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ENVIRONMENT

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1. AIR POLLUTION

1.1. AIR POLLUTION: AN OVERVIEW

Indian cities are reeling under multiple problems, including environmental issues that they must contend with. Most pressing of them all is the issue of air pollution.

Top 10 most polluted cities in India based on pm 2.5

CITY	PM 2.5 (Annual mean, ug/m^3)
Kanpur	173
Faridabad	172
Gaya	149
Varanasi	146
Patna	144
Delhi	143
Lucknow	138
Agra	131
Gurgaon	120
Muzaffarpur	120

Source: WHO Database, as on 21 May 2018.

14, of the world's 15 most polluted cities are in India. :WHO, 2018

Some facts on Air Pollution in India

- According to the World Health Organisation (WHO) global air pollution database, **India has 14 out of the 15 most polluted cities in the world** in terms of PM 2.5 concentrations.
- **India ranks 178 out of 180 countries in Environmental Performance Index, 2018** in terms of air quality. Its overall low ranking was linked to poor performance in the environment health policy and deaths due to air pollution categories.

Major Causes of Air Pollution

- **Emissions from burning of fossil fuels** which include vehicular emissons, industrial emissions, emissions from petroleum refineries and power plants.
- **Emissions from stubble burning**- in agriculture, increases air pollution in Delhi and NCR area.
- **Release of dust and chemicals-** from mining operations.
- **Other Causes-** Dust Storm, Forest Fires, Deforestation, Landfills, Electronic Waste etc.

Effects of Air Pollution

- **Impact on Health-** A recent study by the Centre for Science and Environment (CSE) revealed that **life expectancy in India has gone down by 2.6 years** due to deadly diseases caused by air pollution.
- **Impact on Economy-** Financial cost from pollution-related death, sickness and welfare is about 6.2% of the global economy.
- **Climate Change-** which include global warming**, acid rain**, **depletion of ozone layerImpact on Wildlife-** Toxic chemicals present in the air can force wildlife species to move to new place and change their habitat.

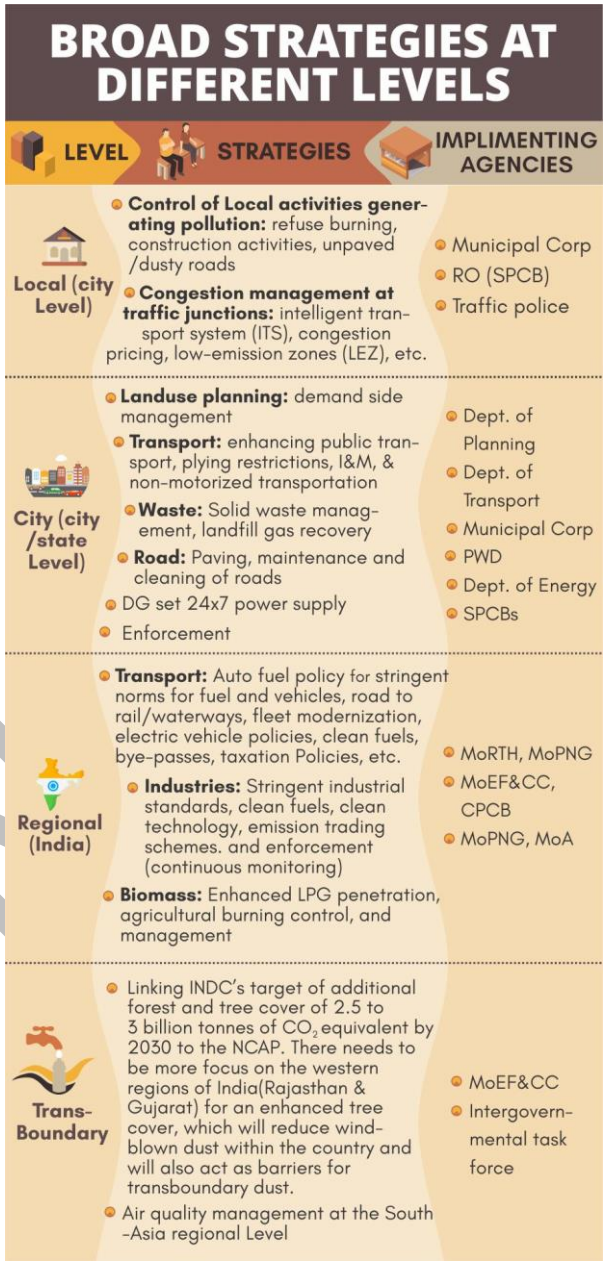
Some Steps taken by the Government

- **Carbon Emission by Thermal Power Plants (TPPs):** Ministry of Environment, Forest and Climate Change had notified environmental norms in December 2015 and direct them to reduce emission of PM 10, SO_2 and oxide of nitrogen.
- **Clean Air- India Initiative:** to curb air pollution in Indian cities by promoting partnerships between Indian start-ups and Dutch companies and build a network of entrepreneurs working on business solutions for cleaner air.
  - Under it, an 'INDUS impact' project aims to halt the hazardous burning of paddy stubble by promoting business partnerships that "up cycle" it. This entails using paddy straw as feedstock to make materials that would find use in construction and packaging.
- **Ban on pet coke and furnace oil:** The Supreme Court banned the use of furnace oil and pet-coke in Haryana, Rajasthan and Uttar Pradesh.
- **Promotion of fuel standards-** Leapfrogging from BS-IV to BS-VI fuel standards by 1st April, 2020.
- Subsidy to cooking fuel under Pradhan Mantri Ujjwala Yojana (PMUY) to curb indoor pollution.
- **Encouraging Alternatives:** Promotion of public transport and network of metro, e-rickshaws, promotion of car-pooling etc.
- Niti Aayog has proposed 15-point action plan titled **'Breathe India'** for combating air pollution in ten most polluted cities in the country, including Delhi, Kanpur and Varanasi.

1.2. NATIONAL CLEAN AIR PROGRAMME

Why in news?

National Clean Air Programme (NCAP) was recently launched by Ministry of Environment, Forest and Climate Change (MoEFCC).



About NCAP

- It is a pollution control initiative to cut the concentration of particles (PM10 & PM2.5) by 20-30% by 2024. It will have 2017 as the base year for comparison and 2019 as the first year.
- It is to be implemented in 102 **non-attainment cities**. These cities are chosen on the basis of **Ambient Air Quality India (2011-2015) and WHO report 2014/2018.**
- **Its objectives include-**
  - **Stringent implementation of mitigation measures for prevention, control and abatement of air pollution;**
  - Augment and strengthen air quality monitoring network across the country;
  - Augment public awareness and capacity building measures.

Three Components of NCAP:

Mitigation Actions: NCAP details seven mitigation actions.

- **Web-based, three-tier mechanism -** to monitor any form of non-compliance. The system will work independently under the supervision of a single authority, which will ensure accreditation of three independently operating entities.
- **Extensive Planation Drive:** to be undertaken under the National Mission for Green India.
- **Technology Support:** Clean Technologies with potential for air pollution prevention and mitigation will be supported for R&D and field scale implementation.
- **Regional and Transboundary Plan:** Air quality management at South-Asia regional level by activating the initiatives under **'Male Declaration on Control** and **Prevention of Air Pollution and its Likely Transboundary Effects for South Asia' and South Asia** Cooperative Environment Programme (SACEP) to be explored.
- **Sectoral Interventions:** such as e-mobility, power sector emissions, indoor air pollution, waste management etc.
- **City Specific Air Quality Management Plan for 102 Non-Attainment Cities:** based on comprehensive science-based approach, involving meteorological conditions and source apportionment studies.
  - A separate emergency action plan in line with Graded Response Action Plan for Delhi will be formulated for each city for addressing the severe and emergency AQIs.
  - Further, the state capitals and cities with a population more than a million may be taken up on priority for implementation.
- State Government's participation is not limited for evolving an effective implementation strategy but also in exploring detailed funding mechanism.

