to extreme flooding events.

Initiatives taken to enhance resilience against coastal vulnerability

- **Integrated Coastal Zone Management (ICZM) Project** being implemented by Society of Integrated Coastal Management (SICOM) with assistance from The World Bank to **establish and support an appropriate national institutional structure** for guiding and coordinating coastal zone management
- **Enhancing Coastal and Ocean Resource Efficiency (ENCORE)** is part of the **World Bank approved a $400 million** multi-year financing envelope to help India to- enhance its **coastal resources, protect coastal populations** from pollution, erosion, and sea level rise, and **improve livelihood opportunities for coastal communities.**

Way Forward

- **Proper implementation and funding support** for Climate action plans at coastal city level.
- **Improve access to Climate Information Services (CIS).**
- **Building capacity** among city government departments or agencies for effective climate change action planning.
- **Strict implementation of Coastal Regulation Zones (CRZ).**

1.5. MITIGATION

CLIMATE CHANGE MITIGATION AT A GLANCE

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

Emission trends

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

Mitigation efforts across the globe

- **Glasgow Climate Pact called on all countries to revisit and strengthen the 2030 targets in their NDCs by the end of 2022,** to align with the Paris Agreement temperature goal.
- As of November 2021, **over 140 countries including India, China, USA etc. announced or are considering net zero targets,** covering 90% of global emissions.
- **Countries like UK, Sweden, Denmark, New Zealand, etc. have enacted net-zero legislations.**
- Under **Global Methane Pledge,** a non-binding agreement, signatory countries have promised to cut **their methane emissions by at least 30% by 2030.**

What needs to be done as per IPCC AR6

To limit global warming to 1.5°C

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

To limit global warming to 2°C

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

For both-

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

Constraints/Concerns

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

Way forward

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

1.5.1. UNIFORM CARBON TRADING MARKET

CARBON TRADING MARKET AT A GLANCE

Also referred to as carbon emissions trading, it is a **market-based system of buying and selling permits and credits** that allow the permit holder to emit carbon dioxide, generally using a 'cap and trade' model.

Idea of applying **a cap-and-trade solution to carbon emissions originated with the Kyoto Protocol** which created three such market mechanisms: Emissions Trading, Clean Development Mechanism, Joint implementation.

Market mechanisms under Paris climate agreement

- **Internationally traded mitigation outcomes** (ITMOs) govern bilateral trading of international carbon credits.
- **Sustainable Development Mechanism (SDM)** is a new voluntary international carbon market for the project-based trade of emissions cuts.

Carbon trading mechanisms in India

- **Renewable Energy Certificate (REC) mechanism:** It facilitates compliance of renewable purchase obligations (RPO) by obligated entities (Discoms, Open Access Consumers and Captive power producers).
- **Energy Saving Certificates (ESCerts) under Perform, Trade and Achieve (PAT) scheme:** It aims to reduce the specific energy consumption (SEC) in 13 energy intensive industries.

Significance of an efficient Carbon trading market in India

- **Economic gains** by exporting decarbonisation to the world.
- **Finance avenues for carbon transition** by letting green plants and energy efficient units estimate earnings through carbon trade.
- **Enhance private sector participation in climate actions.**
- **Incentivizing the adoption of innovative low carbon technologies.**
- **Assigning financial accountability to high emitters** to reduce emissions.

Challenges in existing market in India

- **Low compliance and poor demand,** leading to **surplus of permits** and **low price.**
- **Limited participation and coverage:** For instance, in EScerts trading, only designated consumers, having targets under PAT cycle can participate.
- **Compatibility challenge as RECs and EScerts are not denominated in terms of GHG reductions** (de-facto trading unit of most carbon markets around the world).
- **Poor past performance of markets in emission reduction.**
- **Other issues:** Lack of transparent price discovery mechanism; Short trading period; Lack of integration with other international and regional trading mechanisms etc.

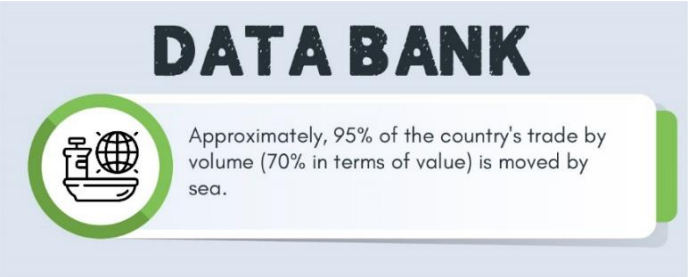
Way forward

- **Effective management of demand and supply** of instruments and **regularizing trading period.**
- **Developing a provision for fungibility of trading unit** to attract voluntary buyers and international participants.
- **Allowing more participant into the trading pool:** like State Designated Agencies, airlines industry, Indian private companies participating etc.
- **Enabling project level registration** accompanied by proper validation and verification of emission reduction.
- **Developing Institutional and policy mechanisms** for fair and transparent price discovery; linking to other carbon trading market; monitoring and reporting of carbon market performance etc.

1.5.2. CLYDEBANK DECLARATION FOR GREEN SHIPPING CORRIDORS

Why in news?

A coalition of 22 countries have signed **'Clydebank Declaration for Green Shipping Corridors'** and agreed to create zero emissions shipping trade routes between ports to speed up the decarbonisation of the global maritime industry.



About the declaration

- The signatory countries signed the **'Clydebank Declaration for Green Shipping Corridors'** (launched at the COP26 climate summit in Glasgow) and agreed to support the establishment of at least **6 green corridors by 2025.**
  - A green corridor is **defined as a shipping route between two major port hubs** on which the **technological, economic and regulatory feasibility of zero-emissions ships** is **accelerated by public and private action.**
- **India has not signed** the declaration yet.
- The strategy for going carbon neutral will include **using ships that run on zero-carbon fuels** and **updating port infrastructure.**

Challenges to green shipping in India

- **Inadequate quality of intermodal infrastructure** (railways, waterways connectivity with highways) which leads to more cargo handling by shipping which causes emissions.
- **Difficulty in securing investment funds to replace existing ships** by eco-friendly ones.
- **Use of polluting fuel** which contain high amounts of sulphur and release sulphur dioxide on burning.
- **Seasonal reversal of winds along with frequently changing localized weather conditions in India** leads to more deviation in shipping routes, more fuel consumption and hence more emissions.

Initiatives for development of Green Ports & Green Shipping in India

- India signed an agreement under IMO **to cut the shipping industry's greenhouse gas emissions by 50%** by **2050.**
- India is a member of **International Maritime Organisation (IMO)** and signatory to **International Convention on Prevention of Marine Pollution (MARPOL).**
- India aims to increase share of renewable energy to more than 60% across major ports by 2030.
- **Fuel sulphur limit has been reduced from the current 3.5% to 0.5% in India.**
- **National Green Tribunal (NGT) has approved the 'Beaching' method of ship recycling** in Alang, Gujarat.

1.5.3. CARBON CAPTURE, UTILISATION AND STORAGE (CCUS)

Why in news?

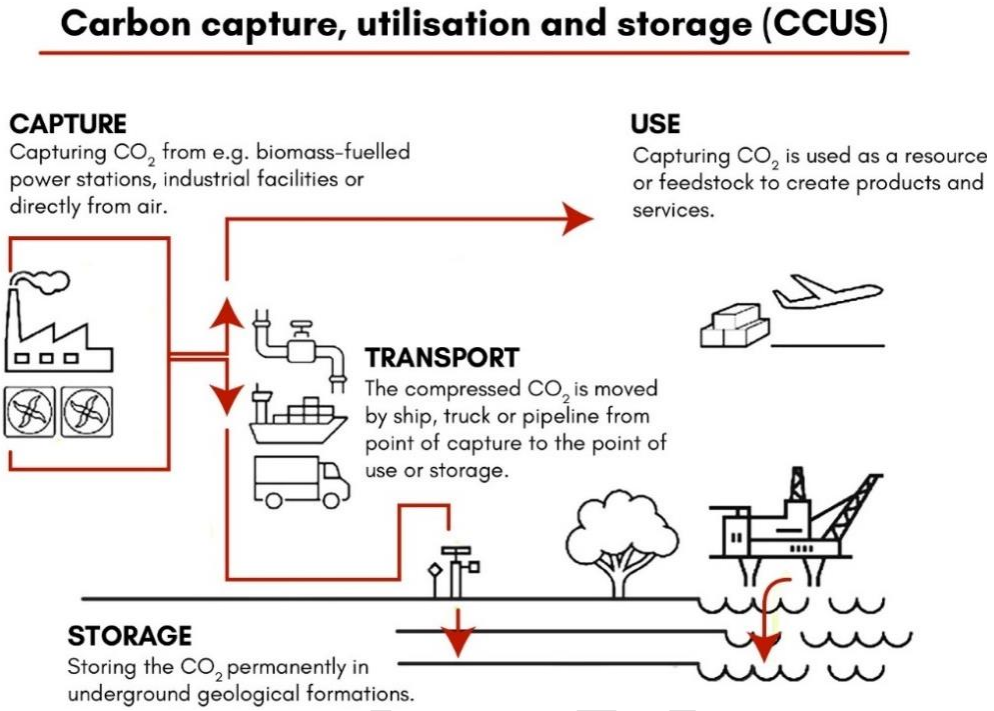
Orca is the world's largest carbon capture plant, created by Climeworks, was launched in Iceland.

About CCUS

- It is group of technologies designed to **reduce the amount of CO_2** released into the atmosphere from coal and gas power stations as well as heavy industry including cement and steel production.
- It involves-
  - **Capture** of CO2 from fuel combustion or industrial processes,
  - **CO_2 is captured using technologies** like Chemical absorption, Physical separation, Oxy-fuel separation, Calcium lopping etc.
  - **Transport** of this CO2 via ship or pipeline.

- Captured **CO_2 can be either re-used in various products,** such as cement or plastics (utilisation), **or stored in geological formations** deep underground (storage).

- **Benefits:** reducing the overall carbon emissions; improving efficiency of coal and gas fired plants to generate reliable and affordable power etc.
- **Issues:** possible leaks and the related damage from underground storage sites; high capture costs; high energy is needed to convert CO_2 into useful products leading to more emissions etc.



- **India is part of following CCUS initiatives**
  - **Mission Innovation:** A global initiative to make clean energy affordable, attractive and accessible for all.
  - **Accelerating CCUS Technologies (ACT):** an international initiative to establish CCUS as a tool to combat global warming.

1.6. ADAPTATION

CLIMATE CHANGE ADAPTATION AT A GLANCE

Process of **adjustment to actual or expected climate and its effects,** like heat stress, food and water insecurity and flood risk.

Regions with high vulnerability

- Regions where species and people exist **close to their upper thermal limits, along coastlines, in close association with ice or seasonal rivers.**
- **Locations with High levels of climate-sensitive livelihoods** (e.g., smallholder farmers, pastoralists, fishing communities).
- These include **West-, Central- and East Africa, South Asia, Central and South America,** Small Island Developing States and the Arctic.

Current Adaptation efforts at global level

- Around **79% of countries have adopted at least one national-level adaptation** planning instrument.
- **Under new market-based mechanism of the Paris Agreement, 5% share of proceeds will be delivered to the Adaptation Fund** to support concrete adaptation projects in developing countries around the world.
- During COP26, **Over USD $450 million was announced for "locally-led adaptation approaches",** and the **Adaptation Fund raised a record US $356 million in new pledges.**
- **Dedicated Glasgow-Sharm el-Sheik Work Programme established on the Global Goal or Adaptation.**

Constraints

- **Fragmented, small in scale, and unequally distributed** across regions.
- Narrow focus on **current impacts or near-term risks** and on **planning rather than implementation.**
- **Risk of maladaptation** (adaptation that results in unintended consequences) with adverse impact on **marginalised and vulnerable groups, Biodiversity and ecosystem resilience etc.**
- **Financial constraints:** insufficient funds especially in developing countries; majority of global tracked climate finance targeted to mitigation etc.
- **Technical constraints:** Limited availability of information; low climate literacy etc.

Way Forward

- **Strengthening implementation** facilitated by institutional frameworks and targeted policies and instruments.
- **Mobilization of dedicated, accessible and adequate financial resources.**
- **Incorporate slow onset and long-term impacts in adaptation plans.**
- **Inclusive planning initiatives** informed by cultural values, Indigenous knowledge, local knowledge, and scientific knowledge.
- **Systemic transformation in vulnerable sectors,** e.g., construction of nature based coastal defense to combat sea rise.

2. AIR POLLUTION

2.1. DELHI AIR POLLUTION

AIR POLLUTION IN DELHI- NATIONAL CAPITAL REGION (NCR) AT A GLANCE

Key Targets

National Clean Air Programme (NCAP): Achieve **20%-30% reduction of PM2.5 and PM10 concentration by 2024 taking 2017** as the base year.

Current Situation

- New Delhi ranked **world's most polluted capital city for the 4th consecutive year** (World Air Quality Report 2021, IQAir).
- **Delhi saw a 14.6% increase in PM2.5** concentrations in 2021.

Reasons for high air pollution in the NCR

- **High pollution from multiple sources concentrated in the city:** vehicular exhaust, industries, stubble burning, construction activities, open waste burning, etc.
- **Inland location and pollution entrapping climatic conditions** (Temperature inversion, Denser wind etc.) during winter.
- **Other compounding sources:** such as diesel generator, dust storms, forest fires, bursting of crackers etc.

Schemes/Policies/Initiatives

- **Graded Response Action Plan (GRAP)** approved by the Supreme Court in 2016, with stage wise actionable guide based on severity of pollution.
- **Constitution of a statutory body- Commission for Air Quality Management (CAQM)** for better coordination and solution to pollution problem in **Delhi-NCR and adjoining areas.**
- **Delhi Electric Vehicle (EV) Policy:** incentives for purchasing electric two-wheelers, cars, auto-rickshaws, e-rickshaws, e-carts and goods carriers.
- **Others: National Clean Air Programme (NCAP); 10-point action plan** by Delhi government; **Stringent pollution norms for coal-based power plants;** Technology upgradation in brick kiln industry; **implementation of the Bharat Stage VI norms etc.**

Constraints

- **Lack of pre-emptive measures and over reliance on ad-hoc measures** during severe conditions.
- **Non-compliance to important norms** such as covering up debris and waste management.
- **Gaps in environmental policies of neighbouring states.**
- **Bureaucratic Apathy.**
- **Lack of public support:** e.g., reluctance in complying with odd-even rule, firecracker bans, etc.

Way forward

- **Dedicated air quality forecasting cells** to facilitate preventative measures.
- **Behavioural change** using suitable incentives, in the direction of green practices such as carpooling, use of public transport, bicycle, sustainable waste management, etc.
- **Promoting use of fuel efficient, zero and low emission vehicles.**
- **Awareness generation among policymakers and the public.**
- **Inter-state coordination** with neighbouring states for pollution norms.

2.2. AIR POLLUTION MEASUREMENT

Why in news?

Every country, including India, exceeded new PM2.5 annual limit set by WHO as per a report by IQAir.

More about news

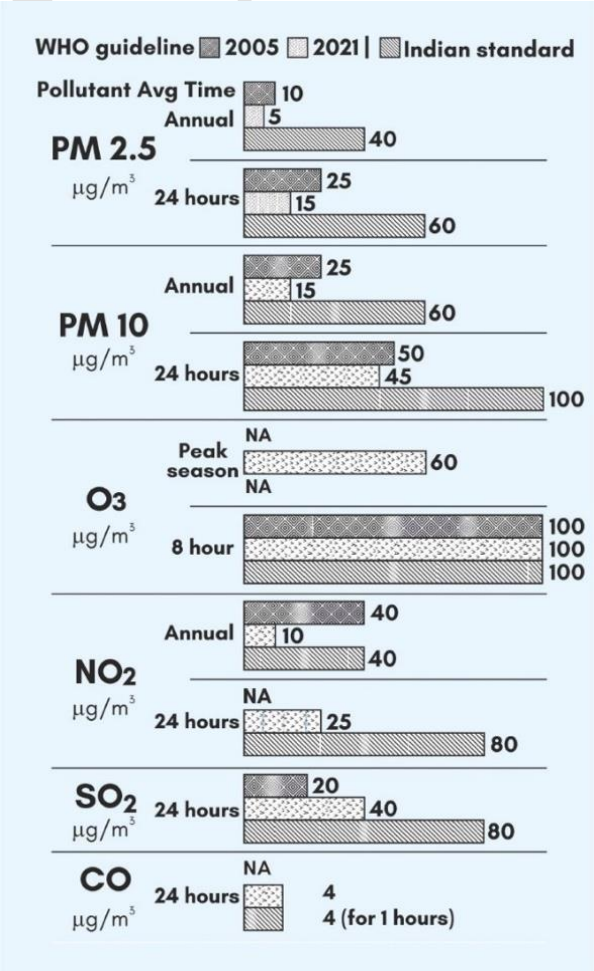
- India's annual average PM2.5 levels reached **58.1 µg/m3** in 2021.
- India is home to **11 of the 15 most polluted cities** in Central and South Asia.
- **No cities** in India met the WHO AQG of **5 µg/m3.**
- **48% of India's cities** exceeded 50 µg/m3 (more than **10 times the guideline**).

About WHO air quality guidelines (AQG)

- Since 1987, WHO has **periodically issued health-based air quality guidelines (AQG)** to assist governments and civil society to reduce human exposure to air pollution.
- The WHO air quality guidelines were recently updated after **last published guidelines in 2006: Air quality guidelines – global update 2005.**
- **Objective of the updated global guidelines: To offer quantitative health-based recommendations** for air quality management, expressed as **long or short-term concentrations** for a number of key air pollutants.
- **Other features of the guidelines:**
  - Highlights **good practices for the management of certain types of particulate matter** (e.g., black carbon/elemental carbon, ultrafine particles, and particles originating from sand and dust storms) for which there is **currently insufficient quantitative evidence** to set air quality guideline levels.
  - Applicable to **both outdoor and indoor environments globally**.
  - **Not legally-binding.**

Air pollution measurement in India and comparison with international standards

- **Central Pollution Control Board (CPCB)** releases air quality standards in form of **NAAQS (National Ambient Air Quality Standards)** which are notified for **12 parameters**- carbon monoxide (CO) nitrogen dioxide (NO_2), sulphur dioxide (SO_2), particulate matter (PM) of less than 2.5 microns size (PM2.5), PM of less than 10 microns size (PM10), Ozone (O_3), Lead (Pb), Ammonia (NH_3), Benzo(a)Pyrene (BaP), Benzene (C_6H_6), Arsenic (As), and Nickel (Ni)).
- NAAQS doesn't meet the **WHO's existing standards (2005 guidelines)** and considerably differ from updated guidelines.
- For instance, NAAQS specify an **annual limit of 60 microgram per cubic metre for PM 10 and 100 for a 24-hour period which are 15 and 45 respectively in revised WHO guidelines.**



Why is it important to measure air pollution?

- **Assessing the level of pollutants** in relation to the ambient air quality standards.
- **Devising effective air pollution reduction strategies.**
- **Determining level of enforcement of Standard** and **identifying faulty standards and inadequate monitoring programs.**
- **Improving** the **abilities to inform the public about the hazards** of air pollution to enhance **health and safety of the public and the environment**.
- **Giving better insight to researchers** through comprehensible datasets.

Limitations of air pollution measurement

- **Not comprehensive:** India is monitoring approximately 344 cities/towns out of the **total 5000 cities and towns.**
- **Uncertainty and biases** due to involvement of various **monitoring agencies, personnel and equipment** in sampling, chemical analyses and data reporting.
- **Possible disruptions in operations of monitoring stations** due to **technical issues, long power cuts** and maintenance problems.
- **Gap in obtaining real-time data** due to the **lack of real-time air quality monitoring** stations in many cities.

Road Ahead

In the past decades the monitoring infrastructure has grown leaps and bounds but is still nascent. To make sure that the measurement framework remains effective, the standards need continuous updation, data gathering techniques must be more precise, data gathering sources have to be diversified and most importantly, more awareness has to be generated regrading importance and implications of this data.

3. WATER AND LAND DEGRADATION

3.1. RIVER POLLUTION

RIVER POLLUTION IN INDIA AT-A-GLANCE

KEY TARGETS

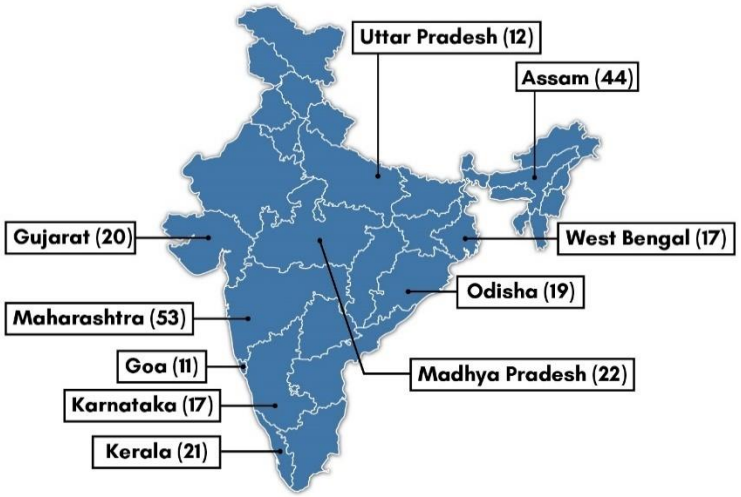
Vision for 2030, unveiled in the **interim budget 2019-2020,** include clean rivers, with safe drinking water to all Indians, sustaining and nourishing life.

CURRENT SITUATION

The Central Pollution Control Board (CPCB) in 2018 **identified 351 polluted river stretches in India.**

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

TOP 10 STATES WITH HIGHEST NUMBER OF POLLUTED RIVER STRETCHES



SCHEMES/POLICIES/INITIATIVES

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

CONSTRAINTS

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

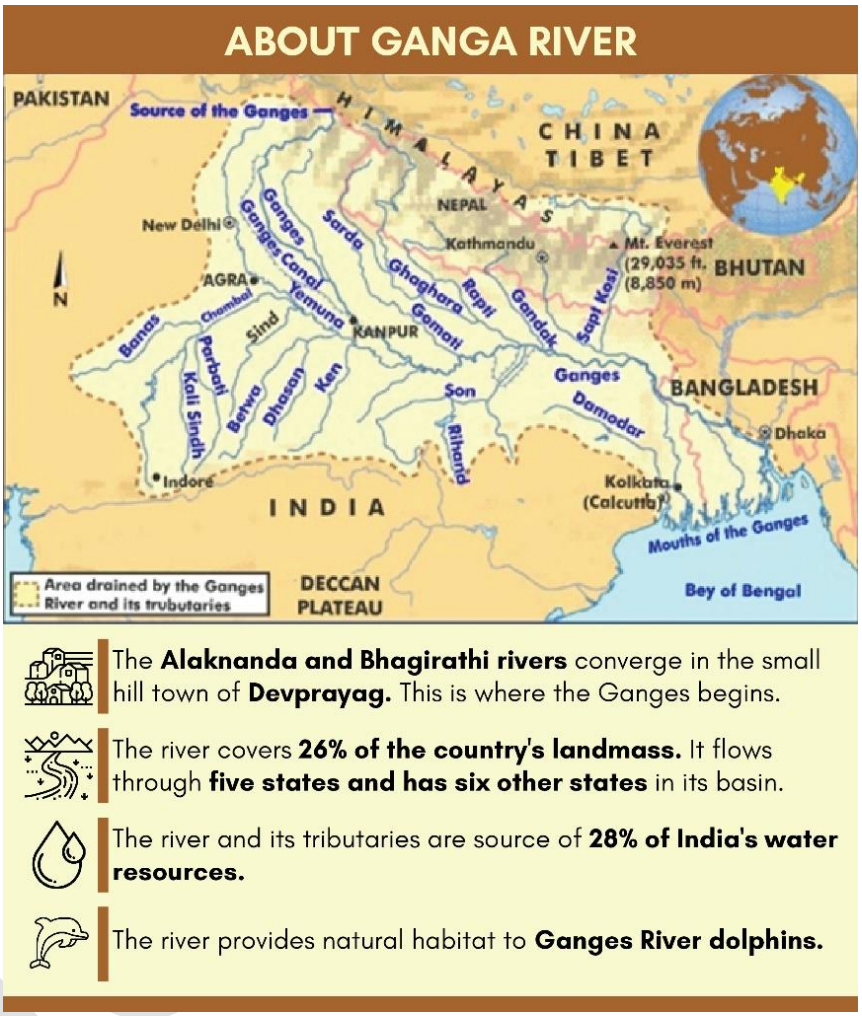
WAY FORWARD

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

3.1.1. CLEANING OF GANGA RIVER

Why in news?

The Ministry of Finance has released only about two-third of the total allocation to the National Mission for Clean Ganga (NMCG) under ₹15,074 the Namami Gange Programme launched to clean Ganga.



Background of India's efforts to clean river Ganga

- **Ganga Action Plan (GAP), 1986:** It was the first attempt to clean the Ganga.
  - **Its objectives were not achieved** due to issues like- little **coordination between the Centre, states and local bodies, delays in project execution,** lack of clarity on basin-level issues and inadequate technology interventions.
- **Namami Gange Yojana, 2014**
  - It is a **World Bank funded Central Sector Scheme under the Ministry of Jal Shakti.**
  - **Implementing agencies: National Mission for Clean Ganga (NMCG)** and its state counterparts, State Programme Management Groups (SPMGs).
  - **The National Ganga Council,** set up as the overseeing authority replaced the erstwhile National Ganga River Basin Authority (NGRBA).
  - **The 2nd Phase of the Mission was approved** by the World Bank Board in June 2020 for US$ 400 million for a period of 5 years **up to December 2026.**
    - ✓ The projects to be undertaken under this phase include **spillover projects** from the first phase of the mission as well **cleaning projects in tributaries** such as the Yamuna and Kali rivers.
- In 2017, **Uttarakhand declared Ganga and Yamuna as living entities** in an effort to conserve and rejuvenate the rivers faster.
  - However, the **Supreme Court stayed the order** taking note of its legal and administrative ramifications.

Structure of National Mission for Clean Ganga (NMCG)

- 5-tiered structure-
  - **National Ganga Council** under chairmanship of Prime Minister of India.
  - **Empowered Task Force (ETF) on river Ganga** under chairmanship of Union Minister of Jal Shakti (Department of Water Resources, River Development and Ganga Rejuvenation).
  - **National Mission for Clean Ganga (NMCG).**
  - **State Ganga Committees.**
  - **District Ganga Committees** in every specified district abutting river Ganga and its tributaries in the states.
- **Other components-**
  - **'Ganga Task Force'** to spread public awareness.
  - **Ganga Praharis,** a grassroot-level workforce.

DATA BANK

In places, the water's bacteria count in Ganga reaches **3,000 times the limit declared safe for bathing** by the World Health Organization (WHO).

- **Other cleaning efforts:** Schemes like Centre's National River Conservation Plan (NRCP), Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Smart Cities Mission, etc. and financial assistance in the form of loans and grants sanctioned by foreign agencies.

Despite all these efforts, being undertaken for more than 3 decades, the **problem of Ganga pollution remains existent.**

Why results for various efforts of cleaning Ganga have been sub-optimal?

- **Unsustainable development in Ganga Basin:**
  - **High discharge of** wastewater from **domestic and industrial sources** such as the leather tanneries.
  - **Increases in the concentration of pollution due to reduced flow of water:** caused by receding Himalayan glaciers, removal of water for irrigation at faster rate than replenishment by rain, obstruction by dams etc.
- **Inadequate infrastructure to manage waste:**
  - **Suboptimal performance of Sewage treatment plants (STPs)** due to- erratic electricity supply, high operation and maintenance costs and their inability to remove the faecal coliform bacteria from the sewage.
  - **Centralised sewage network:** Most of treated effluents mixes with untreated effluents from colonies not connected to the sewerage network.
- **Implementation challenges**
  - **Building consensus among various states with competing interests and jurisdictions** throughout 2,500 km stretch of the Ganga River.
  - **Bureaucratic hurdles:** Shortage of adequate number of trained manpower, red tapism, governance architecture problem, etc.

Some achievements of the Namami Gange programme
- **Dissolved oxygen level has improved at 27 locations.**
- **Biochemical oxygen demand (BOD) and faecal coliform (FC) has improved** at 42 and 21 locations, respectively.

Way Ahead

- **Some critical steps that NMCG may follow-**
  - **Improving STPs: Promoting only decentralised sewage treatment plants (dSTP)** at the colony level; Reusing treated wastewater for irrigation and empty into natural drains; **Verifying efficiency, reliability and technology parameters** of existing and planned STPs by independent agencies.
  - **Enhance focus on Smaller Tributaries of Ganga.**
  - **Identify, define and protect 'river-corridors' as areas for no cement-concrete structures.**
  - **Water Harvesting by development and restoration of local storages (ponds, lakes, wetlands).**
- **Prevention of pollution**
  - **Sewage can be diverted to fields** to be used as manure.
  - **Behavioural Nudges:** People should be nudged to prefer use of Electric crematoria which have been built as an alternative to the traditional and less efficient wood-burning pyres.
  - **Monitoring River water quality as well as** depletion and contamination of groundwater resources.
- **Abating pollution** though **roping in state-of-the-art technologies.**
- **Holistic water management by integrating** strategies like river-linking, riverfront development projects, access to toilets, making villages open defecation free, piped water supply in rural areas, etc.

Related information
Heavy Metal Pollution
- As per CSE report, **75% of river monitoring stations** in India posted alarming levels of **heavy toxic metals.**
- In one- fourth of monitoring stations, which are spread across 117 rivers and tributaries, **high levels of two or more toxic metals** were reported.
  - **Seven states and Union Territories are under threat**- Assam, Arunachal Pradesh, Sikkim, Bihar, Himachal Pradesh, Jammu and Kashmir, and Ladakh.
- Heavy metals are **naturally occurring elements** that have **high atomic weight and density at least 5 times greater than that of water**.
  - They include **lead, iron, nickel, cadmium, arsenic, chromium and copper**.
- **Sources of heavy metal pollution:** Discharge from industries like Mining**, milling, plating and surface finishing industries**.
- **Effects of heavy metals exposure**
  - **Health: Slowly progressing physical, muscular, and neurological degenerative processes** that mimic Alzheimer's, Parkinson's disease etc.

- **Environment:** Affect biodegradability of organic pollutants, making them less degradable.
- **Plants:** Influences soil fertility, disturbs photosynthesis etc.

- In 2021, IIT Mandi has developed **fibrous membrane filter using a biopolymer-based material** to separate out heavy metals from water samples.

3.2. WATER INSECURITY

WATER INSECURITY IN INDIA AT A GLANCE

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

FACTORS RESPONSIBLE FOR INDIA'S RISING WATER INSECURITY

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

CURRENT SITUATION IN INDIA

- **13th among world's 17 'extremely water-stressed' countries** (Aqueduct Water Risk Atlas of the WRI)
- **Annual per capita availability** of water is **1,486 cubic meters** in 2021 (a decline of 75% since independence).
- **Groundwater level declined** by 61% (2007-2017).
- **70% of surface water** unfit for consumption.

CONSTRAINTS

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

SCHEMES/POLICIES/ INITIATIVES

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

WAY FORWARD

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

3.2.1. DRAFT NATIONAL WATER POLICY

Why in news?

After three national water policies--1987, 2002 and 2012--India has prepared a new national policy on water, key to addressing problems with water quality and ensuring water security for all.

More on news

- The water expert Mihir Shah, chairperson of the 13-member committee that has drafted the NWP and has asked it to be implemented by 2030 to solve the water crisis of the country.

Key recommendations of the draft NWP

Shift towards demand management	• **Diversifying public procurement operations** to include low water consuming crops like nutri-cereals, pulses and oilseeds.
	• **Reduce-Recycle-Reuse**
	  ○ **Integrated urban water supply and wastewater management**, with treatment of sewage and eco-restoration of urban river stretches, as far as possible through **decentralised wastewater management**.
	  ○ **All non-potable use**, such as flushing, fire protection, vehicle washing **must mandatorily shift to treated wastewater**.

Supply-side management	• **Deploy Supervisory Control and Data Acquisition (SCADA) system:** Irrigated area could be greatly expanded at very low cost by deploying pressurised closed conveyance pipelines, combined with SCADA systems and pressurised micro-irrigation.
	• **Nature-based solutions: Incentivizing rejuvenation of catchment areas** through compensation for eco-system services.
	  ○ **Specially curated "blue-green infrastructure"** such as rain gardens and bio-swales, restored rivers with wet meadows, wetlands constructed for bio-remediation, urban parks, permeable pavements, green roofs, etc. are proposed for urban areas.
	• **Sustainable, Participatory and equitable management of groundwater** by providing information on aquifer boundaries, water storage capacities and flows in a user-friendly manner to stakeholders, designated as custodians of their aquifers.
	• **Prior & primary importance to river protection and revitalization**
	  ○ Steps to restore river flows include Re-vegetation of catchments, regulation of groundwater extraction, river-bed pumping and mining of sand and boulders.
	  ○ **The NWP outlines a process to draft a Rights of Rivers Act**, including their right to flow, to meander and to meet the sea.

Water quality	• Every water ministry, at the Centre and states to have **a water quality department and a task force on emerging water contaminants** to better understand and tackle the threats they are likely to pose. • Adoption of **state-of-the-art, low-cost, low-energy, eco-sensitive technologies for sewage treatment.** • **Reverse osmosis (RO) units to be discouraged** if the total dissolved solids count in water is less than 500mg/L.
Reforming governance of water	• **Unified multi-disciplinary, multi-stakeholder National Water Commission (NWC)**, which would become an exemplar for states to follow. • **Government water departments to include professionals** predominantly from civil engineering, hydrology and hydrogeology. • **Governments should build enduring partnerships with primary stakeholders of water**, who must become an integral part of the NWC and its counterparts in the states. • **Leveraging indigenous knowledge** for water management. • **Dedicated task group for effective implementation:** It will oversee and coordinate the **implementation, monitoring and assessment of progress on the policy** and also develop a **10-year action plan** with the active involvement of stakeholders at all levels, within one year of its setting up.

3.3. GROUNDWATER EXTRACTION

GROUND WATER EXTRACTION IN INDIA AT A GLANCE

EXTENT OF GROUNDWATER EXTRACTION

- **India** accounts for ~**25% of the global groundwater extraction** (highest globally).
- **Out of the total 6,881 assessment units** surveyed by Central Ground Water Board, 17% have been categorised as 'over-exploited', 5% as 'critical', 14% as 'semi critical' units and 63% as 'safe'.
- Agricultural activities account for **90% of the annual ground water extraction.**

IMPACTS OF HIGH EXTRACTION

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

SCHEMES/POLICIES/INITIATIVES

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

CONSTRAINTS

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

WAY FORWARD

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

3.3.1. 2020 GUIDELINES FOR GROUNDWATER REGULATION

Why in news

According to National Green tribunal (NGT) the new guidelines issued in 2020 are insufficient to address groundwater crises.

More about news

- Central Ground Water Board had notified new guidelines on groundwater extraction **to be effective from September, 2020 after the 2018 guidelines were scrapped by National Green Tribunal (NGT)** for being unsustainable.
- However, recently objections have also been raised by NGT to the 2020 guidelines as -
  - Guidelines issued by the Ministry of Jal Shakti **do not satisfy directions given by it repeatedly and persistently.**
  - Guidelines do not address the **root cause and central issue, i.e., protection and preservation of ground water**, prevention of depletion, and effective attempt for recharge and restoration.

2018 guidelines on groundwater extraction

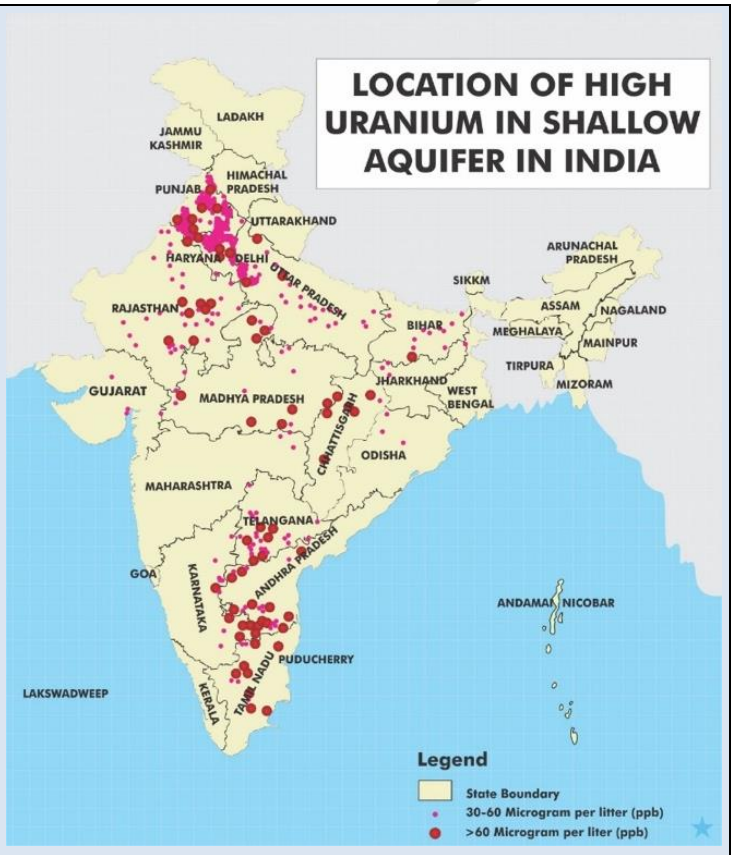
- **Concept of Water Conservation Fee (WCF)** for industrial extraction
- Encouraging use of recycled and treated sewage water by industries,
- Provision of action against polluting industries
- **Mandatory requirement of digital flow meters, piezometers,** and digital water level recorders
- Mandatory water audit.
- Mandatory roof top rainwater harvesting
- Prevention of ground water contamination in premises of polluting industries/ projects.

2020 Guidelines for Groundwater Regulation

- **Mandatory requirement of applying for NOC** for new and existing industries, group housing societies, and private water supply tankers.
- NOC holders to pay **groundwater charges based on quantum extraction** unlike old provision where they had to pay a nominal lump-sum.
- **No NOC to industries in over exploited areas.**
- **Installation of Sewage treatment plants; rooftop rainwater harvesting and recharge systems** and wells for groundwater level monitoring in NOC areas.
- **Categories exempted** from NOC requirements include Domestic consumers; rural drinking water supply schemes; Armed Forces Establishments and Central Armed Police Forces; agricultural activities; MSMEs drawing 10 cubic metre/day.
- **Penalty** between Rs 50,000 and Rs 10 lakh for non-compliance.

Related information
Uranium Contamination of Groundwater

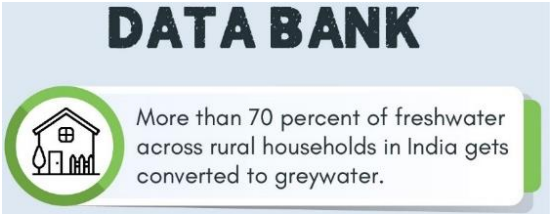
- High levels of uranium contamination found in groundwater of eastern Karnataka.
- Across **India aquifers from 16 states have reported Uranium contamination** in groundwater.
- **Key reasons stated for uranium contamination in groundwater**
  - **Presence of uranium in gneisses and granitoids** rocks in the Dharwar region of the state.
  - **Soil in the state is red loam** with laterite at places which indicates a higher degree of oxidation during weathering which results **in oxidation of uranous to uranyl ion (soluble in water).**
  - **Declining water table also facilitates oxidative weathering** leading to the release of more uranium to the circulating water.
- **Impacts**: Uranium is chemically toxic and on continuous intake, it **causes damage to internal organs** and can cause **leukaemia, stomach and urinary tract cancer as well as kidney toxicity.**
- **Drinking water standards for uranium concentration**:
  - **WHO**: 30 micrograms per litre (µg / l).
  - **Atomic Energy Regulatory Board**: 60 µg/l.
  - However, Bureau of Indian Standards (BIS) has not yet specified the norm for uranium level in drinking water.



3.4. GREYWATER MANAGEMENT

Why in news?

On World Water Day, Union minister for Jal Shakti launched a **'Sujalam 2.0' grey water recycling project.**

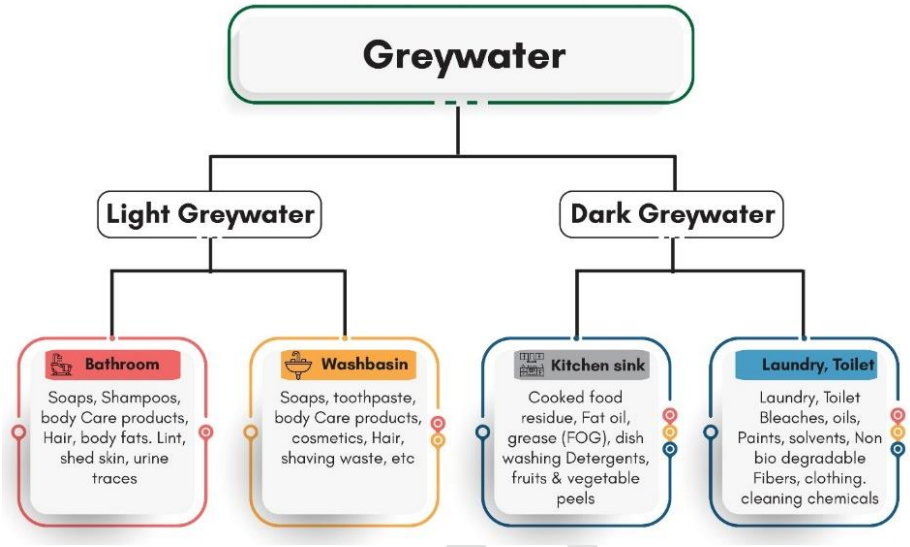


About Greywater

- Grey water is defined as the wastewater that includes **water from baths, showers, hand basins, washing machines, dishwashers and kitchen sinks**, but excludes streams from toilets.
- It makes **50% to 80% of the wastewater** from a household.
- **Principles of Greywater management:**
  - **Reduce:** generation of Greywater by judicious use of fresh water.
  - **Reuse:** Using Greywater for purposes such as kitchen garden, vehicle washing, toilet flushing etc.

- **Recharge:** Recharge of ground water with Greywater by adopting technologies such as soakage pit, leach pit etc.

- **Significance of grey water recycling:** preventing **potential harm** to the environment; reducing the demand for freshwater; r**eliable water resource not dependent on variable** rainfall; can make a **good nutrient or fertiliser source** due to high nitrogen and phosphorus content.
- **Other initiatives in India for greywater management:**
  - **Swachhata Start-Up Challenge** was launched by Ministry of Housing & Urban Affairs in collaboration with AFD (Agence Française de Développement) **to nurture the evolving ecosystem of the Indian waste sector.**



  - Haryana stepped up **ODF+ activities with greywater management** by adopting waste stabilization pond, construction of community leach pits etc.

Related news: Unconventional water resources

- Book titled **'Unconventional Water Resources'** is compiled by experts at **United Nations University's Institute for Water, Environment and Health (UNU-INWEH),** UNU Institute for Integrated Management of Material Fluxes and of Resources and UN Food and Agriculture Organisation.
- Non-conventional/ Unconventional water resources (UWRs) commonly include **saline water, brackish water, agricultural drainage water, treated/untreated wastewater effluents** etc.
  - All these are waters of inferior or marginal quality.
  - Use of this water requires adoption of **more complex management practices and stringent monitoring procedures.**
- **Six broad categories of UWRs identified by book**
  - **Harvesting water from air and ground** by Cloud Seeding or Rain Enhancement, Fog Harvesting.
  - **Desalination of saltwater.**
  - **Tapping fresh and brackish groundwater** offshore and onshore.
  - **Reusing used water i.e.** municipal waste-water and agricultural drainage water.
  - **Moving water physically** to water-scarce areas in ships' ballast holds, or towing icebergs.
  - **Micro-scale capture of rainwater** that would otherwise evaporate.
- **Strategies for UWRs**
  - **Promoting research and practice** on both technical and nontechnical aspects of UWRs.
  - **Ensuring that unconventional waters provide benefits,** not cost to environment
  - **Positioning unconventional waters as a reliable source of water** in times of uncertainty.
  - **Supporting complementary and multidimensional approaches** such as addressing water scarcity and climate change together.