Knowledge and Database Augmentation

- **Air Quality Monitoring Network** which also includes setting rural monitoring network and 10 city super network.
- **Extending Source apportionment studies to all Non-Attainment cities:** which will help in prioritising the sources of pollution and formulation and implementation of most appropriate action plans. A **unified guideline** for source apportionment study will be formulated and updated by the Centre.
- **Air pollution health & economic impact studies** to be undertaken.
- **International Cooperation** including Sharing of International Best Practices on Air Pollution.
- **Review of Ambient Air Quality Standards and Emission Standards.**
- **National Emission Inventory** to be formalized under the NCAP.

Challenges

- **Need for stronger mandate:** NCAP is **not legally binding** and thus remains an advisory programme. Legal backing becomes important not only to establish more enforceable mandate for the state and city governments but also to ensure inter-ministerial coordination.
- **Need for Higher ambitions:** Current ambition levels under NCAP will not lead to breathable air quality in the country, as the pollution levels across much of the country are so high that even a 30% reduction will still leave pollution levels above the NAAQS and WHO standards.
- **Need for fiscal strategy:** NCAP cannot be sustainable in long term if it does not have a clear fiscal strategy. It is also not clear if the proposed allocation (Rs.300 cr) is a one-time exercise or a continuous support.

Institutional Strengthening

- **Institutional Framework:** It involves a **National Apex Committee** at the MoEF&CC and State-level Apex Committee under the chief secretaries in various states. There are various other institutions being envisaged such as Technical Expert Committee and National-level Project Monitoring Unit (PMU) at the MoEF&CC and National-level Project Implementation Unit (PIU) at the CPCB.
- **Public Awareness and Education:** through national portals, media engagement, civil society involvement, etc.
- **Training and Capacity Building:** NCAP identifies lack of capacity on air quality issues due to limited manpower and infrastructure in the CPCB and SPCBs, lack of formal training for various associated stakeholders etc. as one of the major hurdles in an effective implementation of air pollution management plans.
- **Setting up Air Information Centre:** which will be responsible for creating a dashboard, data analysis, interpretation etc.
- **Operationlize the NPL-India Certification Scheme (NPL-ICS)** for certification of monitoring instrument. It will help to cater to the country's needs with respect to the online monitoring of air pollution. The proposed certification scheme will have three major components i.e. NPL-India certification body (NICB), certification committee, and testing and calibration facility.
- **Air-Quality Forecasting System (AQFS):** as a state-of-the-art modelling system, it will forecast the following day's air quality.
- **Network of Technical Institutions- Knowledge Partners: Dedicated air pollution units** will be supported in the universities, organizations, and institutions and a network of highly qualified and experienced academicians, academic administrators, and technical institutions will be created.
- **Technology Assessment Cell (TAC):** It will evaluate significant technologies with reference to prevention, control, and abatement of pollution. Technology induction/ transfer would be facilitated with time bound goals for indigenization and local manufacturing.

Significance of NCAP

- **Maiden attempt to frame a national framework-** for air quality management with a **time-bound** reduction target. It will help decide the level of severity of local and regional action needed to improve the effectiveness of pollution reduction plan.
- **Multi-sectoral Collaboration and Participatory approach** - covering all sources of pollution and coordination between relevant Central ministries, state governments, local bodies and other stakeholders.
- **All-inclusive approach –** It has tried to incorporate measures for **urban as well as rural areas**. Further, NCAP identifies the trans-boundary nature of air pollution and thus specifically assigns **transboundary strategies** in managing the air pollution in the country.

- **Linking Health and Pollution:** NCAP has now taken on board the **National Health Environmental Profile of 20 cities** that the MoEF&CC initiated along with the Indian Council of Medical Research with special focus on air pollution and health. It has asked the Ministry of Health and Family Welfare to maintain health database and integrate that with decision making.
- **Periodic Review-** The **Apex Committee in the MoEFCC** will periodically review the progress. Annual performance will be periodically reported upon. Appropriate indicators will be evolved for assessing the emission reduction benefits of the actions

1.3. OTHER RECENT STEPS TO TACKLE THE AIR POLLUTION

1.3.1. BHARAT STAGE NORMS

Why in news?

Supply of Bharat Stage-VI grade petrol and diesel has begun in cities adjoining the national capital recently. Delhi in April 2018 became the first city in the country to leapfrog from BS-IV grade petrol and diesel to BS-VI fuels.

About Bharat Stage Norms

- India introduced emission norms in 1991 and by 1996 most vehicle manufacturers had to incorporate technology upgrades like catalytic converters to cut exhaust emissions.
- In 2014, Saumitra Chaudhary committee gave recommendations on Auto Fuel Vision Policy 2025 which had recommended implementation of BS-IV (2017), BS-V (2019) and BS-VI (2024) standards.
- In **2016**, the Union Government announced that the country would skip the BS-V norms altogether and adopt BS-VI norms by 2020.
- **Currently, BS IV norms have been enforced across the country since April 2017.** However, recently the Supreme Court of India ordered barring of sale of **Bharat Stage IV vehicles** from April 1, 2020.

Bharat Stage Emission Norms

- These are norms instituted by the government to regulate the output of air pollutants from internal combustion engine equipment, including motor vehicles.
- To bring them into force, the Central Pollution Control Board sets timelines and standards which have to be followed by automakers.
- BS norms are based on European emission norms which, for example, are referred to in a similar manner like 'Euro 4' and 'Euro 6'.

Major Differences in BS VI in comparison with BS-IV

- **Selective Catalytic Reduction Technology-** It reduces oxides of nitrogen by injecting an aqueous urea solution into the system. Hence, NOx from diesel cars can be brought down by nearly 70%. In the petrol cars, they can be reduced by 25%.
- **Sulphur Content-** While the BS-IV fuels contain 50 parts per million (ppm) sulphur, the BS-VI grade fuel only has 10 ppm sulphur content.
- **Particulate Matter-** in diesel cars will be reduced by 80%.
- **Mandatory on-board diagnostics (OBD)-** which inform the vehicle owner or the repair technician about how efficient the systems in the vehicles are.
- **RDE (Real Driving Emission)** will be introduced for the first time that will measure the emission in real-world conditions and not just under test conditions.

Challenges

- **Huge Cost for automakers-**
  - Moving to BS-VI directly will **require significant technological upgrades for which auto companies may have to invest heavily**.
  - Automakers were supposed to make their models BS IV compliant by April 1, 2017. While some automakers have met the targets and updated their products, there is a huge stock of vehicles left to be sold into the market.
- **Timeframe-** Normally it takes 4 years to upgrade and here the companies have to skip the BS V altogether and upgrade directly to BS VI. **Smaller bonnet cars** of India may not be able to imbibe Diesel Particulate Filter in them which was supposed to be a **part of BS-V upgrade**.
- **Impact on buyers-** This can have the effect of making cars and other vehicles more expensive.
- Directly aping the Euro norms is problematic, considering that **driving conditions** in India are different from Europe.
- Further, improving the emission will not alone solve the problem of vehicular pollution as the number of **vehicles is disproportionately high** in Indian cities.

Way Forward

- A successful transition to BS-VI norms will be a landmark event for the country and it must be taken in a mission mode approach by all the stakeholders.
- Governments should incentivize the automobile manufacturers and partner the oil companies to manage this transition.

1.3.2. DUST MITIGATION PLAN

Why in news?

Recently, Centre has notified dust mitigation norms under the Environment (Protection) Act, 1986 to arrest dust pollution. It empowers CPCB to fine companies and agencies for not complying with norms.

Highlight of rules

- **Mandatory dust mitigation plan** for all building or infrastructure projects seeking environment clearance.
- **No soil excavation** without adequate dust mitigation measures in place.
- No loose soil, sand, construction waste could be left **uncovered. Mandatory water sprinkling** system.
- **Prohibition on grinding and cutting** of building materials in open area
- **No uncovered vehicles** carrying construction material and waste would be permitted.
- Dust mitigation measures shall be displayed prominently at the construction site for **easy public viewing.**

1.4. INDOOR AIR POLLUTION

Why in news?

A recent study has pointed out that **household emissions** remained one of the major factors behind air pollution.

State of Global Air 2019 (Published by Health Effects Institute (HEI))

- In 2017, **3.6 billion people (47% of the global population) were exposed to household air pollution** from the use of solid fuels for cooking. These exposures were most common in sub-Saharan Africa, South Asia, and East Asia.
- An estimated **846 million people in India (60% of the population**) were exposed to household air pollution in 2017.
- The **largest numbers of deaths attributed to household pollution were in India** followed by China.

Background

- **Indoor air pollution** refers to the degradation in physical, chemical, and biological characteristics of air in the indoor environment within a home, building, or an institution or commercial facility.
- **According to a recent UNEP report** the contribution of indoor air pollution to ambient air pollution is estimated to vary between 22 and 52%.
- As per the analysis carried out by researchers from IIT Delhi in collaboration with other universities, it was found that-
  - the use of **firewood, kerosene and coal** in the households contributed to about **40% of the PM 2.5 pollution in the Gangetic basin districts.**

Major Causes of Indoor Air Pollution

- **Use of Open Fires, unsafe fuels or combustion of biomass fuels, coal and kerosene.**
- **Gas stoves or badly installed wood-burning units**
- **Construction of more tightly sealed buildings** which accumulate more pollutants. It also leads to **poor ventilation** in houses, which do not allow cross ventilation of air in the indoors.
- **Asbestos released from the construction material** is a big contributor to air contamination indoors. Increased use of synthetic material now a days in construction has resulted in emission of toxins in the indoor air. Paints, coatings and tiles are main sources of asbestos.
- **Volatile Organic Compounds, which** originate mainly from solvents and chemicals, such as perfumes, furniture polish.
- **Tobacco Smoke**- generates a wide range of harmful chemicals.
- **Biological Pollution** which include pollen from plants, mite, hair from pets, fungi, parasites, and some bacteria.

Impact of Indoor Air Pollution

- **On Health-**
  - Indoor air pollution increases the potential of health risks such as respiratory illness, acute respiratory tract infection, stillbirth, lung cancer, leukemia etc.
  - As per a study, if all households transitioned to clean fuels, about 13% of premature mortality in India could be averted
- **On Cognitive abilities of children-** Indoor air pollution significantly affects problem solving, mathematical abilities, IQ and learning capabilities in children.
- **On Overall Productivity-** as it aids in following lifestyle changes like fatigue, dizziness, allergies etc.

Measures to reduce indoor emissions

- **Public Awareness-** spreading awareness among people about the issue and the serious threat it poses to their health and wellbeing.
- **Change in pattern of fuel use-** including electricity, natural gas, LPG in urban areas; advanced biomass cooking, LPG and heating stoves in rural areas; substitution of coal by briquettes.
- **Energy efficiency for households-** Use incentives to improve the energy efficiency of household appliances; encourage roof-top solar installations etc.
- **Improved Ventilation-** such as a window above the cooking stove and cross ventilation though doors should be instituted.
- **Inter-sectoral Coordination and Global Initiative-** Committed efforts between different sectors concerned with health, energy, environment, housing, and rural development.
- **Green Roofs-** that are planted with vegetation -- may improve the indoor air quality of commercial buildings.

Government Measures taken for improving Indoor Air Quality

- **National Programme for Improved Chulhas**
- **National Biomass Cookstoves Initiative**
- **Pradhan Mantri Ujjwala Yojana**
- **Neerdhur-** a novel multi-fuel domestic cooking stove, that uses from wood and other fuel like coal, cow dung and agricultural residue. It also saves 50% fuel and has high thermal efficiency.

India reduced its proportion of households cooking with solid fuels from 76% in 2005 to 60% (846 million) in 2017 due in part to a major government program (Pradhan Mantri Ujjwala Yojana) to shift households from solid fuels to liquefied petroleum gas.

Way Forward

Tackling indoor air pollution and providing universal access to clean household energy is a great opportunity to improve health, reduce poverty, and protect the environment; thus, contributing significantly to achieving the Sustainable Development Goals (SDGs).

1.5. FLY ASH UTILISATION

Why in news?

Various fly ash brick manufacturing units in the country have been closed due to difficulty in procurement of fly ash.

Background

- Owing to large-scale dependence on thermal power generation and high ash content in Indian coal, **large quantity of ash** is generated in the country (nearly 200 million tons). It not only requires large area of precious land for its disposal but is also one of the **sources of pollution of both air and water**
- Hence, the Government of India and some states have mandated compulsory guidelines for utilization of Fly Ash.
- However, the Fly Ash Users have alleged that the generators have created artificial shortage of Fly Ash owing to following reasons-
  - There is cartelization among thermal power plants in terms of supply of fly ash.

Fly ash

- It is a fine powder, which is the by-product of burning coal in thermal power plants.
- **Composition:** Fly ash includes substantial amounts of oxides of silica, aluminum and calcium. Element like Arsenic, Boron, Chromium, lead etc. are also found in trace concentrations.

- Priority is given to road or other project contractors owing to "election compulsions" during the election time.

Government Measures to promote Fly Ash Utilization

- **Central Electricity Authority (CEA)** on behalf of Ministry of Power has been monitoring since 1996-97 the fly ash generation and its utilization in the country at coal/ lignite based thermal power stations.
- **Notifications by Ministry of Environment, Forests and Climate Change on Fly Ash Utilization**, with the latest coming in 2016 with following features-
  - **Mandatory uploading of details** of fly ash available on Thermal Power Station's (TPS) website and updating of stock position at least once in every month;
  - **Increase in mandatory jurisdiction** of area of application from 100 km to 300 km;
  - **Cost of transportation** of fly ash to be borne entirely by TPS up to 100 km and equally shared between user and TPS for more than 100 km and up to 300 km;
  - **Mandatory use of fly ash-based products in all Government schemes** or programmes e.g. Pradhan Mantri Gramin Sadak Yojana, Mahatma Gandhi National Rural Employment Guarantee Act, 2005, Swachh Bharat Abhiyan, etc.

Other Measures taken by Government

- **ASH TRACK-** mobile application that gives plant-wise, utility-wise and State-wise ash utilization status in the country.
- **Maharashtra-** became the 1st state to adopt the fly ash utilization policy.
- **Odisha** has ordered the plants to subsidize the transport costs.
- **NTPC** in collaboration with Institutes like IIT-Delhi and IIT-Kanpur has initiated manufacturing of pre-stressed railway concrete sleepers.

- **Another government notification, released in February 2019 states that-**
  - The existing red clay brick kilns located within 300 km shall be converted into fly ash-based bricks or blocks or tiles manufacturing unit within one year from the date of publication of this notification.
  - In order to encourage the conversion, TPS should provide fly ash at the rate of Rs 1 per tonne and bear the full transportation cost up to 300 km to such units.
- Last year, the **Prime Minister's Office** had asked for multiplying the fly ash usage "by 10 times" in a time-bound manner in the country.

Advantages of Fly Ash Utilization

- **Prevents Soil Erosion-** Helps restrict usage of topsoil for manufacturing of bricks.
- **Used in variety of construction works-** Fly ash is a proven resource material for many applications of construction industries, like Flyash bricks have been found to show better strength. Currently is being utilized in manufacturing of portland cement, bricks/blocks/tiles manufacturing, road embankment construction and low-lying area development, etc..
- **Used in Agriculture**- as an agent for acidic soils, as soil conditioner — improving upon some important physio-chemical properties of the soil such as hydraulic conductivity, bulk density, porosity, water holding capacity, etc.
  - **Use of Fly ash in agriculture** can increase the yield of cereals, oil seeds, pulses, cotton and sugarcane by 10-15%, vegetables by about 20-25% and root vegetables by 30-40%.
- Waste lands, degraded lands, saline alkaline soils, eroded soils etc., can be successfully reclaimed by fly ash.
- **Prevent Contamination of Water Resources-** by preventing contamination of surface water through erosion, runoff, airborne particles landing on the water surface etc.

Way Forward

- **Policy support:** To promote the usage of fly ash, state and local governments should issue preferential policies that encourage its recycling, such as the preferential purchase of recycled fly ash products and reduction of the overall effective tax.
- **Identifying prospective users:** Areas having large prospective of fly ash utilization needs to be discovered for increasing the overall utilization of fly ash in India.
- **Technological enhancements:** Renovation and modernization of coal/lignite based Thermal Power Stations need to include the technological advancement required to ensure **development of dry fly ash**.