3.5. VIRTUAL WATER

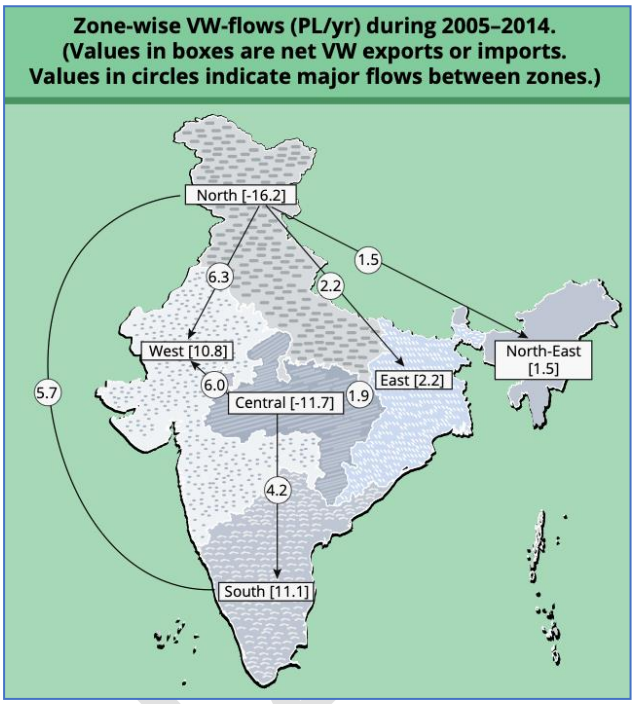
Why in news?

Researchers at IIT-Guwahati have paved the way for **better water management policies in India using 'Virtual Water' analysis.**

About Virtual Water

- It is the **water involved in the production and trade of food and non-food commodities and services.**
- It is that **"invisible" water** that has been **consumed throughout the lifecycle** of the product or service.
- **Virtual water trade** (VWT) is the (international or intra-national) **trade of goods evaluated in terms of VW.**

- **Net import of virtual water** in a water-scarce nation can **relieve the pressure on the nation's own water resources.**



India's Virtual Water analysis

- **International:** India has been a **net exporter of VW owing to its sizeable agricultural exports.**
- **Inter-State:** The recent IIT-study found that **VW flows between states are unsustainable** as water through agricultural products flows from highly water-scarce states in the north to other highly water-scarce states in the west and the south.

Significance of VW analysis

- **Bridging the knowledge-governance gaps** to induce efficient and environmentally friendly use of water.
  - For instance, **assessing Hidden agricultural water flows** from low to high water scarcity zones/states can help combat water scarcity.
- Establishing the **link between the hydrological-economic-institutional aspects** of water scarcity.
- **Incorporating VW in Import-Export Policy decisions** of crops, livestock etc.
- **Product specific VW content** can provide an idea of the environmental impact of consuming that product.

Limitations and issues of VW trade

- **Does not express the social, environmental and economic value of water to water scarce local communities.**
- **Redistribution of water through VW trade is unfair** due to industrial countries' unsustainable consumption patterns, current trade regime etc.
- **Issues related to incorporating virtual water in agricultural trade: Threats to food security, unemployment in agriculture sector, transfer of environmental pollution to exporting country** as a consequence of an increased use of water, pesticides and fertilizer etc.

Way forward

- **Global Water Governance** to **manage water as a global resource** and coordinate the "global water market" in a fair manner.
- **Tradable water footprint Permits** to address fairness issues on a global scale. **Water scarce nations should be accounted for by receiving compensation** in form of a higher tolerable water footprint.
- **Virtual Water Taxes:** Countries should be advised to **reduce or change domestic consumption patterns by raising a tax on water intensive goods.**

3.6. WATER COMMODIFICATION

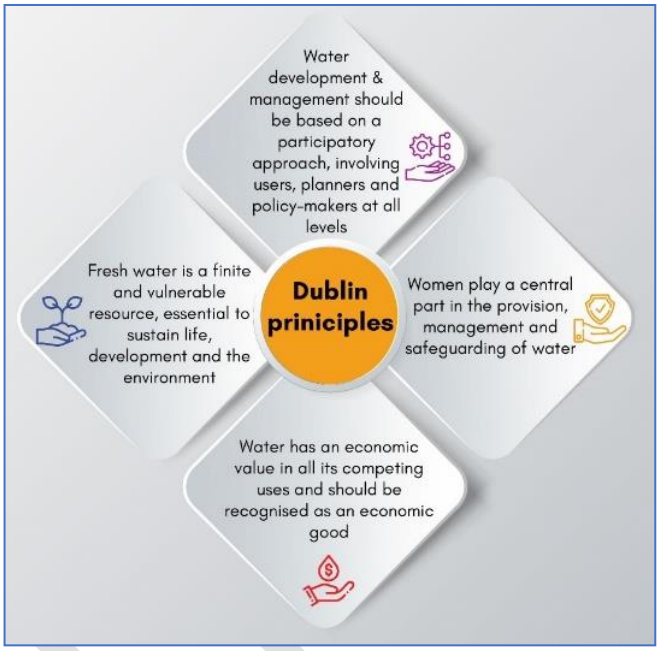
Why in news?

Recently, the Special Rapporteur on the human rights to safe drinking water and sanitation for the United Nations (UN) informed the UN General Assembly (UNGA) that **Water is not a commodity and financial asset to be exploited.**

About water commodification

- It refers to **water handled as a commodity under supply and demand market dynamics** as a way of setting the price of market transactions between users.
  - In December 2020, for the first time in history, a **tradable water price futures index was launched on the Chicago Stock Exchange** on the Nasdaq Veles California Water Index (NQH2O).

- **Dublin Statement on Water and Sustainable Development of 1992** mentions that **water should be recognized as an economic good.**
- While no particular provision in the Indian Constitution categorically recognises water as a positive human right, the **judiciary has interpreted right to water as a fundamental right,** a facet of right to life and dignity under the ambit of **Article 21.**
- **Characteristics of water trading markets**
  - **Separation of water from land** to allow water commodification.
  - **Deregulation of water rights trading** between users and between different uses.
  - **Transition** from publicly regulated pricing, usually for non-profit cost recovery, **to market water pricing.**
  - **Increasing de facto private appropriation of water,** marginalization of vulnerable users and disregard for affected third parties and non-productive values.



- **Issues associated with commodifying water in India**
  - **Commodification can lead to emergence of discriminatory practices** especially against low income populations.
  - **India lacks clear and transparent pricing regulations.**
  - Trading of water use rights in markets **erodes the notion of water as a common good** and the State as a guarantor of the general interest.
- **Potential benefits:** The risk transfer in the private sector could significantly reduce the burden of drought relief, currently borne by banks and governments.

3.7. LAND DEGRADATION

LAND DEGRADATION IN INDIA AT A GLANCE

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

IMPACTS

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

KEY TARGETS

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

CURRENT SITUATION

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

SCHEMES/POLICIES/INITIATIVES

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

CONSTRAINTS

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

WAY FORWARD

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

3.7.1. COP15 OF UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION (UNCCD)

Why in News?

Fifteenth session of Conference of the Parties (COP15) of United Nations Convention to Combat Desertification (UNCCD) concluded recently.

More about News

- UNCCD, established in 1994, is the **sole legally binding international agreement** linking environment and development to sustainable land management.
  - There are 197 Parties to the Convention, including **196 country Parties and the European Union.**
    - ✓ **India is a signatory.**
  - The UNCCD focuses on **coordinated actions to put the world on a path to land degradation and carbon neutrality.**
- COP15 was **held in Abidjan, Côte d'Ivoire.** Theme of COP15 was **'Land. Life. Legacy: From scarcity to prosperity'.**
  - **The COP has been meeting biennially since 2001.**

Sustainable Development Goal connection

- **Sustainable Development Goal 15: Life on Land** calls for the protection, restoration and sustainable management of land-based ecosystems.
- In doing so **target 15.3** specifically aims to achieve a land degradation-neutral world by the year 2030.

Key outcomes of COP15

New commitments	• Accelerate **restoration of one billion hectares of degraded land by 2030** by improving data gathering and monitoring. • Establish an **Intergovernmental Working Group on Drought** for 2022-2024 to support a shift from reactive to proactive drought management. • **Address forced migration and displacement** driven by desertification and land degradation by creating social and economic opportunities that **increase rural resilience and livelihood stability.** • **Improve women's involvement in land management** as important enablers for effective land restoration. • **Address sand and dust storms and other escalating disaster risks** by designing and implementing plans and policies including early warning and risk assessment and mitigating their human-made causes at source. • Ensure greater **synergies among the three Rio Conventions:** convention on Biological Diversity, UNCCD, and United Nations Framework convention on climate change.
New Declaration Issued	• **Abidjan Call issued by the Heads of State and Government** to boost long-term environmental sustainability. • **Abidjan Declaration on achieving gender equality** for successful land restoration. • **COP15 "Land, Life and Legacy" Declaration**, which responds to findings of UNCCD's flagship report Global Land Outlook 2.
Other Initiatives	• **Drought in Numbers, 2022 report** was released which highlighted that nearly **two-thirds of India suffered** drought during 2020-2022. • **Business for Land initiative** aimed at bringing visibility to the commitments made by participating companies towards land degradation neutrality, both in supply chains and CSR activities. • **Sahel Sourcing Challenge** to enable communities growing Great Green Wall (GGW) to use technology to monitor progress, create jobs and commercialize their produce. ○ GGW is an **African-led movement to grow an 8,000km natural wonder** of the world across the entire width of Africa. • **Droughtland**, a new UNCCD public awareness campaign.

Related Information

Desertification process in Rajasthan

- Thar desert is expanding fast with land degradation as per a study by Central University of Rajasthan.
- **Causes of Expansion**
  - Migration of people.
  - Changes in the rainfall pattern.
  - Spread of sand dunes.
  - Unscientific plantation drives.
  - **Over-exploitation of resources** leading to reduction in vegetation cover.
  - **Gradual destruction of the Aravalli ranges which act as a 'natural green wall'** between the desert and the plains.
    - ✓ **Destruction of Aravalli's can make sandstorms intense** and they will travel as far as National Capital Region (NCR) and pollute the air there.

Soil salinization

- Food and Agriculture Organization (FAO) highlighted threat of soil salinization to global food security.
- Soil salinization occurs when soluble salts are retained in the earth.

- Saline soils **contain an excessive amount of soluble salts** that reduces the ability of plants to take up water from soil.
- **Causes of Soil salinization:**
  - **Natural:** lack of water and intense evaporation in deserts, saltwater intrusion, leakage from geological deposits etc.
  - **Anthropological:** Unsustainable agricultural practices such as waterlogging, use of salt-rich irrigation water, inappropriate application of fertilizers etc.
- **Impacts of soil salinization:** significant decreases in agricultural productivity, water quality, soil biodiversity, and soil erosion.
- **Recommendations**
  - **Integrated approach, embracing sustainable soil and irrigation and drainage management**, selection of salt-tolerant crops and plants including halophytes, which are able to grow well in such environments.
  - **Continuous investment in soil laboratories** to provide reliable data for taking decisions to ensure sustainable soil management.
- **Initiatives taken in India**
  - **Reclamation of Problem Soils- as a sub scheme** of Rashtriya Krishi Vikas Yojana.
  - IMD has provided **a country-wide soil moisture forecast,** for better irrigation planning, and understanding crop patterns.
  - **Soil Health Cards**.

4. SUSTAINABLE DEVELOPMENT

4.1. SUSTAINABLE DEVELOPMENT GOALS IN INDIA

SUSTAINABLE DEVELOPMENT GOALS IN INDIA AT A GLANCE

SUSTAINABLE DEVELOPMENT & ITS NEED

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

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

SDGs

- **Universal** and were created to **"leave no one behind".**
- **17 SDGs** accompanied by 169 specific targets and 232 measurable indicators
- **Bottom-up approach.**
- **Include peace-building** to the success of ending poverty and hunger.
- Get to a **statistical "zero"** on hunger, poverty, preventable child deaths and other targets.
- Focus on the **quality of education.**
- Target to increase significantly the **availability of high-quality, timely and reliable data.**
- **Separately treat the issue of poverty** from Food and Nutrition Security perspective.

Difference between Sustainable Development Goals (SDGs) & Millennium Development Goals (MDGs)

MDGs

- In the context of **"rich donors aiding poor"**
- **8 Goals** with 21 targets and 60 indicators.
- **Top-down process.**
- **Overlooked peace-building** in their cor agenda and goals.
- Reach **"halfway"** to the goal of ending hunger and poverty.
- **Focused only on quantity.**
- **Didn't prioritize monitoring, evaluation and accountability of data.**
- **Hunger and Poverty were combined** together.

INDIA'S SDGs PROGRESS

- India ranked **121 out of the 163 countries** falling from 117 in 2020 and 120 in 2021 in the **Sustainable Development Report 2022.**
- **On track or maintaining SDG achievement:** SDGs **12** (Responsible consumption and production) and **13** (Climate Action).
- **Moderately improving:** SDGs **1** (No Poverty), **3** (Good Health and Well-being), **6** (Clean Water and Sanitation), 7 (Affordable and Clean Energy), **8** (Decent Work and Economic Growth), **9** (Industry, Innovation and Infrastructure).
- **Stagnating:** SDGs **2** (Zero Hunger), **4** (Quality Education), **5** (Gender Equality), **14** (Life Below Water), **15** (Life on Land), **16** (Peace and Justice Strong Institutions), **17** (Partnerships to achieve the Goal).
- **Decreasing:** SDG **11** (Sustainable Cities and Communities).
- Further, **India is facing major challenges in achieving 11 of 17 Sustainable Development Goals.**

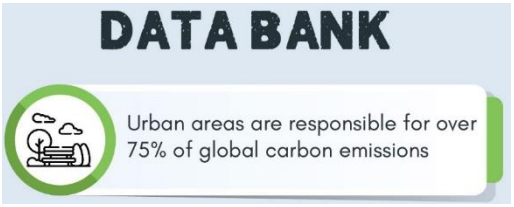
INDIA'S CHALLENGES IN ACHIEVING SDGS

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

WAY AHEAD TO OVERCOME THE BARRIERS IN ACHIEVING SDGS

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

4.2. SUSTAINABLE CITY DEVELOPMENT



Why in news?

Recently, UN-Habitat has identified multi-hazard vulnerabilities, urban sprawl, weak urban mobility and **"green-blue disconnect"** as the pressing issues for Jaipur city.

More in News

UN-Habitat has based its findings on a **Sustainable Cities Integrated Approach Pilot (SCIAP) project**, as part of which the "sustainable urban planning and management" component was implemented in collaboration with the Jaipur Development Authority and Jaipur Greater Municipal Corporation.

Sustainable city

A sustainable city is one designed to address social, environmental, and economic impact through urban planning and city management. A sustainable city offers a good quality of life to current residents but doesn't reduce the opportunities for future residents to enjoy.

Key sustainability issues faced by Indian cities

- **Climate change**:
  - **Cities are one of the main contributors to India's GHG emissions** through industrial, vehicular and domestic emissions, energy demands, changes in land use etc.
  - **Urban areas/cities are highly vulnerable to climate change events** like flooding, sea level rise, cyclones, heat waves, water stress, among others.
- **Burdened infrastructure, congestion and traffic.**
- **Declining green** (trees, parks, fields etc.) **and blue** (lakes, ponds etc.) **spaces** which increases threats like urban flooding, Heat island effect etc.
- **Threats to people's physical and mental wellbeing** due to deterioration of air and water quality, light and noise pollution, lack of green spaces etc.
- **Lack of affordable housing** pushing marginalized populations into disaster prone areas and informal settlements.
- **High waste generation and limited capacity to collect and utilize solid and liquid waste.**

Steps taken by the government to overcome sustainability problems occurring in cities

- **Swachh Bharat Mission-Urban 2.0**
- **Atal Mission for Rejuvenation and Urban Transformation (AMRUT)**
- **Pradhan Mantri Awas Yojana (Housing for All)**
- **Smart City Mission**
- **Others-** Solar Cities Program; ClimateSMART Cities Assessment Framework; National Smart Grid Mission; National Mission for Enhanced Energy Efficiency (NMEEE); Energy Conservation Building Code (ECBC); National Electric Mobility Mission Plan 2020.

Key barriers in sustainable cities development in India

- **Low environmental awareness** of urban population resulting in unsustainable lifestyle.
- **Inefficient funding** for necessary investments which are not economically viable.
- **Segmented approach** in city's political and operational structures result in poor integration of plans and actions.
- **Insufficient transfer of knowledge** on sustainability management and sectoral solutions, which are needed for improving environmental performance.
- **Lack of integrated planning** resulting to sustainable development strategies not being largely taken into account in development plans and not being addressed cohesively in different policy areas.

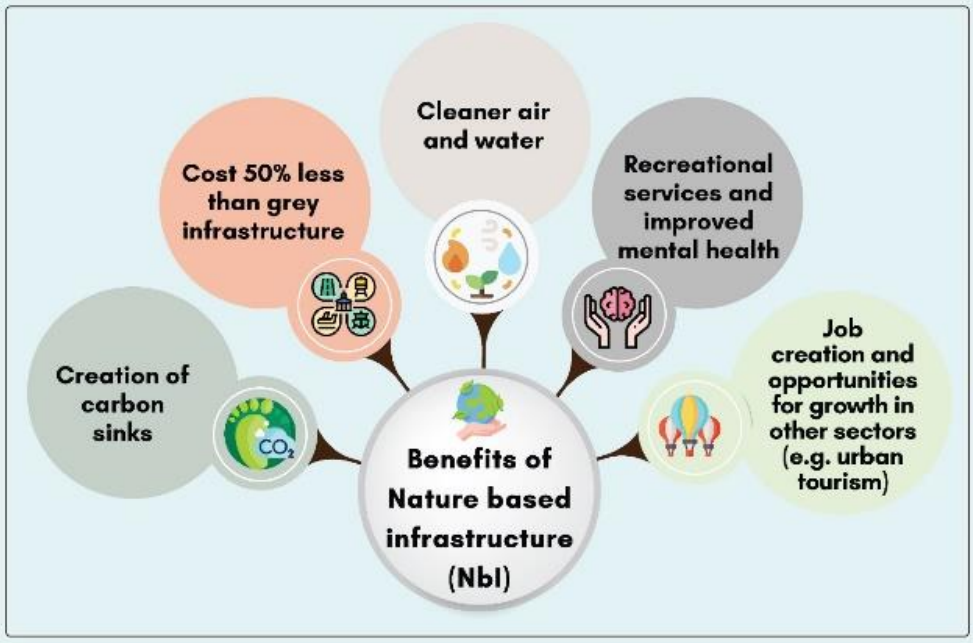
Way Forward

- **Increasing nature in city's infrastructure and built environment** through nature-based solutions (NbS) for infrastructure.
- Improving Urban governance models **by mainstreaming citizens health and wellbeing and biodiversity in decision-making**.
- **Adopting systems approach** in which complex interactions between systems (e.g. healthcare, education and environment,) are mapped, and the outcomes of each action are measured and reported in totality.

- **Prioritizing circular economy and bio-inspired innovations** for economic competitiveness.
- **Utilizing novel investment models like Debt-for-nature swaps**.

Related concept: Nature Based Infrastructure (NbI)/Green Infrastructure

- It seeks to restore or utilize the existing natural extent, connectivity and diversity of cities' natural ecosystems to provide key functions of infrastructure.
- Around cities, NbS interventions can help with watershed management, recreational space, managing wildfires, reducing, and capturing CO_2 emissions, etc.



- **Nature Based Solutions (NbS):** These are actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.

4.3. SUSTAINABLE AGRICULTURE IN INDIA

SUSTAINABLE AGRICULTURE IN INDIA AT A GLANCE

DEFINITION

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

CURRENT SITUATION

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

CONSTRAINTS

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

SIGNIFICANCE OF MOVING TOWARDS SUSTAINABLE AGRICULTURE

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

SCHEMES/POLICIES/INITIATIVES

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

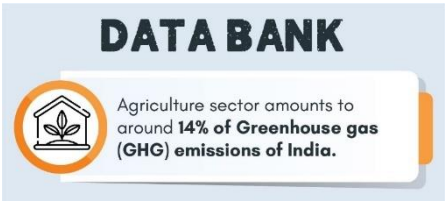
WAY FORWARD

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

4.3.1. GREEN REVOLUTION 2.0: INDIAN AGRICULTURE POST-COP26

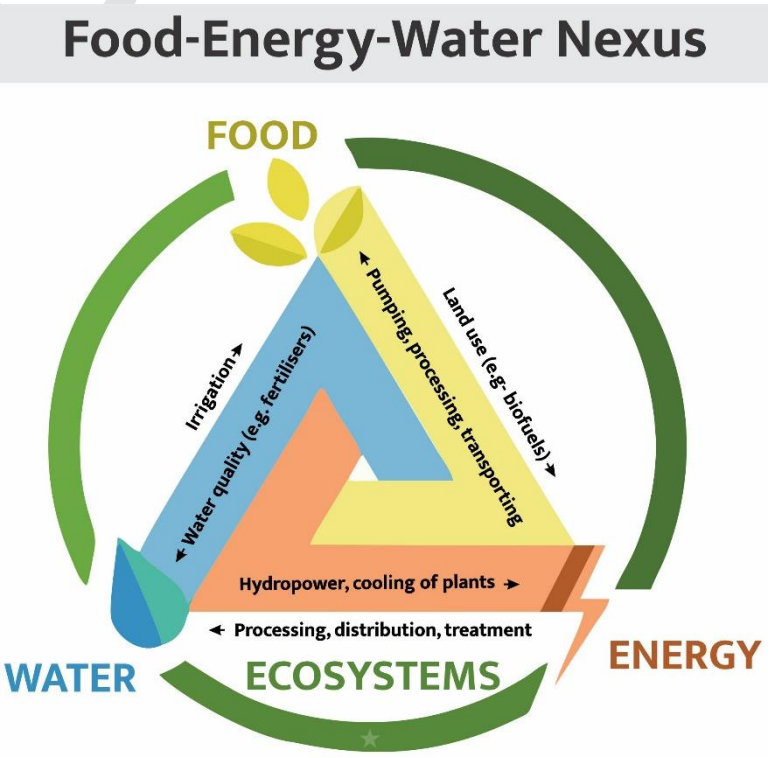
Why in News?

Significant discussions took place at COP26 in the direction of aligning agriculture policies with climate action agenda, warranting a second green revolution along with next-generation reform.



Green Revolution 2.0: The need for reforms in Agriculture sector of India

- **Reducing GHG emissions from the sector.**
- **Build resiliency against Climate change** induced increase in temperatures, rainfall variation and the frequency and intensity of extreme weather events.
- **Address fallouts of Green Revolution** that threaten overall sustainability of India's food systems.
- **Developing comprehensive policy to deal with persistent issues** like low crop productivity, post-harvest loss, poor water use efficiency, food inflation and volatility in prices, fragmented landholdings, lower farm mechanisation, scarce public and private investment in agriculture etc.
- **Addressing 'food–energy–water' (FEW) nexus** (depicts the significant interconnection between the three essential resources).



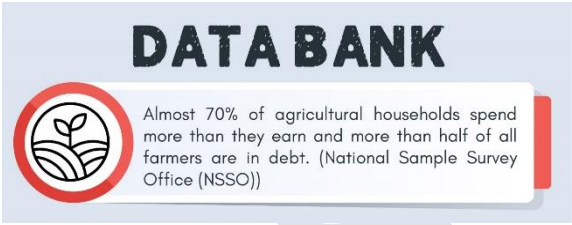
Way Forward

- **Diversification to more nutritious and environment-friendly crops** like millet, pulses, etc.
- **Agro-ecological approaches promoting Nature-positive and regenerative agriculture practices** like Organic farming, No-till farming, crop rotation, etc.
- **Water-use efficiency by moving away from a supply-based to demand-based system** and use of techniques like system of rice intensification (SRI), alternate wetting and drying (AWD), direct seeded rice (DSR), etc.
- **Expansion of Renewable energy usage** on farmlands to address water-energy-food nexus.
- **Promoting new agri-tech start-ups and farm enterprises for developing ICT based tools in fields** like- delivery of farm-based information and services, market integration and intelligence, weather advisories etc.

Progressive steps taken in India

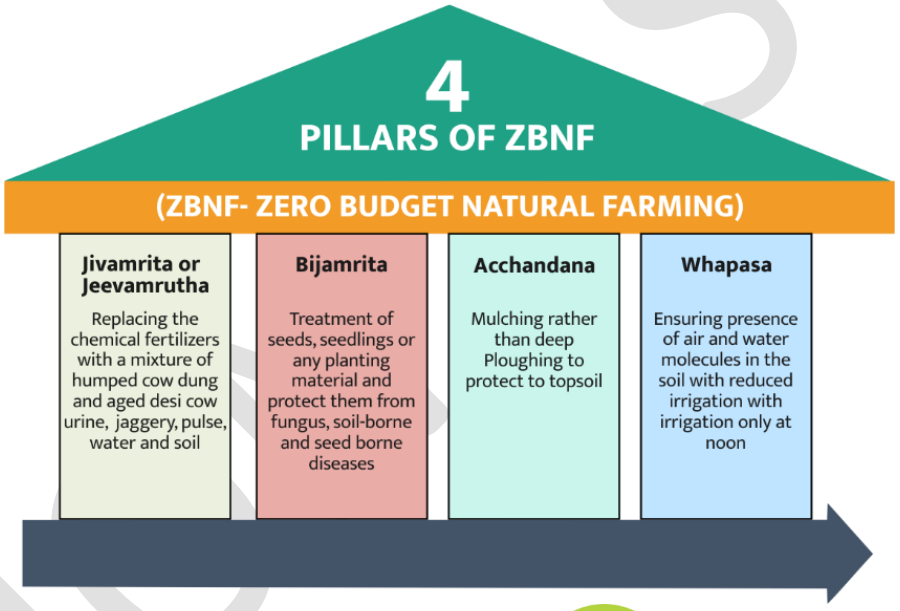
- **Climate resiliency:** National Mission for Sustainable Agriculture (NMSA); National Innovations in Climate Resilient Agriculture (NICRA) programme etc.
- **Resource use efficiency:** Pradhan Mantri Krishi Sinchayi Yojana (PMKSY); Soil Health Cards scheme; Micro Irrigation Fund corpus of Rs. 5000 crore created with NABARD etc.
- **Greener approaches:** Paramparagat Krishi Vikas Yojana; Promotion of Agricultural Mechanization for In-Situ Management of Crop Residue in the States of Punjab, Haryana, Uttar Pradesh and NCT of Delhi; Bharatiya Prakritik Krishi Paddhati Programme (BPKP) etc.
- **Other Steps:** PM-KUSUM; Promotion of millet production through hike in Minimum support price (MSP) etc.

4.3.2. ZERO-BUDGET NATURAL FARMING (ZBNF)



Why in news?

Indian Council of Agricultural Research (ICAR) committee highlighted that **ZBNF would result in tremendous reduction in production of agricultural crops thus compromising India's food security.**



About ZBNF

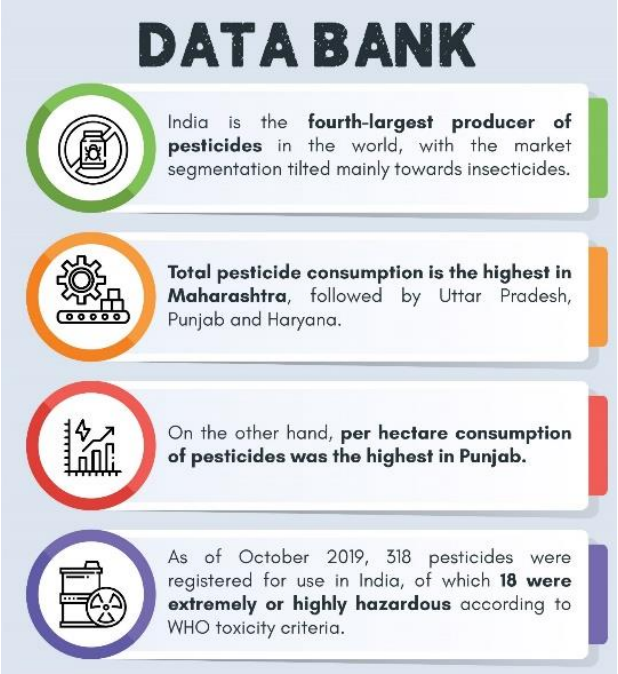
- It is a farming technique based on **natural farming principles** (see infographic)**, done without use of chemicals and without using any credits** or spending any money on purchased inputs.
- It was **originally promoted by** Maharashtrian agriculturist and Padma Shri recipient **Subhash Palekar**, who developed it **in the mid-1990s as an alternative to the Green Revolution.**
- ZBNF was **mentioned in two budget speeches** of the Central government in 2019-20 and 2020-21.
- **Significance of ZBNF**
  - **Requires 50%–60% less water and less electricity** (than non-ZBNF).
  - **Reduces methane emissions** significantly through multiple aeration.
  - **Avoids residue burning** by practising mulching.
  - **Improving soil health** by promoting soil aeration, minimal watering, intercropping, mulching etc.
  - **Doubling farmers' income: Reduces farmers' dependence on loans to purchase inputs** and **inter-cropping** allows for **increased returns.**

Differences between Natural and organic farming	
Natural Farming	**Organic Farming**
• Uses no external fertilizers on farmlands, decomposition of organic matter by microbes and earthworms is encouraged right on the soil surface itself.	• Organic fertilizers and manures like compost, vermicompost, etc. added to farmlands from external sources
• Mimics natural ecosystems: no ploughing, no soil tilling, and no weeding done on natural farms.	• Ploughing, soil tilling, and weeding might be undertaken in organic farms.

4.3.3. PESTICIDE USAGE IN INDIA

Why in news?

According to a recent study, **64% of global agricultural land (approximately 24.5 million km²) is at risk of pesticide pollution** by more than one active ingredient.



About pesticides

- Pesticides are **chemical compounds that kill pests** such as insects, rodents, fungi and unwanted plants (weeds) and mainly include insecticides, fungicides and herbicides.
- **Concerns associated with Pesticide usage in India:**
  - **Health hazards** among farmers due to **lack of awareness and training on safe use of pesticides.**
  - **Environmental contamination** of surface and groundwater through **runoff and infiltration** and **adverse impact on biodiversity.**
  - **Hinders export of agri commodities** due to high residue.
  - **Opaque and out of date regulatory framework.**
  - **Lack of Power with States:** Agriculture is a state subject, but **control for pesticides is vested with the Centre.**
  - **Rising usage** to combat the **possible rise in pest invasions due to warmer climate.**
  - **Monopoly of private sector** guided by the profit motive leading to unregulated sale and spurious and counterfeit pesticides.

Steps taken by Government

- Ministry of Agriculture has so far **banned or phased out 46 pesticides and four pesticide formulations** for import, manufacture or sale in the country.
  - **Anupam Verma committee** had completed the process to review 66 pesticides that are banned, restricted or withdrawn in some other countries, but are used in India.
- **Monitoring of Pesticide Residues at National Level:** Samples of vegetables, fruits and other crops are collected and analysed by enlisted laboratories for pesticide residues.
- **Ban on Persistent Organic Pollutants ("POPs"):** Govt has ratified the ban on **7 POPs** considered hazardous and listed under the **Stockholm Convention,** which are used in **insecticides, pesticides, fungicides etc.**
- **Insecticides Act, 1968 and Insecticides Rules, 1971** governs the **use, manufacture, distribution, sale and transport of insecticides** with a view to lowering risks to human and animal health.
  - **Pesticide Management Bill 2020** is currently pending on the Parliament to replace the act.

Way Forward

- **Enactment of PMB 2020** to rectify concerns arising from usage of Pesticides.
- **Advanced technology to weed out fake pesticides** and identification of genuine pesticides like securing hologram seals and labels, light-sensitive ink designs, etc.
- **Improve coordinated functioning of central and state-level functionaries.**
- **Educating farmers about judicious usage of pesticides** with the help of Farmer producer companies, cooperatives and extension workers.
- **Encouraging use of alternative practices like organic farming and use of bio pesticides** like neem and plant-based formulations etc.

About Pesticide Management Bill 2020

- It seeks to **regulate the manufacture, import, sale, storage, distribution, use, and disposal of pesticides**, in order to ensure the availability of safe pesticides and minimise the risk to humans, animals, and environment.
- **Key Features of the bill**
  - **Constitute Central Pesticides Board** by Central government **to advise the central and state governments** on scientific and technical matters arising under the Act.
  - **Board will formulate standards and best practices** for pesticide manufacturers, laboratories, and pest control operators, working conditions and training of workers, and recall and disposal of pesticides.
  - Centre **may constitute an authority** to regulate their price in a manner as it may prescribe.
  - **Mandatory Registration of pesticides prior production** with stringent criteria.
  - **Licence required** to manufacture, distribute, exhibit for sale, sell, or stock pesticides, or undertake pest control operations.

- **Complete Prohibition on certain notified pesticides.**
- **Other provisions**: Pesticide inspector for selected areas, undertaking activities without licence made punishable with imprisonment of up to three years and/or a fine of up to Rs 40 lakh, or both.

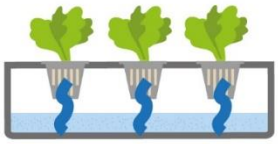
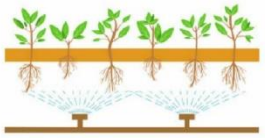
4.3.4. OTHER SUSTAINABLE PRACTICES IN NEWS

Agri-voltaic farming

- Cochin International Airport Ltd (CIAL) has developed **large-scale agri-voltaic farming**.
- Agri-voltaic farming- is a **mixed system of solar energy production associating solar panels and crop** at the same time on the same land area.
- It is an **evolving practice in sustainable development** that combines the production of food and energy.
- **PV-module are installed in Agri voltaic system (AVS)** inclination angle equal to the latitude of the place of installation.
- Agri-PV overcomes the present either-or situation by **achieving both power generation and agricultural yield.**

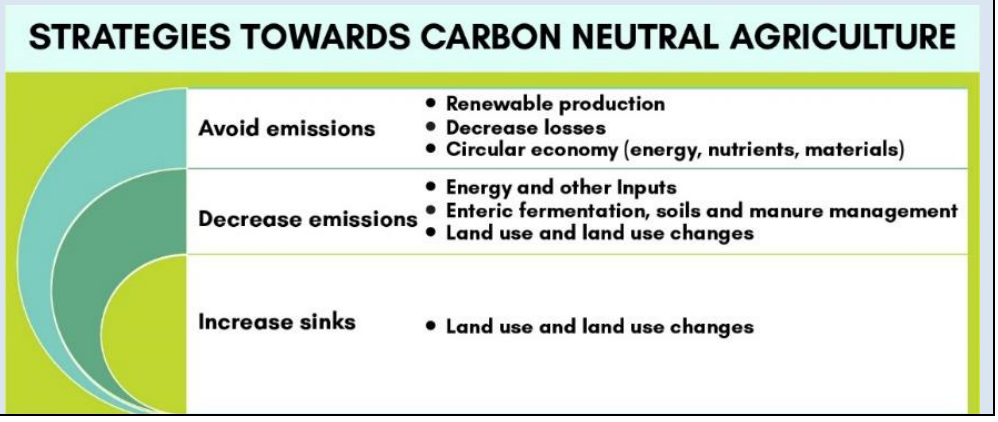
Hydroponics and Aeroponics

- With the **growing climate vulnerability in traditional field based agriculture** either organic or chemical, idea of **Hydroponics and Aeroponics is being put forward as a solution.**
- **Significance of these methods**
  - **Ideal if the available land is not fertile or suitable for cultivation.**
  - With aeroponics, one can **set up vertical farms on grow towers.**
  - **Ideal for short crops such as lettuces, strawberries and other exotic vegetables,** and even flowers.
  - Crops are grown in a **clean and controlled environment, without the use of soil or pesticides** and thus, a very limited chance of contamination.

Hydroponics	Aeroponics
HYDROPONICS 	AEROPONICS 
• **Sapling usually placed on a substrate** (like rock wool, volcanic ash, peat moss, coco coir or clay pebbles), which is **dosed with nutrient-rich water periodically.** • Many a times, plants are simply **along a channel that has flowing water.**	• **Plants are grown in a controlled air environment** and are not placed on a substrate or in water. • The **exposed roots are periodically sprayed with nutrient solutions** for the plants to grow.

Carbon-neutral farming

- Kerala is set to become the **first State to introduce carbon-neutral farming methods** in selected locations, for which the government has set aside Rs.6 crore in the 2022-23 Budget.
- Carbon neutral agriculture refers to the **net zero balance of emissions and sinks of all the greenhouse gases on farms** in terms of their CO_2 equivalents, resulting in climate neutral systems.
- **Need for Carbon neutral agriculture**
  - **To reduce current carbon footprint of agriculture**.
  - **Reduce carbon emissions** and help carbon to be stored in the soil.
  - **Enhance food production** while controlling and reducing the GHG emissions from agriculture.
  - Improves **soil fertility and nutrient retention**. This, in turn, boosts crop productivity.
- **India initiated steps** like using nitrogen fertilisers more efficiently, adopting zero-tillage farming and improving the management of rice water to reduce carbon foorprint.

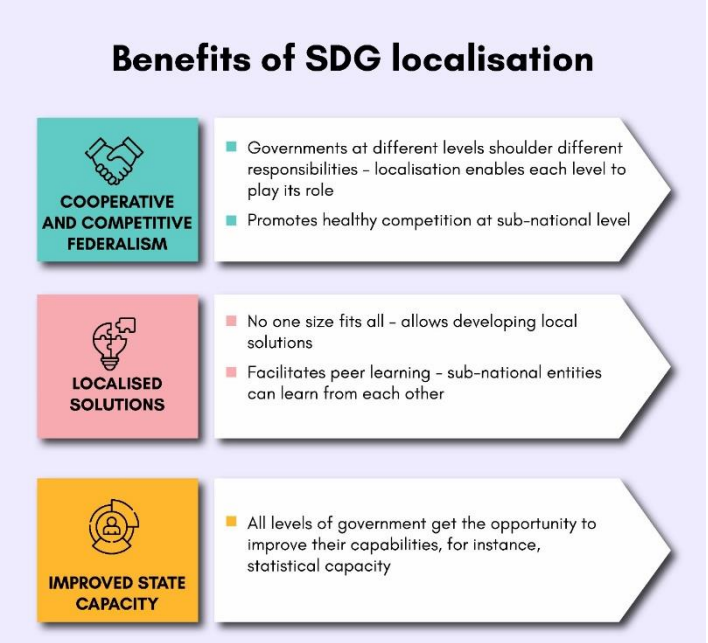


Participatory Irrigation Management (PIM)	• PIM, adhering to the rules and norms of community-based natural resource management, has **gained salience by receiving thrust in the National Water Policy 2002.** • PIM refers to the **participation of irrigation users** -farmers - in **management of irrigation system.** • The purpose of PIM is to **manage water in a decentralised manner** while allowing the local community to play a significant role in its management and governance. • PIM Act, 2007 aims to **monitor the equitable distribution of water resources** between beneficiary farmers through **Water Users' Associations (WUAs).** • **Objectives of PIM:** o To **create a sense of ownership of water resources and irrigation system** among users, so as to promote economy in water use and preservation of system. o To **improve service deliveries** through better operation and maintenance (O&M). o To **achieve optimum utilization of available resources** as per crop needs. • **Need of PIM:** o To increase the agricultural production to keep pace with requirement. o Decrease financial burden of operation and management of old irrigation systems. o To **achieve equity in water distribution**. o Money spent by government to recover water charges is more than the amount recovered due to low tariff of water.

4.4. LOCALISATION OF SUSTAINABLE DEVELOPMENT GOALS (SDGS)

Why in News?

Ministry of Panchayati Raj has signed a joint statement of understanding on **localisation of SDGs** with the United Nations Development Programme (UNDP).



About SDGs and their Localisation

- SDGs is a set of **17 Sustainable Development Goals** to **end poverty, fight inequality** and **injustice,** and **tackle climate change** by **2030**; adopted at the **United Nations Sustainable Development Summit** in **2015.**
- Localization of SDGs is the process of **taking into account sub-national contexts in the achievement of SDGs.** This includes:
  - The use of SDGs to provide a **framework for local development policy,** and
  - **Identifying how bottom-up actions** from local and regional governments can support SDGs achievement.

Challenges in SDG Localisation

- **Local Translation and Adaptation in** diverse country like India.
- **Infrastructure challenges related to availability of local data, its collection and capacities** to perform local monitoring.
- **Functional and coordination issues (vertical and horizontal)** due to prevalence of top-down approach, apathy from state and bureaucracy towards local bodies and lack of political support for local governance.
- **Enhanced responsibilities** with **limited funds transfer and local resource mobilization.**
- **Limited awareness of the SDGs at the sub-national level.**

Importance of localisation of SDGs in Panchayati Raj institutions

- Nearly **65% of the Indian population** living in **rural areas.**
- PRIs provide **last-mile connectivity** and help the government in implementing a number of **social sector schemes** in areas of drinking water, sanitation, housing etc.
- **Active involvement** of PRIs in SDGs can help in achieving SDGs by **keeping the local priorities on top** of the agenda.

Efforts taken for localization of SDGs

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

Some Examples of Successful Localisation from States

Andhra Pradesh	• **Navaratnalu, a cluster of nine flagship programmes, to reach out to vulnerable communities across sectors**, such as, agriculture, health, education, housing, etc**.**
Assam	• **Arunodoi scheme** for women from 1.7 million families through Direct Benefit Transfer.
Bihar	• **Viksit Bihar ke 7 Nischay**, a package of programmes which includes schemes on inclusion, entrepreneurship, women's reservation in jobs, provision of water, electricity, concrete streets, toilets and higher education.
Goa	• **Swayampurna Mitras** (promoters of self-reliance): These are selected government officials to improve development outreach and make villages self-reliant.

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.**
- **Accounting for diversity of India**, especially **tribes** who are among the most deprived sections with almost **90%** living in rural areas (**Census, 2011**).

Related News: Sustainable Development Report 2022

- Recently, **Sustainable Development Solutions Network (SDSN)** released Sustainable Development Report 2022 named 'From Crisis to Sustainable Development: The SDGs as Roadmap to 2030 and Beyond'.
- **Findings of Sustainable Development Report 2022**
  - **For the second year in a row, the world is no longer making progress on the SDGs**
  - The average **SDG Index score declined in 2021 due to slow or non-existent recovery in poor and vulnerable countries.**
  - **Rich countries generate negative international spillovers:** These **effects occur when one country's actions generate benefits or impose costs on another country** that are not reflected in market prices and therefore are not 'internalized' by the actions of consumers and producers. It generates **negative socioeconomic and environmental spillovers, including through unsustainable trade and supply chains**.
- **India specific findings**
  - **India ranked 121 out of the 163 countries** (Finland topped) compared to 117 in 2020 and 120 in 2021, that shows slip in ranking for the third consecutive year.
  - According to report India is facing **major challenges in achieving 11 of 17 Sustainable Development Goals**, while it mentioned India is on track to achieving SDG 13 on climate action. (**Refer infographic**)
  - Report also found that **SDGs are not mentioned in the latest central or federal budget documents of India.**
- **Major priorities to curb negative international spillovers generated by rich countries:**
  - **Scale up international development and climate finance.**
  - **Leverage technical cooperation and SDG diplomacy**.
  - **Adopt national targets and instruments** to address consumption-based impacts on other countries.
    - ✓ E.g. In 2022, **Sweden became the first country** to commit to setting a national target **to curb its imported consumption-based CO_2 emissions**.
  - **Strengthen accountability, data, and statistics.**

4.5. UN-ENERGY PLAN OF ACTION TOWARDS 2025

Why in news?

Recently, **Plan of Action Towards 2025 was launched by the UN Energy** against the backdrop of a global energy crisis and worsening climate emergency.

More on news

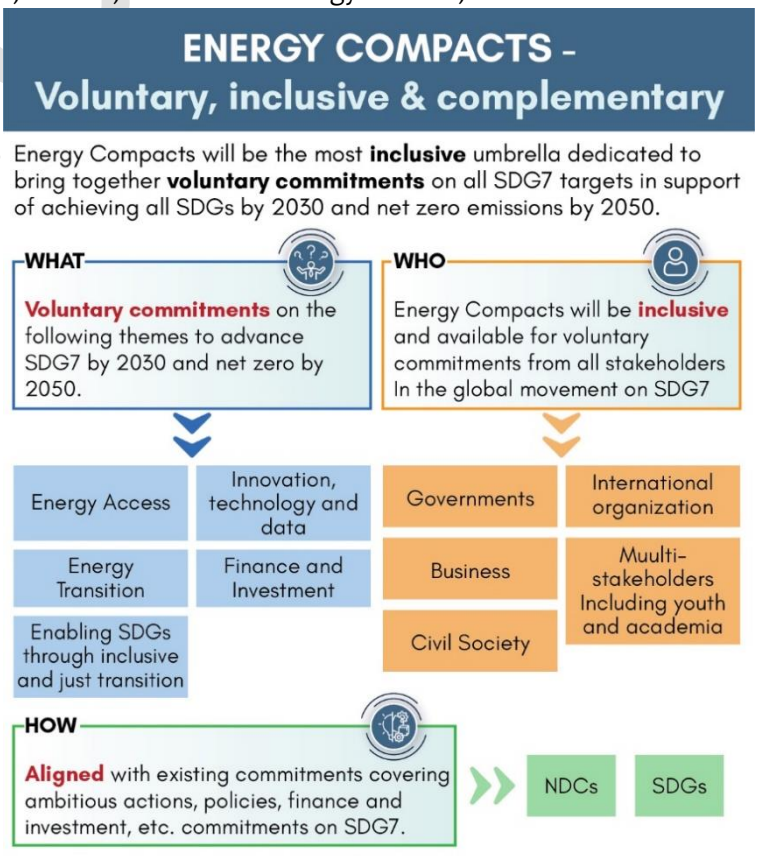
- It is a major step to **catalyse the large-scale action** and **support needed for the transition to clean,** affordable energy for all and **net-zero emissions.**
- **Energy Compact Action Network (ECAN) was also launched** to match governments seeking support for their clean energy goals with governments and businesses that have already pledged over **$600 billion in assistance.**
- **SDG 7 aims to, by 2030:**
  - **Ensure universal access to affordable,** reliable, and modern energy services,
  - **Increase substantially the share of renewable energy** in the global energy mix, and
  - **Double the global rate of improvement** in energy efficiency.