- **Creating a market:** Renovation and modernization should also include a marketing strategy for the development of flyash based industries and making available fly ash and fly-ash based building products in the nearby markets.
- **Spreading awareness:** The road contractors and construction engineers need to know the benefits of using fly ash in construction.
    - Utilization of fly ash in agriculture is below expectation because of presence of heavy metal and radioactive elements in fly ash. Theses apprehensions are mandatory to be addressed for increasing fly ash utilization
- **Industry-Academia Partnership:** There is need to encourage industry-institute interaction for entrepreneur development, creating awareness and organizing training workshops.
    - New emerging areas such as Light Weight Aggregates and Geo-polymers, Coal Beneficiation Blending and Washing, etc. needs to focus for higher utilization of fly ash in the country.
    - In view of large quantity of fly ash generation, utilization of fly ash may be introduced as construction material in academic curriculum of Engineering, Architecture, Mining, Agriculture etc.

2. WATER POLLUTION

2.1. GROUND WATER POLLUTION

- Groundwater has emerged as the **democratic source of water and poverty reduction tool.** Due to its low capital cost, it is the most preferred source of water in India.
  - According to an estimate **groundwater accounts for nearly 80 per cent of the rural domestic water needs**, and **50 per cent of the urban water needs** in India.
- A variety of land and water-based human activities are polluting this reliable and safe source of water.
  - Over-exploitation and unscientific extraction are resulting in an increase in contaminants in groundwater.

Some stats on groundwater in India

- Net Annual Ground Water Availability- 411 bcm.
- Stage of Ground Water Development- 62%.
- Out of total 6584 Units (Blocks/ Mandals/ Firka/Taluks) assessed by Central Ground Water Board-
  - **253 are Critical-** the stage of ground water development is above 90% and within 100% of net annual ground water availability and significant decline is observed in the long-term water level trend.
  - **1034 are Over-Exploited-** the annual ground water extraction exceeds the net annual ground water availability and significant decline in long term ground water level trend.

Ground Water Quality in India: The main ground water quality problems in India are as follows-

- **Ground water pollution**
  - **Fluoride:** High concentration of fluoride in ground water is beyond the permissible limit of 1.5 mg/L. Excess fluoride causes neuro-muscular disorders, gastro- intestinal problems, teeth deformity, hardening of bones, and skeletal fluorosis.
  - **Arsenic:** In West Bengal, 79 blocks in 8 districts have Arsenic beyond the permissible limit of 0.01 mg/L. Chronic exposure to Arsenic causes Black foot disease. It may also cause diarrhea, lung and skin cancer.
  - **Nitrates:** High Nitrate concentration in ground water in India has been found in almost all hydrogeological formations. Excess Nitrate in drinking water causes methemoglobinemia or Blue baby Syndrome.
  - **Iron:** High concentration of Iron (>1.0 mg/l) in ground water has been observed in more than 1.1 lakh habitations in the country, such as from Assam, West Bengal etc.
  - **Uranium:** Aquifers in as many as 16 states of India are contaminated by uranium, whose presence in drinking water has been linked to chronic kidney disease.
- **Inland Salinity:** Inland salinity in ground water is prevalent mainly in the **arid and semi-arid regions** such as Rajasthan, Haryana, Punjab etc
  - It is **also caused due to practice of surface water irrigation without consideration of ground water status**.
  - As per recent assessment about 2.46 m ha of the area under surface water irrigation projects is waterlogged or threatened by water logging.
- **Coastal Salinity:** Withdrawal of fresh ground water from coastal aquifers may result in intrusion of saline water in coastal aquifers. E.g. Problem of salinity ingress has been noticed in Minjur area of Tamil Nadu and Mangrol – Chorwad- Porbander belt along the Saurashtra coast.

Issues in Tackling Groundwater Contamination and Pollution

- **Inadequacies in monitoring groundwater quality-**
  - It is primarily the concern of the **Central Ground Water Board (CGWB)** and state groundwater agencies.
  - However, there are a **few observation stations** in the country that cover all the essential parameters for water quality and hence the data obtained are not decisive on the water quality status. Further, the **monitoring ability is doubtful** as the agencies lack adequate staff to carry out its functions.
  - There are **problems associated with institutional design** itself. The SPCBs perform the dual functions of monitoring pollution and enforcing pollution control norms. This creates a disincentive for them to perform the first function meaningfully.
- **Lack of effective enforcement of pollution control norms**- due to the fact that cost of pollution is much less than the cost of treatment works as a disincentive for polluters.

- The **decentralized nature of Ground water use** makes it hard to keep a check on over exploitations and pollution of ground water. Though de jure rights in groundwater are not clear, land owners enjoy de facto right to extract groundwater under their land.

Government Efforts to control the Ground Water Pollution

- **"A Master Plan for Artificial Recharge of Groundwater"** has been developed by the Central Ground Water Board (CGWB) in 2013. According to this plan, over 85 billion cubic metres will be recharged in rural and urban areas in a phased manner by 2023.
- **India has several legislations and programmes to protect groundwater**. Water (Prevention and Control of Pollution) Act, 1974; Environmental Protection Act, 1986; the creation of Arsenic task force in West Bengal in 2005 and the launch of Salinity Ingress Prevention Scheme in Gujarat in 2008 are a few such Acts and programmes.
- In 2016, the Union government launched the **National Project on Aquifer Management**. The project proposes to cover 1.4 million sq km under aquifer mapping between 2017 and 2022.

Way Forward

- The CAG (Comptroller and Auditor General) has made the following recommendations with regard to the prevention and control of pollution of groundwater:
  - The Ministry of Environment, Forest and Climate change needs to establish enforceable water quality standards for lakes, rivers and groundwater to help protect ecosystem and human health.
  - Penalties need to be levied for violations of water quality standards.
  - States need to take measures for source control of pollutants through sewage and agriculture runoff entering water bodies in projects for conservation and restoration of lakes.

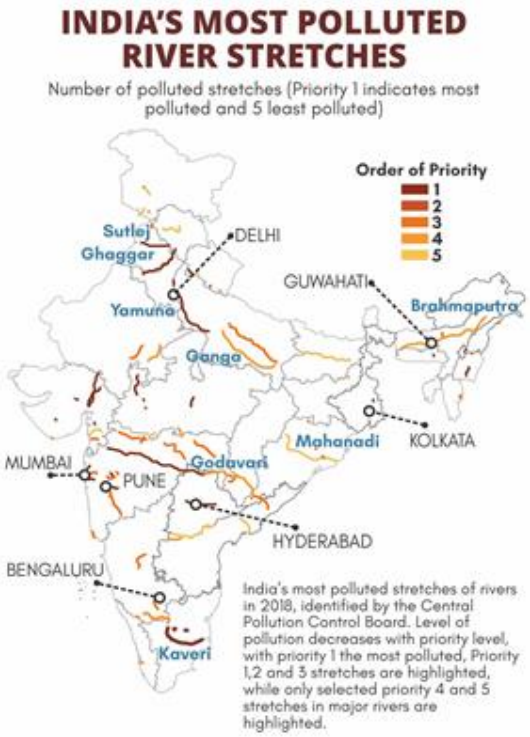
2.2. RIVER POLLUTION

Why in News?

Recently, National Green Tribunal (NGT) has appointed a **Central Monitoring Committee** to prepare and enforce a national plan for reducing polluted river stretches across the country.

More on news

- The committee would comprise of:
  - representative of NITI Aayog;
  - secretaries of Ministry of Water Resources, Ministry of Urban Development and Ministry of Environment;
  - the director general of National Mission for Clean Ganga and
  - the Chairman of Central Pollution Control Board (CPCB).
- **The committee would also** co-ordinate with the **River Rejuvenation Committees of the states** and oversee the execution of the action plans, taking into account the timelines, budgetary mechanism and other factors.
- CPCB will be nodal authority at national level, while Chief secretaries of states will be the nodal agency at state level.



River pollution in India

- According to an assessment by the **CPCB in 2018,** there were **351 polluted river stretches (302 in 2015)** in the country, with 45 of them being critically polluted.
  - The CPCB considers a BOD less than 3 mg/l as an **indicator of a healthy river**.
  - Maharashtra, Assam and Gujarat account for 117 of the 351 polluted rivers stretches.
  - The increase in numbers reflected **higher pollution levels** and **increase in water quality monitoring stations.**

- A report by Central Water Commission has highlighted that 42 rivers in India have at least two toxic heavy metals in quantities beyond the permissible limit. Ganga was found to be polluted with five heavy metals—chromium, copper, nickel, lead and iron.
- **Sources of river pollution:**
  - **Point source pollution:** It refers to the pollution entering the water way through a discrete conveyance like pipes, channels etc., from source such as industry.
  - **Non- point source pollution:** It refers to the pollution that does not enter the water way through a discrete source but is accumulative in nature. These pollutants are:
    - ✓ **Natural contaminants** such as dry leaves, dead insects and animals, bird droppings etc.
    - ✓ **Agricultural contaminants** such as agricultural runoff containing fertilizers, pesticides etc.
    - ✓ **Industrial contaminants** such as industrial runoff containing industrial wastes.
    - ✓ **Microbial contaminants** such as Faecal & Total Coliform, especially during Cultural Congregation like Kumbh in India.
    - ✓ **Human added contaminants** such as organic matter through domestic discharges.

Steps taken to control river pollution

- **National River Conservation Plan:** to reduce the pollution load in rivers through implementation of various pollution abatement works, thereby improving their water quality.
- **National Water Monitoring Programme (NWMP):** Under it, CPCB monitors the water quality of both surface and ground water through a network of monitoring stations in the country.
- **Namami Gange programme for** effective abatement of pollution, conservation and rejuvenation of National River Ganga
- In the **interim budget 2019-2020,** Government's unveiled **vision for 2030** which include clean rivers, with safe drinking water to all Indians, sustaining and nourishing life and efficient use of water in irrigation using micro-irrigation techniques.
- 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.**
  - NGT has also directed MoEFCCC to consider giving **environmental awards** to institutions and states that comply with orders and ensure a reduction in pollution.

Ways to Abate River Pollution

- The enforcement towards **recycling and reuse of wastewater** after treatment should be strictly implemented.
- The drains shall discharge sufficiently treated effluent in proportion to self-cleaning capacity of rivers.
- **Solid waste management** should also be clearly supported through policy initiatives and state of art technology for converting solid waste into useful resources.
- **Suitable bioremediation measures** may be taken on drains of small towns and STPs may be installed at all big cities so that they shall not discharge untreated water directly to the river.
- **Widespread and intense awareness programme** for the common public should be undertaken to inform them about the serious implications of river pollution.
- Provide sufficient water in the river for **ecological flow and dilution.** This can be made possible 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.

2.3. GANGA RIVER POLLUTION

Why in news?

Recently, National Green Tribunal has sought concrete action plan by the National Mission for Clean Ganga (NMCG) to clean the Ganga river.

Various government steps taken for tackling pollution of river Ganga

- **Namami Gange Programme:** It is an Integrated Conservation Mission to accomplish the twin objectives of effective abatement of pollution, conservation and rejuvenation of National River Ganga.
  - **Main pillars of the mission are:**
    - ✓ River front development
    - ✓ Conservation of Aquatic life and biodiversity
    - ✓ Improvement of coverage of sewerage infrastructure in habitations on banks of Ganga.

- ✓ River Surface cleaning for collection of floating solid waste from the surface of the Ghats and River.
- ✓ Afforestation
- ✓ Industrial Effluent Monitoring
- ✓ Development of Ganga Gram
- ✓ Creating Public Awareness

- Under the aegis of National Mission for Clean Ganga (NMCG) & State Programme Management Groups (SPMGs), States and ULBs and PRIs will be involved in this project.

- Under the Environment (Protection) Act, 1986, a five tier structure has been envisaged at national, state and district level to take measures for prevention, control and abatement of environmental pollution in river Ganga and to ensure continuous adequate flow of water so as to rejuvenate the river Ganga as below;
  - National Ganga Council under chairmanship of Prime Minister of India (replaced National Ganga River Basin Authority).
  - Empowered Task Force (ETF) on river Ganga under chairmanship of Union Minister of Water Resources, River Development and Ganga Rejuvenation.
  - National Mission for Clean Ganga (NMCG).
  - State Ganga Committees and
  - District Ganga Committees in every specified district abutting river Ganga and its tributaries in the states.

Current Status of Ganga

- **Ganga is still far away from being clean.** It is evident in the recent report by the Central Pollution Control Board (CPCB) which found that Ganga river water is absolutely unfit for "direct drinking" and only seven spots from where it passes can be consumed after disinfection.
- The report on **'Biological Water Quality Assessment of the River Ganga (2017-18)'** shows that the water quality of the river was either clean or slightly polluted (bathing standard or having a standard which could support aquatic life) at only four out of 41 locations during the pre-monsoon phase and at only one out of 39 locations in post-monsoon period.
- The report also analysed the comparative water quality data **from 2014 to 2018, showing hardly any improvement at most of the locations in the past four years.** Water quality at some locations (Jagjeetpur in Uttarakhand and Kanpur, Allahabad and Varanasi in Uttar Pradesh) had **even deteriorated** in 2017-18 as compared to 2014-15.

Way Forward

- **Sewage treatment. The gap in the functional capacity and required capacity of STPs needs to be plugged to achieve the target.** A 2016 data compiled by CPCB shows that actual measured discharge of waste water into Ganga is 6,087 MLD, 123% higher than the estimated discharge of waste water. **This needs to be tackled effectively.**
- **Restoring the flow:** A river is a **self-purifying system** only when water flows

Progress under Namami Gange Programme:

- **Rural Sanitation:** 4,465 villages on the Ganga stem have been declared ODF and support is being provided to 1,662 Gram Panchayats along Ganga for solid and liquid waste management.
- **Urban River Management:** NMCG, in partnership with National Institute of Urban Affairs (NIUA), is preparing an **Urban River Management Plan** to protect and enhance the status of river health within the city, to prevent their deterioration and to ensure sustainable use of water resources.
  - **High-resolution Light Detection and Ranging (LIDAR) maps** of the entire Ganga stretch would be generated.
- **Industrial Pollution:** 1,109 Grossly Polluting Industries (GPIs) were identified and surveyed. The compliance of the operational GPIs in 2017 as against 2018 improved from 39% to 76%. **Zero black liquor discharge has been achieved** in Paper and Pulp industry and in distillery.
- **Water Quality: Both dissolved oxygen levels and organic pollution load has improved at multiple locations.** Multiple Real Time Water Quality Monitoring Stations (RTWQMS) are operational under Namami Gange Programme.
- **River as Public Space:** 143 ghats have been taken up under the Mission out of which 100 have been completed.
- **Sewerage Project Management:** through Hybrid Annuity Mode (HAM) and improved governance through 'One City One Operator' approach ensuring competitive and positive market participation.
- **Ecosystem Conservation:** Massive afforestation drive undertaken in the five Ganga States with total plantation of 96,46,607 leading to increase in forested area of 8,631 hectares.

through it. If the flow in the river is maintained it can solve the problem of 60-80 per cent of organic pollutants without need for such an elaborate programme.
    - According to a report published by Wildlife Institute of India in May 2018, 16 existing, 14 ongoing and 14 proposed hydroelectric projects on the Bhagirathi and Alaknanda river basins have turned the upper stretch of the Ganga "ecological deserts".
    - The **designs of hydroelectric projects can be tweaked** in such a manner that they consume less water. It may raise the cost of the projects but should be done for long-term preservation of the Ganga.
- **Sludge control: It is more important to address the Solid Liquid Waste in the ODF villages and also in urban areas.** If proper faecal sludge management is not in place, it would invariably pollute the Ganga.
- **Need to avoid cost overruns:** CAG pointed out poor financial management for the programme in its December 2017 report. It said, "Only 8- 63% of the funds were utilised during 2014-15 to 2016-17 for the river clean-up programme." This needs to be addressed.
- **Address Governance glitches:** The cleaning of the Ganga requires seamless coordination between the agencies responsible for carrying out different tasks. This calls for vision and a clear-cut governance strategy. More work needs to be done on the MOUs, which the water resources ministry signed with 10 ministries for better implementation of Namami Gange.