UN Energy

- UN-Energy is the **United Nations' mechanism for inter-agency collaboration in the field of energy** established by the UN System Chief Executives Board for Coordination (CEB).
- UN-Energy reports to the CEB through the High-Level Committee on Programmes (HLCP).
- It **brings together 30 organizations that are global leaders** in their respective fields, covering together all aspects of energy and sustainable development.

Seven areas identified under UN-Energy Plan of Action

- **Scale up collective UN-Energy action:** Joint programmes, supported by UN-Energy and leveraging relevant Energy Compacts to significantly scale up collective UN system action.
- **Scale up Energy Compacts:** Through ECAN, **UN-Energy will create a framework** to bring new stakeholders aboard, **foster coalition-building,** and **drive towards a continuous increase in ambition and accelerated action, catalyzing finance and investment,** etc.
- **Lead a Global Campaign for SDG 7 Action:** Campaign will **advocate the Global Roadmap, contribute to**



mobilizing additional Energy Compacts, communicate best practices in support of accelerating SDG 7 action, making use of dynamic digital platforms and social media.
    - Campaign will also **leverage existing platforms and processes** such as the UNFCCC COP, IRENA Assembly, Vienna Energy Forum and others.
- **Lead by example- Greening UN-Energy organizations' operation**.
- **Convene annual Global SDG 7 Action Forum**: It will be organized under the auspices of the UN General Assembly to **constructively review, discuss and advance relevant issues**.
    - It will be supported by UN-Energy and build on **UN Decade of Sustainable Energy for All 2014-2024**.
- **Inform global agenda-setting and demonstrate thought-leadership**: By harnessing the UN system's collective strengths, UN-Energy can **provide analytical inputs for intergovernmental dialogues, share knowledge,** and document best practices on institutional arrangements, technologies etc.
- **Track and share results**. UN-Energy will track the development and implementation of the Energy Compacts through transparent monitoring frameworks and will then communicate results.

4.6. DEVELOPMENT INDUCED DISPLACEMENT

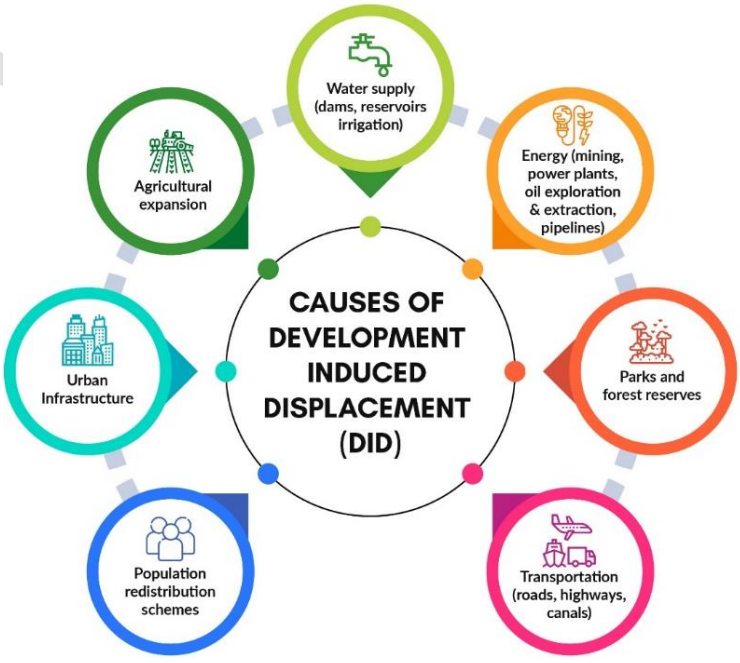
Why in news?

The **Polavaram irrigation project will displace** the highest number of people, predominantly **tribal population,** in India's history of such projects i.e., about 1 lakh families in Andhra Pradesh, upon completion.

About Development Induced Displacement (DID)

- It is characterized by the **permanent relocation of all households within a geographic area** as a result of the construction of **infrastructure projects.**
- **Categories:**
    - **Direct displacement** due to the **initiation and construction** of developmental projects.
    - **Indirect displacement** when the people are forced to leave the area because functioning of the projects **consumes the natural and environmental resources** in the surrounding and deprives their traditional means of livelihood.

Risks associated with DID



- **De-capitalization and Economic marginalization** of displaced people due to expropriation of land.
- **Joblessness and homelessness**.
- Health impacts like **undernourishment,** displacement-induced **social stress** and **psychological trauma, outbreak of diseases** etc. especially in vulnerable sections such as infants, elderly etc.
- **Social disintegration** due to disruption of informal social networks, trade linkages and local labor markets.
- **Violation of Human Rights:** Displacement from one's habitual residence and the loss of property **without fair compensation,** arbitrary arrest, degrading treatment or punishment, temporary or permanent disenfranchisement etc.

Way Forward

- **Developing an action plan** that includes **provisions for prevention and protection against arbitrary displacement** due to development. It should include, inter alia:

- **Equal treatment to women in the eligibility for R & R benefits.**
- **Disseminate information** about the **rights of displaced persons** and **measures undertaken** during displacement to displaced persons.
- **Other measures:**
  - Any developmental projects should be initiated only after **properly rehabilitating everyone affected.**
  - Establish **monitoring and reporting systems** that document violations of the rights guaranteed.
  - Principles of **Sustainable Development, Polluter Pays** Principle and **Precautionary Principle** should be applied while implementing the developmental projects.

Related concept: Rehabilitation and Resettlement (R&R)

- **Issues:** Lack of basic necessities in R&R colonies; multiple exclusion criteria; lack of clear policy; unduly long time taken in rehabilitation; poor compensation; underreporting of displaced persons, etc.
- **Government Efforts:**
  - **National Rehabilitation and Resettlement Policy (2007):** It aims to **minimise displacement,** promote **non-displacing or least-displacing alternatives,** ensure **adequate rehabilitation package** and **expeditious implementation** of the rehabilitation process, among other things.
  - **Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013:** It provides for **rehabilitation & resettlement** and combines it with land acquisition so that the **former does not get neglected.**

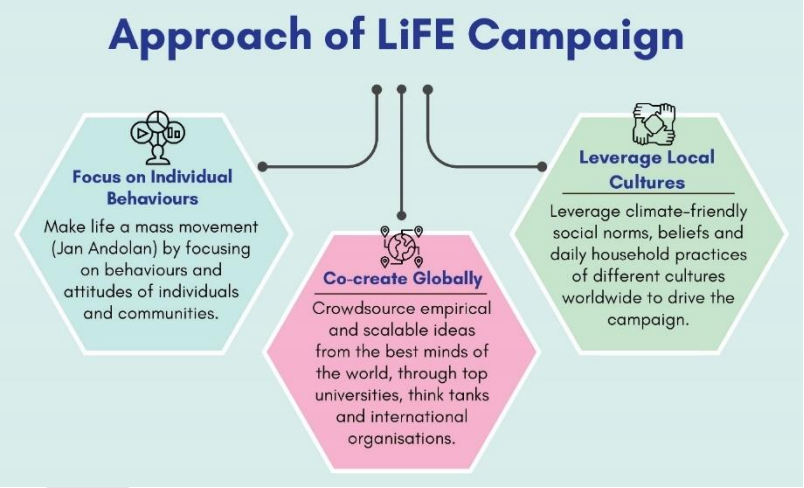
4.7. 'LIFE'- LIFESTYLE FOR ENVIRONMENT

Why in news?

India recently launched a **global initiative Lifestyle for the Environment (LiFE) Movement,** on the occasion of World Environment Day.

More on the news

The launch initiated **'LiFE Global Call for Papers'** inviting ideas and suggestions from academics, universities and research institutions etc. to **influence and persuade individuals, communities and organisations** across the world to adopt an environment-conscious lifestyle.



About LiFE

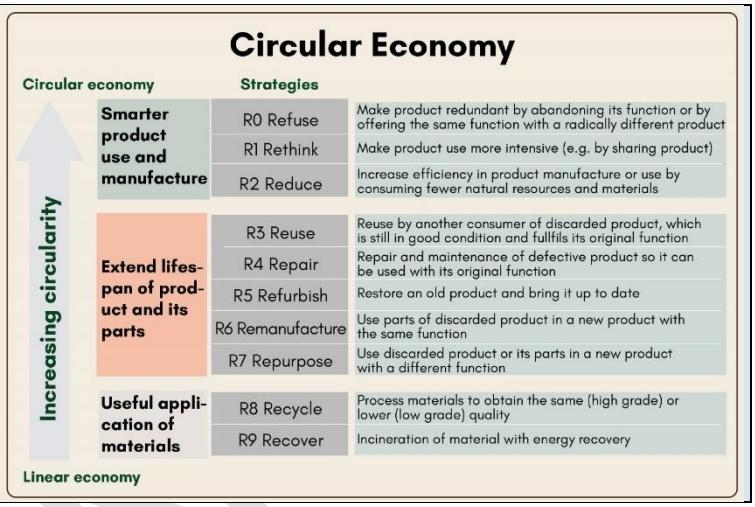
- The idea of LiFE was first introduced by the Prime Minister during the UNFCC **COP-26 in Glasgow.**
- It envisions an **environment conscious lifestyle** that focuses on replacing the prevalent 'use-and-dispose' economy—governed by mindless and destructive consumption—with a **circular economy, defined by mindful and deliberate utilization.**
- **Features of LiFE:**
  - **Leverage the strength of social networks to influence social norms surrounding climate.**
  - **Create and nurture a global network of individuals, namely 'Pro-Planet People' (P3),** who will have a shared commitment to adopt and promote environmentally friendly lifestyles.

- **Borrows from the past, inspired by Indian culture and Gandhi's teachings** to ensure peaceful existence with nature, and **operates in the present** and **focuses on the future.**

- **India's initiatives incorporating principle of 'LiFE'**
  - **Individual-led programs to address climate change,** such as Swachh Bharat Mission, GOBARdhan Scheme and 'Give It Up' Campaign.
  - **'Catch the Rain' campaign** to nudge states for creating rainwater harvesting structures with the active participation of people.
  - **Eco-friendly habits are decoded in our culture**-
    - ✓ Sun-drying of clothes.
    - ✓ Storing and reusing bags, bottles, jars and other items.
    - ✓ Old clothes are often repurposed.

Related concept: Circular economy

- It describes an economic system that is based on business models which replace the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes.



4.8. WASTE MANAGEMENT

4.8.1. PLASTIC POLLUTION

PLASTIC POLLUTION IN INDIA AT A GLANCE

Key Targets

Eliminate all single-use plastic by 2022

Current Situation

- 3.5 million Tonnes of plastic waste generated annually.
- Per capita plastic waste generation has almost doubled over the last five years.
- Only 60 per cent of plastic waste is collected.

Adverse impacts of Plastic use

- **Environmental Impacts:** Accumulates and contaminates soil and water; GHG emissions during production and waste management; Hazard (entanglement, ingestion etc.) for marine, avian and terrestrial wildlife; etc.
- **Economic Impacts:** Negative impacts on fishing and tourism industry Chokes drainage and sewerage infrastructure; Marine plastic debris obstructs ships; etc.
- **Health Impacts:** Can enter human food chain; Leaches toxins into food and drinks with effects like disruption of normal hormone function, cancer etc.

Schemes/Policies/Initiatives

- **Plastic Waste Management Rules, 2016** and recent amendment in 2021.
- **Swachh Bharat Mission 2.0** provides additional Central Assistance to States/UTs for solid waste management including plastic waste management.
- **Clean and Green campaign** of MoHUA encourages States and UTs to take up of activities like- large scale cleaning and plogging drives, etc with special emphasis on plastic waste collection.
- **India had piloted a resolution in the 4th United Nations Environment Assembly held in 2019,** on addressing single-use plastic products pollution.
- **Private sector collaborations:** India Plastics Pact (IPP), Un-Plastic Collective (UPC) etc.

Constraints

- **Lack of adequate infrastructure and technology** for segregation, collection and disposal.
- **Safe disposal of plastic in existing stocks, litter, landfills etc.**
- **Limited manpower and financial and operational capability in the local bodies.**
- **Limited capacity in India to provide biodegradable replacements.**
- **Challenges in bringing behavioral change** among consumers with **alternatives being expensive.**
- **Poor performance of EPR regime** in India. **Unwillingness among plastic industry** due to technological and financial challenges.

Way forward

- **Enhance investment in plastic waste management infrastructure.** **Identify and target priority areas** of source and distribution of plastic waste.
- **Enhance accessibility and affordability of plastic-alternatives and compostable plastics** by incentivising production by promoting innovation, providing tax benefits, etc.
- **Collaborate with plastic industry for sustainable transition.**
- **Encourage community led interventions** for awareness generation and enforcement of norms.

4.8.1.1. BAN ON SINGLE USE PLASTIC

Why in news?

Several single use plastic (SUP) items identified by the Ministry of Environment, Forest and Climate Change (MoEFCC) has been banned across India from 1st July, 2022.

About the SUP Ban

- SUP has been defined as a **plastic item intended to be used once for the same purpose** before being disposed of or recycled.
- Under the Plastic Waste Management (PWM) Amendment Rules, 2021, **several SUP items** which have low utility and high littering potential **were identified whose manufacture, import, stocking, distribution, sale and use was prohibited** with effect from 1st July, 2022.
  - The ban will **not apply to commodities made of compostable plastic.**
- Those found violating the ban can be penalised under the Environment Protection Act 1986 (imprisonment up to 5 years, or a penalty up to Rs 1 lakh, or both)

Related news: Global Plastics Outlook: Policy Scenarios to 2060

- The 'Global Plastics Outlook: Policy Scenarios to 2060' report **was recently released by OECD.**
- **Projections of the report for the year 2060:**
  - **Use of plastics and plastic waste will almost triple globally,** driven by economic and population growth.
  - **Largest increases expected in emerging economies** in Sub-Saharan Africa and Asia.
  - **Half of all plastic waste still expected to reach landfills** with less than a fifth being recycled.
  - **Plastic leakage to the environment will double** and **build-up of plastics in aquatic environments will more than triple,** exacerbating environmental and health impacts.
  - Following impacts from plastic lifecycle are projected to more than double- **Greenhouse gas emissions, Ozone formation, acidification, and human toxicity.**

Other important provisions of PWM Amendment Rules, 2021

- **Thickness of plastic carry bags increased from 50 microns** to 75 microns with effect from 30th September 2021 and to **120 microns with effect from the 31st December, 2022.**
- **Complete ban on** use of sachets using plastic material for **storing, packing, or selling gutkha, tobacco and pan masala.**
- **Extended Producer Responsibility (EPR) Guidelines for collection and management of unnotified plastics** in an environmentally sustainable way.

Steps taken by the Government to ensure enforcement of the ban

- **Setting up of National and state level control rooms** and **special enforcement teams** for checking illegal manufacture, import, stocking, distribution, sale and use of banned SUPs.
- **States/UTs directed to set up border check points** to stop inter-state movement of any banned SUPs.
- **MoEFCC and Central Pollution Control Board (CPCB) launched various e-governance portals & apps,** like- National Dashboard on Elimination of Single Use Plastic and Plastic Waste Management; EPR Portal for Plastic Packaging; Mobile App for Single Use Plastics Grievance Redressal etc.
- **Directions issued at national, state and local level:** E.g., all leading petrochemical industries ordered to not supply plastic raw materials to the industries engaged in banned SUP production.
- **Others- PRAKRITI mascot, Plastic Challenge–Hackathon 2021** etc.

Related Information
Great Pacific Garbage Patch

- **Ocean Clean-up,** a Netherlands based non-profit organization aims at eliminating the Great Pacific Garbage Patch.
- Also known as the Pacific trash vortex, it is a **collection of marine debris/ garbage (mostly plastic) in the North Pacific Ocean.**
- This garbage patch is actually two distinct collections of debris bounded by the **massive North Pacific Subtropical Gyre** (gyre as a large system of swirling ocean currents).
- It is composed of the **Western Garbage Patch, located near Japan, and the Eastern Garbage Patch,** located between the U.S. states of Hawaii and California.

4.8.1.2. EXTENDED PRODUCER RESPONSIBILITY (EPR) ON PLASTIC PACKAGING

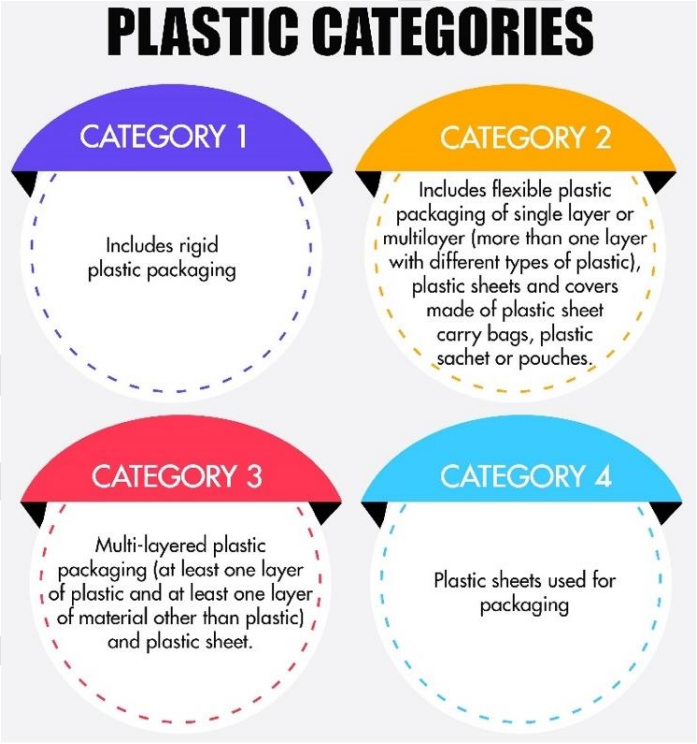
Why in news?

Recently, Ministry of Environment, Forest and Climate Change has notified the Guidelines on Extended Producers Responsibility (EPR) on plastic packaging under Plastic Waste Management Rules, 2016.

What is EPR?

- **EPR is a policy approach where producers are given the responsibility – financial/physical – for environmentally sound treatment** or disposal of post-consumer products.
- Promotes the principles of **circular economy** and **"polluter pays" principle**.
- **Background**
  - **First introduced in India to manage e-waste** in 2012.
  - **Plastic Waste Management (PWM) Rules, 2016** introduced EPR to manage plastics.
  - **EPR Guidelines given legal force** through PWM Amendment Rules, 2021.

New Guidelines of EPR in PWM Amendment rules



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

Potential issues in implementation

- **Lack of accurate data to monitor target fulfilment.**
- **Non-compliance from stakeholders.**
- **Difficulties in inclusion of** informal sector.
- **Lack of awareness among consumers** on the nature of waste and lack of **segregation at source.**
- **Inadequate Infrastructure for** waste disposal, collection, processing, and recycling facilities.
- **High penal** condition may lead to a large number of cases.

Way Forward

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

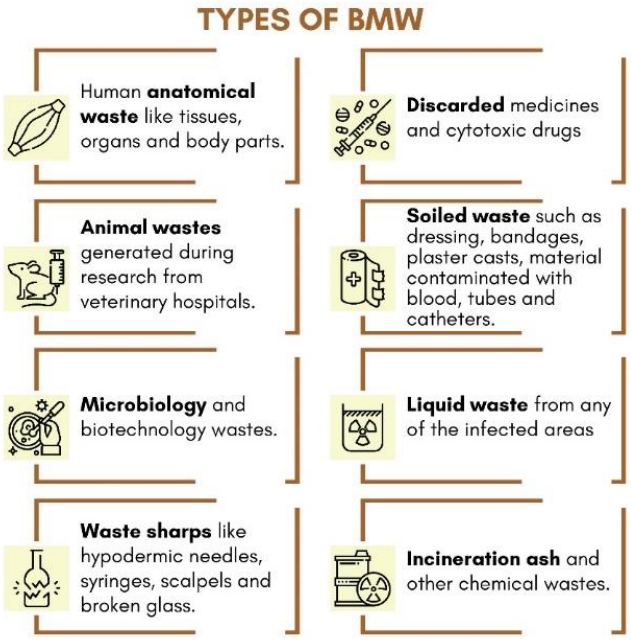
4.8.2. BIOMEDICAL WASTE

Why in news?

The report titled, "State of India's Environment 2021," released by the Centre for Science and Environment, said **2,03,000 kg of COVID-19 biomedical waste was produced daily in May** this year.

About Biomedical Waste (BMW)

- Biomedical waste means any **waste generated during diagnosis, treatment or immunization** of human beings or animals.
- **Sources** of BMW are:
- **Primary source** Hospitals, nursing homes, veterinary hospitals, clinics, dispensaries, blood.
- **Other sources** Households, Industries, education institutes and research centers.



Effects of BMW

Health risks for hospital patients, health workers and the general public:	Environmental impact of improper treatment and disposal of healthcare waste
• **Potential infections**. • **Rise of drug resistant microorganisms.** • **Toxic exposure** to pharmaceutical products. • Injuries associated with waste handling and disposal- Sharps-inflicted injuries, **radiation burns, Chemical burns, thermal injuries.**	• **Release of pathogens and toxic pollutants.** • **Water pollution** and **contamination of ground water.** • **Soil pollution** due to infectious waste, discarded medicines, chemicals used in treatment. • **Heavy metals** such as cadmium, lead, mercury etc. may get absorbed by plants and **can then enter the food chain.**

Challenges with BMW management and how COVID-19 has exacerbated it

- **Inadequate capacity** and **absence of biomedical waste treatment facilities in remote regions.**
- **Disproportionate increase in BMW due to pandemic and vaccination drives.**
- **Difficulties in monitoring flow of waste from innumerable sources** (individual households, isolation centres and makeshift quarantine camps).
- **Waste generators are widely unreported.**
- **Poor segregation in home quarantine centres** and improper disposal due to **poor awareness and lack of communication.**

Way Forward

- **Building a comprehensive system**, addressing **responsibilities, resource allocation, handling, and disposal.**
- **Raising awareness of the risks and of safe practices.**
- **Selecting safe and environmentally friendly management options**, for collecting, handling, storing, transporting, treating, or disposing of waste.
- **Minimization/Recycling of BMW** by the following practices:

BMW related International agreements and Conventions

- **Basel Convention on Hazardous Waste** to protect human health and the environment against the adverse effects resulting from the generation, management, and disposal of **hazardous wastes.**
- **Stockholm Convention on Persistent Organic Pollutants (POPs)** to protect human health and the environment from POPs (dioxins and furans).
- **Minamata Convention on Mercury**: It includes the **phasing out of certain medical equipment** in health-care services, including **mercury-containing medical items** such as thermometers and blood pressure device.
- **Blue book**: WHO handbook on **safe management of wastes from health-care activities**. Its second edition published in 2014 includes topics such as health-care waste management in emergencies, emerging pandemics, drug-resistant bacteria, and climate changes.

Reducing the amount of waste at source	• Choosing equipment and products that generate **less waste** and **can be reused.** • Choosing suppliers who **take back empty containers** for refilling (cleaning products).
Purchasing policy	• Opting for the **least toxic** products. • Purchase of **mercury-free** equipment.

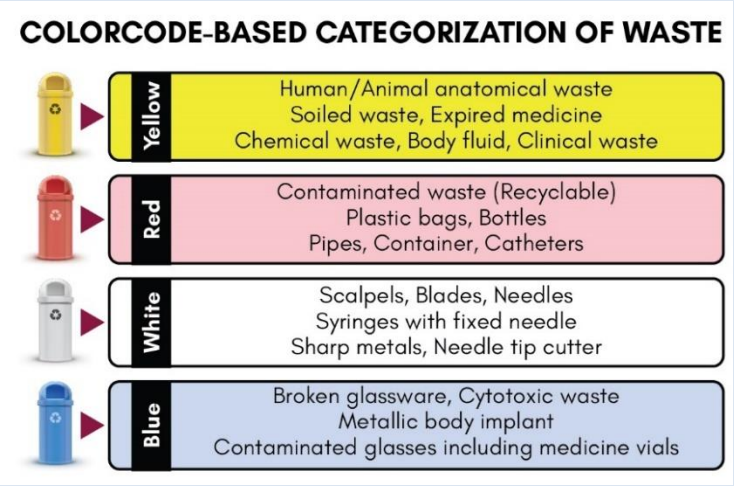
Product recycling	• Recycling of **glass, metals, and plastic etc.**
Stock management	• Centralized purchasing. • Chemical and pharmaceutical stock management **aiming to avoid a build-up of expired or unused items:** "first-in—first out" stock management, expiry date monitoring etc. • Choice of suppliers according to **how promptly they deliver small quantities.**

Biomedical Waste Management (BMWM) rules in India

- In July 1998, first BMWM rules were notified by Government of India which were modified multiple times (latest in 2016).
- **Salient features of Biomedical Waste Management Rules, 2016 (**issued in exercise of the powers conferred by **Environment (Protection) Act, 1986**) are:
  - **Expansion of Scope of the rules** to include **various health camps** such as vaccination camps, blood donation camps, and surgical camps.
  - Classification into **four categories based on color code-type** of waste and treatment options (see fig).
  - **Pre-treatment of the certain waste** through **disinfection or sterilization on-site.**
  - **Provide training** to and **immunize** all health care workers regularly.
  - **Establish a Bar-Code System** for bags/containers containing BMW.
  - **More stringent standards** for **incinerator**s.
  - No occupier shall establish on-site treatment and disposal facility, **if a service of common bio-medical waste treatment facility is available at a distance of seventy-five kilometers.**
  - **Operator of a common bio-medical waste treatment and disposal facility to ensure the timely collection.**

CPCB Guidelines for BMWM during pandemic

- CPCB issued separate guidelines for **'Handling, Treatment & Disposal of bio-medical waste generated during Treatment/Diagnosis/Quarantine of COVID-19 patients'** which gives guidance on management of COVID-19 related BMW including used masks and gloves.
  - Used PPEs like face shields, goggles, used masks, head cover etc. generated from **COVID-19 isolation wards at Healthcare Facilities** to be **segregated and sent to Common Facilities for disposal** as per BMWM Rules (2016).
  - BMW generated in **Common Households, Commercial Establishments, Institutions, etc.**, are required to store **separately for minimum 72 hours for disposal** along with solid waste after cutting or shredding. which can be collected as **dry solid waste by Urban Local Bodies (ULBs).**
- CPCB has issued **directions under section 5 of Environment (Protection) Act** to all State Pollution Control Boards (SPCBs)/ Pollution Control Committees (PCCs) to **ensure compliance** to guidelines.



4.8.3. E-WASTE

Why in news?

Recently, the **Ministry of Environment, Forest and Climate Change (MoEFCC)** placed Draft E-Waste Management Rules in the public domain for comments.

Key Provisions of Draft Rules

- It is brought under powers conferred to Central Government **under the Environment (Protection) Act of 1986,** and it will supersede the 2016 rules and their amendments.
- **Targets:** Consumer goods companies and makers of electronics goods have to ensure atleast **60% of their electronic waste is collected and recycled by 2023** and **70% and 80% in 2024 and 2025** respectively.
- It covers **manufacturer, producer, recycler** and **refurbishers** under the **Extended Producer Responsibility (EPR) Framework** who shall register with **Central Pollution Control board (CPCB).**
- **Steering Committee headed by Chairman of CPCB** will oversee overall implementation of regulations.
- Adds **Bureau of Indian Standards (BIS)** in the list of authorities with responsibility to issue **refurbished products standards.**

- It lays out **a system of companies securing Extended Producer Responsibility (EPR) certificates.**

About E-waste

The **discarded and end-of-life electronics products** ranging from computers, equipment used in Information and Communication Technology (ICT), home appliances, audio and video products and all of their peripherals are known as Electronic waste (E-waste).

Significance of E-waste mangement

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

Toxic/Hazardous substances found in e-waste

Pollutant	Found in
Lead (Pb)	Cathode ray tubes (CRT)
Cadmium (Cd)	Monitors, CRTs
Mercury	Switches, flat screen monitors, CFL
Polychlorinated biphenyls	Capacitors and transformers
Brominated flame retardant	Printed circuit boards

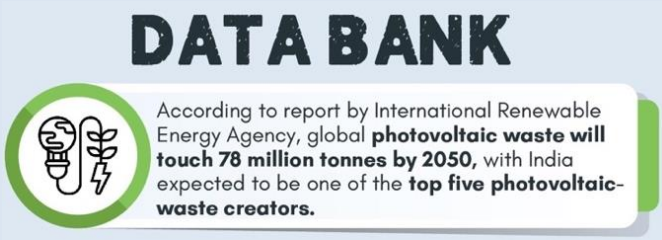
Challenges in E-waste management in India

- **Poor tracking and monitoring** of the quantum of e-waste being produced.
- **Involvement of Informal sector** and their **lack of knowledge about safe handling and extraction processes.**
  - More than 95% of this waste is handled by informal sector.
- **High waste handling, extraction and procurement costs** needed for safety equipment, extraction technologies etc.
- **Rapidly growing waste:** "Internet of things" gadgets are expected to generate e-waste at a faster rate.
- **Limited number of dismantlers and recyclers and** inadequate recycling capacity.
- **Poor segregation and collection of waste.**

Way Forward

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

Related News: Solar Waste



- Ministry of New and Renewable Energy has highlighted that **India currently considers solar waste a part of electronic waste and does not account for it separately.**
- **Solar waste** is the e-waste generated by discarded solar panels.
- If fully injected back into the economy, the **value of the recovered material could exceed USD 15 billion by 2050.**
- **Solar waste in India**
  - Most of installed solar panel systems are in **end-of-life cycle (25 years).**
  - M**odules also get damaged during transportation and installation** and during plant operations.
- **Suggestions**
  - Devising **sustainable end-of-life management policies** for PV panels,

- **Expand waste management infrastructure,**
- Environmental disposal and recycling of solar waste to be **part of power purchase agreement,**
- **Ban on Landfills** as solar waste is harmful to the environment.

- **Practices in other countries**
  - European Union (EU) has adopted **PV-specific waste regulations**.
  - **Extended producer responsibility (EPR)** regulations in Washington and California.

4.8.4. WASTE TO WEALTH

WASTE TO WEALTH AT A GLANCE

Waste to Wealth Techniques

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

Potential

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

Significance

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

Schemes/Policies/Initiatives

- **Waste to Wealth Mission under PM-STIAC** to identify, develop, and deploy technologies to treat waste to generate energy, recycle materials, and extract resources of value
  - It has components like-**Swachhta Saarthi Fellowship, Su-Dhara Community** Engagement project on urban **waste management, Waste to Wealth portal, Biomedical Waste Treatment Innovation Challenge etc.**
- **Promotion under Policies and guidelines for waste management** like- Solid Waste Management Rules, 2016; Plastic Waste Management Rules, 2022; Construction & demolition waste Management Rules, 2016 etc.
- **Gobardhan Scheme** under Swachh Bharat Mission aims to effectively manage cow dung and other biodegradable waste.
- **Mandating use of Plastic Waste in Road Construction.**

Constraints

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

Way forward

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

5. RENEWABLE ENERGY AND ALTERNATIVE ENERGY RESOURCES

5.1. RENEWABLE ENERGY

RENEWABLE ENERGY AT A GLANCE

Key Targets

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

CURRENT SITUATION

- **India stands at 4th position in the world** in terms of installed RE capacity **5th in Solar** and **4th in Wind energy** capacity.
- Energy from renewable energy sources (including Hydro) makes **40% of total installed capacity** (April 2022).

CONSTRAINTS

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

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

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

SCHEMES/POLICIES/ INITIATIVES'

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

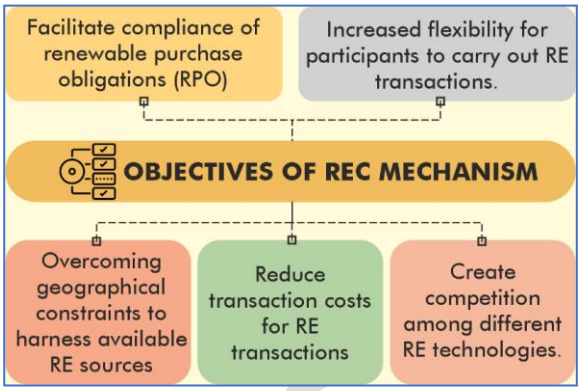
WAY FORWARD

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

5.1.1. RENEWABLE ENERGY CERTIFICATE (REC)

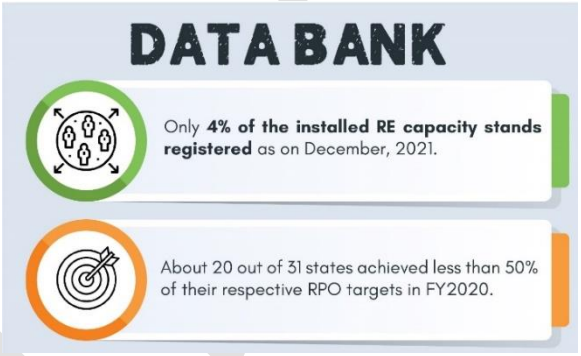
Why in news?

Ministry of Power redesigned Renewable Energy Certificate (REC) Mechanism to boost green economy.



About Renewable Energy Certificates (REC)

- Renewable Energy Certificate (REC) also called as **Renewable Energy Credit,** is a **market based instrument** where the owner of the REC can legally claim to have purchased renewable energy.
- **One Renewable Energy Certificate (REC) is treated as equivalent to 1 MWh.**
- There are **two categories of RECs**, viz., **Solar RECs and Non-solar RECs**.
- RECs are traded in power exchange within the **forbearance price and floor price determined by Central Electricity Regulatory Commission (CERC)** from time to time.
- **National Load Despatch Centre (NLDC)** is responsible for registration of Renewable Energy Generation Facilities, issuance of Renewable Energy Certificates etc.
- **The distribution companies, Open Access consumer, Captive Power Plants (CPPs)** are eligible of purchasing the REC.



Need to redesign REC mechanism

- **To align with the emerging changes in the power scenario:**
  - **Declining trend of prices of solar and wind energy** due to technology advancement, economies of scale and market competitiveness.
  - **Renewable Energy Management centres** (REMCs) have been commissioned for better forecasting and scheduling.
  - **Power exchanges are in place for an alternate mechanism to sell and buy RE power** through various products viz Day Ahead Market (DAM), Term Ahead Market (TAM), Green Term Ahead Market (GTAM), Real Time Market (RTM) etc.
- **To promote new and high cost RE technologies** like Off-shore wind, Pumped Storage Hydro power Station, Hydrogen, etc.
- **To deal with challenges associated with REC market:**
  - **Excess supply over demand resulted in REC prices remaining close to the floor price** range.
  - **Lag in RPO targets and compliance** which impacted overall REC demand**.**
  - Concentration of RE potential in a few states, hence **expensive cross-border procurement.**

Way Forward

- Government needs to **lay out a clear RPO trajectory until 2030 and seek consistency between national and state RPO targets.**
- State government should ensure **no waiver or carry forward of RPO targets are provided to discoms.**
- **Merge solar, non-solar and hydro power RPO targets into one consolidated target** and **allow more technologies** including solar-wind hybrid, rooftop solar, and green hydrogen to participate in the scheme.

Related News:

Ministry of Power (MoP) notifies rules for the sustainability of the electricity sector and promotion of clean energy

- New rules are notified (under Electricity Act, 2003) **to sustain economic viability of the sector, ease financial stress of various stakeholders and ensure timely recovery of costs** involved in electricity generation.
- **Renewable energy (RE) sector has been facing following issues**
  - Various states have sought to cut procurement from renewables or **renegotiate power purchase agreements (PPAs) citing lower tariffs** for solar power.
  - **Inordinate payment delays** by states such as Telangana.
  - **Delays in land acquisition and clearances,** regulatory uncertainty, inadequate grid connectivity etc.
- **Key highlights of the rules**
  - **Compensation shall be payable by the procurer** in the event of a curtailment of supply from a must-run power plant.
    - ✓ Must run status means that the concerned power plant has to supply electricity to the grid under all conditions.
  - **RE generator is also allowed to sell power in the power exchange** and recover the cost suitably.
- These rules will help in achieving the **targets of RE generation,** will ensure that the **consumers get green and clean power,** will help in **creating investment friendly environment** etc.

Power companies can bundle renewable energy (RE)

- Ministry of Power (MoP) has also amended norms to allow power producers to bundle RE under existing power purchase agreements (PPAs).
- In 2018, **MoP introduced a mechanism to promote bundling of RE with thermal power** and for meeting the renewable purchase obligation (RPO) of distribution companies (DISCOMs).
- **Mechanism is now revised considering changes in energy-mix** and as part of the larger **efforts to have 500 GW of clean energy** generation capacity by 2030.
- **Benefits of the move**
  - Selling renewable energy and thermal power together in a 'bundle' **will provide buyers the assurance of receiving firm uninterrupted electricity supply.**
  - It would address the **issues of intermittency, limited hours of supply and low-capacity utilizations** of renewable power plants.
  - DISCOMs will be able to count **RE supplied under the scheme towards their RPO.**

5.2. SOLAR ENERGY

SOLAR ENERGY AT A GLANCE

KEY TARGETS

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

CURRENT SITUATION

- Globally, **India currently ranks 5th in terms of installed solar power capacity**
- **Expected shortfall in meeting target:** Total installed solar power capacity stood at ~**57 GW (May 2022).**
- On the current trajectory, **India's solar target of 300GW by 2030 will be off the mark** by about 86GW.

SCHEMES/POLICIES/INITIATIVES

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

CONSTRAINTS

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

WAY FORWARD

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

5.2.1. PRADHAN MANTRI URJA SURAKSHA EVAM UTTHAAN MAHABHIYAAN (PM KUSUM) SCHEME

Why in News?

Reports from various states highlight that PM KUSUM scheme has been off to a slow start.

About PM KUSUM Scheme

- The scheme was launched with the **objective of providing financial and water security to farmers.**
- **The Scheme consists of three components:**

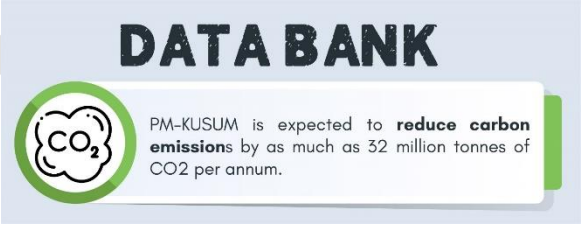
Component	Features
Component-A (Harvesting Solar Energy): Installation of	• **Small solar power plants of capacity up to 2 MW can be set-up** by individual farmers/ cooperatives / panchayats / Farmer Producer Organisations (FPO) **on barren/ fallow/marshy/ pasture or cultivable lands.**

Decentralized Ground Mounted Grid Connected Renewable Power Plants	• Power generated from solar plants **will be purchased by the Distribution Companies (DISCOMs)** at tariffs determined by the respective State Electricity Regulatory Commissions (SERCs). • The plant **can be installed by the farmer, or he can provide his land on lease** to a developer. • RBI has included this Component **under priority sector lending.**
Component-B (De-dieselisation of Farm Sector): Installation of standalone Solar Powered Agriculture Pumps	• **Individual farmers, Group of farmers,** such as Water User Associations and community/cluster-based irrigation systems will also be covered. • **Central Financial Assistance (CFA) of 30% of the benchmark cost** (fixed by MNRE every year) of the stand-alone solar agriculture pump will be provided. • The State Government will give a **subsidy of 30% and the remaining 40% will be provided by the farmer.** • All solar pumps installed under this Component will be **provided with remote monitoring systems** for monitoring on a real-time basis.
Component-C: Includes Solarisation of Grid-connected Agriculture Pumps	• Under this Component, **individual farmers having grid connected agriculture pump will be supported to solarise pumps.** • **Government of India will provide 30% subsidy** for solarisation of agricultural feeders. • The **farmer will be able to use the generated solar power to meet the irrigation needs and the excess solar power will be sold to DISCOMs** at pre-fixed tariff.

- The **targeted solar capacity addition is 30.8 GW.**
- **State Nodal Agencies (SNAs) of MNRE will coordinate** with States/UTs, Discoms and farmers for implementation of the scheme.

Potential benefits of the scheme

- **Employment generation** for skilled and unskilled workers.
- De-dieselization of farm sector leading to **cheaper and more reliable power for irrigation** and **reduction in emissions**.
- **Additional famer income** through **sale of surplus solar power.**
- **Reducing the agriculture electricity subsidy burden** on states.
- **Improving the financial health of DISCOMs**.
- **Boosting Domestic Solar Manufacturing** through domestic content requirements.
- **Reducing the import bill.**



Challenges/limitations of KUSUM Scheme

- **Inadequate attention to possibility of excessive groundwater withdrawal.**
- **Challenges for low income small and marginal farmers:** Inability to pay 10 per cent of the upfront cost, lack of awareness, social exclusion or corruption.
- **Land regulations challenge** related to leasing or conversion of agricultural land for non-agricultural uses emerged under Component-A.
- **Gaps in inter-departmental coordination leading to delays** in obtaining all the requisite approvals.
- **Logistics issues due to the domestic Content Requirement and supply chain disruptions.**
- **Limited incentive for farmers, especially in states with free power supply.**

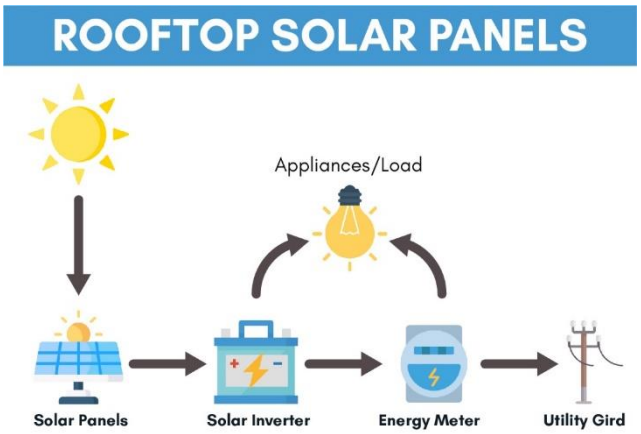
Way Forward

- Solar pump schemes should accompany **explicit and strict measures of monitoring and control to manage groundwater extraction.**
- **Rationalize tariff** with gradual increase in agricultural tariffs and limits on hours of power supply.
- **Ensure financial support** for small and marginal farmers.
- **Simplifying the process for clearances, reducing delays in various stages of approvals, etc.**
- **Efficient DISCOMs operations should be ensured by regulatory mandates** for regular reporting on installations, operations, evacuation, billing and payment to farmers.

5.2.2. ROOFTOP SOLAR (RTS) SCHEME

Why in news?

Centre simplifies procedure for the residential consumers to install Solar Rooftop (SRT) plant.



More on the news

- **New procedure will include**
  - **A national portal for registering applications,** approval and tracking progress.
  - Residents **to get SRT plant installed by themselves or through any vendor of their choice**.
- Ministry of New and Renewable Energy will issue **standards and specifications for SRT plant,** to ensure quality and post installation services.

About Solar Roof top scheme

- **Phase-II** of "Grid Connected Rooftop and Small Solar Power Plants Programme" **was launched in 2019 for achieving cumulative capacity of 40 GW RTS plants by 2022.**
  - Phase I was launched in 2015.
- **Key objectives are to:**
  - **Promote grid connected RTS in all consumer segments,** viz., residential, institutional, social, Government, commercial, industrial etc.
  - **Bring DISCOMs at forefront** for rapid deployment of RTS.
- **Advantages of RTS:** savings in transmission and distribution losses; no requirement of additional land; local employment generation; reduction of power bill by supplying surplus electricity to local supplier; environment friendly etc.
- **Challenges:** High initial capital cost; slow adoption (only 5.7 GW has been installed so far); import dependency for solar modules and solar PV; lack of R&D etc.
- **Other steps taken to increase public participation in RTS Scheme**
  - **Central Financial Assistance for residential sector** and incentives in slabs for DISCOMs under Phase II.
  - Renewable energy **included under priority sector lending**.
  - State Rooftop Solar Attractiveness Index–**SARAL.**
  - **SPIN-an online platform developed** for expediting project approval.