Minimum River Flow for Ganga

Recently National Mission for Clean Ganga has laid down the flow specifications for river Ganga to maintain a minimum river flow or ecological flow.

About Minimum River Flow

- Minimum River Flow or Minimum Environmental Flow or **E-flow** is a regime of flow in a river that mimics the natural pattern. It refers to the **water considered enough for protecting the structure and function of an ecosystem and its dependent species**.
- It means enough water is to be released in the downstream of the river system after utilizing the water for the development projects in order to ensure downstream environmental, social and economic benefits.
- It is either defined in **terms of percentage of the average flow** (monthly average or average of any predefined number of days) or in **terms of cubic meters of water flow per second.**
- It will also ensure **demand side management** of water as it will help to reduce water withdrawal from the river by adopting scientific practices in irrigation, reusing and recycling of water and regulating groundwater withdrawals for various purpose
- Uninterrupted flow of water in Ganga is also important to keep it clean through its natural ecological functions and processes.

2.4. DRAFT RIVER BASIN MANAGEMENT BILL, 2018

Why in News?

Recently, Draft River Basin Management Bill, 2018 was released by government.

Background

- **Second Administrative Reform Commision (2008)** had recommended that **River Basin Organisations (RBOs)** should be set up for each inter-State river, as proposed by **National Commission for Integrated Water resources Development, 1999** by enacting a legislation to replace the River Boards Act, 1956.
- **River Basin:** A geographical area determined by the watershed limit of the system of waters, flowing into the ocean/sea either directly or through another sovereign nation or into a natural lake having no outlet.
  - It is considered as the basic hydrological unit for planning and development of water resources.
  - There are **13 Major river basins in India** and cover 80 per cent of the population and 85 per cent of total river discharge.
  - The major river basin is **the Ganga-Brahmaputra-Meghna**, which is the largest with catchment area of about 11.0 lakh km2 (more than 43% of the catchment area of all the major rivers in the country).
- **Need:** A lack of integrated river basin management often results in decision-making dominated by powerful economic sectors such as navigation, dam construction and intensive agriculture.

Advantage of River Basin Management (RBM)

- **Economic Importance:** River Basin absorb and c hannel the run-off from snowmelt and rainfall, which can provide fresh drinking water as well as access to food, hydropower, building materials (e.g. reeds for thatching), medicines and recreational opportunities.
- **Control Water Pollution**: They are natural 'filters' and 'sponges', and play a vital role in water purification, water retention and regulation of flood peaks.
- **Ecosystem Service**: They act as a critical link between land and sea, providing transportation routes for people, and making it possible for fish to migrate between marine and freshwater systems.
- **Biodiversity Conservation**: RBM combine both terrestrial (e.g. forest and grassland) and aquatic (e.g. river, lake and marsh) components, thereby providing a wide diversity of habitats for plants and animals.

Some highlights of Bill

- **Repeal River Boards Act,1956:** which was enacted with a declaration that centre should take control of regulation and development of Inter-state rivers and river valleys in public interest. However, not a single river board has been constituted so far.
- **River Basin Authorities (RBA):** It seeks to establish 13 RBAs for development, management, and regulation of waters of an inter-state river basin, consisting of a Governing Council and an Executive Board.
- **Binding Decision**: Recommendations of the authority will be binding on all states within the river basin, except those concerning sharing of inter-state river waters. The dispute between two or more states will go to the **Inter-State River Water Disputes Tribunal** only if governing council of the concerned authority fails to address it.

Principle governing River Basin Development, Management and Regulation according to the Draft bill

- **Cooperation:** Basin States shall participate and cooperate in best interest of the nation, in the development, management and regulation of waters of inter-State river basin for the mutual benefit of the basin States and the Indian Union.
- **Equitable and Sustainable Utilisation of water**: Basin States shall in their respective territories develop, manage and regulate the waters of an inter-State river basin in an equitable and sustainable manner.
- **Water as a Common Pool Community Resource:** Water needs to be managed as a common pool community resource held, by the State, under public trust doctrine to achieve food security, support livelihood, and ensure equitable and sustainable development for all.
- **Demand Management:** The demand management of water needs to be given priority, especially through:
  - Evolving an agricultural system which economizes on water use and maximizes value from water.
  - Bringing in maximum efficiency in use of water and avoiding wastages.

Related news – Planning for River Basin

Urban River Management Plan for Ganga River Basin (GRB) – Recently, at the India Water Impact Summit, there were calls for a dedicated plan having a planning horizon of 25 years for comprehensive riverbank management of Ganga along with wastewater management in the town.

- **Why URMPs are essential?**
  - At the present time, many projects on riverbank and wastewater management in various towns are being sanctioned by various ministries under various programmes with the general objective of improvement of the state of rivers in the GRB.
  - However, in the absence of URMPs, it appears that the micro-level planning that is required for obtaining the optimal benefits from such projects is not in place.
  - Preparation of URMPs thus provides the underlying planning structure that is required for obtaining the optimal benefits from implementation of such projects.
- **Salient Features of Proposed URMPs**
  - Removal of encroachments and land acquisition for riverbank beautification and related development works.
  - **Restriction/banning of certain activities** on the riverbank or in the river, viz., open defecation, disposal of solid waste, washing of clothes, etc.
  - **Development/restoration of the riverbank area**, i.e., construction / restoration of ghats, provision of public baths and toilets, etc.
  - **Prevention of the discharge of treated and untreated sewage into the river** through construction of sewers and 'nala' diversion works.
  - **Disposal of sludge** generated due to sewage treatment in an acceptable manner and **reuse of sludge and sludge-derived products**, i.e., manure, compost, etc. within the town and/or elsewhere.
- **URMPs vs Other City-Specific Development Plans**
  - City-specific development plans, e.g, city master plans, city development plans, etc. are **'city-centric'**, i.e., their main objective is the development in the town and not necessarily the prevention and management of adverse impacts to the riverbank and the river.
  - In contrast, the proposed URMP is a **river-centric plan**, whose main purpose is the delineation of a roadmap for prevention and management of adverse impacts on river bank and the river from adjoining urban centers.

3. LAND DEGRADATION

3.1. LAND DEGRADATION NEUTRALITY

Why in news?

Recently a session was held at United Nations Convention to Combat Desertification (UNCCD) to review the first global assessment of land degradation, which seeks to achieve Land Degradation Neutrality (LDN) by 2030.

About LDN

- As per the UNCCD definition, LDN is a state whereby **the amount and quality of land resources,** necessary to support ecosystem functions and services and enhance food security, **remains stable or increases** within specified temporal and spatial scales.
- It is a unique approach that counterbalances the expected loss of productive land with the recovery of degraded areas.
- The **overarching principle for LDN** includes:
  - **Avoid**: Land degradation can be avoided by addressing drivers of degradation and through proactive measures to prevent adverse change in land quality and confer resilience, via appropriate regulation, planning and management practices.
  - **Reduce**: Land degradation can be reduced or mitigated on agricultural and forest land through application of sustainable management practices.
  - **Reverse**: Where feasible, some of the productive potential and ecological services of degraded land can be restored or rehabilitated through actively assisting the recovery of ecosystem functions.
- LDN can prevent Soil erosion, desertification, water scarcity, migration insecurity and income inequalities caused by land degradation. Thus, it helps in **combating the impacts of climate change.**

India and LDN

- India has adopted the same goal of achieving LDN by 2030 as adopted under SDG.
- In 2011-2013, India's land degradation area totaled 29.3% of India's total land area, representing an area of 96.4 million hectares.
- As per a study by **The Energy and Resources Institute (TERI),** Desertification, Land Degradation and Drought (DLDD) cost India about 2.54 per cent of its Gross Domestic Product (GDP) i.e. $47 billion in 2014-15.
- **State of India's Environment 2019** shows that 30% of India's total geographical area being affected by land degradation. 82% of these degraded land lies in just nine states: Rajasthan, Maharashtra, Gujarat, Jammu & Kashmir, Karnataka, Jharkhand, Odisha, Madhya Pradesh and Telangana.
  - It shows 1.87 million hectares of land in the country faced process of desertification between 2003-13 period.
  - Water erosion alone was responsible for nearly 11% of total desertification in the country followed by vegetation degradation (nearly 9%).
- **Water erosion followed by vegetation degradation and wind erosion** are the major reasons for desertification in India.