Related news: Floating solar plants

- **Bihar's first floating power plant in Darbhanga to be commissioned soon**
  - Earlier, India's **largest Floating Solar PV plant** was commissioned at NTPC Simhadri in Andhra Pradesh.
- Under the floating plants, the photovoltaic panels are **deployed on the surface of water bodies**. They are considered as a **viable alternative to land-based solar arrays**.
- **Benefits of floating solar power plant:**
  - No need for **land space.**
  - **Increased power generation** as water cools the solar panels, ensuring their **efficiency** when temperatures rise.
  - Shade from floating solar panels can **help reduce the presence of algae** that blooms and **evaporation water loss**, which **will protect the water resources**.
  - Relatively open water surface can effectively **prevent the shade** from the trees, mountains, etc.
- **Limitations: Expensive** to install, risk of **degradation and corrosion** due to moisture, electrical safety issues arise, racking system should have **long lifespan, high load capacity** etc.

5.2.3. GLOBAL INITIATIVES IN SOLAR ENERGY

5.2.3.1. INTERNATIONAL SOLAR ALLIANCE

Why in News?

UN General Assembly has granted Observer Status for the International solar Alliance (ISA).

About Observer status

- **United Nations General Assembly Grants Permanent Observer Status** to non-member states, international organisations and other entities.

- The Permanent Observers **may participate in the sessions and workings of the General Assembly** and maintain missions at the U.N. headquarters.

- The **granting of Observer Status to the ISA** in the General Assembly would help provide for a regular and well-defined cooperation between the Alliance and the United Nations that would **benefit global energy growth and development.**

About ISA

- It was **launched at Paris Climate Change Conference in 2015** by the President of France and the Prime Minister of India.
- It is a multi-country partnership organization with **membership from solar resource rich countries between the two tropics,** where the global community can make a positive contribution towards increasing the use of solar energy.
  - It has now been decided to **extend the membership of the alliance to all the UN member states.**
    - At the **COP26 in Glasgow, USA became its 101st member** to catalyse global energy transition through a solar-led approach.
- The body aims to **scale up solar energy applications**, take coordinated action through programmes and activities launched on a voluntary basis and facilitate collaborative research and development activities in solar energy technologies.
  - **Each Member shares and updates, for those solar applications** for which it seeks the benefits of collective action under the ISA.
- ISA is the **first international organization headquartered in India.**

Initiatives taken by ISA

- **ISA partnered with Bloomberg Philanthropies to mobilize $1 trillion** in global investments for solar energy across ISA's member countries.
- **Global Energy Alliance for People and Planet (GEAPP)** launched at COP26 with USD10 billion of committed capital to accelerate investment in green energy transitions and renewable energy solutions in developing and emerging economies.
- ISA's Programme on **Scaling Solar Applications for Agriculture Use (SSAAU)** focuses on **providing greater energy access and a sustainable irrigation solution** to farmers through deployment of Solar Water Pumping Systems in member countries.
- **Supported governments to make their energy legislation and policies solar friendly** through Ease of Doing Solar analytics and advisory.
- **Green Grids Initiative-One Sun One World One Grid project.**

Significance of ISA

- **Supporting the implementation of Paris Climate agreement** through promotion of renewable Solar energy.
- **Break monopoly of oil and gas**-based energy providers.
- **Improvement of the standard of living of the population** through supply of solar energy.
- **Ensure global equity by giving** representation to countries like Fiji and South Sudan, along with advanced countries like Australia and France.

5.2.3.2. GREEN GRIDS INITIATIVE-ONE SUN ONE WORLD ONE GRID (GGI-OSOWOG)

Why in News?

The Green Grids Initiative-One Sun One World One Grid project was launched by India in partnership with the UK at COP26 in Glasgow.

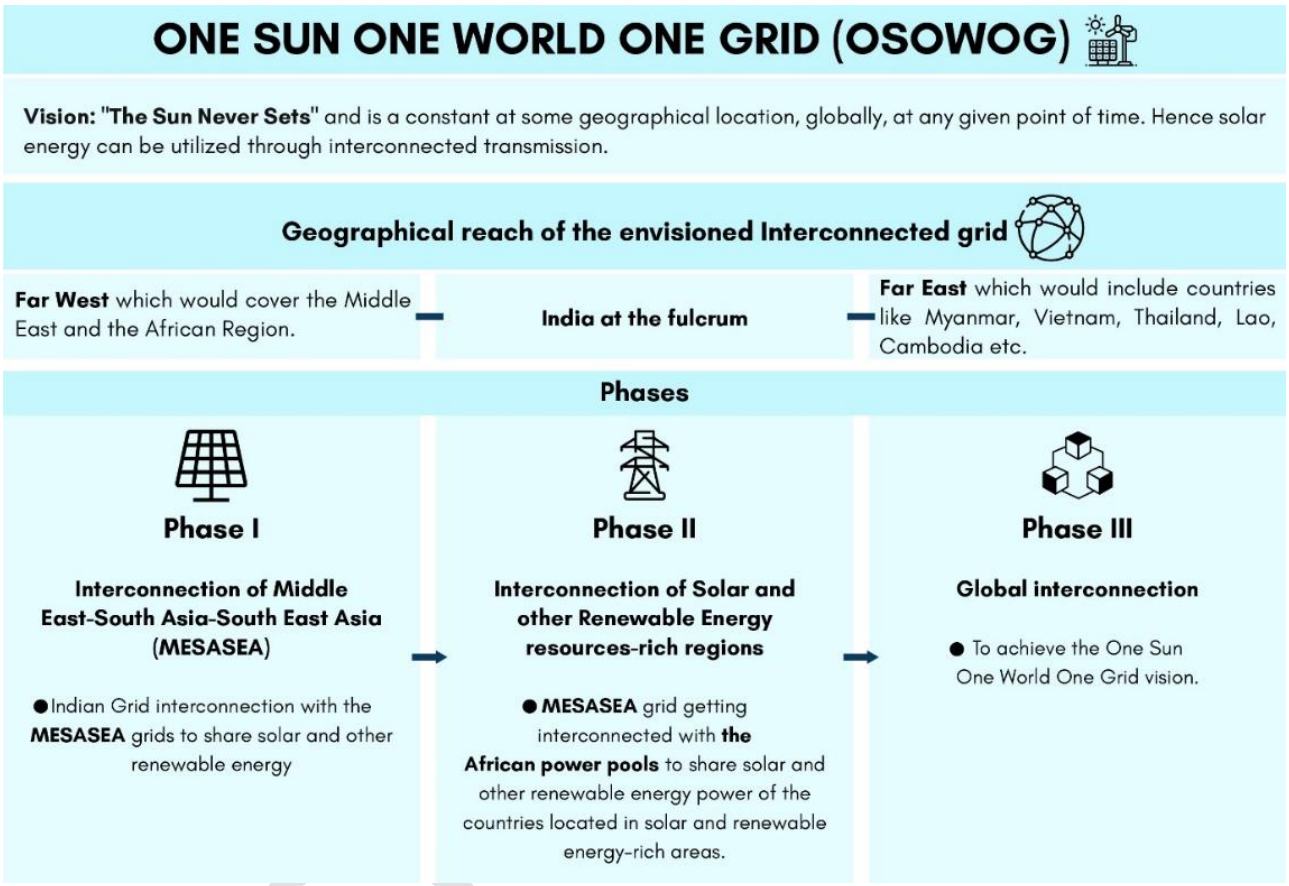
About GGI-OSOWOG

- The Green Grids Initiative-One Sun One World One Grid (GGI-OSOWOG) is an international initiative to create an interconnected global power grid.
- The idea for OSOWOG was for the first time pitched by Indian Prime Minister in **2018** during the first General Assembly of International Solar Alliance (ISA).
  - Through the OSOWOG initiative India plans build a **global ecosystem of interconnected renewable energy resources** that are seamlessly shared for mutual benefits and global sustainability.
- In May 2021 a partnership was revealed with the UK's Green Grids Initiative, a coalition to accelerate the deployment of solar infrastructure around the world.

Significance of GGI-OSOWOG for India

- **Reduce reliance on coal** for meeting energy demand when renewable energy is not available.

- **Help India fulfil its commitments**: Reach net-zero emissions by 2070; Generate 50% of its electricity from renewable sources by 2030.
- **Reduce costs of renewable energy integration** by acting as potential alternative to storage, which is expensive and is used to complement intermittent solar/wind capacity and stabilise the grid.
- **Help scale up global cooperation on climate action** and bring in increased investment into research and development.
- **Mini-grids can help communities** to harness local energy resources, bringing electricity to off-grid villages and ensuring a more resilient supply during heat waves, storms and floods



Challenges

- **Lack of regional cooperation mechanisms, robust regulatory institutions and a flexible electricity market.**
- **Absence of necessary transmission infrastructure and technology** in several regions.
- **Geopolitical risk associated with connected Electricity Grids** which are vulnerable to **accidents, weather, and cyber-attacks**.
- **Requirement of large capital investment** to set up long transmission lines across vast distances.
- **Maintaining a stable grid over large geographical areas:** It's difficult to predict energy demand across a geographically diverse region such as South Asia, where population density, and consequent energy demand, varies widely.

Way forward

- **Utilizing existing cross-border cables and multilateral power trading** between India and Nepal, Bhutan, Bangladesh and Myanmar to build a regional network.
- **Investing in infrastructure upgrades** in transmission and interconnections, as well as **cutting edge techniques and technologies and knowledge transfer** to modernise power systems and support green grids for underdeveloped solar markets.
- **Creating stable and equitable institutional mechanisms** to facilitate regional cooperation in electricity trade and interconnection.

- **Developing innovative financial instruments,** market structures, and facilitate financial and technical assistance to attract low-cost capital, including climate finance, for global solar grid infrastructure.
- **Undertaking technological and local grid management measures to ensure grid stability and counter geopolitical risks.**

5.3. ROLE OF PRIVATE SECTOR IN PROVIDING CLEAN ENERGY

Why in News?

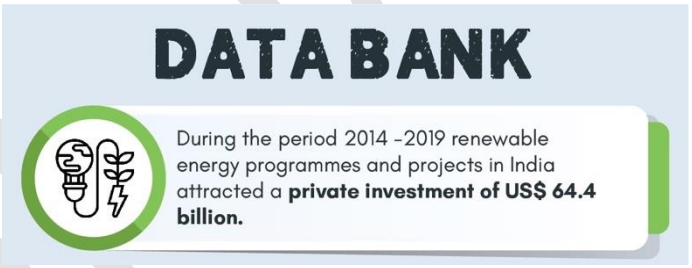
Union Minister of Science & Technology recently launched Mission Integrated Bio-refineries to accelerate Clean Energy solutions through Public -Private Alliances.

About Mission Integrated Bio-refineries

- It was launched, under Mission Innovation, with the goal of **replacing 10% of fossil-based fuels, chemicals, and materials with bio-based alternatives by 2030.**
  - This is the **sixth Mission launched by Mission Innovation.**
  - **Other five missions launched are:** Clean Hydrogen, Green Powered Future, Zero-Emission Shipping, Carbon Dioxide Removal and Urban Transitions.
- **Integrated Bio-refineries Mission will support**
  - Development and commercialization of bio-based fuels, chemicals, and materials.
  - De-risking new and emerging technology, while improving the cost-competitiveness of bio-based alternatives, notably biofuels.

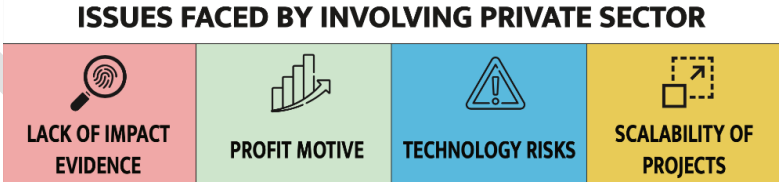
About Mission Innovation (MI)

- It is a **global initiative to catalyze action** and investment in research, development and demonstration **to make clean energy affordable, attractive and accessible** to all this decade.
  - It consists of 22 countries and EU. **India is a founding member.**
  - **First phase of the mission** was launched alongside the **Paris Agreement in 2015. Mission Innovation 2.0**, second phase of MI, was also launched in 2021.



Need of private sector in ensuring clean energy production

- **Budget constraints** with global public debt running at an all-time high.
- **Enable technological innovation and developing new products and solutions.**
- **Driving green growth across the supply chains.**
- **Improving efficiency in functioning of private sector** and **cut costs** by introducing new technologies, labour productivity etc.
- **Aid in providing universal energy access,** one of the SDGs.



Recent Examples of Private Sector Initiatives

- **Climate Finance Leadership Initiative (CFLI):** It is an **industry-led initiative to unlock private capital** to help finance India's low-carbon transition.
  - It was launched during the **11th UK-India Economic and Financial Dialogue**
- **First Movers Coalition (FMC):** It is a **public-private partnership launched by World Economic Forum** in partnership with US and over 30 global businesses.
  - It brings together global companies, with supply chains across carbon-intensive sectors, **to invest in innovative green technologies** so they are available for massive scale-up by 2030 **to enable net-zero emissions by 2050.**

Way forward

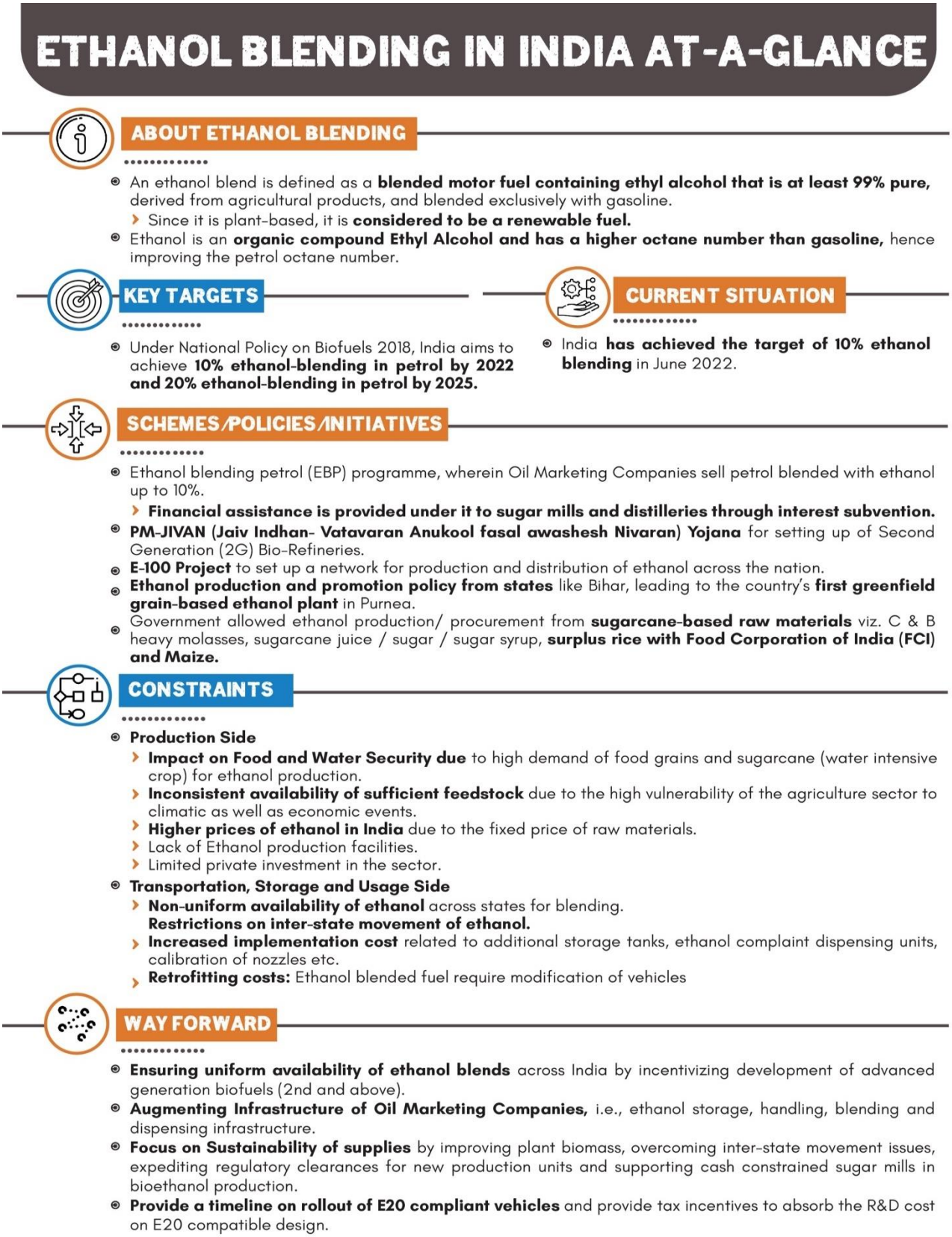
- **Establishing Social enterprises rather than purely profit driven companies.**
- **Understand private sector needs like-** Non-discriminatory market access and locally adapted policy mechanisms.
- **Establishing a green financing framework to leverage green private investments.**
  - Green finance refers to the financial arrangements that are specific to the use for projects that are environmentally sustainable or projects that adopt the aspects of climate change.

- **Improving the policy and regulatory mechanism** that conflict with clean energy development goals or create market uncertainties.
- **Institute new policies and incentives** that provide clear direction and support the business case for investment.

Related news: Green bonds

- **India's first ever Euro-denominated green bonds** were issued by **Power Finance Corporation Ltd (PFC),** the leading non-banking finance corporation (NBFC) in power sector.
- Green bonds are issued by companies, countries and multilateral organisations to exclusively **fund projects that have positive environmental or climate benefits** and **provide investors with fixed income payments.**
  - In 2007, green bonds were launched by development banks such as European Investment Bank and World Bank.
  - **For India, Yes Bank was the first** bank to come out with green bonds in 2015.
  - In the first half-year of 2019, India became the **second-largest Green Bond market worldwide** after China with $10.3 billion worth of transactions **(Economic Survey 2019-20).**
- **Benefits of green bonds**
  - **Mitigate climate change-related risks** due to changing policies such as carbon taxation which could lead to stranded assets.
  - **Increase transparency and accountability** on the use and management of proceeds.
  - Crucial in **increasing finances to sunrise sectors** like renewable energy, thus contributing to India's sustainable growth.
  - Satisfies **Environment, Social and Governance (ESG) requirements** and green investment mandates.
  - **Contribute to national climate adaptation**, food security, public health, energy supply, amongst others.
- **Challenges**: **Lack of credit ratings** for green bonds projects; Lack of commonly accepted green standards.

5.4. ETHANOL BLENDING



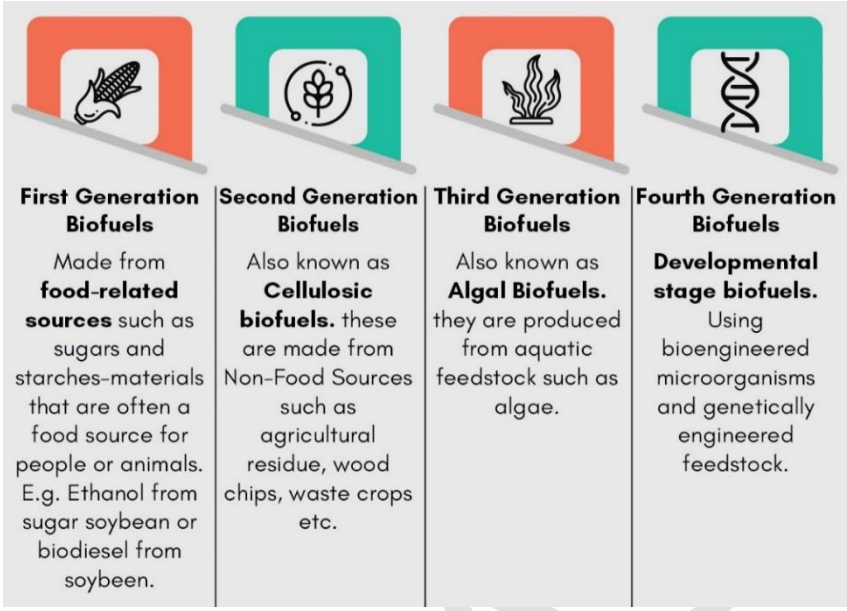
5.4.1. NATIONAL POLICY ON BIOFUELS-2018

Why in News?

Recently, the Cabinet approved amendments to the **National Policy on Biofuels, 2018** to advance the target of 20% ethanol blending in petrol to Ethanol Supply Year (ESY) 2025-26 from earlier 2030.

About Biofuels

- Biofuels refers to **liquid transportation fuels**, such as **ethanol** and **biodiesel**, derived from agricultural produce, forests or any other organic material (feedstock).
- Due to **Low-Carbon intensity**, biofuels burn cleaner than fossil fuels.
- Based on the feedstock (raw materials) used to produce biofuels, they are classified into **four generations** (see image).
    - Presently, first-generation biofuels are the main source of biofuels globally.

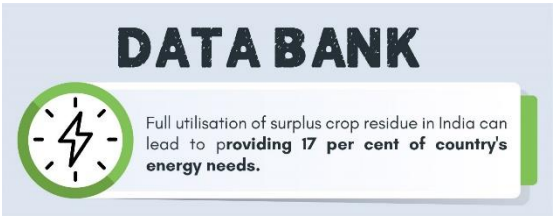


National Policy on Biofuels-2018

- **Aim:** To increase usage of biofuels in the energy and transportation sectors of the country in the coming decade; and to utilize, develop and promote domestic feedstock and its utilization for production of biofuels.
- **Biofuels Covered:** Bioethanol, Biodiesel and BioCNG.
- **Implementation:** By **National Bio-fuel Coordination Committee (NBCC),** set up in **2020,** chaired by **Minister Petroleum and Natural Gas**. It has representatives from 14 other ministries and departments to-
    - **Take decisions for effective implementation and monitoring** of biofuels program in the country, and
    - **Provide overall coordination** among FCI and oil marketing companies.
- **Other Features (apart from achieved and amended targets):**
    - **Categorization of Biofuels up to three generations** and support production of second-generation ethanol Bio refineries through **Viability Gap Funding**.
    - **Increased scope of Raw Material** for 1st Generation Ethanol such as damaged foodgrains, Starch containing materials, sugar containing materials etc.
        - ✓ It also allows use of surplus foodgrains as raw material after **NBCC** approval.
    - To develop the **National Biomass Repository** by conducting appraisal of biomass across the country.
- **Recent Amendments:** Apart from advancing of target, the cabinet also approved-
    - Use of **more feedstock** for production of biofuels.
    - Production of biofuels **under the 'Make in India' programme** in Special Economic Zones and Export Oriented Units.
    - To grant permission for **export of biofuels** in specific cases.
    - **Addition of new members to the NBCC** and it has the permission to change the policy.

Significance of National Policy on Biofuels

- **Economic benefits:**
    - **Reduce India's dependence on foreign oil resources.**
    - **Increased Farmers income**, especially sugarcane farmers, through additional income generation.
    - **Waste to Wealth** in agriculture, forestry and Municipal solid waste.
    - **Increased infrastructure investment in rural areas and job Creation** through bio-refineries, plant operations, supply chain management etc.
    - **Reduced impact of price volatility** and fuel cost for consumers.
- **Environmental benefits:** Lower greenhouse gas emissions; Promotion of carbon neutrality; Help in Municipal Solid Waste Management etc.



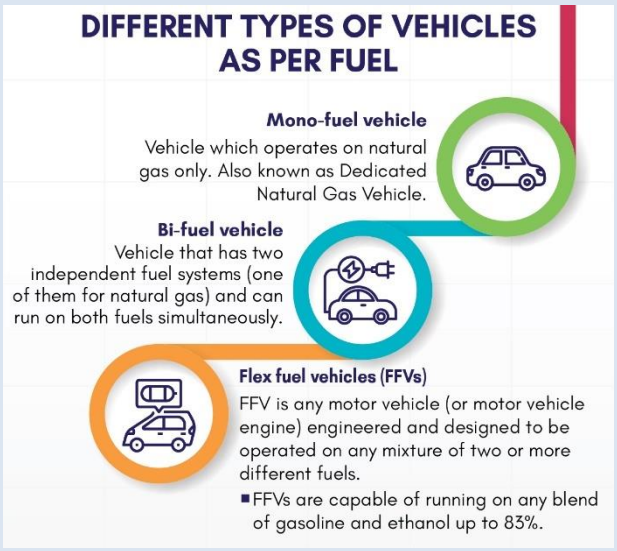
Other biofuels initiatives

- **Pradhan mantri JI-VAN (Jaiv Indhan- Vatavaran Anukool fasal awashesh Nivaran) Yojana** to provide financial support to integrated Bioethanol Projects using lignocellulosic biomass and other renewable feedstock.
- **Repurpose Used Cooking Oil (RUCO)** by **FSSAI** to divert used cooking oil from the food value chain to biodiesel manufacturers.
- **GOBARDHAN Scheme** which supports villages in managing organic waste and converting it into biogas and fertilizer.

Related News:

Flex-fuel engines

- Government issued advisory to carmakers to introduce flex-fuel engines in vehicles.
- **About Flex-fuel engines**
  - **Flex Fuel Vehicle (FFV)** is a **modified version of vehicles that could run both on gasoline and blended petrol** with different levels of ethanol blends.
  - These are currently being used successfully in Brazil, **giving people the option to switch fuel**(gasoline and ethanol).
  - Flex-fuel, or flexible fuel, is an **alternative fuel** made of a combination of gasoline and methanol or ethanol.
- **Advantage of FFV**
  - Provides **option for using bio-fuels,** which are better than petrol (are import substitute, cost effective, pollution-free and indigenous).
  - Help in **addressing the problems of surplus food grains** (can be used in making ethanol).
  - **Reduce dependence on oil imports**.
- **Challenges**
  - Require **additional investment from auto companies** in production lines and technology transfers.
  - Ethanol can also cause **corrosion and damage to the engine.**
  - Ethanol is also **not as economical as gasoline** as it does not provide the same level of fuel efficiency.



Zero-liquid discharge plant

- **Bihar opened India's first greenfield grain-based ethanol plant.**
- It is the first one developed since the Centre gave a **go-ahead to Bihar's ethanol production and promotion policy-2021.** Ethanol production will help **reduce the cost of petrol and generate employment.**
  - The ethanol plant has been built using the latest technology and **will not discharge any waste,** making it a **zero-liquid discharge plant** that is completely environment friendly.
- **About Zero liquid discharge (ZLD)**
  - It is an engineering approach to water treatment where **all water is recovered** and contaminants are **reduced to solid waste.**
  - It is achieved by **stringing together water treatment technology** that can treat wastewater as the contaminants are concentrated.

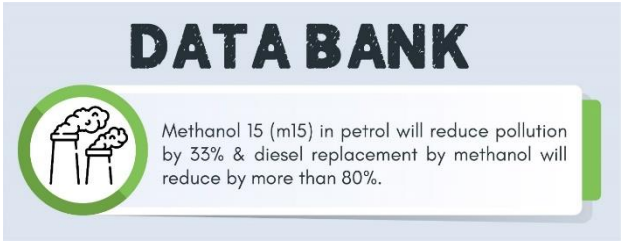
5.4.2. METHANOL

Why in News?

Recently, India's first Indigenously Designed High Ash Coal Gasification Based Methanol Production Plant was inaugurated at BHEL R&D Centre, Hyderabad.

About methanol

- Methanol (also known as wood alcohol, methyl alcohol or carbinol) is a low carbon, hydrogen carrier fuel produced from high ash coal, agricultural residue, CO_2 from thermal power plants and natural gas.
  - Methanol production from coal uses coal gasification followed by catalytic conversion to produce methanol.
- **Applications:**
  - Can be processed to make di-methyl ether (DME), a liquid fuel that closely resembles diesel.
  - Its chemical derivatives are used in production of building materials, foams, resins, plastics, paints, polyester and a variety of health and pharmaceutical products.



- **Advantages of methanol use:**
  - **Water soluble and readily biodegradable**.
  - **Polygeneration**-can be made from any resource that can be converted into synthesis gas.
  - **Substantially cheaper** than conventional fuel.

- **Near Zero Pollution:** Burns efficiently in all internal combustion engines, produces no particulate matter, no soot, almost nil SOx and NOx emissions.
- **Very little modifications to existing engines** and fuel distribution infrastructure required.
- **Can replace or be blended with petrol and diesel** in transport and energy sectors.
- **Can replace LPG (partially), kerosene and wood charcoal** in retail cooking sector.
- Other benefits: Reducing import dependency, generating employment, boost to make in India in Methanol based industries.

- **Disadvantages of methanol use:**
  - **Lack of efficient technology** to produce methanol from **high ash percentage of Indian coal**.
  - Producing from imported natural gas may lead to- **outflow of foreign exchange and high price**.
  - Concerns about the use of methanol in transportation fuels: **corrosivity and materials compatibility, low energy content, Fire risks and toxicity**.
  - **Has less gas mileage**, so it would require more frequent fuelling.
  - **High costs of plunging in new technology.**
- **Initiatives taken in India**
  - **NITI Aayog's road map for Methanol Economy:**
    - ✓ Substitute 10% of Crude imports by 2030, by Methanol alone.
    - ✓ 20MT of methanol annually can be produced @ Rs. 19 a litre by 2025 by using Indian High Ash coal, Stranded gas, and Biomass.
  - **Methanol Economy Research Programme**, by Department of Science and Technology, for production of Methanol from various sources including Indian coal and CO_2 from thermal plants, steel plants etc.
  - **Bureau of Indian Standards has notified 20% DME blending with LPG.**
  - **Notification for M-15, M-85, M-100 blends** has been issued by the Ministry of Road, Transport and Highways.
  - **Railway is working towards blending methanol** in the range of 5-20% through direct fuel injection in locomotives.
  - In 2018, Assam Petrochemicals launched **Asia's first canister-based methanol cooking fuel programme.**

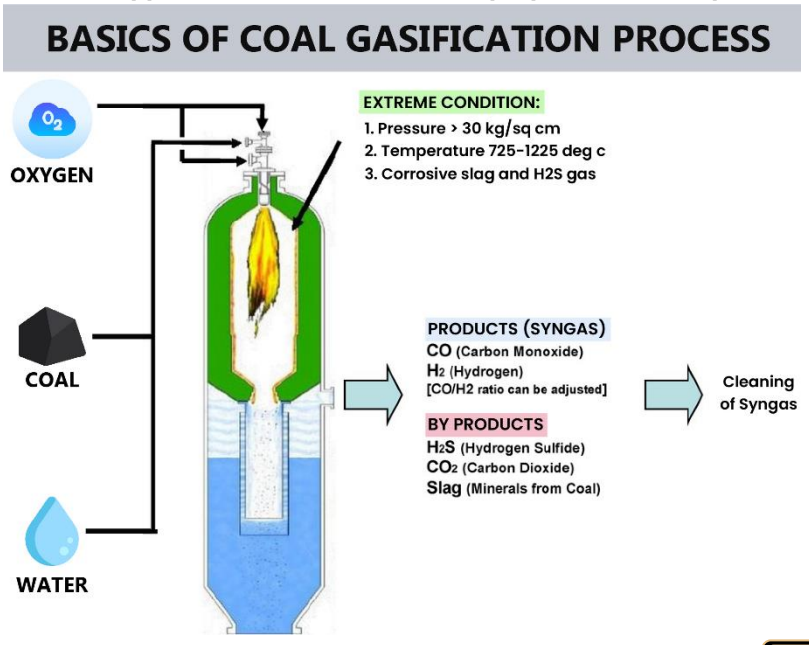
5.5. NATIONAL COAL GASIFICATION MISSION

Why in News?

Recently, a blueprint for the 'National Coal Gasification Mission' was prepared by the Union Coal Ministry.

About National Coal Gasification Mission

- Under Atmanirbhar Bharat Abhiyaan, Ministry of Coal took initiative for utilizing coal through coal gasification and achieve 100 MT coal gasification by year 2030. Its key features include-
  - **All coal companies have been advised to appoint a nodal officer** and to **prepare an action plan** for gasifying at least 10% of their coal production.
  - **Interest Rate Subvention may be provided** thereby reducing the interest burden on coal gasification projects and improve the bankability of these projects.
  - **Import duty exemption for capital goods** for setting up coal gasification projects may be considered.
- Highlights of implementation strategy:
  - **Mapping of gasification potential of coalfields** especially in North east.



- **Development of indigenous technology** suitable for various feed stock (low ash coal, coal mixed with pet coke and high ash coal).
- **Development of suitable business model** for setting up of various projects.
- **Marketing strategy for end products**.
- **Policy support** with a view to encourage Atmanirbhar Bharat Scheme.
- **Coordination with various stake holding Ministries.**
- **Providing quantifiable targets** to various companies and monitoring the implementation of activities.

About Coal Gasification (CG)

- Coal gasification is the **process of converting coal into synthesis gas** (syngas), which is **a mixture of hydrogen, carbon monoxide and carbon dioxide**.
- It is an **in-situ process**, in which oxygen is injected into the seam along with water and ignited at high temperature, that causes coal to partially oxidize.
  - In **ex-situ process,** reactor is developed for simulating the gasification process above the surface of ground.

Benefits of coal gasification

- **Eco-Friendly, cleaner option** compared to burning of coal.
- **Multiple applications of Syngas produced**, in energy sector, fertilizers and petro-chemicals industry, Steel Industry, Pharmaceutical Sector etc.
- **Boosts domestic production of methanol, dimethyl ether and ammonia**, reducing import dependency**.**
- **Coal gasification plants do not produce any scrubber sludge which need careful and costly disposal.**
- Underground coal gasification could help **exploit non-mineable coal/lignite reserves.**

Challenges in coal gasification

- CG plants are **costlier than conventional power plants**.
- **Produces more carbon dioxide** than conventional coal-powered thermal power plant.
- **One of the more water-intensive forms** of energy production which also raises concerns about **water contamination, land subsidence and disposing of wastewater safely**.
- **Infrastructure requirement land, water, electricity** in establishing Syn Gas conversion (SCG) projects.
- **Inadequate expertise in domestic sector** for coal gasification.
- **Low quality high ash coal** available in India.
- **Domestic syngas prices may not be globally competitive due to fluctuations in coal prices.**

Other initiatives taken by India

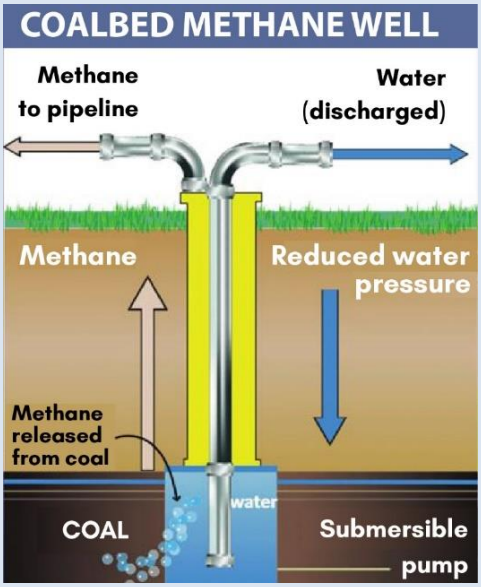
- **SHAKTI Policy** for allocation of long-term coal linkages through auction in coal gasification projects.
- **Union government has allowed a concession of 50 percent in revenue share** for promotion of coal gasification.
- Ministry of Coal has **created a Resource Group of academic and research institutions for research activities related to Coal Gasification.**
- **Bharat Heavy Electricals Limited (BHEL) has developed the fluidized bed gasification technology** suitable for high ash Indian coals to produce syngas and then convert syngas to methanol with 99% purity.
- **Jindal Steel & Power Limited has installed world's first DRI plant based on Coal gasification technology by using domestic coal** which is already operating in Angul District of Orissa for steel making.

Way Forward

- **Develop research and development facilities** to promote indigenous gasification technology in India.
- **Attract various private investors through financial tools** such as Viability Gap Funding, long term off-take contracts, creation of special economic zones and low cost of capital.
- **Policy support** may be provided to encourage investments in the sector such as-
  - **Waiver of GST compensation cess of Rs. 400 per tonne** on the quantity of coal consumed and/ or sold for coal gasification;
  - **Tax holiday** for coal gasification projects;
  - **Subsidy for purchase of capital equipment** etc.
- **Rationalizing domestic coal prices** on an integrated basis to ensure viability of coal gasification.

Related Information
Coal-bed methane (CBM)

- **Government is planning to set up renewable energy, Coal-bed methane (CBM) extraction projects on mined-out coal land.**
- Ministry of Coal has released policy guidelines for utilization of de-coaled land for **setting up thermal and renewable energy (RE) power plants, CBM extraction units**, and coal to chemical plants.
- CBM is an **unconventional form of natural gas** found in **coal deposits or coal seams**.
  - It is formed during the **process of coalification, transformation of plant material into coal.**
  - When coal and methane conversion process occur such that **coal is saturated with water** and **methane is trapped within coal**, the result is CBM.
  - **Applications**: **Power generation, as CNG auto fuel**, feedstock for fertilisers, **industrial uses** such as in cement production, rolling mills, steel plants, and for methanol production.
  - Ministry of Petroleum & Natural Gas formulated **CBM Policy** under Oilfields (Regulation & Development) Act 1948 and Petroleum & Natural Gas Rules 1959 to **harness the potential of CBM.**
- **India has fifth-largest coal reserves** in the world as of 2020, and thus holds significant prospects for exploration of CBM.
  - India's coal and CBM reserves are **found in 12 states**, with Gondwana sediments of eastern India holding the bulk.
  - **DamodarKoel valley and Son valley** are prospective areas for CBM development.



5.6. ELECTRICITY (PROMOTING RENEWABLE ENERGY THROUGH GREEN ENERGY OPEN ACCESS) RULES, 2022.

Why in news?

Ministry of Power has recently notified Electricity (Promoting Renewable Energy Through Green Energy Open Access) Rules, 2022.

- **Key highlights**
  - **Reduction in the limit of Open Access Transaction** from 1 MW to 100 KW for green energy.
    - ✓ This aims to **enable small consumers also to purchase renewable power through open access.**
  - **Increase transparency** in approval process of OA.
    - ✓ OA approvals will be **granted in 15 days** or else it will be deemed to have been approved subject to fulfilment of technical requirements. It will be **through national portal**.
  - **Uniform renewable purchase obligation** on all obligated entities in the area of a distribution licensees.
  - **Green certificates for consumers** if they consume green power.
  - **Cross subsidy surcharge and additional surcharge shall not be applicable** if green energy is utilized for production of green hydrogen and green ammonia.
- **Significance of the move**
  - To ensure the **access to affordable, reliable, sustainable and green energy** for all.
  - **To promote generation, purchase and consumption of green energy** including energy from Waste-to-Energy plants.
  - To **streamline overall approval process for granting OA**, including timely approval, etc.
  - To **enable simplified procedure for OA to green power**.
  - To help in **achieving India's commitment of 500 GW of non-fossil fuel by 2030.**

6. CONSERVATION EFFORTS

6.1. FOREST CONSERVATION

FOREST CONSERVATION IN INDIA AT A GLANCE

Key Targets

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

Current Situation (India State of Forest Report 2021)

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

Significance of Forests

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

Threats to forests

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

Schemes/Policies/Initiatives

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

Constraints in Forest management in India

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

Way forward

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

6.1.1. DRAFT AMENDMENTS IN FOREST CONSERVATION ACT

Why in News?

Recently, the Ministry of Environment, Forests and Climate Change (MoEFCC) issued a letter and consultation paper that documented proposed changes to the Forest Conservation Act, 1980 (FCA).

About Forest Conservation Act, 1980

- The Forest (Conservation) Act, 1980, came into force to provide for the conservation of forests in India.
- The Act **prohibits state and other authorities, except with the prior approval of the Central Government,** to give any order directing:
  - de-reservation of forest;
  - use of forest land for non-forest purpose;
  - assigning any forest land or its portion by way of lease to any private person or organization;
  - Clearing of trees which have grown naturally in forested land.
- **Any diversion of land for non-forest purpose requires approval** as well as payment of stipulated compensatory levies such as Net Present Value (NPV), Compensatory Afforestation (CA), etc.
- **Power to make rules: Empowers Central Government to make rules** for carrying out the provisions of this Act.
- **Definition of Non-forest purpose:** It means the breaking up or clearing of any forest land for the cultivation of tea, coffee, spices, medicinal plants, etc. and for any purpose other than reforestation.
  - Non-forest purposes don't include work relating or ancillary to conservation, development and management of forests and wildlife like establishment of check-posts, fire lines, wireless communications and construction of fencing, etc.
- **Constitution of Advisory Committee**: The Central Government may constitute a Committee consisting to advise that Government for the grant of approval and any other matter connected with the conservation of forests.
- **Penalties:** Contravention of any of the provisions of the Act is punishable imprisonment of upto fifteen days.
  - **Offences by the Authorities and Government Departments** are punishable as well.
- **Appeal**: Any person aggrieved may file an appeal to the National Green Tribunal.

Definition of Forest: T N Godavarman case

- Till 1996 concerned authorities used to apply the provisions of the Act only to the forests notified under the Indian Forest Act, 1927.
- However, following a Supreme Court judgment in **T N Godavarman case**, the 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 which are identified as "forest" by an expert committee** constituted by the Supreme Court following the 1996 order.
- Thus, forest lands in India include unclassified forests, undemarcated forests, existing or deemed forests, protected forests, reserved forests, sanctuaries and national parks etc.

Related news

The **Ministry of Environment Forest and Climate Change** approved consideration of **Central Zoo Authority** approved **Zoos on forest land as forestry activity** under the **Forest Conservation Act (FCA), 1980.**

Proposed Amendment in Forest Conservation Act 1980		
	Need for amendment in the Present Act	**Proposed Amendments**
Scope of the Act	• **Presently, identification of forest land is subjective and arbitrary** to some extent. For instance, it includes lands bearing vegetation irrespective of ownership and classification even if they are considered forest based on some locally defined criteria.	• **Define 'forests' in an objective manner**.
Land Acquired before 1980	• **Unused land with vegetation acquired by various ministries**, including Ministry of Road, Railway, Defense etc., before 1980 for construction/expansion purposes **are protected under the Act.**	• **Exempt such lands** acquired before 25.10.1980 from the purview of the Act.
Differences in land records of forests	• Scope of Mis-interpretation and litigation due to **several contrasting entries existing in revenue**	• **Revenue records** to be statutorily **required to reflect the occupier**

	records and forest records, such as in case of plantations.	**and the nature of land** including forest. • **Lands identified as plantation, afforestation** etc. after 12.12.1996 **to remain outside the purview** of the Act to encourage forestry activities.
Construction alongside road and railways	• **Approval issues for construction of amenities and facilities in strip plantations alongside roads and railway lines**, which are notified as forests.	• **Exemption up to 0.05 ha for each such accesses** may be allowed to alleviate the hardship of the residents/business owners.
Conservation of Pristine Land	• **No prohibitory (only regulatory) provisions** in the Act **for non-forestry use of pristine forest**.	• **Introducing provision to keep certain pristine forests showcasing rich ecological values intact** for a specific period.
Development of infrastructure along the international border areas	• **Delays and difficulties in obtaining approval** from central government for **projects** of **national importance**.	• **Such projects to be exempted** from obtaining prior approval of Central Government.
Misuse of provisions by mining companies	• Forest land can be diverted under two provisions- o 2(ii) For use of forest land for non-forestry purpose by paying only NPV. o 2(iii) For assignment of lease which requires detailed examination of the proposal and payment of other compensatory levies such as CA in addition to NPV. • However, mining leaseholder misuse provision 2(ii) and get away with paying the NPV money only.	• Delete 2(iii) of the Act and clarify that 2 (ii) can be invoked for any kind of lease assignment having an intention of using for non-forestry purpose.
New drilling technologies	• **Emergence of New environmentally friendly technologies** which enables exploration or extraction of oil & natural gas deep beneath without impacting the forest soil or aquifer.	• Such environmentally friendly technologies to be kept outside the purview of Act.
Private land covered under definition of forests	• **Current definition of forest includes private areas** which restrict the right of an individual to use his/her own land for any non forestry activity.	• **Allow owners of such lands for construction of structures and residential unit** up to an area of 250 sq mtr as one time relaxation.
Activities related to conservation of forests and wildlife	• **Activities like establishment of zoos, safaris, Forest Training infrastructures etc. are not excluded from definition non-forestry purposes**.	• **Such activities to be excluded from "non-forestry activity"**.
Imposition of compensatory levies	• **Compensatory levies are imposed twice**, at the time of assignment as well as renewal of lease of land.	• Double imposition of any levy should be removed.
Penal Provisions	• **Present penal provisions are insufficient** to deter violations.	• Offences to be made **cognizable, non-bailable and punishable with imprisonment of upto one year**.

Concerns regarding amendments

- **Dilution of definition of forests may lead to exclusion and degradation** of certain forested areas.
- Proposal to exempt certain lands **can impact protection rights provided under Forest Rights Act, 2006.**
- Activities like **Ecotourism, Roads and railway lines, Extended Reach Drilling, Monoculture plantation projects** etc. may adversely impact biodiversity and forest ecosystem.
- **Lack of consultation with forest-dwelling communities.**
- **Infringement on right of states:** The amendments propose changes in recording of land revenue. However, land revenue is categorically a State subject in Schedule VII of the Constitution.

Conclusion

The Act in its current form has created several hurdles in the way of development. Yet, any change in this act can only work if it recognizes the 'symbiotic relationships' between the forest, the stakeholders and the

biodiversity. Therefore, better engagement with stakeholders is required while keeping biodiversity at the center is must.