Global scenario in Land Degradation

- 20% of the world's healthy land degraded in last 15 years and impacted over 3.2 billion people in the world.
- Artificial areas development (e.g. urbanization) account for highest lands diversion with 32.2 per cent growth in the 2000-2015 period (addition of 1, 68, 000 sq.km).
- The economic costs of desertification and land degradation are estimated at USD 490 billion per year.

Steps taken to achieve LDN

- Achieving land degradation neutrality by 2030 is one of the targets within **Sustainable Development Goals** adopted in 2015.
- **LDN Target Setting Programme**: Under this, UNCCD is supporting interested countries in the national land degradation neutrality (LDN) target setting process, including the definition of national baselines, targets and associated measures to achieve LDN.
- **Creation of an LDN fund** to invest in bankable projects on land rehabilitation and sustainable land management worldwide including sustainable agriculture, sustainable livestock management, agro-forestry, etc.
- UNCCD releases **the Global Land Outlook** which demonstrates the central importance of land quality to human wellbeing, assesses current trends in land conversion, degradation and loss, identifies the driving factors and analyzes the impacts etc.
- **The Land for Life Programme** was launched at UNCCD Conference of the Parties (COP) 10 in 2011 to confront the challenges of land degradation and desertification.

- In India, **National Action Plan** (NAP) to combat desertification was launched in 2001 for 20 years.
- **Desertification and Land Degradation Atlas** (2016) of entire country was prepared by ISRO and 19 other partners using Indian remote sensing satellites data in GIS environment.
- At the UNFCCC's CoP 2015 in Paris, the government of India made **a Bonn Challenge pledge,** (a global effort to bring 150 million hectares of world's deforested and degraded land into restoration by 2020 and 350 million hectares by 2030).
- Schemes like Integrated Watershed Development Program, Per Drop More Crop, National Afforestation Program, National Green Mission, etc. have components to tackle Land degradation.

Related news

India has launched a pilot project to restore degraded forest landscapes in five states to enhance the capacity **on forest landscape restoration (FLR).**

- The project will be implemented by **National Afforestation and Eco-Development Board** (NAEB) in partnership with the **International Union for Conservation of Nature (IUCN).**
- **Forest landscape restoration (FLR):** manifests through different processes such as: new tree plantings, managed natural regeneration, agroforestry etc.
- FLR interventions aim to restore multiple ecological, social and economic functions across a landscape and generate a range of ecosystem goods and services.
- FLR actively engages stakeholders at different scales, including vulnerable groups, in planning and decision-making.

Way forward

To reduce land degradation, the increasing pressures on land resources should also be reduced. In this context, Global Land outlook by UNCCD outlines certain pathways that producers, consumers, governments and corporations can follow to stabilize and reduce pressure on land resources:

- **Multifunctional landscape approach:** Prioritizing and balancing different stakeholder needs at a landscape scale while identifying those land uses in Land-use planning that best meet the demands of people towards safeguarding biodiversity.
- **Farming for multiple benefits**: The agricultural practices should be shifted in a way to support a wider array of social, environmental, and economic benefits and optimize the most desirable suite of ecosystem services from food production activities.
- **Managing the rural-urban interface**: Cities designed for sustainability in the wider landscape can reduce environmental costs of transport, food, water, and energy, and offer new opportunities for resource efficiency.
- **No net loss of healthy and productive land** by providing incentives for the sustainable consumption and production of natural resources. For eg: incentivizing reduction in the current levels of food waste and loss.
- **Creating an enabling environment** to scale local successes into large-scale through stakeholder engagement, land tenure, gender equality, and the availability of sustained investment and infrastructure.

4. WASTE MANAGEMENT

4.1. EXTENDED PRODUCERS RESPONSIBILITY (EPR)

Why in news?

Over the last one year, the CPCB has begun imposing Extended Producer Responsibility waste-recovery targets.

Introduction

- An effective way of waste management is to encourage manufacturers to design environmentally friendly products by holding producers responsible for the costs of managing their products at end of life because the producers have the greatest control over product design and marketing; these same companies have the greatest ability and responsibility to reduce toxicity and waste. This is the idea behind the policy of **extended producer responsibility (EPR).**
- Organisation for Economic Co-operation and Development (OECD) countries, Japan and China etc., are some of the countries which have benefited themselves out of the EPR programmes.

EPR in Indian Context

In India, the principle of EPR has been an integral part of the waste management rules for used lead acid batteries (ULABs), e-waste, and plastics.

- The **E-Waste (Management and Handling) Rules, 2011 introduced the concept of EPR for the first time in India** which made all the producers of electronic goods responsible for the waste production management.
- The amendment to the e-waste policy, with the new E-Waste (Management) Rules, 2016, set stringent targets for the producers to collect and recycle end-of-life products of their goods.
- The EPR policy also finds place in **Plastic Waste Management Rules, 2016** as well as the **Solid Waste Management Rules, 2016.**

Liabilities under EPR

The extended producer responsibility entails **three liabilities** and the extent of these liabilities is determined by legislation. These three liabilities are described below:

- ***ECONOMIC RESPONSIBILITY*** means that the producer will cover all or part of the expenses, for example, for the collection, recycling or final disposal of products he is manufacturing. These expenses could be paid for directly by producer or by a special fee.
- ***PHYSICAL RESPONSIBILITY*** is used to characterize the systems where the manufacturer is involved in the physical management of the products and/or their effects. The manufacturer may also retain ownership of his product throughout the product's lifecycle and therefore be responsible for environmental damage caused by it.
- ***INFORMATIVE RESPONSIBILITY*** signifies several different possibilities to extend responsibility for the products by requiring the producers to supply information on the environmental properties of the products they are manufacturing.

Challenges in EPR Compliance in India

- The e-waste rules, 2016 state that the companies have to meet the collection target in a phased manner, which shall be 30% of the estimated quantity of waste generation during first two year of implementation of Rules. However, **it lacks the mechanism to verify the claims** of these companies.
- The waste management **rules primarily focus upon the formal sectors of recycling** even though most of the recycling is handled by informal sector. Further, it does not even provide incentives for the informal recyclers either to sell to the formal recyclers or to formalise.
    - In the present system, dealers have **no incentive to collect the waste and send it for formal recycling**. A **strong presence of the informal sector** and the frequent visits of kabadiwalas pushes the dealers to channelise the waste to informal recyclers.
- The rules make the producers responsible only for the waste arising from their own products. The existence of **an illegal market or "grey market" for electrical and electronic equipment (EEE)** and

unknown producers in India make it difficult to identify all the producers. This results in the production of a large amount of unaccounted waste.
    - In addition, a **large amount of WEEE is illegally imported** into India, which adds to the already significant amount of domestic WEEE.
- Considering the **low scale of operational and locational aspects (of producers and users),** it may not be economically viable and physically feasible for each and every producer to establish an e-waste recycling unit either individually or collectively, nor will it be feasible for them to set up collection centres individually or collectively.
- The **dearth of proper recycling infrastructure** in the country also makes it difficult to observe the take-back scheme.

Way Forward

- **Integrating informal recycling with formal recycling:** An EPR mechanism which integrates the informal collection system, comprising of kabadiwalas and scrap dealers, with the formal recycling system and the elimination of informal recycling units, will enhance the collection efficiency of the separate collection agencies set up by the producers.
- **Outsourcing the responsibility of collection** of end-of-life products by the producers to separate collection agencies or producer responsibility organisation (PRO) is key to the success of EPR schemes. The latest rules for electronic and plastic waste are in line with this.
- The latest rules have a **provision for a financial role of retailers or dealers** in implementing the deposit refund system (DRS) or the take-back system. **This is a matter of concern**, because retailers are the major leakage point from where the flow of waste gets channelised into the informal sector. This need to be plugged through integration of informal recycling into the formal waste management.