Related News:
Community forest rights (CFR)

- Chhattisgarh recently recognised community forest rights (CFR) of the tribals of the KangerGhati National Park (KNP).
  - CFR area is **common forest land** that has been **traditionally protected and conserved for sustainable use** by a particular community.
  - It may **include forest of any category** – revenue forest, classified & unclassified forest, deemed forest, reserve forest, protected forest, sanctuary and national parks etc.
- CFR rights are recognised under the **Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act** (FRA), 2006.
- **Significance of the move**
  - **Empower villagers, encourage community-based conservation and strengthen livelihood** means and **food security** for them.
  - **Underline integral role that forests dwellers play** in conservation of forests and biodiversity.
  - **Undoing "historic injustice"** meted out to forest-dependent communities.

6.1.2. FOREST (CONSERVATION) RULES, 2022

Why in news?

Recently, **Ministry of Environment, Forest and Climate** change has notified the Forest Conservation Rules 2022.

Salient features of Forest (Conservation) Rules, 2022

- These rules are notified under the **Forest (Conservation) Act, 1980** and will **replace the Forest (Conservation) Rules, 2003.**
- **The rules establish certain committees to perform various functions-**

Committees	Features
Project screening committee	• To be constituted by State or UT. • It shall meet atleast twice every month to recommend projects to State/UTs administration. • It shall **examine the proposal received from the State Government or Union territory Administration, except proposals involving forest land of five hectares** or less.
Regional Empowered Committee	• To be setup by Central govt in each of the regional offices. • To meet atleast twice every month to examine every referred project for approval or rejection.
Advisory Committee	• To be setup by the Central govt consisting of 6 members to meet every month. • The role of the Advisory Committee is to **advise with regards to grant of approval under various sections of rules.**

- **Time frame:**
  - **Non-mining projects between 5-40 hectares:** reviewed within 60 days.
  - **Mining projects between 5-40 hectares:** reviewed within 75 days.
  - For projects involving a **larger area:**
    - **120 days for non-mining projects involving more than 100 hectares.**
    - ✓ **150 days for mining projects involving more than 100 hectares.**
- **Proposals for Prior Approval of the Central Government**
  - **In- Principle' approval after considering the recommendation of the Advisory Committee.**
  - **Final approval**: The **Nodal Officer may, after receipt of the 'In-Principle' approval from the Central Government.**
- **Compensatory Afforestation**
  - Land for compensatory afforestation shall be provided which is **neither notified as forest under the Indian Forest Act, 1927 or any other law nor managed as forest** by the Forest Department.

Analysis of the Forest Conservation Rules 2022

- **Compensatory afforestation**: Rules **aims to make land availability for compensatory afforestation easier.**
  - But it is **necessary to ensure, that these compensated tree lots or plantations offer the same ecological features and services as the natural forest** that is diverted.

- **Tribal rights**: Rules states that **only the state government will now be responsible to ensure that the rights of the forest dwellers are secured**, that too after the union government has given its final approval.
  - Rules **goes against the Gram Sabha's decision under the Forest Rights Act 2006** who is the authority to initiate the process for determining the nature and extent of individual or community forest rights and issuing certificate that the forest rights recognition process is complete.
- **Lack of proper scrutiny**: Rules seek to simplify and shorten the process of appraising any infrastructure or other development project involving the diversion of forest land.
  - However, rules **don't scrutinise** the impacts of projects for **less than 5 hectares.**

Compensatory Afforestation Fund Act, 2016

- Compensatory Afforestation (CA) refers to afforestation and regeneration activities carried out as a way of compensating for forest land diverted to non-forest purposes.
- The act establishes **National and State Funds for the same purpose.**
- **90% of the all monies** collected for compensatory afforestation by a State/UT shall be **transferred to the State Fund** and the **balance 10% to the National Fund.**
  - The monies received in the National and State fund shall be an **interest bearing and non-lapsable under public accoun**t.
- **National and State Authority**
  - Their function is to **manage and utilise the respective funds for the purposes of this Act** such as conservation and development of forest and wildlife.

Conclusion

The new rules ease and streamlines the procedure for development purpose, but it is also necessary to secure traditional rights of tribal and other forest-dwelling communities over forestlands through their consent and make development more inclusive.

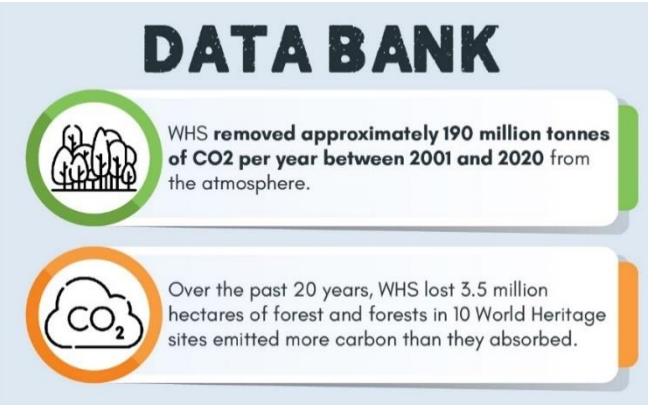
Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006

- The Act provides that the **gram sabha, or village assembly, will initially pass a resolution recommending whose rights to which resources should be recognised**. This resolution is then screened and approved at the level of the sub-division and subsequently at the district level.
- **The rights granted under the act are:**
  - **Title rights**: It is ownership to land that is being farmed by tribals or forest dwellers as on 13 December 2005, subject to a maximum of 4 hectares
  - **Use rights:** Use of minor forest produce and its ownership, grazing areas, pastoralist routes, etc.
  - **Relief and development rights:** For rehabilitation in case of illegal eviction or forced displacement; and to basic amenities, subject to restrictions for forest protection.
  - **Forest management rights:** To protect forests and wildlife.

6.1.3. WORLD HERITAGE FORESTS

Why in News?

Recently, UNESCO, World Resources Institute (WRI) and International Union for Conservation of Nature (IUCN) released a report titled 'World Heritage Forests: Carbon Sinks under Pressure'.



About World Heritage sites (WHS)

- These are **cultural and/or natural sites of 'Outstanding Universal Value',** which are important across countries and generations.
  - **UNESCO seeks to encourage** the identification, protection, and preservation of cultural and natural heritage around the world considered to be of outstanding value to humanity.
  - This is embodied in **Convention concerning the Protection of the World Cultural and Natural Heritage**, adopted by UNESCO in 1972.
- **Distribution**: They are **distributed across more than 110 countries** and cover approximately 350 million hectares (Mha).
  - Collectively, they **include almost 1% of the Earth's land surface and 0.6% of the world's oceans.**
- **Significance of the sites**: Act as **carbon sink; provide crucial ecosystem service** like preventing hazards such as floods or landslides, supply of freshwater etc.; **contribute to biodiversity conservation** and well-**being of local communities** and wider human society.

- **Two most widespread threats** to UNESCO WHF -
  - **Climate change with associated severe weather** (e.g., fires, storms, floods, droughts, temperature extremes, and habitat shifting/alteration).
  - **Land-use pressures associated with various human activities** such as illegal logging, wood harvesting, and agricultural encroachment due to livestock farming/grazing and crops.

Related concept: Blue carbon

- Blue carbon is the organic carbon (**mainly obtained from decaying plant leaves, wood, roots and animals)** stored in coastal and marine ecosystems.
- Blue carbon ecosystems include seagrass meadows, tidal marshes and mangroves.

- India's **Sundarbans National Park is among five sites that have the highest blue carbon stocks** globally.

Recommendations to protect UNESCO WHS and maintain their climate benefits

- **Rapid response to climate-related events** by adopting climate change adaptation plans and supporting disaster risk reduction initiatives.
- **Integrated landscape management** and the **creation of ecological corridors and buffer zones**.
- **Integrating continued protection of WHS** into climate, biodiversity, and sustainable development strategies.
  - This should be in line with the Paris climate agreement, the Post-2020 Global Biodiversity Framework and the Sustainable Development Goals.

6.1.4. SEOUL FOREST DECLARATION (SFD)

Why in news?

XV World Forestry Congress (WFC) recently endorsed the Seoul Forest Declaration (SFD).

About Seoul Forest Declaration (SFD)

- SFD focuses on **identifying key areas, that can help combat multiple crises humanity faces, including:**
  - **Responsibility for forests should be shared** and integrated across institutions, sectors and stakeholders.
  - **Investment in forest and landscape restoration globally needs to triple by 2030** to meet internationally agreed targets on restoring degraded land.
  - **Innovative green financing mechanisms to upscale investment** in forest conservation, restoration etc.
  - **Sustainably produced wood must be used** to transform building sector, provide renewable energy and innovative new materials, and move towards a circular bio-economy and climate neutrality.
- **Other initiatives launched at WFC**
  - **Assuring the Future of Forests with Integrated Risk Management (AFFIRM) Mechanism** to enable countries better understand, manage and affront forest fires.
  - **Sustaining an Abundance of Forest Ecosystems (SAFE) initiative.**
  - **Youth Statement on Forests** and **Ministerial Call on Sustainable Wood.**

6.1.5. ECO-SENSITIVE ZONES

ECO-SENSITIVE ZONES (ESZs) AT-A-GLANCE

Ecologically important and fragile areas around protected areas designated to be protected from industrial pollution and unregulated development under the Environment Protection Act (EPA), 1986.

Notified by: The Central Government, i.e., MoEFCC, in exercise of the powers conferred by EPA, 1986.

BACKGROUND OF ESZS IN INDIA

- **'Wildlife Conservation Strategy-2002'** envisaged lands falling within 10 Kms of the boundaries of National Parks and Sanctuaries to be notified as Eco fragile zones.
- **All the Chief Wildlife Wardens requested for listing out such areas** for notification as eco-sensitive areas.
- **Many states didn't comply** due to concerns regarding impacts of ESZ on habitations and developmental activities.
- **Goa Foundation v. Union of India:** SC ordered all States/UTs to comply to 2005 order.
- The court contemplated notifying 10 km area around PAs as ESZS if there is delay in site specific preparation of ESZ by States/UTS.

2002

2005

- National Board of wildlife communicated to all states/UTS for **site specific delineation of ESZs.**
- **The purpose of ESZ clarified** to regulate, rather than prohibit, specific activities.

2006

2011

- Guidelines for declaration of ESZ around National Parks and Wildlife Sanctuaries' notified by MOEFCC to deal with the process and procedures to be adopted for declaring ESZ.

Purpose of declaring ESZs

- Create some kind of **"Shock Absorber" for the Protected Areas** (PAs).
- **Act as a transition zone** from areas requiring higher protection to those requiring lesser protection.
- **Regulate human activities, rather than prohibit,** around PAs.

Extent of ESZs as per 2011 guidelines

- Width of **up to 10 kms around a PA** as a general principle.
- Sensitive corridors, connectivity and ecologically important patches, crucial for landscape linkages, even beyond 10 kms width, are also included in the ESZ.
- **Distribution** of an area of ESZ and the **extent** of regulation may **not be in uniform** all around and are kept PA specific.

Categories of activities undertaken within an ESZ

(as per 2011 Guidelines)

Prohibited	Commercial mining, setting of saw mills, polluting industries, major hydroelectric projects etc.
Regulated (Restricted with safeguards)	Felling of trees, Establishment of hotels and resorts, drastic change of agriculture system, widening of roads, introduction of exotic species etc.
Permissible	Rainwater Harvesting, Organic farming, Ongoing Agricultural and Horticulture practices by local communities, Adoption of green technology for all activities etc.

PROCEDURE OF DECLARATION OF ESZ

Creation of inventory

- Inventory of activities around each of the Protected Area as well as important Corridors is made with the help of range officers.

Constitution of a committee

- The committee is tasked wtih demarcating extent of ESZ and create a Master Plan for its management (including classification of activities to be regulated).
- The committee generally comprises of: Wildlife Warden, Warden, an Ecologist and officials from local self-government and Revenue Department.

Notification of ESZ

- Final proposal is forwarded to the MoEFCC for further processing and notification.

6.1.6. JUDGEMENT ON ESZ

Why in news?

The Supreme Court has directed that every protected forest, national park and wildlife sanctuary in the country should **mandatorily have a minimum 1 km eco-sensitive zone (ESZ),** from their demarcated boundaries.

More about the judgment

- The directions were passed in reference to applications filed under the **TN Godavarman Thirumalpad versus Union of India** case.
- The order would apply in **all such states/UTs where the minimum ESZ is not prescribed.**
- **Other highlights of the judgment:**
  - **Extended boundary shall prevail** if the existing ESZ goes beyond 1 km buffer zone or if any statutory instrument prescribes a higher limit.
  - **No new permanent structure** will be allowed within the ESZ.
  - **Mining within national wildlife sanctuary or national park is not permitted.**
  - **Activity already being undertaken,** within the 1km or extended ESZ, **but lying outside the ambit of prohibited activities may continue with permission.**
  - The **Principal Chief Conservator of Forests** of each State/UT has been directed to make a list of subsisting structures at the ESZs and **submit a report to the court within 3 months.**
  - The requirements could be **diluted if there is "overwhelming public interest".**
  - In respect of Pas for which the proposal of a State/UT has not been given, **the 10 kilometres buffer zone as ESZ shall be implemented,** according to MoEFCC guidelines, till a final decision is arrived.

Significance of the judgement

- **Moving beyond bare-minimum legal compliance:** Some states have conceded only a few metres of area to ESZs which is insufficient in fulfilling the purpose and role of ESZs.
- **Maintaining ecological connectivity** between different PAs.
- **Preventing ecological damage in fragile areas like Western ghats** where demarcation of ESZs has not been finalized yet.
- **Managing negative impacts** (deforestation, displacement of local people, littering, pollution etc.) **of rising tourist activities** on land around parks and sanctuaries.

Issues related to creation of ESZs

- **Opposition from States** due to their **impact on developmental activities and state revenue.**
- **Lack of participatory planning exercises** while implementing the ESZ.
- **Enforcing a one-size-fits-all '1 km' buffer zone in all protected areas.**
- **Lack of ground investigation** for proposals with areas being **randomly marked** on topographic sheets.
- **ESZs restricts land-use change and affects livelihood prospects of people** living in human settlements located close to the forest boundary.
- **Practical difficulties in ESZ** implementation due to **high density of human population around the forest lands.**

Way Forward

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

Related news: Ecologically sensitive areas (ESA) of the Western Ghats

- The deadline to finalise the **draft notification to officially earmark ecologically sensitive areas (ESA) of the Western Ghats has been extended for another year** due to persistent differences between the governments of Kerala, Karnataka, Tamil Nadu, Maharashtra, Goa and Gujarat — through which the Western Ghats extends.
- **Recommendations for ESA under the draft notification:**
  - **Complete ban on mining, quarrying and sand mining;**
    - ✓ **A phase out of all existing mines within 5 years** from the date of the final notification;
  - **Ban on new thermal power projects** or expansion of existing plants;

- **Ban on new or expansion of 'Red' category polluting industries** as specified by the Central Pollution Control Board or State Pollution Control Board.
- **Permits new hydropower projects** on the basis of the Environmental Impact Assessment notification.
- **Allows existing health care establishments to continue** in ESA.
- **Allows establishment of "Orange/White" category of Industries** with strict compliance of environmental regulations.
- **Concerned state governments are responsible for monitoring and enforcing the provisions** of the notification and will prepare a **'State of Health Report' of the Western Ghats on an annual basis** to provide details of the steps in the direction.

- The MoEFCC had earlier **constituted several committees with a mandate to demarcate areas within the Western Ghats Region** which need to be notified as ecologically sensitive, and make recommendations for its conservation, protection and rejuvenation, including-
  - **Gadgil Committee, 2010:** Gadgil panel submitted a report to the environment ministry in 2011 **tagging 64% of the Western Ghats region** as an ESA.
    - ✓ However, report was rejected by many states deeming it too restrictive.
  - **Kasturirangan committee,2012**: It proposed **37% of the total area** of Western Ghats, 59,940 square kilometres, to be **declared as eco-sensitive area (ESA).**
- The **draft notification further reduced the proposed ESA** from 59,940 square km to 56,825 square km due to inputs from States like Kerala.

6.2. BIOLOGICAL DIVERSITY

6.2.1. 15TH COP TO THE CONVENTION ON BIOLOGICAL DIVERSITY

Why in News?

Recently, first part of 15th meeting of the Conference of the Parties (COP) to the United Nations Convention on Biological Diversity (CBD) was held virtually in Kunming, China.

More on the News

- The main objective of the COP 15 was to develop and adopt a **post-2020 "Global Biodiversity Framework"** to replace and update the **Strategic Plan for Biodiversity (SPB) 2011-2020** and **Aichi Biodiversity Targets**.
- The framework will include a set of global goals, targets and indicators that will guide conservation, protection, restoration and sustainable management of biodiversity and ecosystems for the next 10 years.
  - The first draft of the GBF was released in July 2021, containing **21 targets for 2030** and 4 Goals to achieve **humanity "living in harmony with nature," vision by 2050.**
- **Parties will reconvene in 2022** for further negotiations and to come to a final agreement on the post-2020 Global Biodiversity Framework.

SPB 2011-2020

- It was adopted by the parties to the CBD, during the tenth meeting of the Conference of the Parties **(COP10)** in 2010 in **Nagoya, Japan**, with the purpose of inspiring **broad-based action in support of biodiversity** over the next decade by all countries and stakeholders.
- It was comprised of a shared vision for 2050, a mission and **20 targets organized under 5 strategic goals,** collectively known as the **Aichi Biodiversity Targets (ABTs).**
- **Vision:** Living in Harmony with Nature where by **2050, biodiversity is valued, conserved, restored and wisely used,** maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people.

Key Outcomes of the conference

- **Adoption of Kunming Declaration:** The declaration called for urgent and integrated action to reflect biodiversity considerations in all sectors of the global economy.
  - **More than 100 nations, including India,** made commitments to-
    - ✓ ensure the development, adoption and implementation of an effective post-2020 global biodiversity framework.
    - ✓ reverse the current loss of biodiversity.
    - ✓ ensure that biodiversity is put on a path to recovery by 2030 at the latest.
  - It also noted the efforts and commitment of many countries **to protect 30 percent of their land and sea areas by 2030 (30 by 30 target)**, which is critical for reversing a major driver of nature's decline.
  - **Kunming Biodiversity Fund:** China established the Fund with approximately USD 230 million to support projects for protecting biodiversity in developing countries.
  - **Open letter to Private sector:** The conference called for increased involvement of the private sector, including an open letter from business CEOs to world leaders, urging for bold action.
  - **Global Environment Facility, the UN Development Programme and the UN Environment Programme,** committed to fast-tracking financial and technical support to developing countries for GBF implementation.

Key issues related to post-2020 Global Biodiversity Framework

- **Adoption of the 30 by 30 Targets:** Related issues--
  - **Could harm the rights of indigenous peoples and local communities** living in biodiverse regions.
  - **Difficulties in multilateral cooperation** for conservation of cross border land/ocean areas.
  - **Lack of quality targets will result in the protection of areas of little conservation value**.
- **Presently commercial benefits of Digital sequence information (DSI) are not covered by benefit-sharing mechanisms.**
  - DSI is information that has been obtained from sequencing and analysing genetic material. Countries rich in genetic resources but lacking the capacity to utilise them want DSI to be covered by benefit-sharing mechanisms – a move opposed by countries strong in biotech.
- **Lack of ambition and urgency.**
- **Financing gap of estimated USD 700 billion** that is needed annually to halt biodiversity decline.
- **Lack of convenient mechanisms to track collective ambitions, or to regularly take stock of progress.**
- **Need for integrated efforts to address interlinked crises** of biodiversity loss, climate change, land degradation and desertification, ocean degradation, and pollution.
- **Adverse impact on small farmers, fishers** etc. **in developing nations** on redirecting agricultural, forestry and fishing subsidies which harm biodiversity

Way Forward

- **Expanding Protected areas and other effective area-based conservation measures.**
- **Recognising the rights and roles of indigenous peoples and local communities**.
- **Global targets should be measurable, underpinned by science, and have explicit outcomes**.
- **Targets within the framework should be aligned to existing commitments related to climate, land, sea etc**.
- Governments should make efforts to raise and contribute **additional investment in nature**.
  - At least **10% of the overall recovery investment for** COVID-19 crisis can be directed **towards protecting and restoring nature**.
- **Measures for successful implementation** require capacity building, technology transfer, technical support, South-South and other forms of cooperation, gender mainstreaming, incorporation of traditional and local knowledge, public awareness and participation, and transparency.

Related News:
High Ambition Coalition (HAC) for Nature and People
- **India officially joined** the High Ambition Coalition for Nature and People.
- India is the first of the BRICS bloc of major emerging economies (Brazil, Russia, India, China and South Africa) to join the HAC.

- It is an intergovernmental group of **70 countries** co-chaired by Costa Rica and France and by the United Kingdom as Ocean co-chair, championing a global deal for nature and people with the central goal of **protecting at least 30 percent of world's land and ocean by 2030**.
- The **30x30 target** is a global target which aims to halt the accelerating loss of species, and protect vital ecosystems that are the source of our economic security.

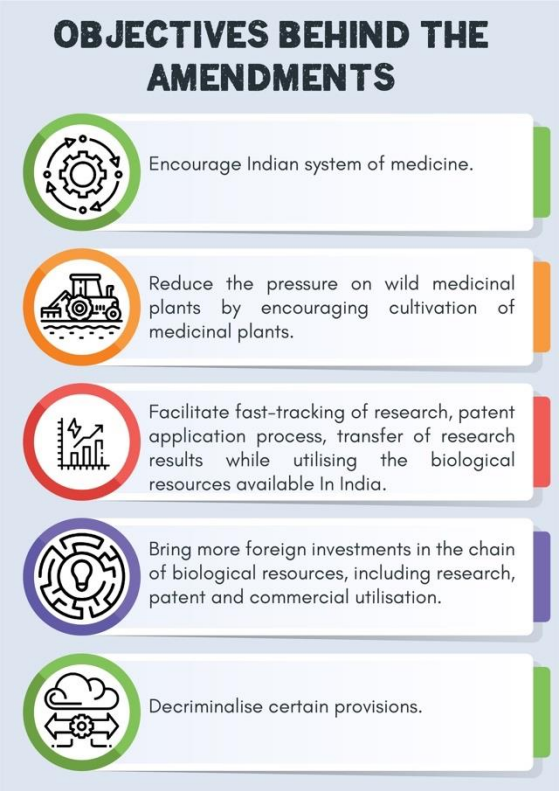
United Nations Geneva Biodiversity Meetings

- The **United Nations Geneva Biodiversity Meetings** recently concluded.
- The meetings were held in Geneva, Switzerland to discuss the **post-2020 Global Biodiversity Framework** before second part of CoP15 of the Convention on Biological Diversity (CBD).
- **Major outcomes of the meetings**-
  - **Release of first negotiated text** of goals, targets and supporting mechanisms for a Post-2020 framework for nature.
  - Progress made towards a **solution for the fair and equitable sharing of benefits from Digital Sequence Information on the use of Genetic Resources;**
  - Agreement to address **resource mobilization and monitoring framework, marine and coastal biodiversity**, and other issues.

6.2.2. BIOLOGICAL DIVERSITY (AMENDMENT) BILL, 2021

Why in News?

The Biological Diversity (Amendment) Bill, 2021 was recently introduced in Lok Sabha and then referred to a joint parliamentary committee (JPC).



About Biological Diversity Act, 2002

- It was enacted to provide for the conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources and knowledge.
- **Aim:** To fulfill India's obligations under the **Convention of Biological Diversity and Nagoya Protocol on Access and Benefit Sharing**.
- It provides for a **decentralised three-tiered mechanism** for implementation of the Act: National Biodiversity Authority (NBA), State Biodiversity Boards (SBBs) and Biodiversity Management Committees (BMCs).
- **Biodiversity Management Committees (BMC) are responsible for preparing People's Biodiversity Registers** which keep a record of all flora and fauna including details of traditional knowledge available in their region.

Key Provisions of the Proposed Amendments

- **Registered AYUSH medical Practitioners, people involved in traditional knowledge and indigenous etc. are exempted** from giving prior intimation to SBB for accessing biological resource from certain purposes.
- **Any foreign-controlled company registered in India can seek approval** from the NBA for obtaining biological resources.
- Applicants can obtain **NBA's approval before the grant of IPR** and not before applying for IPR.
- **Deletion of provision which made offences under the act cognizable and non-bailable.**
- **State government will prescribe the composition of BMCs** and may also constitute BMCs at the intermediate or district Panchayat level.
- **Power to notify any threatened species can be delegated to the state government.**

What is Access and Benefit-Sharing?

- When an Indian or foreign company or **individual accesses biological resources such as medicinal plants and associated knowledge, it has to take prior consent** from the national biodiversity board.
- The board can impose a benefit-sharing fee or royalty or impose conditions so that the **company shares the monetary benefit from commercial utilisation of these resources with local people** who are conserving biodiversity in the region.

- However, before notifying any threatened species, the state government must consult the NBA.

- **Expansion of NBA to include** 11 additional members.
- **Changes in Definitions:** For example, 'bio-utilisation' has been removed, and 'bio-survey' has been redefined.

Concerns regarding Amendments

- **Allowing large AYUSH firms to evade the requirement for prior approval or sharing the benefits.**
- **Difficult to certify whether the raw material used by companies came from the forest areas or cultivated lands.**
- Monetary benefits arising from products developed by foreign companies **may not reach the local communities.**
- **Issues regarding changes in definitions:**
  - **Threat of Bio-piracy** due to deletion of the term Bio-utilisation.
  - **Uncertainty regarding regulation of biosurveys.**

Case in Point: Ayush companies seeking relaxation of the benefit-sharing provisions

- The Uttarakhand Biodiversity Board (UBB) sent a notice to Divya Pharmacy in 2016 stating that the company was in violation of the Biodiversity Act for using biological resources from the state for its ayurvedic formulations, without intimating the board and that it was liable to pay an access and benefit-sharing fee.
- Challenging the board's notice, the company filed a writ petition before the Uttarakhand high court in December 2016 challenging the powers of the biodiversity board to determine benefit-sharing by Indian companies.
- The court in 2018 upheld the powers of the biodiversity board in its judgement.

Conclusion

There is a need to bring back the focus on protecting the interests of the local communities and sharing the profits with them. The main focus of the legislation should be to protect India's rich biodiversity and associated knowledge and protect biological diversity and local growers through a three-tier structure of Central and State boards and local committees.

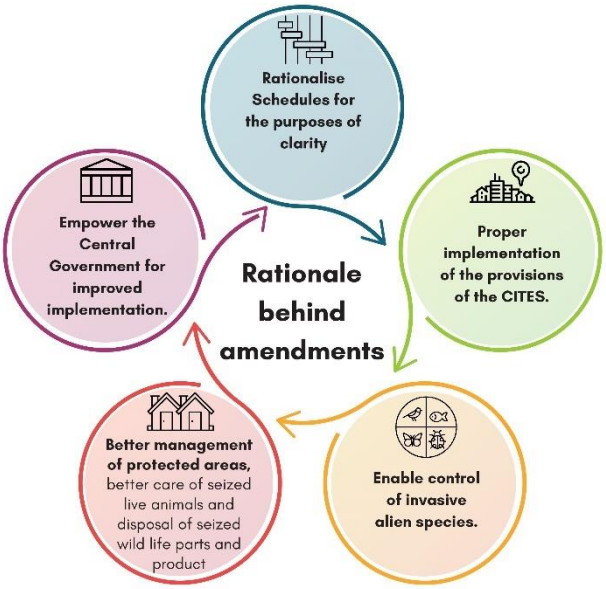
6.3. WILD LIFE (PROTECTION) AMENDMENT BILL, 2021

Why in News?

A bill to amend the Wild Life (Protection) Act, 1972 was recently introduced in Lok Sabha.

About Wild Life (Protection) Act, 1972 (WPA)

- The act provides for the protection of wild animals, birds and plants with a view to ensuring the ecological and environmental security of the country.
- It empowers the State to declare protected areas, under **four categories**- National Parks, Wildlife Sanctuaries, Community Reserves and Conservation Reserves.
- The act has created **6 schedules for specially protected plants (one), specially protected animals (four), and vermin species (one),** which gave varying degrees of protection to classes of flora and fauna.



Proposed Amendments in the Wild Life (Protection) Amendment Bill, 2021

- **Rationalisation of the Schedules:** The Bill reduces the total number of schedules from 6 to 4 by:
  - reducing the number of schedules for specially protected animals to two (one for greater protection level),
  - removing the schedule for vermin species, and

Proposed Structure of Schedules

- **Schedule I:** Animal species with the highest level of protection.
- **Schedule II:** Animal species with a lesser level of protection.
- **Schedule III:** Protected plant species.
- **Schedule IV:** Species listed in the Appendices under CITES.

- inserting a new schedule for specimens listed in the Appendices under CITES (scheduled specimens).

- **Wild animals to be declared as Vermin by the way of notification** by the Central Government for any area and for a specified period.
- Empowers the central government to **regulate or prohibit the import, trade, possession or proliferation of invasive alien species**. An officer can be authorised to seize and dispose the invasive species.
  - Invasive alien species refers to plant or animal species which are not native to India and whose introduction may adversely impact wild life or its habitat.
- **New Chapter VB for implementation of CITES**: with following provisions-
  - **Designation of authorities**: The Central government will designate a:
    - ✓ **Management Authority**, which grants export or import permits for trade of scheduled specimens.
    - ✓ **Scientific Authority**, which gives advice on aspects related to impact on the survival of the specimens being traded.
  - **Use of an identification mark for a specimen** whose modification or removal is prohibited.
  - **Person possessing live specimens of scheduled animals must obtain a registration certificate** from the Management Authority.
- **Chief Wild Life Warden shall control, manage and maintain all sanctuaries** in accordance with the management plan prepared as per guidelines issued by the Central Government.
  - In the case of sanctuaries falling in Scheduled Areas or areas where the Forest rights Act, 2006 is applicable, in accordance with the management plan prepared after **due consultation with the concerned Gram Sabha.**
- **New section 42A for** voluntarily **Surrender of captive animals** or animal products (without any compensation).
- **Increased fines for violations** of the provisions of the Act. E.g., maximum penalty for general violation increased from Rs. 25,000 to Rs. 1 Lakh.
- **Relaxation of certain restrictions** like film-making, **transfer or transport of live elephants** by person having ownership certificates, grazing or movement of livestock, bona fide use of drinking and household water by local communities, etc.
- **Other changes:**
  - **Allow the Central Government to declare conservation reserves** in areas leased or otherwise transferred to it by the State Government.
  - **State Board for Wild Life permitted to constitute a Standing Committee.**
  - **No renewal of any arms licences shall be granted to any person residing within ten kilometres of a sanctuary** except under the intimation to the Chief Wild Life Warden or the authorised officer

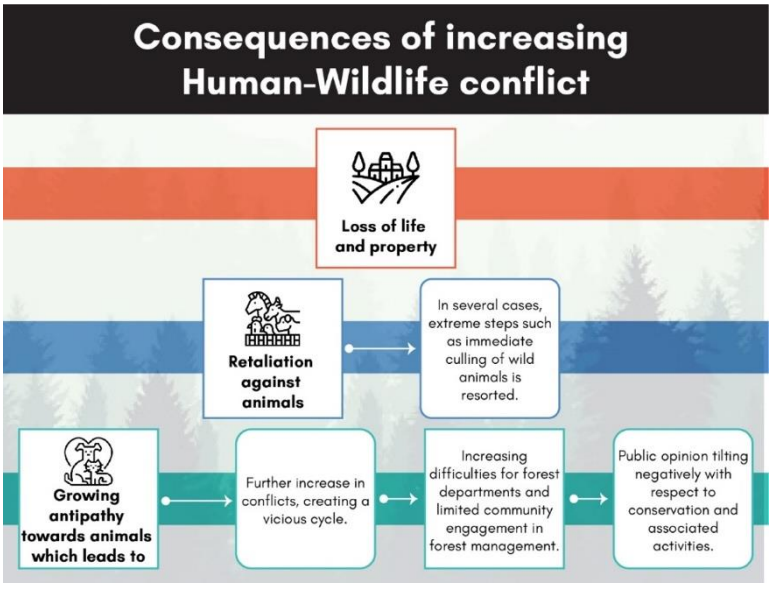
Conclusion

The amendments to the WPA, 1972 were long overdue and needed for efficient implementation of the CITES.

6.4. HUMAN WILDLIFE CONFLICT

Why in news?

The Union Ministry of Environment, Forest, and Climate Change (MoEFCC) has constituted a **permanent coordination committee** that also includes the Ministry of Railways **to prevent elephant deaths on railway tracks**.



Extent of Human Wildlife Conflict in India

- **Between 2018-19 and 2020-21, 222 elephants were killed by electrocution.**
- **29 tigers were killed by poaching** between 2019 and 2021.
- **Odisha accounted for highest number of elephants deaths** followed by Jharkhand and West Bengal.

What are the reasons behind human-wildlife conflicts?

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

Way forward

- **Recognizing the key sources of conflict** and focusing on **promotion of community centric management and conservation**.
- **Local traffic management measures like** restricting the speed of trains at vulnerable locations, night closure of roads, etc. to reduce chances of collisions.
- **Landscape level approach that deals with large scale processes in an integrated and multidisciplinary manner**, combining natural resources management with environmental and livelihood considerations.
- **Encouraging Non-Infrastructural solutions** like extended tree canopy, corridor planting etc.
- **Advisory for management of Human-Wildlife Conflict (HWC)**, by Standing Committee of National Board of Wildlife (NBWL), prescribes various steps for States/ UTs for dealing with HWC situations-
  - **Empower gram panchayats to deal with the problematic wild animals** as per WPA, 1972.
  - **Utilise PM Fasal Bima Yojna for compensation** against crop damage due to HWC.
  - **Augment fodder and water sources** within the forest areas.
  - **Adopt of early warning systems, create of barriers, dedicated circle wise Control Rooms** with toll free hotline numbers etc.

Steps taken by the Government to prevent and reduce human wildlife conflict

- **Structural Measures to reduce accidental killings like** installation of road signs in corridors/habitats, speed calming measures, etc.
- **'Eco-Friendly Measures to Mitigate Impacts of Linear Infrastructure' was published by** Wildlife Institute of India in consultation with MoEFCC among others to assist project agencies in designing linear infrastructure to reduce human-animal conflicts.
- **National awareness campaign on Prevention of Human, Animal Mortality on Highways** by Ministry of Road Transport and Highways.
- **National Wildlife Action Plan (NWAP-3) (2017-2031)** prescribes guidelines to mitigate the human wildlife conflict like creation of **national, regional, and state level database for HWC**, **scientific management of wildlife populations** as well as **land use practices** and comprehensive, **species- and region-specific conflict-migration plans.**

Innovative mechanisms used for dealing with HWC

- Tamil Nadu Forest department has installed **infrared sensors on 6-meter-long poles** and on trees on either side of the railway track close to the elephant corridor in the Coimbatore Forest division.
- Under **Project RE-HAB** of Khadi and Village Industries Commission, **Bee-fences are created by setting up bee boxes in the passageways** of elephants to block their entrance to human territories.

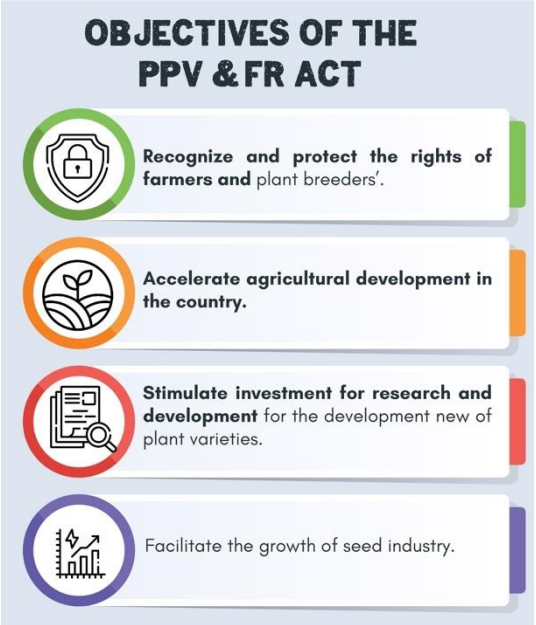
6.5. PROTECTION OF PLANT VARIETIES AND FARMERS' RIGHTS ACT

Why in news?

Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA) under the PPV&FR Act has revoked a plant variety protection certificate granted to PepsiCo India Holding on to FC-5 potato variety (also called as FL-2027) on multiple grounds.

About the Protection of Plant Varieties and Farmers' Rights (PPV&FR) Act

- The PPV&FR Act was **enacted in 2001 under Article 27(3) (b) of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS).**



- The act is in conformity with **International Union for the Protection of New Varieties of Plants (UPOV), 1978** (an intergovernmental organization, to provide and promote an effective system of plant variety protection, with the aim of encouraging the development of new varieties of plants, for the benefit of society).

- The Act **introduced intellectual property protection in Indian agriculture** and is the **world's only IPR legislation which grants intellectual property rights not only to the plant breeders but also to the farmers**.
- **Institutional Mechanism:**
  - **PPV&FR Authority** with following functions:
    - ✓ **Registration of new plant varieties.**
    - ✓ **Developing DUS (Distinctiveness, Uniformity and Stability) test guidelines** for new plant species.
    - ✓ **Facilitate development and commercialisation of new varieties**.
    - ✓ **Recognizing and rewarding farmers**, community of farmers, particularly tribal and rural community engaged in conservation and improvement.
    - ✓ **Maintenance of National Gene Bank** to store the seed material.
    - ✓ **Preservation of plant genetic resources** of economic plants and their wild relatives.
  - **Plant Varieties Protection Appellate Tribunal (PVPAT):** The decisions of the PVPAT can be challenged in High Court. The Tribunal shall dispose of the appeal within one year.
- **Eligibility criteria** for registration of variety of seed: **Fulfilling the criteria of Distinctiveness, Uniformity and Stability (DUS).** The protection period is for 15 years for trees and 18 years in the case of vines.
- **Plant varieties that can be registered for protection**: New varieties, Extant variety, Farmers' variety and Essentially derived variety.
- **Rights under the Act:**

Breeders' Rights	• **Exclusive rights to produce, sell, market, distribute, import or export the protected/ registered variety.** • Can appoint agent/ licensee and may exercise for civil remedy in case of infringement of rights.
Researchers' Rights	• Can **use any of the registered variety under the Act for conducting experiment or research.** • This includes the use of a variety as an initial source of variety for the purpose of developing another variety, but repeated use needs prior permission of the registered breeder.
Farmers' Rights	• A farmer who has evolved or developed a new variety is **entitled for registration and protection** in like manner as a breeder of a variety. • **Section 39(1):** Allows all farmers cultivating a registered new variety the **right to "save, use, sow, resow, exchange, share or sell farm produce including seeds" except the branded seeds**. • **Section 39 (2):** Provides for **compensation to the farmers for non-performance of variety**. • Farmer shall **not be liable to pay any fee** in any proceeding before the Authority or Registrar or the Tribunal or the High Court under the Act. It will be paid through National Gene Fund.

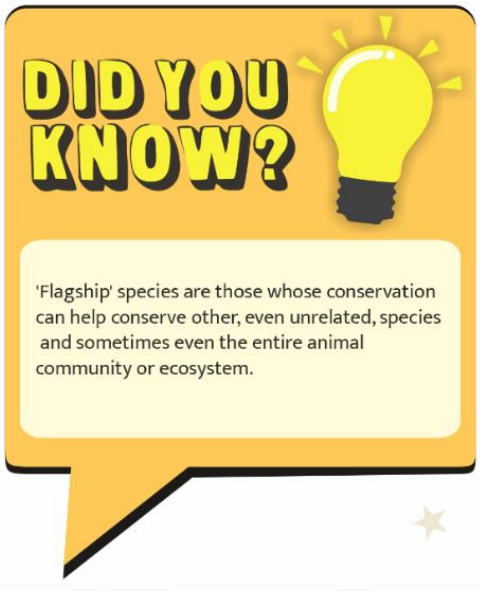
Implications of the current verdict

- **Setting a precedent of upholding farmers' seed freedoms.**
- **Highlighted the loopholes in the present act and its implementation** such as:
  - **Enforcement issues:** large variance in law enforcement across states, difficulties in differentiating between farmers and aggregators.
  - **Lack of IPR protection may hinder innovation.**
  - **Complicated and slow process for registration** of new varieties.
  - **Procedural gaps exist in the process of registration.**

Way ahead

- **Widespread variance in State-level laws and regulations need to be addressed.**
- **Need to ensure that the farmer has a stake in innovation** by ensuring better realisations for adopting innovative varieties.
- For this, there is a need for more investment in farm infrastructure, including processing and pre-processing plants, as well as identity protected supply chains.

6.6. CHEETAH RELOCATION



Why in news?

By end of 2022, India is set to receive **cheetahs from South Africa** and **Namibia** at **Kuno Palpur in Sheopur district of Madhya Pradesh.**

About Cheetah Reintroduction Project

- Project to translocate cheetahs is **being implemented by Ministry of Environment with the help of Wildlife Institute of India (WII).**
- **Kuno Palpur wildlife sanctuary** is suitable location due to **favorable habitat, prey abundance** etc.
    - It is **only wildlife sanctuary in world** to host **all four major cat species**—lion, tiger, cheetah and leopard.

Importance of relocation

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

Concerns

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

Way forward

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

6.7. SIXTH MASS EXTINCTION

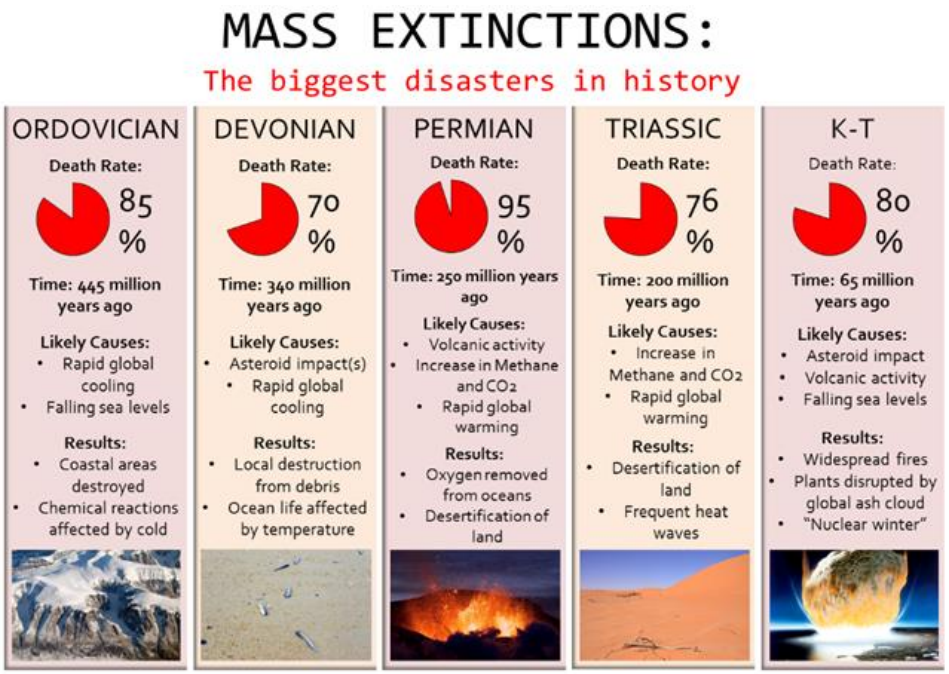
Why in news?

A recent study states that earth is going through its sixth mass extinction.

About Mass extinction

- Mass extinction event is usually defined as about **75% of the world's species being lost in a 'short' amount of geological time** - less than 2.8 million years.

- There have been **five mass extinctions so far** (see infographic).
- However, **all of those were caused by natural phenomena.** This time, it is being **caused entirely by humans** and hence referred to as **Anthropocene extinction.**
- **Evidence of 6th mass extinction:**
  - **More than 400 vertebrate species went extinct** in the last century.
  - **29,400 species of terrestrial vertebrates are on the brink of extinction** because they have fewer than 1,000 individuals.
  - More than 30% of animals with a backbone fish, birds, mammals are **declining in both range and population.**



- **Causes of mass extinction:**
  - **Rising climate change activities** i.e., extreme temperature changes, rising or falling sea levels, depletion of oceanic oxygen etc.
  - **Geologic catastrophes** (volcanic eruptions, asteroid hitting Earth).
  - **Invasive species.**
  - **Overconsumption** of resources.
  - **Agriculture, leading to diminishing wild spaces** and driving out species from their natural habitats.

Related Information
Biomonitoring

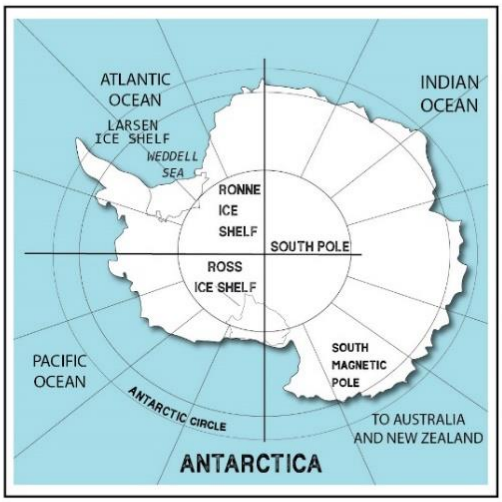
- Researchers in ecology **are testing a new method** that can **vastly expand bio-monitoring using eDNA**, in rivers to catalogue and count species.
- Biomonitoring is defined as the **act of observing and assessing the state and ongoing changes in ecosystems,** components of biodiversity and landscape, including the types of natural habitats, populations and species.
  - Biomonitoring has become an **indispensable tool for studying occupational and environmental exposure to chemicals, including persistent organic pollutants (POPs).**
- **eDNA is isolated from environmental samples,** in contrast to genomic DNA that is extracted directly from specimens.
  - It **originates from cellular material shed by organisms** (via skin, excrement, etc.) **into aquatic or terrestrial environments** that can be sampled and monitored using new molecular methods.
- **Advantages of eDNA**
  - **Collecting eDNA is easy.** One 4-ounce water sample can capture remnant DNA from thousands of aquatic species.
    - ✓ **Traditional bio monitoring methods, scientists count individual species** and their abundance at just a few sites.
  - This method **doesn't require killing wildlife** for identification.
  - It is **labour and cost effective**. This process requires just a **cheap filter, a syringe and vials**, and anyone can do it.

6.8. INDIA AND ANTARCTIC

ANTARCTICA AT-A-GLANCE

About Antarctica

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



Significance of Antarctica

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

Challenges faced by the Antarctica

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

Way Forward

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

6.8.1. THE INDIAN ANTARCTIC BILL, 2022

Why in news?

Recently, the government has tabled **The Indian Antarctic Bill, 2022** in Lok Sabha. The draft bill is the first domestic legislation about the Antarctica in India.

Need of the Bill

- **Need for domestic protocols which can regulate India's increasing activities in Antarctica.**
- **Enforcement of the Antarctica Treaty:** The Antarctic Treaty of 1959, which India is a signatory of, makes it mandatory for all the member countries to have provisions to prevent or check unlawful activities at their research stations.
- **Extending Jurisdiction of Indian courts to Antarctica:** Currently there is no recourse for crimes committed during any Indian expedition, including crimes against the environment.
- **Regulate tourism and fishing in Antarctica.**

Key Provisions of the Bill

- **Applicable to** any Indian/foreign person, vessel or aircraft involved in any Indian expedition to Antarctica.
- **Establishment of a Committee on Antarctic Governance and Environmental Protection** chaired by the **Secretary of the Ministry of Earth Sciences** along with ten members and two experts by the Union Government. The functions of the Committee include:
  - **Granting permits** for various activities,
  - Implementing and **ensuring compliance** of relevant international laws for protection of Antarctic environment,
  - **Obtaining and reviewing relevant information** provided by parties to the Treaty, Convention, and Protocol, and
  - **Negotiating fees/charges with other parties** for activities in Antarctica.
- **A permit by the Committee or written authorization from another party to the Protocol (other than India) will be required** for various activities such as:
  - **Entering and staying in Antarctica.**
  - **Activities related to collection of Mineral resource.**
  - **Introduction of non-native** organisms into Antarctica.
  - **Removal of biological specimen** from Antarctica.
  - **Activities which may harm native species.**
  - **Waste disposal** in Antarctica or discharge into sea.
- **Prohibited activities** include nuclear explosion, disposal of radioactive wastes, introduction of non-sterile soil, discharge of garbage, plastic, or other substance harmful to marine environment in Antarctica etc.

India's other endeavours in Antarctica

- The Protocol on Environmental Protection to the Antarctic Treaty (the Environmental Protocol or **Madrid Protocol**) **entered into force for India in 1998.**
- India is also **a member of** Council of Managers of National Antarctic Programme **(COMNAP**), Scientific Committee of Antarctica Research **(SCAR)** and Commission for Conservation of Antarctic Marine Living Recourses **(CCAMLR).**
- **India's Research stations: Maitri** at Schirmacher Hills, **Bharati** at Larsemann Hills (Dakshin Gangotri was the first Indian base established in 1984).
- The Antarctic operations of India are currently funded from the **budget allocated to the Ministry of Earth Sciences** under relevant head.

About Antarctic Treaty

- The treaty was signed in 1959 and came into force in 1961 after ratification by 12 original members.
  - **These 12 countries are:** Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, South Africa, USSR (now Russia) the UK, and the US.
- **Parties:** Currently 54 countries have acceded it.
  - India joined the treaty in 1983 and soon received consultative status.
- **Objectives of the treaty**
  - **To demilitarize Antarctica** and to establish it as a zone free of nuclear tests and the disposal of radioactive waste, and to ensure that it is used for peaceful purposes only.
  - **To promote international scientific cooperation** in Antarctica.
  - **To set aside disputes over territorial sovereignty.**
- The Treaty parties have also negotiated three international agreements which govern activities in Antarctica, collectively known as the **Antarctic Treaty System**-
  - **Convention for the Conservation of Antarctic Seals (1972)**
  - **Convention on the Conservation of Antarctic Marine Living Resources (1980)**
  - **Protocol on Environmental Protection to the Antarctic Treaty (1991) (Madrid Protocol)**

- **Stringent penalties for contravention of its provisions:** E.g., Conducting a nuclear explosion in Antarctica can lead to imprisonment of 20 years to life imprisonment and a fine of at least Rs 50 crore.
- **Sessions court** notified by the central government **to try punishable offences.**
- **Other provisions:**
  - **Constitution of the Antarctic fund** to be applied towards the welfare of Antarctic research work and protection of Antarctic environment.
  - **Grant of Special permit for commercial fishing in Antarctica.**
  - **Inspection in India by an officer designated by the Central Government.**
  - **Specifies Duties and liabilities of Operator** in case of environmental emergency.
  - **Establishment of waste classification system** and waste management plan.

6.9. INDIA'S ARCTIC POLICY

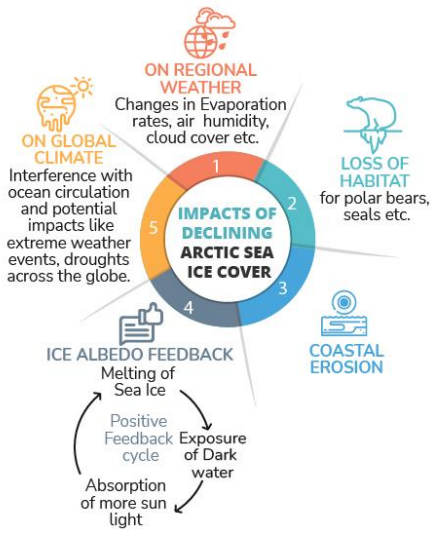
Why in news?

Ministry of Earth Sciences released India's Arctic Policy titled 'India and the Arctic: building a partnership for sustainable development' to enhance the country's cooperation with the resource-rich and rapidly transforming region.

Six Pillars of the policy		
Strengthening India's scientific research and cooperation • Strengthening the existing research **base at Himadri.** • Encourage research to align with **International arctic priorities.** • Channelise and harness existing expertise across disciplines such as **geoengineering, cold biology, and microbial diversity.**	**Climate and environmental protection** • **Engage with partners** to improve earth system modelling to support weather and climate predictions. • Contribute towards **environmental management** in Arctic. • Contribute towards environmental management in the **Arctic-methane emissions.**	**Economic and human development** • Explore **opportunities for responsible exploration** of natural resources and minerals. • Identify **opportunities for investment** in Arctic infrastructure.
Transportation and connectivity • Collaborate in the field of **ship building** with partners who have relevant expertise. • Promote **opportunities for Indian seafarers** to crew ships engaged in Arctic transits.	**Governance and international cooperation** • Improve understanding of the **complex governance structures** in the Arctic • Actively participate in international **climate change and environmental treaty frameworks** relating to the Arctic	**National capacity building** • **Strengthening institutional and human resource capacities.** • Build **indigenous capacity** in building ships of ice-class standards.

Significance of Arctic for India:

- Changes in the Arctic, especially melting Arctic ice, can **accelerate global warming, submerge coastal regions and be highly disruptive for national development.**
- Synergies between **polar studies and Himalayas.**
- **Melting Arctic ice opens up new opportunities** like energy exploration, mining, shipping etc.
- India **holds one of the 13 positions as the Observer in the Arctic Council.**



6.10. DEEP AND SHALLOW ECOLOGISM

Why in news?

Shallow and deep ecologism are the **two strands of environmental philosophy** that have become point of discussion as India continues to grapple with the unrelenting heat waves.

What does Shallow and deep ecologism mean?

- Deep ecologism is one of the most **radical forms of environmental ethics** which was first advocated by Norwegian philosopher Arne Naess in 1970. The **alternative** to deep ecology is often referred to as **shallow ecology.**
  - They both have **recognized and examined the anthropogenic problems with the environment,** albeit in different ways.

Key difference between the two styles of ecologism

Specifications	Deep ecologism	Shallow ecologism
Place of Human beings in the environment	• **Anthropocentrism is blamed for the environmental crisis.** • It argues that all living things have the same right to live and flourish. This means that the interests of other living beings have to be treated as seriously as the interests of humans. • **For example:** Even if we could provide a way of protecting humans from climate change, it would still be a bad thing because many other living beings would suffer.	• There is **nothing necessarily wrong with the anthropocentric worldview.** Nature is only valuable insofar as it serves human interests. • **For example:** Climate change is bad because it will affect human interests.
Priority	**Prioritises a 'live and let live' attitude** over an 'either you or me' approach. 	It gives **priority to humans** above other forms of life. 
Approach to deal with pollution and resource depletion	• It aspires **to sustain nature by making large-scale changes to our lifestyle.** • **For example:** The reshaping of transport systems which involve the use of internal combustion engines.	• Exponents of this philosophy believe in **continuing our present lifestyle,** but **with specific tweaks** aimed at minimising the damage to the environment. • **For example:** Use of vehicles that cause less pollution or air conditioners that do not release chlorofluorocarbons (CFCs).
Decision making on environmental crisis	It considers that developed countries are more responsible for the climate change. Hence, argues for a holistic perspective to the crisis which acknowledges **regional differences and the disparities** between under and over-developed nations.	**'Global' approach** to the environmental crisis.
Impact on inequality • Deep ecologism maintains that by not changing the lifestyle, shallow **ecologism further widens the inequalities between countries.** For instance, ○ Despite constituting **only 5% of the world's population, the U.S. accounts for 17% of the world's energy consumption** and is the second largest consumer of electricity after China.		

7. DISASTER MANAGEMENT

7.1. DISASTER MANAGEMENT IN INDIA

DISASTER MANAGEMENT IN INDIA AT A GLANCE

Disaster Risks in India

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

India's Vision and Approach to DM

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

Government Initiatives/ Schemes/Policies/Acts

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

Constraints

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

Way Forward

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

7.2. DISASTER MANAGEMENT PLAN OF MINISTRY OF PANCHAYATI RAJ

Why in news?

Disaster Management Plan of Ministry of Panchayati Raj (DMP–MoPR) was recently released.

About DMP–MoPR

It has been prepared in **compliance of Section 37 of Disaster Management Act** and **guidelines issued by National Disaster Management Authority** with larger perspective of community-based planning starting from village to District Panchayat level.

What is the significance of involvement of PRIs in Disaster Management (DM)?

- **Rural population makes up majority (~65%) of India's total population.**
- **Act as catalysts for social mobilization in key DM activities** like risk assessment of areas, identification of vulnerable groups, response measures undertaken during disaster and in post-disaster periods etc. **by utilizing close linkages with village communities.**
- **Helps in maintaining transparency and accountability** in the activities undertaken during and post disaster through **social audits**.
- **Elected representatives can address needs of marginalized groups** who are more vulnerable to extreme events and disasters.
- **Help in tapping the traditional wisdom of the local communities** and **spreading authentic awareness in the community.**
- **Play a role of leadership** in Disaster Risk Management at all stages.
- **Provide a base for integration of village community and NGOs** engaged in various Developmental activities at the grassroots level.

Constitutional Provision for DM Planning at local level

- **Article 243G:** It is intended to empower all three tiers of Panchayats by enabling the State Governments to devolve powers and authority including 29 subjects listed in the **Eleventh Schedule**.
  - Although, the word 'disaster' has not been mentioned in the Eleventh Schedule, they cover most of the activities required for disaster management preparedness, mitigation, recovery and reconstruction under like maintenance of community assets.
- **Article 43ZD:** It makes it mandatory for the States to constitute **District Planning Committee (DPC)** which prepares a Draft District Development Plan by consolidating the plans prepared by all the Panchayats and Municipalities in the district.
  - Disaster risk reduction is a critical component of these plans.

Challenges faced by PRIs in effectively tackling disasters

- **Insufficient institutional, financial and human capacities** to implement their disaster plans.
- **Low level of devolution of powers and functions** by the States.
- **Lack of clarity regarding roles and responsibilities** of PRIs in disaster management.
- **Low participation of vulnerable groups** at the grassroots level.
- **Absence of effective of inter-agency coordination** at district, state, and central levels.
- **Lack of training of Elected Representatives and Official Functionaries** regarding mechanisms and strategies of Disaster Management.

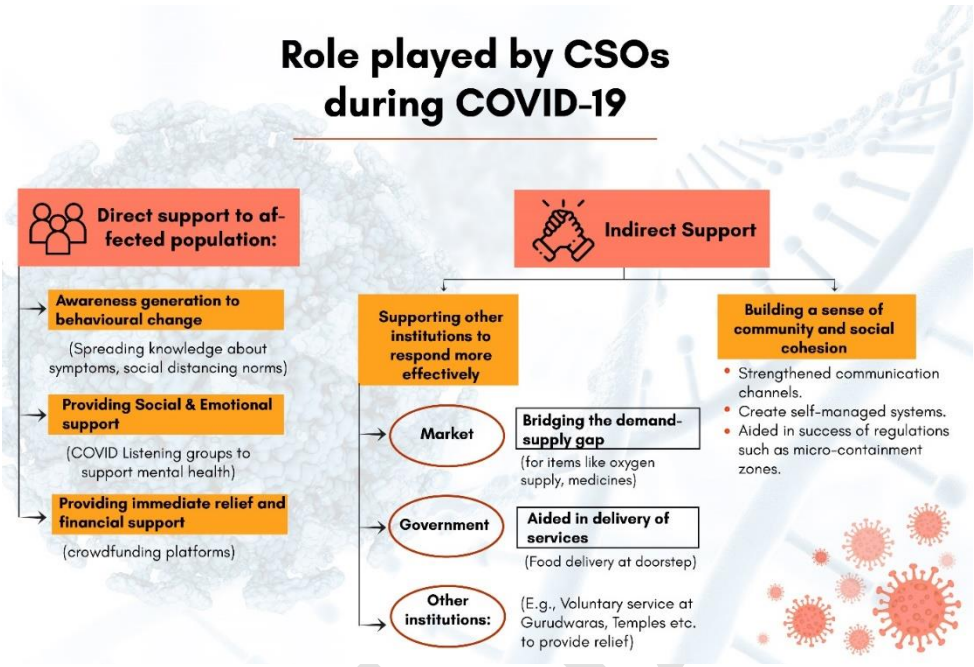
Conclusion

The **DMP–MoPR** can help in empowerment of PRIs functionally, financially and administratively to effectively shoulder responsibilities, while being hand-held to continuously build their capacities for economic development, social justice, and disaster management.

7.3. CIVIL SOCIETY ORGANIZATIONS (CSOS) AND DISASTER MANAGEMENT

Why in news?

Civil society networks have been bridging the supply-demand gap of essentials like Oxygen supply, Hospital beds, Remdesivir etc. during outbreak of the 2nd wave of COVID-19 in India.



What are CSOs and what are the roles they have been playing in Disaster Management?

- Civil Society Organizations (CSOs) broadly refer to non-State, not-for-profit, voluntary entities formed by people in the social sphere that are separate from the State and the market. E.g.
- **Role of CSOs in DM-**
  - **Acting as the first responder,** during search and rescue efforts.
  - **Providing financial and emotional support to families** or individuals.
  - **Damage Assessment at the Local Level.**
  - **Mobilization and channelizing of Funds for Relief and Rehabilitation.**
    - ✓ Developed microfinance networks in rural Odisha have aided has aided by post-cyclone rehabilitation in the region.
  - **Capacity building** of the most vulnerable sections of the society.

What are the limitations or gaps in these conventional roles?

- **Absence of proactive and continuous efforts in mitigation and building resilience** as most CSOs focus on post-disaster efforts.
- Limited financial and functional capacity **of lower CSO for responding to large scale disasters.**
- **Low number of volunteers and other participants.**
- **Duplication of efforts due to limited Coordination among the stakeholders.**
- **Lack of integration with other players like Government or market** limits their potential contribution.

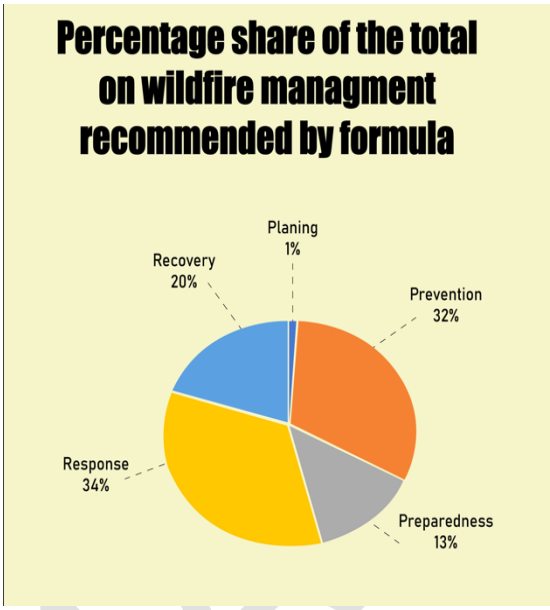
What needs to be done maximize the contribution that CSOs can provide?

- Government and other agents should **incorporate the role and efforts of CSOs in Disaster Management Framework.**
- **Recognize and support social role played by CSOs.**
- **Moving towards the concept of Individual responsibility:** The idea states that individuals as part of the society have a duty to give back by helping ones who are less fortunate.
- **Expand their role to include tasks such as-**
  - **Conducting collective discussions** among all stakeholders,
  - Regular interaction with local communities to **build long term resilience and mitigate for disasters.**
  - **Giving inputs in integrated plan of action during a disaster.**
    - ✓ For instance, India has already adopted the Sendai Disaster Risk Reduction Framework which provides large emphasis on local CSOs and participation of people.

7.4. WILDFIRES/FOREST FIRES

Why in news

The United Nations Environment Programme (UNEP), called on **global governments to adopt a new 'Fire Ready Formula,'** as it warned that incidences of wildfires would rise in the future.

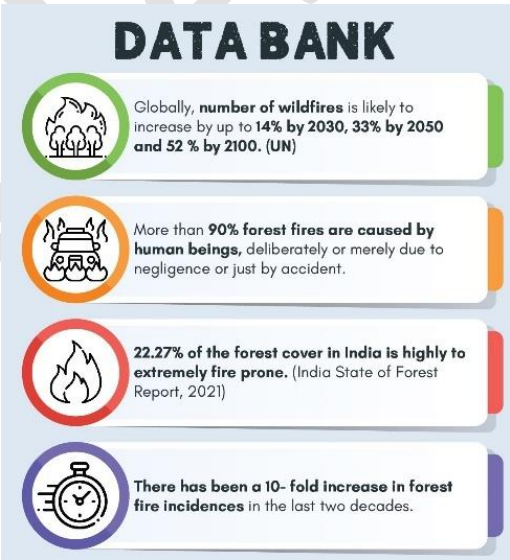


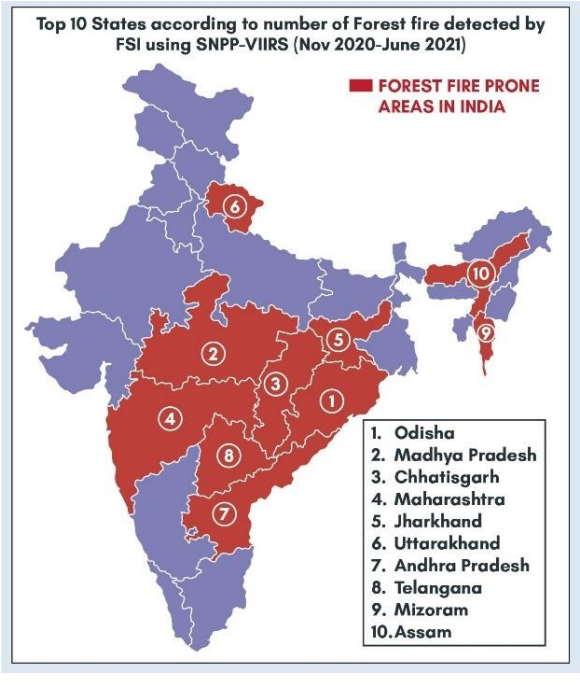
About UNEP's Fire Ready Formula

- Formula envisages **66% of spending to be devoted to planning, prevention, preparedness, and recovery** and the remaining **34% to be spent on response.**
- **Significance of the formula**
  - **Effective use of** government funds.
  - **Focus on prevention.**
  - **Development of international standard** for wildfire management.
  - **Help in SDG achievement.**

About Wildfire

- Wildfire is an **unusual or extraordinary free-burning vegetation fire** which may be started maliciously, accidently, or through natural means, that negatively influences social, economic, or environmental values.
- **Difference between wildfire and forest fire:** National Institute of Disaster Management (NIDM) defines Forest fire as **an unclosed and freely spreading fire that consumes the natural fuels.** When a **fire burns out of control it is known as Wildfire.**
- **Causes of forest fires:**
  - **Natural-** Lightning, friction of rolling stones, volcanic eruptions, friction among dry foliage etc.
  - **Anthropogenic-** slash and burn cultivation, accidental fires from campfires, cigarettes, etc., sparks from vehicles, transformers etc.
- **Recent example**- Australia saw **extreme wildfire in 2019-20 terming it as "Black summer"** season.
- **Occurrence in India:** Most commonly reported **during March and April.**
- **Significance of small scaled, controlled and natural Forest fire:** Useful and for natural forest development and regeneration; Reduced risk of catastrophic forest fire; Improving silvicultural opportunities; Increasing forage and habitat opportunities for wildlife etc.





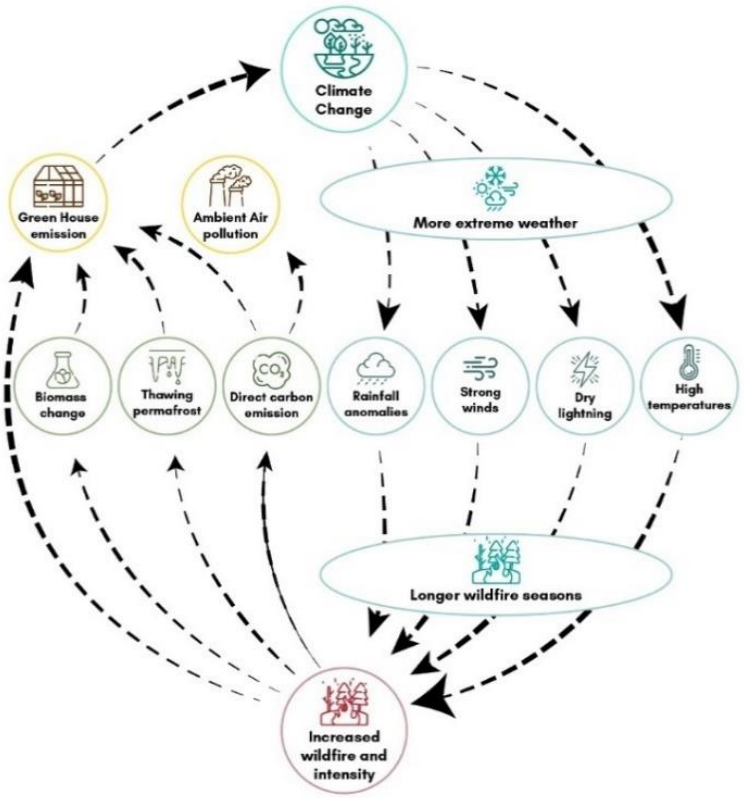
Impact of Wildfires/forest fire

- **On Ecosystem:** Induces changes in species mix, habitat structure and biodiversity; causes wildlife mortality, habitat destruction and loss in forest cover etc.
- **On Environment:**
  - **Changes in microclimate** caused by removal of litter and duff, opening of the canopy and darkening of soil surface by residual soot.
  - **Climate change** due to release of vast quantities of CO_2 in the atmosphere.

- **Negatively impacts water catchments** due to contaminants, increased soil erosion, changed soil composition, etc.

- **Socio Economic impacts:** Threatens livelihood of people are directly/indirectly dependent on forest ecosystems; loss of personal property, public infrastructure etc.; **health hazard** emanating from polluting smoke and noxious gases etc.

POTENTIAL REINFORCING FEEDBACK LOOP OF CLIMATE CHANGE ON WILDFIRES



Key gaps in India's Forest fire management (FFM)

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

Way Forward

- **Recognize and respond to the impact of climate change** on the prevalence and behavior of wildfires.
- **Rebalance investments** spent on reactive suppression to **proactive wildfire mitigation and management.**
- **Dedicated institutional mechanism** within Forest Department covering **all aspects** of FFM.
- **Develop and update forest fire manuals** for field staff guiding them in simple way to detect/ report about and suppress forest fire.
- **Empower communities and local authorities and integrate indigenous, traditional**, and contemporary fire management practices into policy**.**
- **Enact appropriate legal framework** at national and state level **to control and check the illegal activities** within or near the forest, leading to severe forest fires.
- **Adequate preventive and preparedness measures** such as clearing fire lines, removing the fuel (dead wood, leaves etc.), recruiting forest fire watchers, making the equipment ready to use etc.
- **Recognise forest fires as a disaster type** and integrate them into national, sub-national, and local disaster management plans.

Schemes/Policies/Initiatives to Manage Forest Fires

- **Centrally Sponsored Forest Fire Prevention and Management Scheme:** State Governments prepare **Annual Plan of Operation** for prevention and management of forest fire.
- **National Action Plan on Forest Fire (NAPFF):** Launched in 2018, its objective to minimize forest fires from taking place by **informing, enabling and empowering forest fringe communities** and incentivizing them to work in tandem with the forest departments.
- **FSI Fire Alert System (FAST) Version 3.0:** FSI has been alerting State Forest Departments of forest fire locations detected by **Near Real Time monitoring** of Forest Fire based on **MODIS (Moderate Resolution Imaging Spectro-radiometer) sensor** and **SNPP-VIIRS (Suomi-National Polar-orbiting Partnership - Visible Infrared Imaging Radiometer Suite)**. It includes components like-
  - **Forest fire geoportal-** VAN AGNI (forest fire) Geoportal
  - **Forest fire Danger rating for early warning.**
  - **Large Forest Forest Fire programme based on SNPP-VIIRS.**

- **Adopt UNEP's Fire Ready Formula to fund wildfire management.**

Related news: Wildfires across Europe

- Wildfires were raging across several countries in Europe including **Greece, Portugal, Spain, Italy, Turkey, the United Kingdom and France.**
- **Reasons for these wildfires:**
  - Intense Heatwaves across European region due to factors like-
    - ✓ **Changes in the jet stream**: Jet stream had temporarily split in two, leaving an area of weak winds and high-pressure air between the two branches that is conducive to the build-up of extreme heat.
    - ✓ **Creation of heat dome,** a low-pressure area that began to attract hot air from northern Africa.
    - ✓ **Creation of a region of upper level low-pressure air** that has been stalled off the coast of Portugal for days.
  - **Climate change** led to increased hot and dry conditions that help fires spread faster, burn longer and rage more intensely.
  - **Rural to urban migration in countries,** including Spain, reduced workforce to clear vegetation and dry scrub that spark forest fires.
  - **Forest management issues and negligent human activities.**

7.5. URBAN FIRE RISK

Why in News?

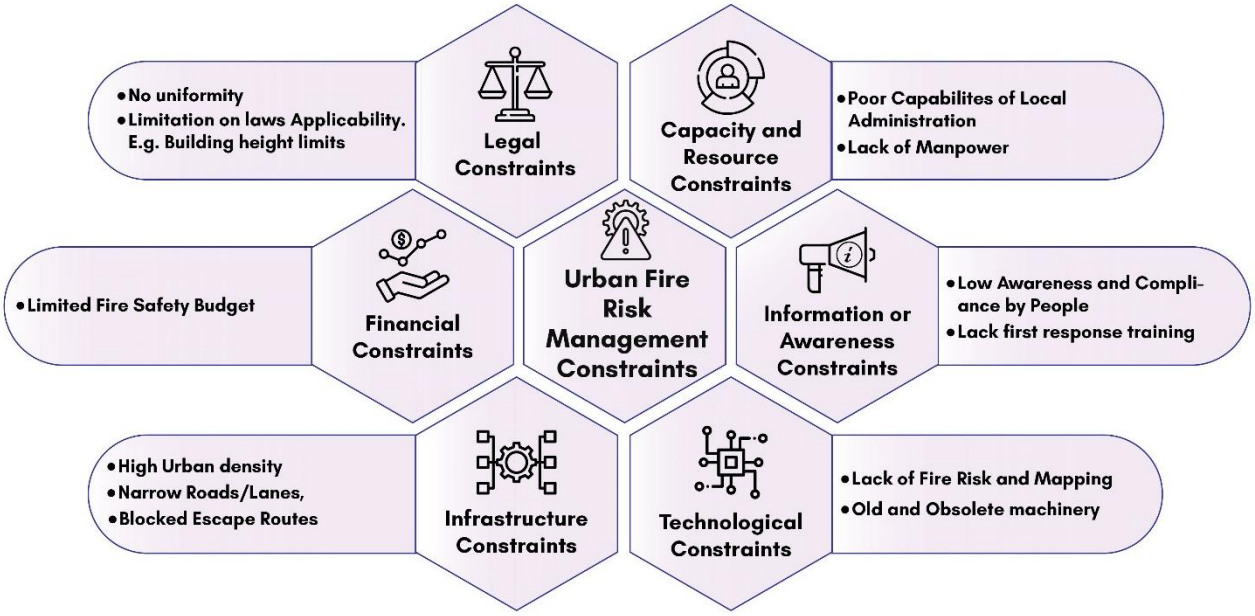
Recently, a 60-floor residential building caught fire in Mumbai with initial responses pointing out absence of six-monthly fire audit and failure of fire-fighting system to respond automatically.

Urban Fires

- Urban fire occurs primarily in cities or towns with the **potential to rapidly spread to adjoining structures.** These fires damage and destroy homes, schools, commercial buildings, and vehicles.
- **Impact:** Urban fires have a devastating impact on-
  - **People's health** due to asphyxiation, release of the toxic gases and explosions/bursts caused by it.
  - **Communities** due to the breaking up of economic activities and environmental destruction.

Fire safety regulations in India

- **Constitutional Provisions:** Fire Services come under Twelfth Schedule (Article 243W), so either **municipalities or the State Government/UTs** look regulate it through **local building bye laws.**
- **National Building Code of India 2016** (published by Bureau of Indian Standards) was issued to the States to incorporate the recommendations in their building byelaws with detailed provisions **under Part – IV "Fire & Life Safety"** on fire prevention, life safety and fire protection including **General Exit requirements and Standards for construction.**
- In 2020, Ministry of Health & Family welfare circulated strict **guidelines stipulating third-party accreditation for fire safety.**
- **NDMA has stipulated requirements for fire safety** in public buildings, including hospitals.



What can be done to overcome these constraints?

Component	Measures
Legal and Administrative	• **Risk Identification by carrying out Baseline assessments.** • **Updating laws/regulations to strengthen the fire safety guidelines and policy framework.**
Development and Maintenance	• **Mainstreaming of fire risks mitigation and management** in urban planning and development. • **Risk Reduction either through retrofitting or new construction** of the old and congested urban spaces with high risk. • **Fill up vacant posts with upgradation of Fire Safety equipment and infrastructure.** • **Technological Upgradation** like use of **automatic smoke alarm**, sprinklers, gas leakage alarm etc. with built-in fire suppression system or technologies to aerially track the fire incidents.
Enforcement of fire safety norms	• **Regular Fire safety Audits** can be made **mandatory via third party agencies** for all the buildings. • **Proper evaluation and scrutiny** before the sanction/renewal of the permits, licenses, etc.
Local Implementation	• **Early education on Fire Safety.** • **Evacuation and safety mock drills.**

7.6. DROUGHT IN INDIA

DROUGHT MANAGEMENT IN INDIA AT A GLANCE

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

Extent of drought in India

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

Causes of recurring drought in India

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

Schemes/Policies/Initiatives

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

Constraints in drought management

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

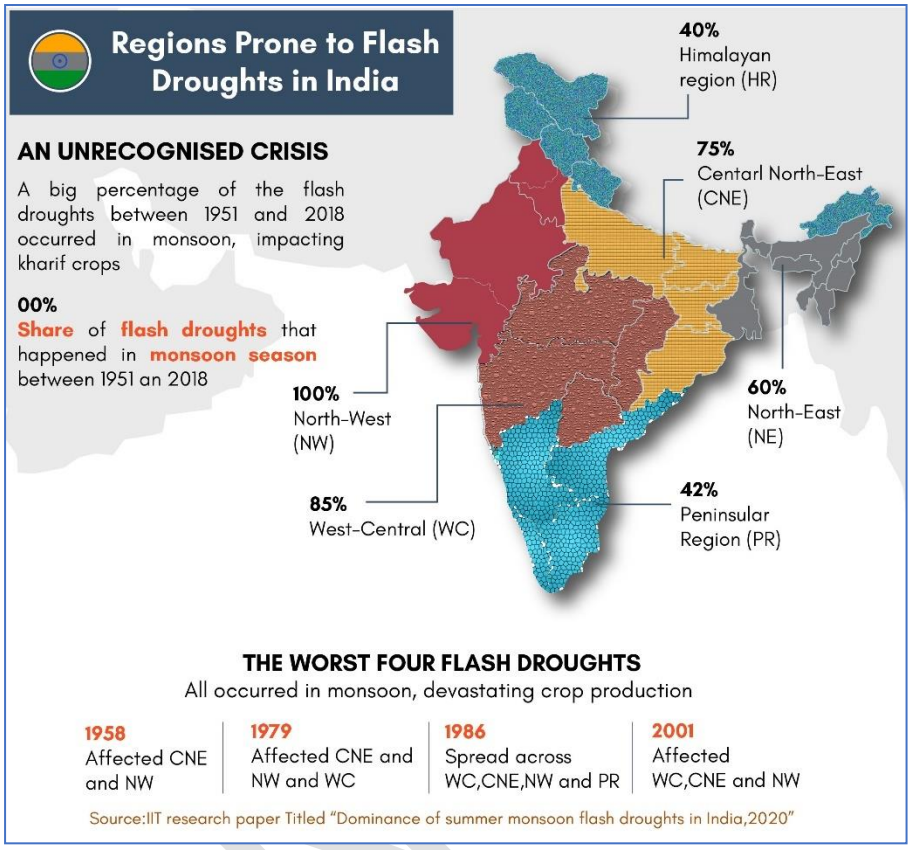
Way Forward

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

7.6.1. FLASH DROUGHT

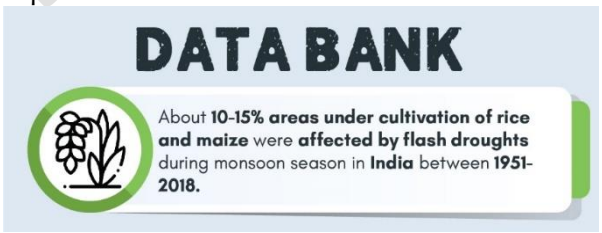
Why in news?

According to a new study, majority of the flash drought events in India have occurred during the monsoon season.



About Flash drought

- Flash drought is characterized by a **period of rapid drought intensification** with **impacts** on **agriculture, water resources, ecosystems, and the human environment. Flash Drought**
- **Causes of flash drought:** High evapo-transpiration rates due to abnormally high temperatures (Heatwave flash drought), winds, and high insolation and rain staying away (Precipitation deficit flash drought) for 15-20 days at a stretch.
    - Evapo-transpiration is the process by which water is transferred from the land to the atmosphere by evaporation from the soil and by transpiration from plants.
- **Flash drought can also be tied to climatic patterns like**:
    - **El Niño-Southern Oscillation (ENSO)** promotes drier and warmer conditions which **may increase flash drought frequency**.
    - **Delayed onset of the Inter-Tropical Convergence Zone (ITCZ) induced rainfall can trigger** Flash drought.
    - **Anticyclones:** They **suppress rainfall** which limits soil moisture replenishment and lead to **less cloud coverage and high surface temperatures** increasing evaporative demand of moisture.
- Tropics and Sub-Tropics have high potential for drought development due to high precipitation variability and evaporative demand.



Effects of Flash drought

- **On agriculture:** Affects crop yield and can cause crop failure.
- **On Economy:** Industries dependent on agriculture sector for raw materials may suffer losses due to reduced supply and increased prices.
- **On environment: Reduce availability of drinking water**; wildfires and increase desertification; **increased stress on endangered species** and **loss of biodiversity**.
- **On society:** Threatens food security; impacts livelihood; may lead to emergence of conflicts due to scarce water resources etc.

Way forward

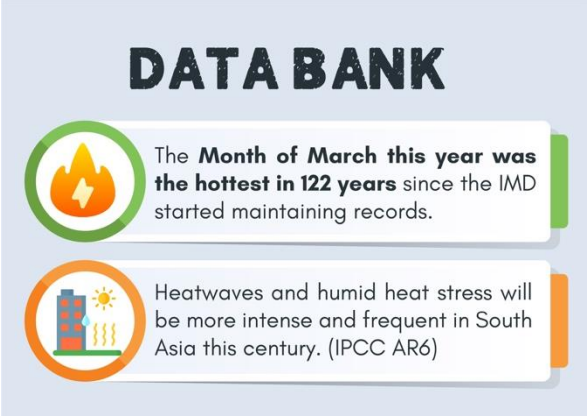
- **Early-warning systems (EWS) can identify trends in climate and sources of water** that are required to detect the emergence or probability of the occurrence of flash droughts.

- **Monitoring in states by setting up of Drought Monitoring Centres (DMCs)** staffed by a multi-disciplinary team of meteorologists, hydrologists and agriculture scientists.
- **Use of satellite imagery to check for anomalies**. e.g., **delayed sowing** indicates **rainfall deficiency** and **wilting of crops** signifies **soil moisture stress** – both are indicators of flash drought.
- **Inter-Agency cooperation** for efficient dissemination of information and activate contingency measures.

7.7. HEAT WAVES

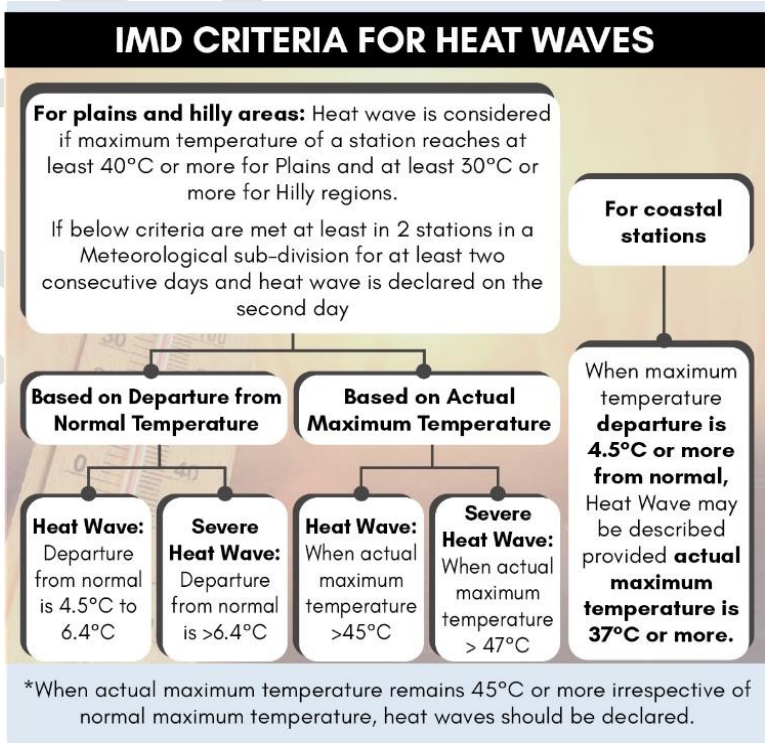
Why in news?

India recorded **280 heatwave days across 16 states in 2022** — most in decade as per the **State of India's Environment (SoE) in figures, 2022** released by Centre for Science and Environment.



About Heatwaves

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



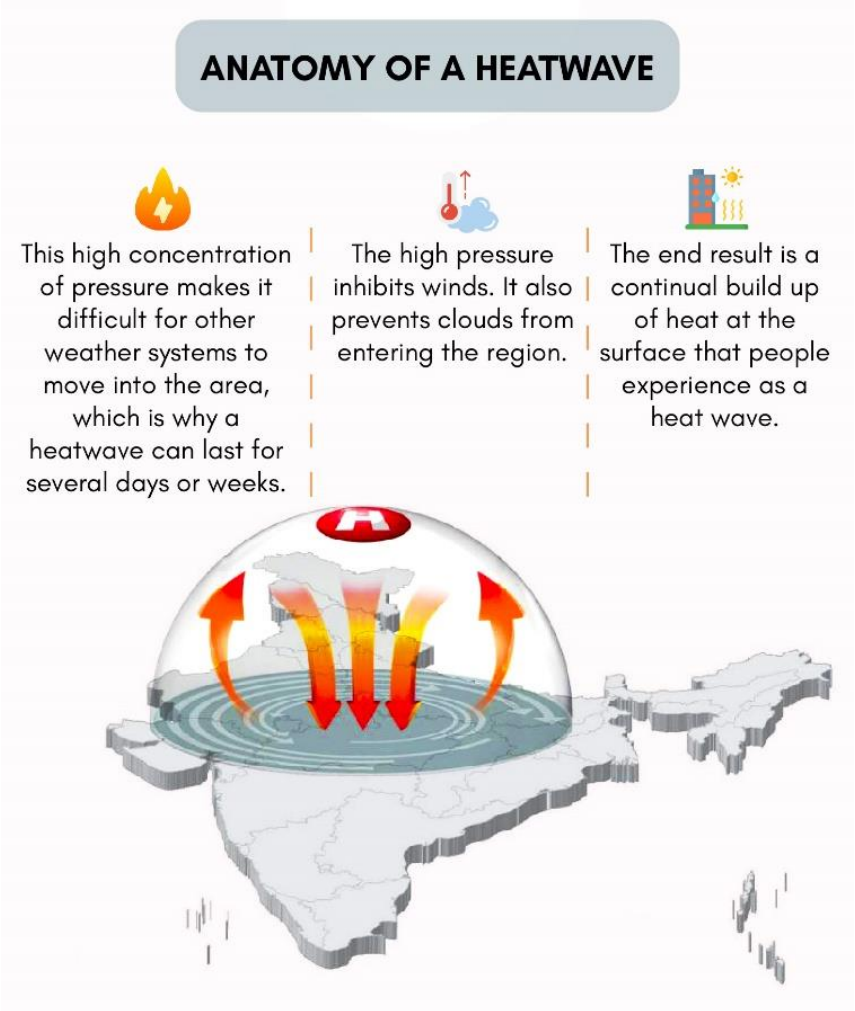
Reasons for intense and prolonged heatwaves in 2022

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

Impacts of Heatwaves

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

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



Way Forward

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

Steps taken to tackle heatwaves in India:

- India Meteorological Department (IMD) and the National Disaster Management Authority (NDMA) are working with **23 Heat wave prone states** identified in **2019 to develop HAPs.**
- **IMD issues colour code impact-based heat warning** jointly with NDMA with suggested actions classified under 4 colors-
  - **Green Alert**- No action
  - **Yellow and Orange Alerts**- Preparatory actions.
  - **Red Alert**- Action for Severe heatwaves.
- **Ahmedabad was the first South Asian city to develop and implement a city-wide heat health adaptation** in 2013 after experiencing a devastating heatwave in 2010.

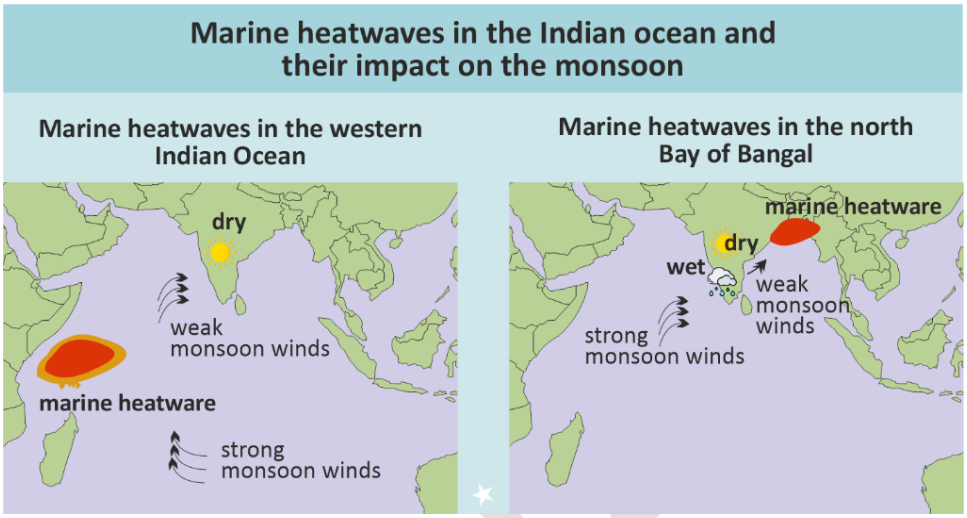
7.7.1. MARINE HEAT WAVES

Why in news?

Recently, Experts found that frequent marine heatwaves in Indian Ocean disrupts India's monsoon patterns.

About Marine Heat Waves (MHWs)

- MHWs occur when **seawater temperatures exceed a seasonally varying threshold for at least 5 consecutive days.**
  - Successive heatwaves with gaps of 2 days or less are considered part of the same event.
- MHWs have been recorded in **surface and deep waters, across all latitudes, and in all types of marine ecosystems.**
  - During an MHW, the average temperatures of the ocean surface up to a depth of 300 feet goes 5-7 degrees Celsius above normal.



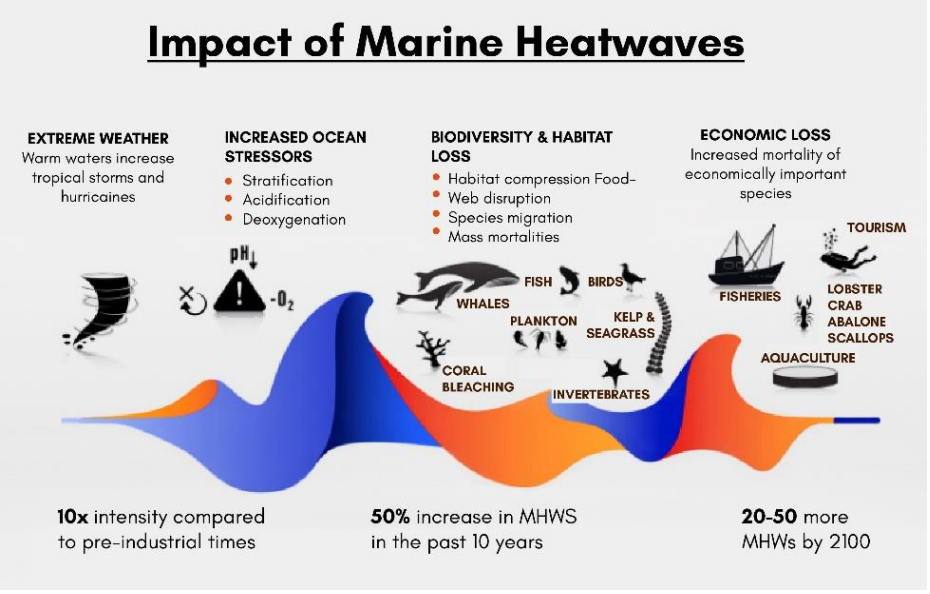
- They can **occur in summer or winter**.
- They can last for weeks or even years and can **affect small areas of coastline or span multiple oceans.**
- **Causes of MHW**
  - **Increased Sea surface temperatures (SST):** SST have increased at a rate of nearly 0.6°C per century.
  - **Climate change has caused unusual weather patterns, ocean warming and disruptions in ocean currents and mixing.**
  - **Around 90 per cent of the warming caused by GHG emissions is absorbed by the ocean**s.
  - **Ocean Currents can build up areas of warm water** and air-sea heat flux or warming through the ocean surface from the atmosphere.

Causes of MHW over Indian Ocean:

- **Background ocean warming in the Indian Ocean** and also in **response to El Niño events in the Pacific Ocean.**
- Locally, a **peak in solar radiation and a dip in evaporative cooling** due to weak winds.
- In the western Indian Ocean, the weak winds also **reduce the heat transported by ocean currents from the near-equatorial regions toward the north,** intensifying the MHW.

Way Forward

- **Invest in nature-based solutions** alongside **ambitiously reducing fossil fuel-based emissions.**
- **Build research capacity** to monitor MHWs, understand their impacts, and predict future heatwave events.
- **Raise Awareness** across all stakeholders and **implement forecast systems** to help achieve a coordinated response.



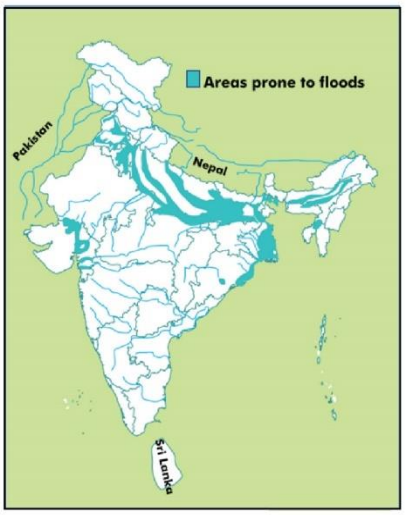
- National and sub-national governments should **design and implement measures to protect communities and build regional ocean resilience.**
  - Examples of such measures include **creating and protecting marine protected areas to act as refuges for species of coral, kelp and seagrass**; and **enforcing catch management or fishing restrictions** to help limit economic losses linked to MHWs.

7.8. FLOODS IN INDIA

FLOOD MANAGEMENT IN INDIA AT A GLANCE

Extent of Floods in India

- Around **49.8 million hectare** area in India is **flood prone.**
- On an average every year, due to floods, **75 lakh hectares of land is affected, 1600 lives are lost** and **the damage caused to crops, houses and public utilities is Rs.1805 crores.**



Major causes of Flood

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

Schemes/Policies/Initiatives

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

Constraints in Flood management

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

Way forward

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

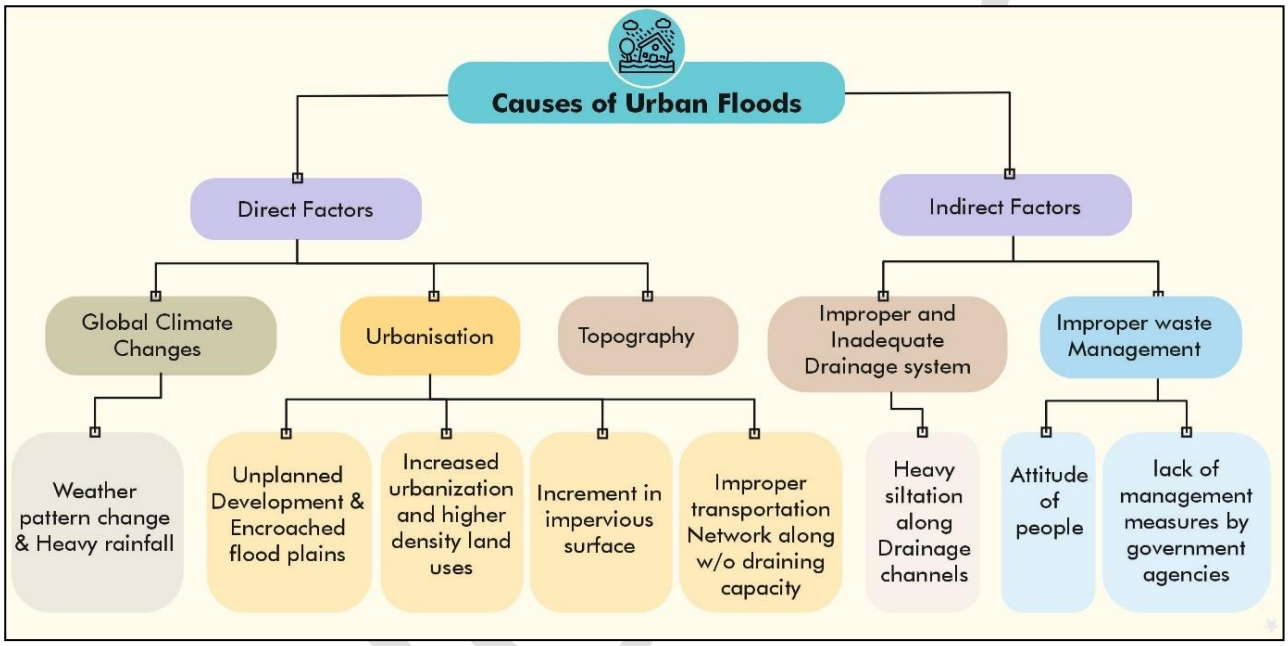
7.8.1. URBAN FLOODING

Why in news?

Recently, many parts of Chennai have been flooded by heavy rainfall and faced a wide range of urban flood-related issues repeatedly over last few years.

What is Urban Flooding and its causes?

- Urban flooding is the inundation of property in a built environment, particularly in densely populated urban areas, caused by intense rainfall (on impermeable surfaces) which **overwhelms the capacity of drainage systems.**
- Urban flooding is significantly different from rural flooding as urbanization leads to developed catchments, which **increases the flood peaks from 1.8 to 8 times** and **flood volumes by up to 6 times**. Consequently, flooding occurs very quickly due to faster flow times (in a matter of minutes).



Why in spite of Chennai being a well-developed city faces issue of Urban Flooding?

- **Geographical reasons:** low-lying topography, relatively **flat terrain** and **close to sea-level.**
- **Man-made reasons: Encroachment of wetlands** for settlement and agriculture; **Concretization** leading to reduced percolation of rainwater; **Wetlands clogged with sewage impacting their buffer role.**
- **Politico-Administrative reasons:** Lack of funding and functions with urban local bodies; **Poor design and construction and inadequate carrying capacity** of the city's streets and storm-water drains; **Lack of scientific Disaster management plans and roadmaps etc.**

Government initiatives to tackle urban flooding:

- **Sponge Cities mission:** It aims to promote positive interactions between socio-economic systems within the cityscape and with the urban water cycle to enhance local urban resilience, particularly in the face of increasingly volatile water-related disasters.
- **Atal Mission for Rejuvenation and Urban Transformation (AMRUT)**
- **Flood management programme:** It provides financial assistance to the state governments for undertaking flood management works in critical areas.
- **Integrated Flood Warning system like IFLOWS-Mumbai:** It is a state of art Integrated Flood Warning system for Mumbai which makes it possible to have an estimate of the flood inundation three days in advance, along with immediate weather updates.

Impacts of urban flooding

- **Socio- Economic impact:**
  - **Damage to urban infrastructure** and **temporary disruption of utility services;**
  - **Economic losses** due to disruption in industrial activity and supply chains;
  - Risk of epidemics due to **spread of waterborne diseases;**
  - Can **trigger mass migration or population displacement,** especially of people in low lying areas etc.

- **Environmental: Destruction of biodiversity and wildlife habitats** by floodwater and contamination of **rivers and habitats.**

Measures required to control urban flooding

- **Water-Sensitive Urban Design and Planning and a green infrastructure approach** for stormwater management.
- **Prepare drainage master plans for cities** to augment stormwater infrastructure in cities.
- **Integrating Flood mitigation plans (floodplain, river basin, surface water, etc.)** within the overall land use policy and master planning of a city.
- **Participatory approach for a risk-based early action coordination** among stakeholders to mitigate flood risks.
- **National Disaster Management Authority (NDMA) guidelines on urban flood management:**
  - CWC (Central Water Commission) should **maximize the real-time hydrometeorological network** to cover all the urban centers in support of the emerging priorities in dealing with urban flooding.
  - **Doppler Weather Radars** to be expanded to cover all urban areas in the country.
  - **In situ flood management approaches** should ensure community preparedness. This includes **participatory urban flood planning and management** involving both local government and the community.
  - Stormwater drainage concerns will be made a part of all **Environmental Impact Assessment (EIA) norms.**
  - **National Urban Information System (NUIS)** to cover infrastructure facilities at community level integrated with socioeconomic data.

Related News: Kerala's 2018 floods

- A CAG report has attributed the massive floods in state of Kerala in 2018 to **poor response on part of the Kerala government.**
- Report has pointed at **severe lapses in planning, capacity building, flood forecasting and dam management** like:
  - Flood plains of Kerala had **not been identified and restricted** so far.
  - No large-scale **flood hazard map** was available in Kerala.
  - Kerala State Water Policy 2008 **lacked provisions for effective flood control** and flood management.
  - **Real time data is not available** to State Emergency Operations Centre hampering its effective functioning.

Related concept: Flood plain zoning (FPZ)

- FPZ is aimed at **demarcating zones or areas likely to be affected by floods,** and specify types of permissible developments in these zones, **to minimize damage caused by floods.**
- Floodplains are **crucial for regulating flow of water in a river**.
  - However, in recent years, **floodplains have become sites for urban development resulting in alterations** like increase in impervious surfaces, development in-filling on and near floodplain, construction of embankments etc.
- **FPZ policies in India**
  - FPZ is within **state government's ambit** as it is deals with land along the riverbanks and land is a state subject.
  - **Union Government circulated a Model Bill for Flood Plain Zoning (MBFPZ)** which provides for surveys of floodplain area, notification of limits of floodplains, prohibition or restriction of the use of the floodplains etc
  - **National Disaster Management Guidelines for floods** includes regulation of floodplains and enforcement of FPZ.

7.8.2. RECURRING FLOODS IN NORTH-EAST INDIA

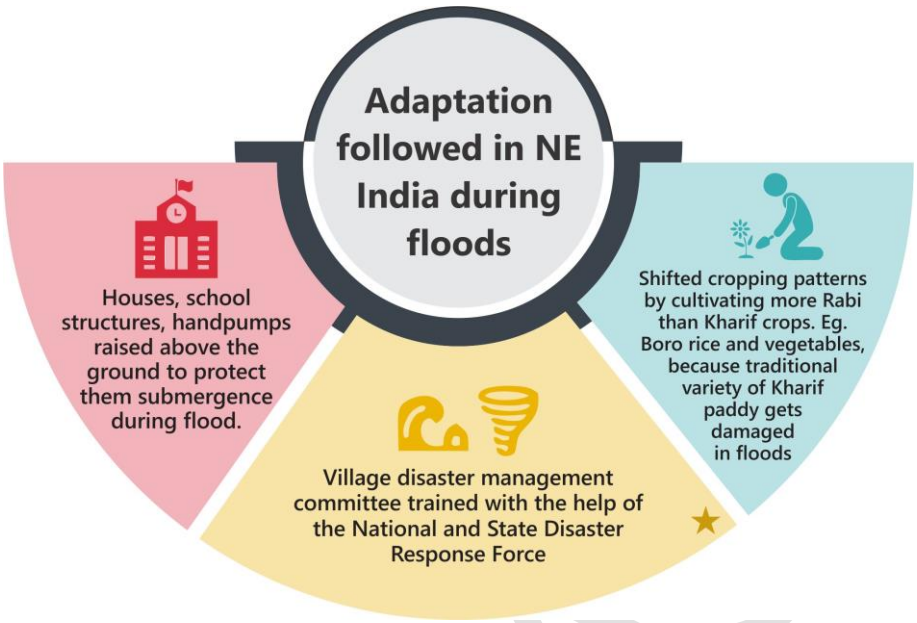
Why in news?

Floods situation have displaced millions of people in northeast India.

Causes for recurring floods in NE India

- **Natural Causes:**
  - **High rainfall zone** due to geographical and topographical features,
  - Passage of **a large number of major rivers originating from lower Himalayan ranges**.
  - **Rivers in North East are known for shifting their course frequently** due to meandering and flows through several channels.
  - **High siltation and braided channels,** which leads to drainage congestion and flooding.
- **Anthropogenic Causes**
  - **Weak embankments**.
  - **Encroachment of riverine areas**.
  - **Deforestation and destruction of wetlands**.

- **Climate change** induced surge in extreme weather events.
- **Lack of inter-state cooperation** in respect of inter-state projects, difficulty in implementation of flood plain zoning and regulations etc.



Measures needed to be taken for flood management

- **Structural measures**
  - **Flood storage and integrated reservoir operation** along with the construction of storage reservoirs on the tributaries and distributaries.
  - **Strengthening embankments** with bank protection measures in form of revetment or Reinforced cement concrete (RCC) porcupines.
  - **Regular dredging of rivers.**
  - **Set up modern weather stations** in the upstream catchment of all dams in the North East and install sirens on river banks near dams.
- **Administrative measures**
  - **Set up North East Water Management Authority (NEWMA)** as an apex body involved in implementation and monitoring of all projects related to hydro-power, bio-diversity conservation, irrigation, flood control, inland waterways, forestry, fishery and eco-tourism in all north-eastern states.
  - **Set up River Basin Organizations (RBO)** for integrated basin management and minimize flood situations.
  - **Adopting Flood Plain Zoning** measures.
  - **Trained medical responders and Patient Evacuation Plan.**

Initiatives taken by government for flood management

- **Brahmaputra Board**: Its vision is to **Integrated Management of Flood and River Basins of interstate / international rivers of NE Region** by involving expertise of domain experts, state of art knowledge & technology, working closely with State Governments and other Stake Holders.
- **Flood Management Programme (FMP)**: It was implemented during XI Plan for taking up works related to **river management, flood control, anti-erosion, drainage development, etc.**

Summary of NDMA guidelines on Floods	
Structural Measures	**Non-Structural Measures**
• **Embankments/Banks, Flood Walls, Flood Levees** to prevent river shifting its course. • **Dams and reservoirs** to manage flood water. • **Channel improvement** to increase river's carrying capacity. • **De-silting of rivers**. • **Catchment areas afforestation** to control river water run-off.	• **Flood plain zoning** to regulate land use in flood plains. • **Flood proofing** with raised platforms, flood shelters, etc. • **Flood Forecasting and warning.** • **Integrated watershed management** for water resources assessment, socio-economic assessment, water resources planning, implementation of action plans, day-to- day water resources management. • Measures to **strengthen Ganga and Brahmaputra Flood Control Boards.**

7.9. CYCLONE MANAGEMENT

CYCLONE MANAGEMENT IN INDIA AT A GLANCE

Tropical cyclones (also called typhoons or hurricanes) are intense water-rotating systems formed by strong winds around low-pressure areas.

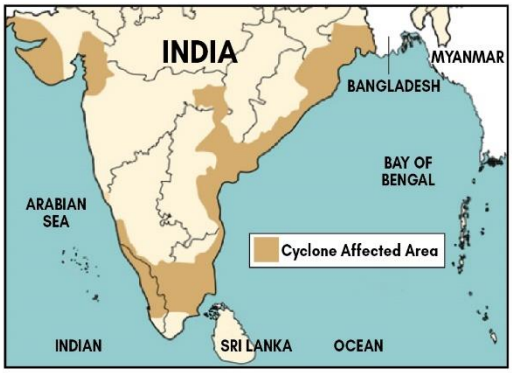
Favourable Conditions for cyclone formation: Large sea surface with temperature > 27° C; Presence of Coriolis force; Small variations in the vertical wind speed; Pre-existing weak low-pressure area or low-level-cyclonic circulation etc.

Cyclones in India

- Occur in the months of **May-June and October-November.**
- **More cyclones occur in the Bay of Bengal than the Arabian Sea** as it has higher sea-surface temperature and humidity, constant fresh water supply, while stronger wind in Arabian Sea dissipates the heat.

India's Vulnerability

- India is exposed to **nearly 10 percent of the world's tropical cyclones.**
- **Recent cyclones in Indian Ocean**
  - **Bay of Bengal:** Cyclone Asani, Gulab, Jawad
  - **Arabian Sea:** Cyclone Shaheen



India's cyclone management framework

- **National Cyclone Risk Management Project** from Ministry of Home Affairs:
  - **Component A: Improvement of early warning dissemination systems.**
  - **Component B: Cyclone risk mitigation investment** in disaster infrastructure, coastal management and conservation etc.
  - **Component C: Technical assistance for hazard risk management and capacity building** through Vulnerability Analysis and Risk Assessment and community capacity building.
  - **Component D: Project management and institutional support** at National, State and District level.
- **Other efforts:**
  - **Indian National Centre for Ocean Information Services (INCOIS) set up Storm Surge Early Warning System (SSEWS)** for the Indian coasts.
  - **IMD launched dynamic, impact-based cyclone warning system** with four color coded warnings.

Limitations of the current framework

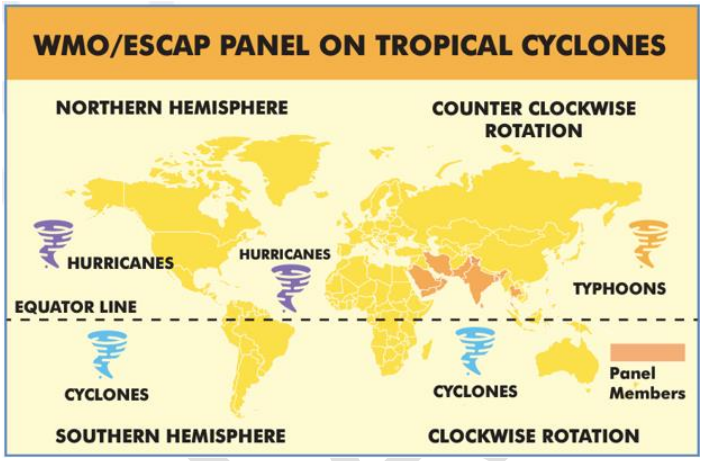
- **Technological and observational limitations** vis-à-vis forecasting.
- **Inadequacy of Infrastructural measures** such as embankments, cyclone shelters, cyclone resilient critical infrastructure etc.
- **Low awareness and community engagement.**
- **Duplication of efforts due to lack of coordination among stakeholders** such as local panchayat, NGOs, State Government, Central Government and coastal authorities.
- **Long response time** of the authorities.

Way forward

- Establishing State-of-the-art **cyclone Early Warning System (EWS)** such as **Aircraft Probing of Cyclone Facility**
- **PPP to mobilise finance** in creating resilient infrastructure.
- Establishing a **comprehensive Cyclone Disaster Management Information System (CDMIS).**
- **Integrated hazard mitigation framework** taking into account cyclone and associated storm surge, wind hazard, rainfall run-off etc.
- **Following NDMA guidelines for the Management of Cyclones with components like**- Structural and Non - Structural Measures; Disaster Risk Management and Capacity Development and Awareness Generation.

7.9.1. NAMING OF CYCLONES

- The names for cyclones are suggested by **13 member countries of WMO/ESCAP Panel on Tropical Cyclones from the regions:** Bangladesh, India, Iran, Maldives, Myanmar, Oman, Pakistan, Qatar, Saudi Arabia, Sri Lanka, Thailand, United Arab Emirates and Yemen.
- This naming of cyclones in Arabian Sea and Bay of Bengal **started in 2004**, based on **WMO/ESCAP Panel on Tropical Cyclones 2000** agreement to it, offering benefits like-
  - **Removing confusion** through easy identification of cyclones
  - **Easy remembrance** for rapid and effective dissemination of warnings
  - **Create Awareness** among people
- The list of names on tropical cyclones is maintained by WMO with naming to be done by the regional specialised meteorological centres (RSMCs) and Tropical Cyclone Warning Centres (TCWCs) for the ocean basin.
- For Arabian Sea and Bay of Bengal, **Indian Meteorological Department** (IMD) acts as the RSMCs (one among six in the world).



Related concept: Bomb Cyclone

- **Eastern coast of U.S. was hit by a bomb cyclone** recently.
- Bomb cyclone is **created by formation of a rapidly strengthening weather system, called bombogenesis.**
- Bombogenesis occurs **when a mid-latitude cyclone rapidly intensifies, dropping at least 24 millibars over 24 hours** (A millibar measures atmospheric pressure).
- This can happen **when a cold air mass collides with a warm air mass,** such as air over warm ocean waters.

7.10. OTHER DISASTERS IN NEWS

Sand and dust storms	• According to System of Air Quality and Weather Forecasting and Research (SAFAR), the current high pollution in Mumbai is due to a second dust storm that has hit the city.
	• Sand and dust storms (SDS) are natural events caused by **strong, turbulent winds blowing over dry land surfaces** that have little or no protection from vegetation cover.
	  ○ Geography and **plant diversity and abundance**, play a critical role in the birth of dust storms.
	  ○ For instance, **flat areas with sparse vegetation or dunes are most prone to such storms** since these features allow winds to build momentum.
	• **Negative impacts of dust storms:** Deposition of dust on glaciers induces a warming effect; Reduces crop yields by burying seedlings, causing loss of plant tissue etc.; Larger particles can cause skin and eye irritations or infections, while smaller particles may trigger respiratory disorders like asthma.
	• **Positive impacts of dust storms:** Increases the nutrient content in the areas of deposition and **benefits vegetation**; Dust particles that carry iron can enrich parts of oceans, **improving the phytoplankton balance** and impacting marine food webs.
	DATA BANK
	Sand and dust storms impact over 500 million people in India.

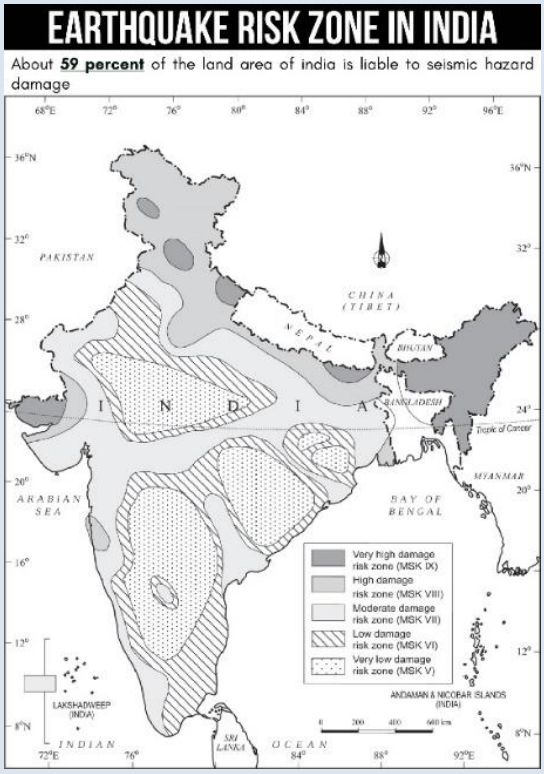
Cold Waves	• India Meteorological Department (IMD) has **predicted severe cold day conditions** in several states for the next two to three days. • IMD defines **cold wave as a rapid fall in temperature within 24 hours** accompanied by "a marked cooling of the air, or with the invasion of very cold air, over a large area". • **Criteria used to determine cold wave** **For Hill stations**: When the **minimum temperature is less than or equal to 0°C** and the minimum temperature is 4.5 °C to 6.4 °C below the normal. **In plains**: • **When the minimum temperature is equal to or less than 10°C and -**

		○ **Temperature is 4.5°C to 6.4 °C below the normal temperature** for that period or when the minimum temperature is less than or equal to 4 **°C.**
	For coastal areas	When **minimum temperature departure is less than or equal to 4.5 °C** below normal and actual minimum temperature is less than 15 **°C.**

- **Factor for occurrence of Cold Wave**
  - Two **continuous phases of western disturbances in December 2021 and a jet stream over northwest Asia.**
  - **La Nina** can spur an increase in the amount of moisture over the Indian subcontinent, leading to excess snowfall and rainfall, hence colder conditions.
  - **Snowfall and rainfall over the western Himalayan region** — brought clouds of moist easterly winds over the region.
- **Impact of Cold Waves:** Impacting vulnerable people (infants, pregnant women, elderly, people with chronic diseases), causes damage to rabi crops and reduces visibility etc.
- **NDMA Strategy for Cold Wave Management**
  - Identification of risk and vulnerability assessment.
  - Establish qualitative early warning, and forecasting.
  - Inter-agency coordination.
  - Public awareness and research & development.
  - Impact Assessment.

Great Assam Earthquake

- Researchers traced the 1950 Great Assam earthquake to the complex tectonics of **the north-eastern edge of the East Himalayan Indian Plate** and the **Indo-Burma Range (IBR).**

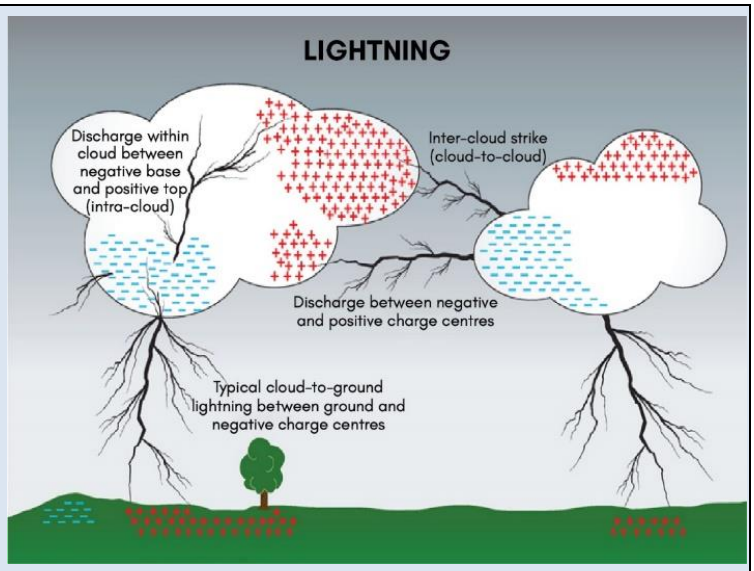


- The Great Assam Earthquake is the **largest intra-continental earthquake ever recorded,** which was located at the **India-China border near the Mishmi Hills of Arunachal Himalaya**.
- The **Eastern Himalayan Synthesis (EHS)** in **Arunachal Pradesh and the areas adjacent to Assam** is known as one of the most seismically active areas in the world.
  - It belongs to seismic zone V (**Very High-Risk zone).**
- Study stated that, the **area between Upper Assam and Mishmi Block** is considered a **seismic gap area** (i.e., active fault area in which earthquake has not occurred in a long time).
- The **Tidding-Tuting Suture Zone (TTSZ)** is seismically active up to ~40 km depth, whereas the seismicity in the IBR is observed up to a depth of around 200 km suggesting the **active subduction process** of the **Indian plate beneath the IBR.**
  - **TTSZ is a major part of the Eastern Himalaya,** where the Himalaya takes a sharp southward bend and connects with the IBR. This bend is called **the Syntaxial bend**.
  - Western and Eastern Himalayan syntaxial bend are near **Nanga Parwat, and at Namcha Barwa respectively.**
- It suggests that the IBR is more susceptible to deeper earthquakes, while crustal-scale earthquakes are more likely to occur in the TTSZ.

Lightning Strikes

- 17 people have been killed by lightning over the last two days in various parts of different states.
- In India, lightning kills about 2,000-2,500 people every year and **more than 96% of lightning deaths** happen in rural areas.
- Lightning is a **very rapid** and **massive discharge of electrification in the atmosphere**, some of which is directed toward the earth's surface.

	○ The **discharges are generated in giant moisture-bearing clouds** that are **10-12 km tall** and **temperatures** at the top of these clouds are in the **range of –35° to –45°C.** • Lightning is **not classified as a natural disaster in India.** • **Initiatives** ○ **India Meteorological Department issues forecast and warning thunderstorms** and associated weather phenomena five days in advance. ○ **Damini lightning app** by **Indian Institute of Tropical Meteorology (IITM) Pune** for monitoring all lighting activity. ○ **National Disaster Management Authority** advisory to state government and UTs like: ○ **Mapping lightning-affected zones** based on data of deaths and data of lightning incidence ○ **Effective Early Warning System, inter-agency coordination and communication,** capacity building and training etc.



8. GEOGRAPHY

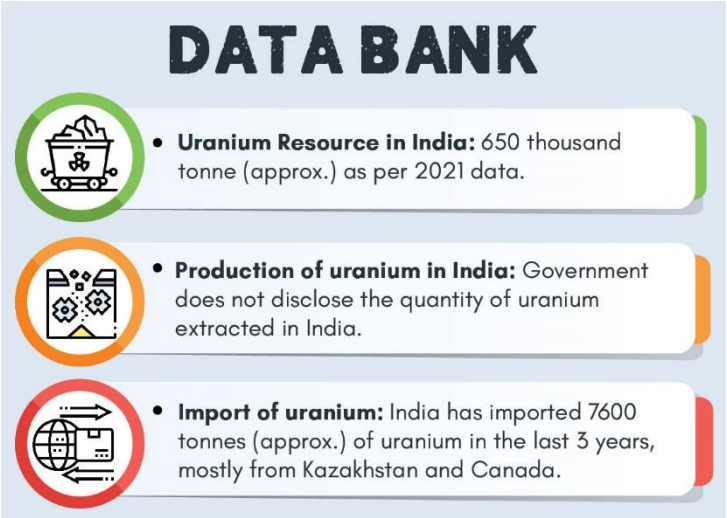
8.1. URANIUM MINING

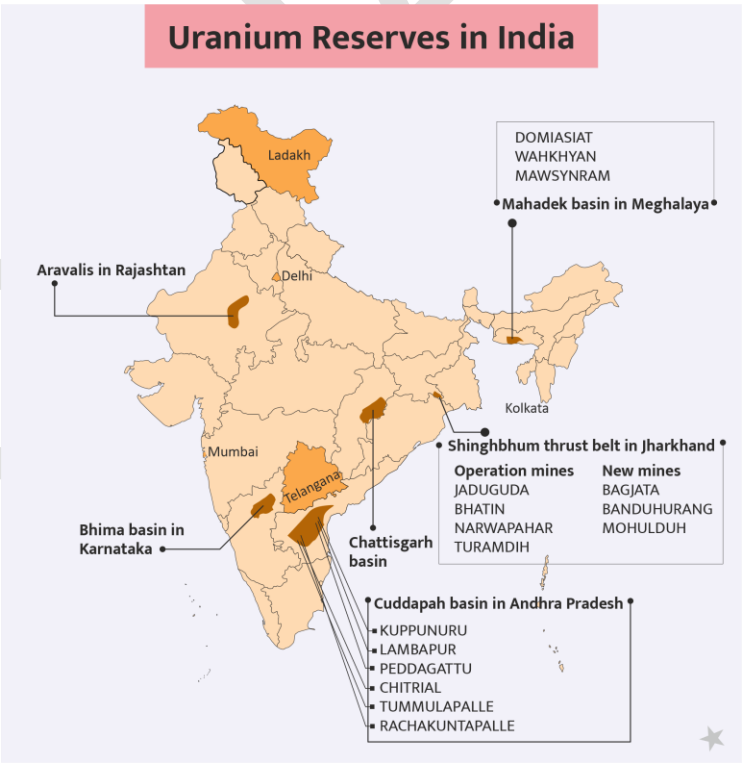
vWhy in news?

Recently, Rajasthan has issued Letter of Intent for Uranium mining

About Uranium

- Uranium is a **naturally occurring radioactive mineral** and is vital to India's nuclear power programme.
  - **Uranium is not a rare element on Earth.**
  - It occurs in **2.8 parts per million in the Earth's crust and occurs** in fairly large quantities in various geological settings.
  - It is **more abundant than gold, silver, or mercury, about the same as tin and slightly less abundant than cobalt, lead or molybdenum.**
  - Vast amounts of uranium **also occur in the world's oceans, but in very low concentrations.**
- **Kazakhstan has the world's largest Uranium reserves and is also the largest producer** (45% of world supply), followed by Namibia and Canada.
  - Most of the uranium deposits around the world are of low grade but there are quite a few medium **to high grade deposits especially in Canada and Australia.**
- **All isotopes of uranium are radioactive** and over time they decay to other lighter elements.
  - The most **common isotope of Uranium is U-238** with a relative abundance of 99.3%. The second most common is **U-235 with a relative abundance of 0.7% and the rest occur in trace amounts.**
  - **U-235 is fissile** and so neutrons emitted during fission can cause other U-235 nuclei to fission also, releasing a lot of energy.
    - ✓ This reaction is the basis of operation for the world's current nuclear power stations.
- India is one of the few countries in the world which has **mastered all the stages of nuclear fuel**



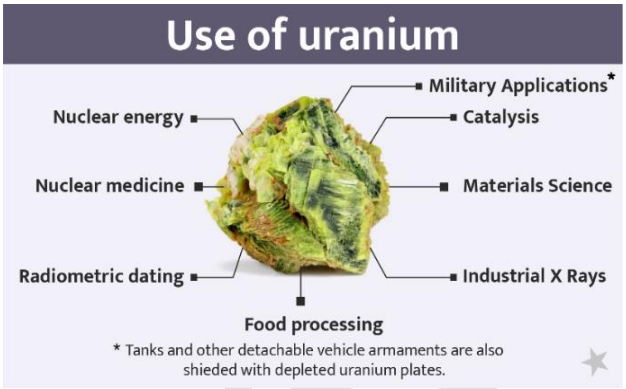


Uranium Mining in India

- According to the UCIL, **mining operations at Jaduguda began in 1967, and it is also India's first uranium mine.**
- **Atomic Minerals Directorate for Exploration and Research** is **to identify and evaluate uranium resources required for the successful implementation of Atomic Energy program of the country.**
  - After the AMD completes the final exploration of uranium, **it hands over information/data to Uranium Corporation of India Limited (UCIL).**
  - In India, **UCIL is the only organisation responsible for mining and processing of uranium ore for commercial purposes.**
- **Mines and Minerals (Development and Regulation) Act** as well as Mineral Conservation & Development Rules along with Mineral Conservation Rules further guide mining and exploration of uranium.

cycle – starting from uranium exploration, mining, extraction and conversion, through fuel fabrication, to reprocessing and waste management.

- India is **both a producer and importer of uranium** and given its limited reserves it consumes all the uranium it produces.
- Uranium resources can be extracted from the ground in three ways: **open pit, underground, and in-situ leach (ISL).**



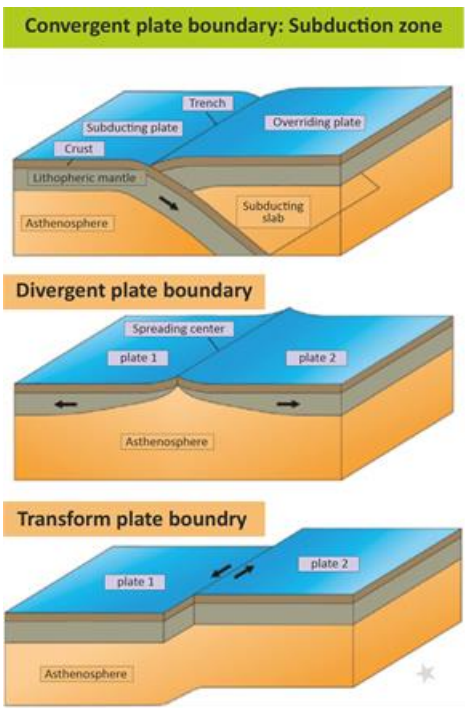
Way Forward

- **Technology upgrade** for locating better grade, large, buried deposits.
- **Mobilisation of manpower** like a dedicated training centre at one of the operating units which may help inculcating professionalism within the work force.
- **Managing waste** with greater public awareness of health hazards, stringent environmental guidelines, etc.
- **Acquiring stakes in uranium properties abroad.**
- **Global Cooperation** by assimilating the global technology and adopting the best practices in uranium production sector.

8.2. GREATER MALDIVE RIDGE (GMR)

Why in news?

A recent study has traced the **tectonic evolution** and the nature of the **Greater Maldive Ridge (GMR)** which shed light on Gondwanaland break up & dispersal.



About Greater Maldive Ridge (GMR)

- GMR is an **aseismic ridge** not associated with earthquake activities and is **located in the western Indian Ocean,** southwest of India.
- Study postulated that **GMR may be underlain by an oceanic crust.**
- It highlighted that the **Maldive Ridge might have formed in the close vicinity of the Mid-Oceanic Ridge.**
  - Mid-ocean ridge system is a **continuous range of underwater volcanoes that wraps around globe stretching nearly 65,000 kilometers.**
- **Significance of the study**
  - Will provide valuable inputs towards understanding **evolution of ocean basins;**
  - Can **help reconstruct the original Gondwanaland break up** and dispersal that led to **present-day configuration of continents, continental fragments** etc.

About formation of ridges through tectonic plates

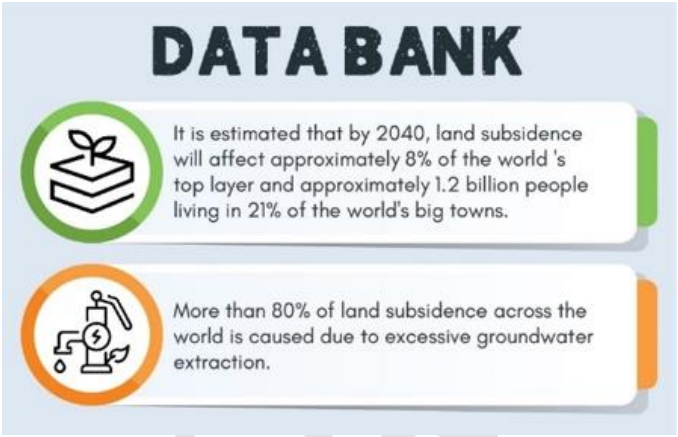
- In plate tectonics, **Earth's outermost layer, or lithosphere** made up of the crust and upper mantle is **broken into large rocky plates called tectonic plates.**

- Due to the **convection currents of the asthenosphere** (lying below tectonic plates), the **plates move relative to each other.**
- Ridge occurs along **divergent plate boundaries,** where new ocean floor is created as the **Earth's tectonic plates spread apart**.

8.3. LAND SUBSIDENCE

Why in news?

According to new research conducted by IIT Bombay experts, Mumbai is sinking at a pace of 2mm per year due to a geographical phenomenon known as land subsidence.



What is Land Subsidence?

- Land subsidence is the **gradual settling or sudden sinking of the earth's surface** due to removal or displacement of subsurface earth materials.
- It is considered a **natural-anthropogenic hazard** and is **irreversible.**
- The extent of subsidence is usually measured by analysing satellite data using the InSAR (Interferometric Synthetic Aperture Radar method), a commonly used technique for measuring deformations of the earth's surface.
- **Other locations in in India experiencing or vulnerable to land subsidence**: Kolkata, Delhi and NCR region, Areas where the earth matter is made up of thin soil particles, like the alluvial deposits of fertile Gangetic plains.

Major causes of Land subsidence

- **Natural factors:** Gradual or sudden natural compaction or collapse of soils due to reasons like- tectonic activities (e.g. earthquake and faulting), volcanic activities, landslide, formation of sinkholes, thawing of permafrost etc.
- **Anthropogenic causes:**
  - **Compaction of aquifer-systems due to extensive groundwater withdrawals:** When water is extracted from aquifers, the clay between pockets of water collapse gradually, leading to land subsidence.
  - **Development of underground infrastructure** such as metro, tunnels etc.
  - **Excessive underground mining** of minerals, oil and gas.
  - **High load of constructions** such as high rise buildings.

Way Forward

- **Using advanced satellite technology to accurately identify hotspots** afflicted by land deformation.
- **Understanding the geophysical properties of the subsiding areas to tackle causes.**

ADVERSE IMPACTS OF LAND SUBSIDENCE

Infrastructural	● Weakening of foundations or cracking of permanent constructions and roads. ● Tilting and/or sinking of houses and buildings. ● Damage to underground pipelines and utilities. ● Deterioration in function of building and infrastructures. ● Permanent inundation of areas and infrastructures. ● Frequent Waterlogging.
Environmental	● Changes in river canal and drain flow systems. ● Permanent destruction of underground aquifer. ● Earthquakes due to weakened soil layers. ● Frequent coastal flooding. ● Wider expansion of coastal and/or inland flooding area. ● Increased inland sea water intrusion. ● Deterioration in quality of ecosystems such as wetlands, mangroves etc.
Economic	● Increase in maintenance cost of infrastructure. ● Decrease in land and property values. ● Abandoned buildings and facilities. ● Disruption to economic activities.
Social	● Deterioration in quality of living environment and life (e.g. health and sanitation condition) ● High impact on people living in low lying regions leading to loss of homes and livelihood, migration, etc. ● **Compounding risks and hazards** like rising sea level, extreme rain events, earthquakes, floods etc. **can lead to devastating disasters.**

- For instance, in regions with high groundwater extraction, stricter measures can be implemented for rainwater harvesting, punishing illegal groundwater mining etc.

- **Implementing solutions to offset the over-extraction of groundwater**.
- **Evaluating building conditions in hazard zones** to undertake necessary repair and maintenance.
- **Incorporating land subsidence in assessment and modeling of flooding and inundation** in urban areas.
- **Systematic and continuous monitoring of land subsidence to avoid widespread disasters,** especially in areas which are highly populated and prone to other hazards like earthquakes, floods etc.

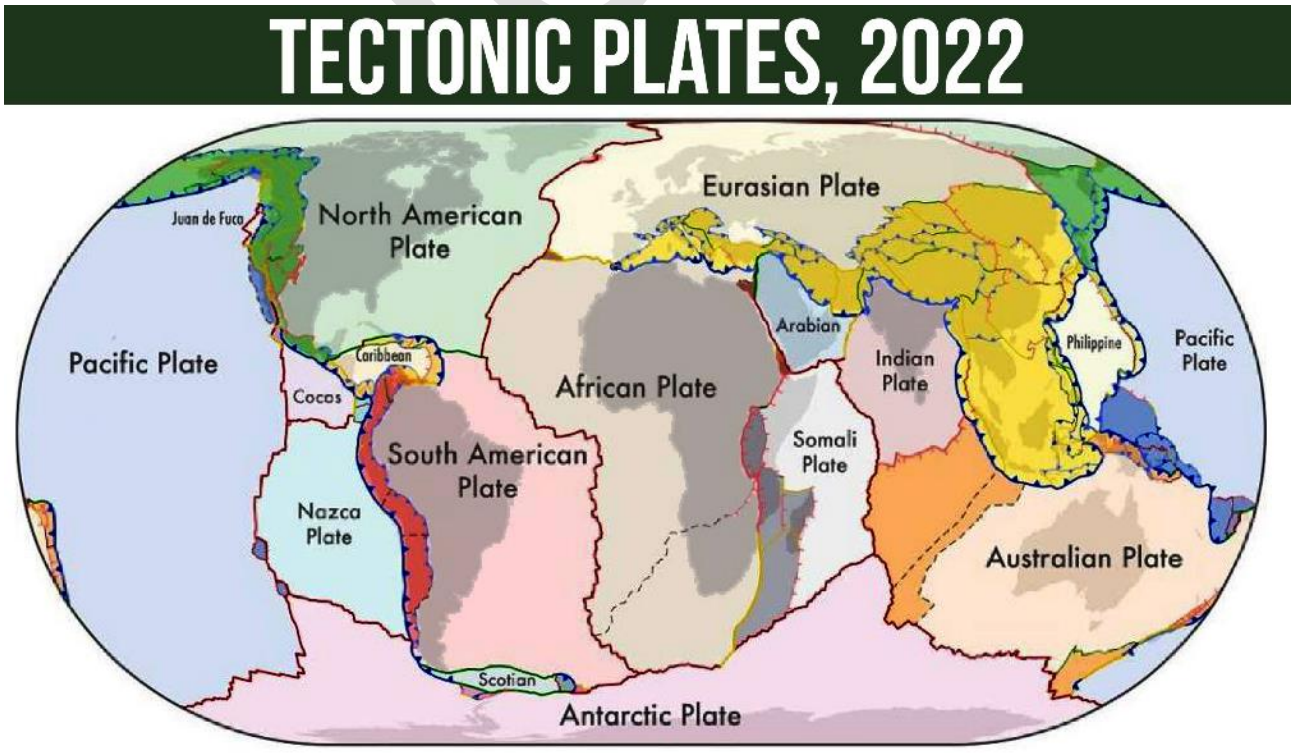
8.4. NEW MAP OF EARTH'S TECTONIC PLATES

Why in news?

The study titled **'New maps of global geological provinces and tectonic plates'**, delved into past construction of continents like **first supercontinent, Vaalbara**.

More on the news

- Vaalbara **fragmented to form other supercontinents** over the years, **last being Pangea**, which existed 335-65 million years ago.
  - Pangea gave way to **seven modern continents** which make the earth's land surface today.
- Plate tectonics is a scientific theory that explains how major landforms are created as a result of Earth's subterranean movements.
  - Tectonic plate model was updated in 2003.
- **Researchers combined three geological models** to create new map
  - **Plate model** based on existing knowledge of plate boundaries.
  - **Province model** based on geology of Earth's surface.
  - **An orogeny model** based on mountain formation process which is triggered when two tectonic plates collide.
- New plate model includes **several new microplates including Macquarie microplate** which sits **south of Tasmania** and **Capricorn microplate** that **separates Indian and Australian plates**.
- **Significance**
  - **Provide better understanding of natural hazards like earthquakes and volcanoes** occurring along plate boundaries.
  - Exploration of minerals and better understanding of earth evolution.



9. MISCELLANEOUS

9.1. INTERLINKING OF RIVERS

9.1.1. INTEGRATED LANDSCAPE MANAGEMENT (ILM) PLAN FOR GREATER PANNA LANDSCAPE

Why in News?

Ministry of Jal Shakti released Integrated Landscape Management (ILM) Plan for Greater Panna Landscape. Plan has been prepared in respect of **Ken-Betwa Link Project** by Wildlife Institute of India.

About Integrated Landscape Management (ILM)

- ILM refers to **long-term collaboration among different stakeholders to achieve multiple objectives** required from landscape, such as **agricultural production, delivery of ecosystem services,** cultural heritage and values, rural livelihood etc.

- **Rationale for ILM plan:** Growing pressures on natural resources due to climate change, Unclear land tenure rights, Unsustainable land management practices, Uncoordinated and often competing sectoral policies etc.
- **Key features of ILM are**
  - **Shared or agreed management** that encompasses multiple landscape benefits.
  - **Collaborative, community engaged planning** and monitoring processes.
  - **Integrated management of natural resources** for optimization of ecosystem functions and services.
  - **Re-configuration of markets and public policies** to achieve diverse landscape objectives.
- **Benefits of ILM**
  - **Cost efficiencies:** By coordinating strategies and encouraging synergies between different levels of government.
  - **Empower communities:** Given that ILM supports an inclusive, participatory process.
  - **Better habitat protection** and management of flagship species such as tigers, vultures, and gharials.
  - **Holistically consolidate the landscape for biodiversity conservation** and human well-being, especially forest dependent communities.

9.2. DAM SAFETY

DAM SAFETY IN INDIA AT A GLANCE

KEY TARGETS

Dam Rehabilitation and Improvement Project (DRIP): Comprehensive rehabilitation of 736 existing dams across India.

CURRENT SITUATION

- India ranks **3rd globally** after China and U.S in **number of dams.**
- There are around **5,700 large dams in India,** of which about **80% are already over 25 years old.**
- Nearly **227 large dams are more than 100 years old.**
- **Completion of DRIP Phase-I:** During April 2012 to March 2021, 223 existing large dams located in 7 States have been comprehensively audited and rehabilitated.

SCHEMES/POLICIES/ INITIATIVES

- **DHARMA (Dam Health and Rehabilitation Monitoring) a web tool to digitize all dam related data** effectively.
- **DRIP Phase-II is** being co-financed by two multi-lateral funding Agencies - **World Bank and Asian Infrastructure Investment Bank (AIIB), with funding of US$ 250 million each.**
- **Dam safety Act, 2021** for surveillance, inspection, operation, and maintenance of dams to prevent disasters.

MAIN PROVISIONS OF DAM SAFETY ACT, 2021

- **Setting up of 2 National bodies:**
  - **National Committee on Dam Safety to formulate policies and recommend regulations** regarding dam safety standard.
  - **National Dam Safety Authority to implements policies of the National Committee,** and resolve matters between State Dam Safety Organisations (SDSOs), or between a SDSO and any dam owners.
- **Two state bodies:** State Committee on Dam Safety, and State Dam Safety Organisation.
- Drawing up of **emergency action plans and comprehensive dam safety reviews** by an independent panel of experts.
- **Regular inspection and hazard classification of dams.**
- **Emergency flood warning system** to address the safety concerns of downstream inhabitants.

DAME SAFETY ISSUES IN INDIA

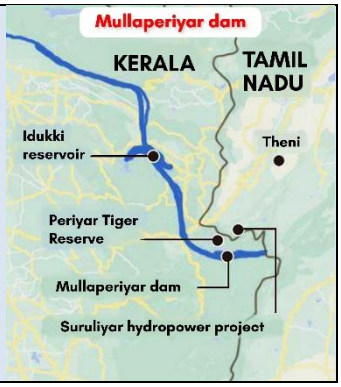
- **Ageing Dams have become weak.**
- **Lack of real time inflow forecasting** systems even in important reservoirs.
- **Poor maintenance and repair** due to lack of regular assessment and monitoring; shortage of funds and trained manpower in Dam Safety Organizations (DSO) etc.
- **Flood events lead to increase in sedimentation** and reduction in flood storage capacity.
- **Environmental concerns related to sediment disposal.**
- **Human displacement** and **threat to downstream flora** and fauna due to submergence.

WAY FORWARD

- **Proper assessment** of possible inflow and outflow of water.
- **Restoration of old dams using the latest materials and technologies.**
- **Timely and Well-planned monitoring systems for early detection of defects and ageing scenarios.**
- **Institutional Capacity building and training of Dam engineers.**
- **Upgradation to Latest technologies** for constructing new dams to extend lifespan.

About Mullaperiyar Dam issue

- The dam is a **126-year-old dam** owned, operated, and maintained by Tamil Nadu Government.
- It is **located in the upper reaches of the river Periyar,** which flows into Kerala after originating in Tamil Nadu. The reservoir is within the Periyar Tiger Reserve.
- **Dispute**
  - In 1886, the then Maharaja of Travancore sign a 999-year **lease agreement** with British rule that the operational rights were handed over to Tamil Nadu.
  - **Kerala says that the dam structure is weak** and can give way at any moment, causing the deaths of thousands in the state, Tamil Nadu claims Mullaperiyar is safe and well-maintained.



9.3. INDIAN ENVIRONMENT SERVICE

Why in news?

The Supreme Court asked the Centre whether it was planning a dedicated Indian Environment Service in the national bureaucratic set-up, as recommended by a committee headed by former Cabinet secretary TSR Subramanian in 2014.

Background

- The high-level committee was constituted in 2014 under the chairmanship of Subramanian by the Ministry of Environment, Forests and Climate Change (MoEF&CC) to **review environmental laws in the country, and to bring them in line with the current requirements.**
- The report recorded the fact that **India had a strong environmental policy and legislative framework, but weak implementation** has resulted in environmental governance being criticised by conservation experts and the judiciary.
- **As a step for the future,** the committee said, **"An Indian Environment Service** may be created, as an all-India Service, based on qualifications and other details prescribed by MoEF&CC/DoPT/ UPSC."
- The committee also proposed that **necessary institutional framework be created for this purpose.**
- Officers dealing with environment clearances and policies **currently come from the all India civil services conducted by the UPSC.**

Need for the All India Environment Services

- **Need of specialisation in environment governance in the public sector**, including the Central and State Governments, and various other quasi-official bodies, such as corporations, municipal boards, enforcement agencies, as well as the industrial sectors.
- **Current approval systems and monitoring mechanism function in a quasi-amateurish manner,** leading to sub-optimal management of environmental issues.
- **Paucity of time with bureaucrats in existing institutions** for resolution of environmental isseues.
- **Need of proactive approach in resolving environmental issue**.
- **Inadequacy of the current system** to deal with ongoing degradation of environment**.**

Way ahead

- **Union Government should persuade State Governments** to agree to the constitution of the Indian Environment Service.
- **Well-planned selection, training, deployment, development and promotion policies** and methods should be formulated.
- **Greater coordination and periodical dialogue between the Union and State authorities** for the management of All India Services.
- **Bridge the socio-economic inequality by ensuring equal opportunity** to rural candidates to compete in the Civil Services examination with candidates belonging to the urban elite.

9.4. WEATHER FORECASTING IN INDIA

Why in News?

Recently, a string of wrong monsoon forecasts by India Meteorological Department (IMD) has raised questions about weather forecasting models in India.

About Weather Forecasting

- It is the **application of technology and science to predict the state of the atmosphere** for a future time and a given location.
- Weather forecasts are made by **collecting as much data as possible about the current state of the atmosphere** (particularly the temperature, humidity, and wind) by using ground observations, observations from ships, observation from aircraft, radio sounds, doppler radar and satellites.
    - This **information is sent to meteorological centers** where the data are collected, analyzed, and made into a variety of charts, maps, and graphs.
    - Modern **high-speed computers transfer the many thousands of observations** onto surface and upper-air maps.

Importance of accurate weather forecasting

- **Helps in their early response and actions during adverse weather** to Protect Life and Property.
- **Enables farmers to adjust their farming activities** to suit the expected weather condition.
- **Essential for Transportation sector**, especially aviation and shipping industry as well as recreational use of waterways.
- **Facilitates demand Projection in Electricity and gas companies**.
- **Weather briefs are provided to military pilots and naval ships** to provide real time resource protection services for military installations.
- Weather forecasting of wind, precipitations and humidity is essential for **preventing and controlling wildfires**.

Types of Weather Forecasts issued by IMD

Range	About	Time period	Utility
Nowcasting	In which the details about the current weather and forecasts upto a few hours ahead are given.	6 hours	Severe Weather Warnings (~ 500 m)
Short range forecasts	This forecast range is mainly concerned with the weather systems observed in the latest weather charts, although generation of new systems is also considered.	1 to 3 days	Conventional Forecasting resolution (3-25 km)
Medium range forecasts	Average weather conditions and the weather on each day may be prescribed with progressively lesser details and accuracy than that for short range forecasts.	4 to 10 days	Conventional Forecasting resolution (25 – 50 km)
Long range /Extended Range forecasts	There is no rigid definition for Long Range Forecasting, which may range from a monthly to a seasonal forecast.	10 days to a season	Droughts and Heat / Cold Waves

Forecasting models used by IMD

- **Statistical Ensemble Forecasting system (SEFS)** based on following parameters:
    - Sea Surface Temperature (SST) Gradient between North Atlantic and North Pacific
    - Equatorial South Indian Ocean SST
    - East Asia Mean Sea Level Pressure
    - Northwest Europe Land Surface Air Temperature
    - Equatorial Pacific Warm Water Volume
- **Dynamical global climate forecasting system** that simulates land, atmosphere and ocean state on supercomputers and extrapolate it into the monsoon months.
- **Multi-Model Ensemble forecasting system** based on coupled global climate models from different global climate prediction and research centers.

Challenges in India's weather prediction

- **Meteorological issues:** Difficulties in monitoring vast and complex atmosphere; **weather systems destabilise faster in the tropics than they do in the extra-tropics etc.**
- **Climate change** induced increase in frequency and intensity of extreme events **introduces fresh uncertainties in weather forecasting.**
- **Weak forecast capacity of present models used by the IMD.**
- **Need of more radars to fill data gaps.**
- **Shortage of professionals like** modelers and atmospheric scientists.
- **Lack dedicated research groups of Indian scientists** conducting long-term experiments examining the complexities of Indian weather systems.

Initiatives taken

- **Under the National Monsoon Mission initiative**, the Indian Institute of Tropical Meteorology (IITM), Pune, Indian National Centre for Ocean Information Services (INCOIS), Hyderabad and National Centre for Medium Range Weather Forecasting (NCMRWF), NOIDA have built **a state-of-the-art coupled ocean atmospheric model for improved prediction of** Monsoon rainfall and other weather conditions.
- Government has initiated a **comprehensive modernization programme for IMD** covering up-gradation of observation systems, advanced data assimilation tools, advanced communication and IT infrastructure, high performance computing systems and intensive/sophisticated training of IMD personnel.
- Farmers are using the **Gramin Krishi Mausam Seva (GKMS) service products of IMD** for various farm operations.
- To upgrade the forecasting capabilities, various programs are being implemented in IMD under the umbrella scheme **"Atmosphere & Climate Research-Modelling Observing Systems & Services (ACROSS)"** of the Ministry of Earth Sciences.

Related Concept: Doppler Weather Radar

- Recently, a state-of-the-art **Doppler Weather Radar** was inaugurated at Indian Meteorological Department in Jammu along with an indigenous GPS based **Pilot Sonde.**
- **Doppler Weather Radar (DWR)** is based on **doppler effect**, i.e. change in frequency of a wave based on the relative motion between wave source and observer.
  - To monitor weather, DWR sends **pulses of electromagnetic energy** into the atmosphere, which are reflected back to radar by raindrops or snow.
  - It helps in providing advance information for early warning in the event of severe weather; **protecting life and property.**

Way forward

- **Improve coordination between all relevant operational centres** across the country in the national, regional, and state level.
- **Enhance the computing capacity of the existing weather and climate research centres** to accelerate prediction research.
- **Encourage research and training in clime related curriculums** through scholarships, grants etc.
- **Observation and communication systems must be improved** to make updated weather information available to everyone, every hour.

9.5. SEABED MINING

Why in news?

India's first manned ocean mission **'Samudrayan'** was recently launched under the ambitious **Deep Ocean Mission**.

About the Deep Ocean Mission

- Mission aims **to explore Deep Ocean for resources and develop deep sea technologies** for sustainable use of ocean resources.
- It will be **a mission mode project to support Blue Economy Initiatives**.
- Mission will be implemented in a **phase-wise manner over a period of 5 years.** Ministry of Earth Sciences will be the nodal Ministry.
- **Matsya 6000** (the deep water manned submersible) under **Samudrayan initiative** is capable of carrying **three human beings** with an endurance **of 12 hours** and an additional **96 hours in case of emergency situation.**

About Deep sea mining

- The part of the ocean that lies **below a depth of 200 metres is defined as the deep sea,** and the process of **extracting mineral**s from this area is known as **deep-sea mining.**

- **Types of minerals present in the seabed:** There are three types of mineral deposits that are at present deemed suitable for commercial exploitation: **Polymetallic nodules, Polymetallic sulphides and Cobalt crusts.**
  - They contain metals such as manganese, iron, copper, nickel, cobalt, zinc, gold, silver, rare metals etc.
- **Regulation:** International Seabed Authority **(ISA)** is the agency under the United Nations Convention on the Law of the Sea (UNCLOS) for **monitoring all activities related to mineral resources in the deep sea.**
  - According to the ISA the **international seabed** is the area that lies **beyond the limits of national jurisdiction** and represents **around 50%** of the total area of the world's oceans.

Related concept: Blue Economy

- Blue economy is the **sustainable use of ocean resources** for economic growth, improved livelihoods, and jobs while preserving the health of ocean ecosystem.
- It includes wide range of economic sectors like- fisheries, aquaculture, maritime transport, Coastal, marine and maritime tourism, coastal renewable energy, marine ecosystem services (i.e., blue carbon), seabed mining, and bioprospecting.

Challenges for India in seabed mining

- **Economically viability:** The latest estimate from the ISA says it will be commercially viable only if about three million tonnes are mined per year.
- **Absence of existing large-scale impact trials.**
- **Lack of indigenous Technological capabilities.**
- **Possible deleterious impact on species that inhabit the bottom of the ocean**, due to **disturbance of the seafloor habitats**.
- **Noise and light pollution** caused by mining equipment and surface vessels.
- **Risk of accidents like leaks and spills of fuel** that could endanger deep sea life.

Way Forward

- **Conducting trials for impact assessment on deep sea marine environment.**
- **Ensuring minimal disturbance to deep sea marine species.**
- **Developing indigenous technologies via collaboration** with leading institutes and private industries.
- **Prior assessment to check economic feasibility of mining activities.**

9.6. ENVIRONMENTAL, SOCIAL AND GOVERNANCE (ESG)

Why in news?

It is being reported that **Ministry of Finance is working to obtain ESG (environment, social and governance) score for LIC** before filing for its mega initial public offer (IPO).

More on the news

- A good ESG score **will add to LIC's valuation** and will help **attract larger and responsible pool of capital.**

About ESG

- **ESG is a form of sustainable investing** that measures the impact of a **company's ethical contribution to its stakeholders.**
  - Most of the world's largest companies report their ESG performance as investors increasingly consider it **to identify companies that comply with inclusive growth factors.**

- **Benefits of ESG**
  - Help investors to align their **investment goals to their personal values and beliefs.**
  - **Increased Access to Capital** by attracting growing sustainability funds.
  - Results in **better operational performance, better stock performance and lowers cost of capital** to companies.
- **Status of ESG in India**
  - Under **Business Responsibility and Sustainability Reporting** (BRSR) by listed entities, SEBI has notified inclusion of **ESG** reporting.
  - BRSR is applicable on voluntary basis to the **top 1000 listed entities** (by market capitalization). Reporting of BRSR shall be **mandatory from FY 2022-23.**

9.7. SMART METERING

Why in news?

As per reports, government has suspended smart meter bids under its Rs. 3.03 trillion **Revamped Distribution Sector Scheme (RDSS)** till March 15 due to multiple issues.

About Revamped Distribution Sector Scheme (RDSS)
RDSS aims to **bring down India's average aggregate technical and commercial (AT&C) loss from the present level of 20% to 12-15%** and gradually **narrow the deficit between the cost of electricity and the price** at which it is supplied to zero by 2024-25.

About Smart Metering

- Smart Meter is an advanced energy meter that provides the **tracking of utility energy consumption** that occurs on the system or outlet it is attached to.
  - A smart meter is **one component of a smart grid.**
- **Benefits of smart metering**
  - **To customers**: Greater control over their electricity use; enhanced consumer satisfaction through better complaint management, system stability, reliability and transparency.
  - **To discoms**: reduce AT&C losses, improve financial health, incentivise energy conservation, enhance ease of bill payments and ensure billing accuracy.
- **Issues with smart metering in India**
  - **Delay in operationalizing prepaid functionality** in these meters.
  - **Connections and disconnections are done manually**, defeating the objective of avoiding human intervention.
  - **Cybersecurity risks** include data privacy issue.
- **Government steps**
  - **National smart metering programme (NSMP) aims to replace 250 million conventional meters with smart ones** that will **reduce power theft** and **ensure reliable electricity supply.**
  - **National Smart Grid Mission (NSGM)** plans and monitors the implementation of policies and programmes related to Smart Grid activities in India.

- **Way Forward**
  - Investing in development of automated systems of smart metering.
  - Strengthening cyber-security infrastructure to protect smart connections.

Related information
Energy Accounting (EA)

- Ministry of Power Mandates Electricity Distribution Companies (DISCOMS) to Undertake Energy Accounting (EA)
- EA prescribes **accounting of all energy inflows at various voltage levels in the distribution periphery of the network,** including renewable energy generation and open access consumers, as well as energy consumption by the end consumers.
  - EA will provide **detailed information about electricity consumption** by different categories of consumers & the **transmission and distribution losses** in various areas. Enable **fixation of responsibility on officers** for losses and theft.
  - Enable the DISCOMS to plan for **suitable infrastructure up-gradation** as well as **demand side management** efforts.
  - Contribute towards **India's climate actions in meeting our Paris Agreement Goals.**
- **Key regulations**
  - **Quarterly energy accounting** by DISCOMs, through a **certified Energy Manager**, within 60 days.
  - **Annual energy audit** by an independent Accredited Energy Auditor.
  - Both annual and quarterly reports will be published in the public domain.
  - The regulation was issued by Bureau of Energy Efficiency (BEE) under the provisions of Energy Conservation (EC) Act, 2001.

APPENDIX: KEY DATA AND FACTS

CLIMATE CHANGE

Global GHG Emissions	⊕ **Global Trend:** GHG emissions were **54% higher in 2019 than they were in 1990,** but growth is slowing. ⊕ **Sectoral emissions:** In 2019, **energy supply sector had the highest share (34%) in total net anthropogenic GHG emissions,** followed by industry (24%), agriculture, forestry and other land use (22%), transport (15%) and buildings (6%).
Impact of Climate Change on Environment	⊕ **Surface temperature:** Human-caused **global surface temperature** increase from 1850–1900 to 2010–2019 is estimated to be **1.07°C.** ⊕ **Ocean:** Global mean sea level **increased by 0.20 m between 1901 and 2018.** ⊕ **Ocean Warming:** 1 degree rise in SST of tropical Indian ocean (1951-2015). ⊕ **Cryosphere:** The **Arctic Sea ice area has decreased about 10%** (in March) **to 40%** (in September) in between 1979–1988 and 2010–2019.
Impact of Climate change on Vulnerable sections	⊕ **Women:** UN figures estimate that **80% of people displaced by climate change are women.** ⊕ **Indigenous peoples:** They are among the first to face the direct consequences of climate change, due to their dependence upon, and close relationship, with the environment and its resources. ⊕ **Displacement:** Climate crisis could **displace 1.2 billion people by 2050.** ⊕ **SIDS:** SIDS combined account for ~1% of global CO2 emissions, but are at the frontlines of climate change's worse effects like sea level rise, extreme weather events etc.
Impact of climate change on Coastal areas	⊕ About **11% of the global population lived within the coastal areas below 10 m of elevation above sea level in 2020,** potentially increasing to beyond 1 billion people by 2050. ⊕ **Sea level rise along the Indian coast: 8.5 cm** during the past 50 years.
Climate Change Adaptation And Mitigation	⊕ **Adaptation Fund raised during COP26:** US $356 million in new pledges (highest ever). ⊕ **Adaptation costs** and financing needs **in developing countries are 5 to 10 times greater** than current finance flows. ⊕ **Mitigation targets prescribed by IPCC:** → **To limit global warming to 1.5°C:** Global GHG emissions peak before 2025, reduced by 43% by 2030 and reach Global net zero CO2 emissions in the early 2050s. → **To limit global warming to 2°C:** Global GHG emissions peak before 2025, reduced by 27% by 2030 and reach Global net zero CO2 emissions around the early 2070s.
Climate Inequity	⊕ **Exhausted Carbon budget:** Historical cumulative net CO2 emissions between 1850 and 2019 have exhausted about 4/5th and 2/3rds of the total carbon budget for limiting global warming to 1.5°C and 2°C respectively. ***(IPCC AR6).*** ⊕ **Carbon inequality:** The top three greenhouse gas emitters — China, the European Union and the United States — contribute 41.5% of total global emissions.
Climate Finance	⊕ **Financing Needs:** $1.6 to $3.8 trillion per year required to remain within the 1.5°C to 2°C scenario. ***(IPCC report).*** ⊕ **Financing gap:** Global financial flows are 3-6 times lower than levels needed by 2030 to limit warming to below 1.5°C or 2°C.
Impact of climate change on India	⊕ **Temperature rise:** 0.7°C Rise in Average temperature (1901–2018). ⊕ **Extreme weather events:** 75% increase in frequency of localized heavy rain events (1950-2015). ⊕ **Droughts:** 1.3% increase in area affected by drought per decade (1951-2016). ⊕ **Glacier melting:** 15% decline in glaciers in the Hindukush Himalayan (HKH) region since 1970s. ⊕ **Monsoon variation:** 6% decline in summer monsoon rainfall (1951-2015).
India's Performance in Climate Change indicators	⊕ **India ranked 10th in the Climate Change Performance Index (CCPI)** among 60 countries and the EU. ⊕ **Emissions: India's historical emissions** (~ 4% over 1850 to 2017) and current annual GHG emissions (~ 5%) remain **very low.** ⊕ **Progress towards NDCs:** → India has already **achieved emission reduction of 28% over 2005 levels, against the target of 35% by 2030.** → India has achieved **40% of installed electricity capacity from non-fossil fuel sources.** ⊕ **India ranked last among 180 countries** in the **Environmental Performance Index (EPI) 2022.** ⊕ **Initiatives:** National Action Plan on Climate Change (NAPCC), National Adaptation Fund on Climate Change and Climate Change Action Program etc.

Carbon Trading Markets	⊕ **Market mechanisms under Paris climate agreement:** Internationally traded mitigation outcomes (ITMOs) and Sustainable Development Mechanism (SDM). ⊕ **Carbon trading mechanisms in India: Renewable Energy Certificate (REC)** and **Energy Saving Certificates (ESCerts)** under Perform, Trade and Achieve (PAT) scheme.
Gaps in Climate Change efforts	⊕ **Emissions Gap:** Latest climate promises for 2030 put the world on track for a **temperature rise this century of at least 2.7°C *(Emissions Gap Report 2021)*.** ⊕ **Production gap:** World's governments plan to produce **around 110% more fossil fuels in 2030** than would be consistent with limiting warming to **1.5°C,** and **45% more than consistent with 2°C *(Production gap report 2021)*.**

AIR

Air Pollution in India	⊕ **Major air pollutants:** Particulate Matters (PM): PM1, PM2.5, PM10, Nitrogen oxides (NO and NO2), Sulphur dioxide (SO2), Carbon Monoxide (CO), Ground level ozone (O3), Lead (Pb), Volatile Organic Compounds (VOCs). ⊕ **Polluted cities:** 35 Indian cities in top 50 of world's most polluted list. ***(World Air Quality Report, 2021)*** **Non-compliance with WHO guidelines:** In 2021, no cities in India met the WHO air quality guideline of 5 µg/m3 PM2.5 with 48% of India's cities exceeding 50 µg/m3. ⊕ **Deaths attributed to air pollution:** 1.67 million (17.8% of the total deaths in India) in 2019.
Air Pollution in Delhi NCR	⊕ **Delhi ranked** as the **most polluted capital city globally** for the 4th consecutive year. ***(World Air Quality Report, 2021)*** ⊕ **Stubble burning:** The contribution of stubble burning to Delhi Pollution reached 36% (PM2.5) for 2021, in comparison to 42% in 2020 and 44% in 2019. ⊕ **Initiatives:** National Clean Air Programme (NCAP), Graded Response Action Plan (GRAP), statutory body- Commission for Air Quality Management (CAQM), Delhi Electric Vehicle (EV) Policy. → **For stubble burning:** National Policy for Management of Crop Residues, NGT ban on crop residue burning, Bio-Decomposer technology, Happy Seeder machines etc.

WATER AND LAND

Water Pollution	⊕ **Drinking water:** Around **70%** of surface water in India is **unfit for consumption *(NITI Aayog report, 2019)*.** **Water Pollutants:** ⊕ **Heavy metals** (lead, iron, nickel, cadmium, arsenic, chromium and copper): **75% of river monitoring stations** in India posted alarming levels of heavy toxic metals. ***(CSE)*** ⊕ **Uranium:** Across India, **aquifers from 16 states** have reported Uranium contamination in groundwater.
River Pollution	⊕ **River Pollution:** CPCB **identified 351 polluted river stretches in 2018 in India,** with 45 of them being critically polluted. ⊕ **Ganga river:** In places, the water's bacteria count reaches **3,000 times the limit declared safe for bathing** by the World Health Organization (WHO). ⊕ **Achievements of the Namami Gange programme:** → **Dissolved oxygen level has improved at 27 locations**. → **Biochemical oxygen demand (BOD) and faecal coliform (FC) has improved** at 42 and 21 locations, respectively ⊕ **Initiatives:** National River Conservation Plan, National Water Monitoring Programme, Namami Gange programme, Water Prevention and Control of Pollution Act, 1974 etc.
Groundwater Extraction	⊕ **Decline:** Groundwater level in India has **declined by 61% between 2007 and 2017 *(Central ground water board)*.** ⊕ **India is the largest extractor of groundwater in the world**. ⊕ **Initiatives:** Atal Bhujal Yojana, Jal Shakti Abhiyaan, Master Plan for Artificial Recharge to Ground Water in India, Pradhan Mantri Krishi Sinchayee Yojana etc.
Wastewater Management	⊕ **Sewage treatment: More than 60% of sewage generated by urban India is untreated** and enters water bodies like rivers, urban water bodies etc. (NGT) ⊕ **Greywater generation:** More than **70 percent of freshwater across rural households** in India gets converted to greywater.

Land Degradation in India	⊕ **Extent:** Around **30% of the Total Geographic Area of India has undergone land degradation** during 2018-19, an increase from 2011-13. ***(Desertification and Land Degradation Atlas of India)*** ⊕ **Initiatives:** National Afforestation Programme , National Mission for a Green India, National REDD+ Strategy in 2018, Soil Health Card Scheme, Pradhan Mantri Krishi Sinchayee Yojna, etc

SUSTAINABLE DEVELOPMENT

SDG Performance	⊕ **India ranked 121 out of the 163 countries** falling from 117 in 2020 and 120 in 2021 in **Sustainable Development Report 2022.** ⊕ **Progress:** India is facing major challenges in achieving 11 of 17 Sustainable Development Goals, **while it is on track to achieving SDG 13 on climate action and SDG 12 on Responsible consumption and production.**
Sustainable Cities	⊕ Urban areas are responsible for over **75% of global carbon emissions.** ⊕ **Initiatives:** Smart cities mission, Swachh Bharat Mission-Urban 2.0, Pradhan Mantri Awas Yojana, Solar Cities Program, ClimateSMART Cities Assessment Framework, National Smart Grid Mission, Energy Conservation Building Code etc.
Sustainable Agriculture	⊕ **Food security:** By 2030, India's **food production could drop 16%** and the number of those at risk for **hunger could increase 23%.** ⊕ **Emissions from Agriculture sector:** Amounts to around **14% of GHG emissions** of India. ⊕ **Pesticide use:** India is the **4th largest producer of pesticides** in the world. ⊕ **Organic farming:** India **ranks 1st in number of organic farmers** and is home to **world's first fully organic state- Sikkim.** ⊕ **Initiatives:** National Mission for Sustainable Agriculture, Paramparagat Krishi Vikas Yojana, Bhartiya Prakritik Krishi Padhati, Participatory Guarantee System, National Programme for Organic Production etc.
Development induced displacement	⊕ **In India around 50 million people have been displaced** due to development projects in over 50 years. The tribals are estimated to be **more than 40% of the displaced population.**
Plastic Waste	⊕ **Trend: Per capita plastic waste generation in India has almost doubled** over the last five years. ⊕ **Collection: Only 60% of plastic waste** is collected In India. ⊕ **Marine plastic: India accounts for 13% of the total marine plastic** waste in the world, ⊕ **Initiatives:** Plastic Waste Management Amendment Rules, 2021 placed a ban on Single use plastic, Swachh Bharat Mission 2.0, Clean and Green campaign, India Plastics Pact etc.
E-waste	⊕ **Generation:** India is the **3rd largest e-waste generator** in the world. ***(Global E-waste Monitor 2020)*** ⊕ **Collection:** Only 22.7% of the total e-waste generated in 2019-20 in India was collected, dismantled, and recycled or disposed off. ⊕ **Initiatives:** EPR Framework under E-Waste Management Rules.
Biomedical waste	⊕ India **witnessed 46% increase in COVID-19 biomedical waste generation** in April- May 2021. ⊕ **Initiatives:** Biomedical Waste Management (BMWM) rules, CPCB Guidelines for BMWM during COVID-19.
Waste to wealth	⊕ **Potential:** India has the potential to generate **3GW of electricity from waste by 2050.** ⊕ **Initiatives:** Waste to Wealth Mission, Gobardhan Scheme, Mandating use of Plastic Waste in Road Construction etc.

RENEWABLE ENERGY AND ALTERNATIVE ENERGY RESOURCES

Renewable Energy Capacity in India	⊕ Energy from **renewable energy sources (including Hydro) makes 40% of total installed capacity (April 2022).** ⊕ **Targets for 2022:** → **Installed capacity of 227 GW** of renewable energy. ⊕ **Targets for 2030** → **Meet 50% of energy requirements** from renewable energy. → **Installed capacity of 500 GW of non-fossil energy.** → Production of **5 million tonnes of Green hydrogen.**
Solar Energy	⊕ Globally, India **ranks 5th** in terms of installed solar power capacity. ⊕ **Targets:** Total installed capacity of **100 GW by 2022,** including 60 GW of utility-scale and 40 GW of rooftop solar capacity, and 3**00 GW by 2030.** ⊕ **Total installed capacity (May,2022):** ~57 GW ⊕ **India's solar potential:** 748 GW assuming 3% of the waste land area to be covered by Solar PV module. ⊕ **Initiatives:** National Solar Mission, Grid connected solar rooftop programme, National Programme on High Efficiency Solar PV Modules, International Solar Alliances etc.
Wind	⊕ Globally, India ranks **4th in installed wind capacity.** ⊕ **Target:** Total installed capacity of 60 GW of wind by 2022. ⊕ **Total installed capacity (May,2022):** 40 GW ⊕ **India's gross wind power potential:** 302 GW in the country at 100 meter and 695.50 GW at 120 meter above ground level. → Most of this potential exists in **seven windy States- Gujarat (highest), Rajasthan, Maharashtra, Tamil Nadu, Madhya Pradesh, Karnataka, Andhra Pradesh.** ⊕ **Initiatives:** National Offshore Wind Energy Policy, National Wind Solar hybrid policy etc.
Hydro	⊕ **Target:** Total installed capacity of 5 GW of small hydropower by 2022. ⊕ Hydropower comprises **~11% of Total installed capacity.** ⊕ **Total installed capacity (May,2022):** 467 GW in Large hydro and 4GW in small hydro.
Ethanol blending	⊕ **Target preponed:** India has **brought forward its 20% ethanol blending target with gasoline** from 2030 **to 2025.** ⊕ **Target achieved:** India has **achieved the target of 10% ethanol blending in June 2022.**
Coal Gasification	⊕ **Target:** Achieve **100 MT coal gasification.** ⊕ **Initiatives:** National Coal Gasification Mission, SHAKTI Policy, Bharat Heavy Electricals Limited (BHEL) developed the fluidized bed gasification technology etc.
Methanol	⊕ **NITI Aayog's road map for Methanol Economy** aims to **substitute 10% of Crude imports by 2030,** by Methanol alone. ⊕ **Methanol 15 (m15)** in petrol will **reduce pollution by 33%.** ⊕ **Initiatives:** Methanol Economy Research Programme, Notification for M-15, M-85, M-100 blends etc.

CONSERVATION EFFORTS

Forests	⊕ **Total forest and tree cover makes up 24.62%** of the geographical area of India. ***(India State of Forest Report, 2021)*** ⊕ **Initiatives:** Forest (Conservation) Act of 1980, Compensatory Afforestation Fund Act of 2016, National Afforestation Programme, National Mission for a Green India, etc.
Human Wildlife conflict	⊕ **Between2018-19 and 2020-21, 222** elephants were killed by electrocution. ⊕ **29 tigers were killed** by poaching between 2019 and 2021. ⊕ **Odisha accounnted for highest number of elephants deaths** followed by Jharkhand and West Bengal. ⊕ **Initiatives:** National Wildlife Action Plan (2017-2031), National awareness campaign on Prevention of Human, Animal Mortality on Highways, Project RE-HAB of Khadi and Village Industries Commission etc.
Mass Extinction	⊕ **More than 900 species have been declared extinct** by the International Union for Conservation of Nature (IUCN).

Antarctic	⊖ Holds **90% of the Earth's total ice volume** and **70% of its fresh water.** ⊖ Melting of the Antarctic Ice Sheet is enough to **increase sea level by more than 60 m.** ⊖ **India's endeavours in Antarctica:** Indian Antarctic Bill, 2022, India's Research stations- Maitri and Bharati, **member of** Council of Managers of National Antarctic Programme **(COMNAP),** Scientific Committee of Antarctica Research **(SCAR)** etc. ⊖ **International Treaties:** Antarctic Treaty, Protocol on Environmental Protection to the Antarctic Treaty (1991) (Madrid Protocol) etc.

DISASTER MANAGEMENT

Forest Fires	⊖ **Fire prone region: 22.27% of the forest cover** in India is **highly to extremely** fire prone. ***(India State of Forest Report, 2021)*** ⊖ **Future predictions:** Number of wildfires is likely to increase by up to 14% by 2030, 33% by 2050 and 52 % by 2100. ***(UNEP)*** ⊖ **Initiatives:** Centrally Sponsored Forest Fire Prevention and Management Scheme, FSI Fire Alert System (FAST) Version 3.0 etc.
Urban Fires	⊖ In 2020, **9,329 incidents** of fire accidents happened in India with the death of **9,110 people, with majority of deaths (57%) in residential buildings.** ***(National Crime Record Bureau)*** ⊖ **Initiatives:** National Building Code of India 2016.
Drought	⊖ **68% of the cultivable area** is vulnerable to drought. ⊖ Nearly **two-thirds of the country suffered** drought during 2020-2022. ⊖ **Initiatives:** Pradhan Mantri Fasal Bima Yojana, Integrated Watershed Management Programme, etc.
Heatwaves	⊖ The **Month of March in 2022 was the hottest in 122 years** since the IMD started maintaining records. ⊖ **Initiatives:** IMD issues colour code impact-based heat warning.
Flooding	⊖ **Over 49.8 million hectares** is prone to floods and river erosion. ⊖ **Initiatives:** Flood management programme, Sponge Cities mission, Integrated Flood Warning system like IFLOWS-Mumbai etc
Cyclones	⊖ India is exposed to **nearly 10 percent of the world's tropical cyclones.** ⊖ **Initiatives:** National Cyclone Risk Management Project
Other Disasters	⊖ **Earthquakes: 58.6% of the landmass** is prone to earthquakes of moderate to very high intensity. ⊖ **Tsunamis: ~5,700 km** of the 7,516 km long coastline is prone to cyclones and tsunamis.

MISCELLANEOUS

Dam Safety	⊖ **Nearly 227 large dams in India are more than 100 years old.** ⊖ **Initiatives:** Dam safety Act, 2019, Dam Rehabilitation and Improvement Project (DRIP), DHARMA (Dam Health and Rehabilitation Monitoring), etc.
Deep Sea mining	⊖ **Mineral deposits found for commercial exploitation:** Polymetallic nodules, Polymetallic sulphides and Cobalt crusts. ⊖ **Initiatives:** Deep Ocean Mission

WEEKLY FOCUS

Environment

TOPIC	DESCRIPTION	LEARN MORE
 **Climate Change and its impact on Indian Region**	Warming induced mainly by anthropogenic factors since 1950s has contributed to a significant increase in weather and climate extremes globally (including in the Indian Ocean Region). The impact on the Indian Ocean Region will have a direct bearing for the Indian sub-continent. To accept this and understand 'what are the challenges India may face' and 'what policy options India has' should be the topmost priority to mitigate and adapt to this situation.	
 **Climate Change Negotiations**	Climate change is one of the most heard of phenomena in the present times that is impacting lives across the globe. COVID pandemic is also being touted as the latest manifestation of this phenomenon. Dealing with the widespread impacts of climate change hence calls for coordinated international efforts. This document describes the tale of emergence of various global climate change negotiations and agreements and discusses the issues plaguing their sincere adoption and effective implementation.	
 **Transitioning to a Sustainable Energy Ecosystem**	Energy is the engine that fuels our economies and modern human activities. Societal and economic disruptions due to the COVID-19 pandemic have given rise to calls for nations to "build back better", and to steer economies towards more sustainable trajectories. The document analyses the developmental benefits of investing in a sustainable energy ecosystem and India's progress in this domain. It further discusses models such as Energy Trilemma to develop greener and more inclusive energy systems that offer greater resilience to future crises.	
 **Conserving the Forests: Save Today, Survive Tomorrow**	The intense global debate on sustainable development and sustainable management of natural resources puts the importance of forests for humanity at the centre of discussion. The emerging threats faced by forests calls for forming intense strategies for their conservation and sustainable management. This document discusses various strategies in practice in India and potential opportunities for future to achieve desired level of forest cover.	

Sustainable Development Goals: The Pathway to the Future	The 2030 Agenda for Sustainable Development is more than the sum of measurable Goals, targets, and indicators. It provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. With less than a decade left, countries across the world, including India, still remain off track to achieve the Sustainable Development Goals, with the pandemic threatening to reverse years of progress. This document provides an assessment of India's current actions and progress towards achieving the SDGs, whilst listing the obstacles it faces in its way and suggesting measures to overcome these barriers.	
Nature-positive Cities: Rejuvenating Cities relationship with nature	At a time when the world is losing its biodiversity at an alarming rate, and that loss has been linked to disease outbreaks, urban nature is more important than ever. Yet urbanization is a major cause of habitat loss – which drives much of the staggering loss of biodiversity. Explaining the intricate relationship between nature and urban spaces, the document examines the factors for lack of sync between cities and nature and strategies for reviving and restoring that sync so as to create a better, greener and a healthier world.	
Sustainable Agriculture Part 1_Understanding the concept and practices	Advances in science and technology, shifting consumption patterns, continuing population growth, trade globalization, and the impacts of local and global environmental change converge and lead to new and serious risks to agricultural production systems and producers. In light of these changes, sustainability of the agri-food system and farming as a multi-functional enterprise is of increasing importance. This document is an effort to identify the ideas, practices and policies that constitute concept of sustainable agriculture and highlights the emerging need to tweak the existing agricultural practices.	
Sustainable Agriculture Part II_Transforming India's Food Systems	There is growing consensus in India among agri-scientists, policymakers and farmers that the Green Revolution has reached its limits and raised several issues of environmental sustainability. While millions of farmers in India have rejected chemical pesticides as part of a growing movement that favors natural alternatives, sustainable agriculture is still far from mainstream in India. This document provides an overview of the current state of sustainable agriculture practices and systems (SAPSs) in India and hurdles in the path of their wider application.	

8 IN TOP 10 SELECTIONS IN CSE 2021

from various programs of VisionIAS

CIVIL SERVICES EXAMINATION 2020

1 AIR

SHUBHAM KUMAR

2 AIR

ANKITA AGARWAL

3 AIR

GAMINI SINGLA

4 AIR

AISHWARYA VERMA

5 AIR

UTKARSH DWIVEDI

6 AIR

YAKSH CHAUDHARY

7 AIR

SAMYAK S JAIN

8 AIR

ISHITA RATHI

9 AIR

PREETAM KUMAR

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