Informal Economy in waste management of india

Though India has rules on every aspect of waste management but the implementation is a problem. Due to lack of new technologies, tools and techniques, the **waste recycling industry is largely driven by the informal sector which is estimated to account for almost 90% of waste recycling in India.**

Benefits of Informal Waste Management

- It is an **extremely competitive supply chain**, there are large tensions between the informal and the formal waste sectors on sourcing high value plastics and pricing. The informal sector, in a **decentralized approach**, competes very well in this area, despite very poor conditions.
- **Informal recycling improves industrial competitiveness in two main ways**.
    - First, materials recovered by waste pickers are generally cheaper than virgin materials.
    - Second, recycling requires less energy than obtaining virgin raw materials, lowering industry's operating costs.

- Recycling by waste pickers **saves municipalities money** by reducing the volume of waste that needs to be collected, transported, and disposed of. By some estimates, ragpickers save almost 14% of the municipal budget annually In India.

Problems with Informal Waste Management:

- **Poor working conditions**, exposure to hazardous waste without protective gloves and masks and prevalence of child labour are serious issues with the informal waste management.
- Often, they don't get their due share in the economic benefit. It hampers their income and also their bargaining power in the market.
- There is a **real capital crunch** among the waste collectors that prevents them from generating higher volumes. Moreover, **lack of proper knowledge** about the various wastes and their potential with regards to the health hazards and economic gains limits the benefits.

Potential benefits of integration with formal sector

- **One of the main benefits of formalization** is the possibility of entering into agreements or contracts for recycling programs with separation at source. Recovering materials that have been separated at source raises the productivity and incomes of waste pickers by freeing them from having to walk several miles a day in search of materials.
- By taking their work out of dumpsites, it also **greatly reduces health risks** from contact with waste. The recyclables gathered are sold or given to waste picker organizations.
- **Formalization** could be a significant step to **control the child labour** and ensure **better health** and **education**.
- Legalisation would also ensure **better price** for their collected waste.

4.2. CONSTRUCTION AND DEMOLITION (C&D) WASTE MANAGEMENT IN INDIA

Why in News?

The Supreme Court has created a flutter by staying construction activity in States that do not have a **solid waste management policy.**

Data and Facts

- **Construction accounts for nearly 65 per cent of the total investment in infrastructure.**
- **25-30 million tonnes of C&D waste is generated annually** in India of which only **5 per cent is processed.**
- According to studies, **36 per cent of C&D waste comprises soil, sand and gravel.** With rampant sand mining having destroyed riverbeds, worsening the impact of floods, there is a crying need to recycle C&D

About C&D waste

- It is generated during the construction, renovation, and demolition of buildings or structures. These wastes include materials such as concrete, bricks, wood and lumber, roofing, drywall, landscape and other wastes.
- There is a **huge demand of aggregates in the housing and road sectors** but there is **significant gap in demand and supply**, which can be reduced by recycling construction and demolition waste to certain specifications.

Issues and Challenges

- It **impacts soil fertility** and is a **health hazard** in urban areas.
- The virtual absence of recycling also goes **against India's commitments with respect to carbon emission reduction.**
- There is **neither strong social awareness nor enough political will** to promote recycling.
- Waste collection and segregation mechanism is **largely unorganised** leading to scrap contamination.
- Most municipal **infrastructure is outdated and inadequate** in terms of collection, transportation and scrap yards.
- Appropriate **technologies** to maximise recovery from recycling are still nascent.

- While some of the items like bricks, tiles, wood, metal etc. are re-used and recycled, **concrete and masonry, constituting about 50% of the C&D waste is not currently recycled** in India.
- The private contractors remove this waste to privately owned low-lying land for a price or more commonly, **dump it in an unauthorized manner** along roads or other public land.
- The Central Pollution Control Board's **Waste Management Rules of 2016** and the **Guidelines in 2017** spelt out clear timelines on formulating policies, identifying sites for processing and commissioning these, but there has been no action on the ground.

Initiatives to promote recycling of C & D waste in India

- The **Swachh Bharat Mission** envisages processing of 100% solid waste generated in cities / towns by October 2019 as a key objective, which includes C & D wastes.
- Ministry of Urban Development directed States to set-up **ecofriendly C & D recycling facilities** in all cities with a population of over 10 lakhs.
- The **Bureau of Indian Standards and Indian Roads Congress** shall be responsible for preparation of code of practices and standards for use of recycled materials and products of construction and demolition waste in respect of construction activities.
- **Building Material & Technology Promoting Council** in 2016 released "Guidelines for utilization of C & D waste in construction of dwelling units and related infrastructure in housing schemes of the Government".
- **Central Pubic Works Division's** "Guidelines for Sustainable Habitat" discusses 'Guidelines on reuse and recycling of Construction and Demolition (C & D) waste.

Benefits of reducing the Disposal of C&D Materials

- **Environmental-** It **reduces demand for energy and water** in manufacture of building materials from mined / naturals resources (thereby reducing GHGs and environmental impacts arising from mining, manufacturing and transportation).
  - Along with need for **fewer disposal facilities** it reduced the need for space for disposing it off.
- **Economical-** It can also **create employment** and economic activities in recycling industries.
  - **It reduces overall building project expenses** through avoided purchase/disposal costs and reducing transportation costs by onsite reuse.
  - Recycling will reduce housing costs, given the materials shortage, and should be an integral aspect of **'affordable housing'.**

Construction & Demolition (C&D) Waste Management Rules, 2016: Among various things, following are some of the most important provisions under the guidelines-

- **At Individual level**: Every waste generator shall **segregate construction and demolition waste** and deposit at collection centre or handover it to the authorised processing facilities.
    - Large generators shall **segregate the waste into four streams** such as concrete, soil, steel, wood and plastics, bricks and mortar. They shall ensure that there **is no littering or deposition** to prevent obstruction to the traffic or the public or drains.

'Sustainable Model' on C&D waste management: The key components of a **'Sustainable Model'** on C&D Waste Management Rules, 2016 can include the following:

- **Practical estimation** of C&D waste generation
- **Identified sites and timely acquisition** of land for development of integrated C&D processing facilities with necessary approval from local administration / civic bodies
- **Specifications / standards for recycled C&D waste** products for quality acceptance
- **List out and mandate use of recycled products** from C & D wastes
- **Penalty** - Landfill levy
- **Map water bodies** in a city / region – encroachment of water bodies in cities for generating 'land' is a common practice observed in several cities.
- **Research on economically viable C & D recycling** options
- **Awareness campaign** – tools for sensitization of general public.

- **At Local level**: The service providers shall prepare a **comprehensive waste management plan** for waste generated within their jurisdiction.
    - Service providers shall **remove all construction and demolition waste** in consultation with the concerned local authority on their own or through any agency.
- **At State level**: The concerned department in the State Government dealing with land shall **provide suitable sites for setting up of the storage, processing and recycling facilities** for C&D waste.
- **At national level:** The Central Pollution Control Board shall prepare **operational guidelines related to environmental management** of C&D waste and **Indian Roads Congress** need to prepare standards and practices pertaining to products of C&D waste in roads construction.
- The processing / recycling site shall be **away from habitation clusters, forest areas, water bodies,** monuments, National Parks, Wetlands and places of important cultural, historical or religious interest.

Conclusion

To make the efforts put forth in the direction of C&D waste management, following a **"Sustainable Model"** may further accelerate the results.

4.3. WASTE-TO-ENERGY (WTE) PLANTS

Why in News?

Recently, residents of Okhla and surrounding areas in Delhi have been protesting against WtE plant in their vicinity.

Types of Technique at WtE

- **Incineration** It uses MSW as a fuel, burning it with high volumes of air to form carbon dioxide and heat. In a waste-to-energy plant that uses incineration, these hot gases are used to make steam, which is then used to generate electricity.
- **Gasification** is a process that converts organic or fossil fuel based carbonaceous materials into carbon monoxide, hydrogen and carbon dioxide.
- **Pyrolysis** involves application of heat with no added oxygen in order to generate oils and/or syngas (as well as solid waste outputs) and requires more homogenous waste streams.
- **Biomethanation** is a process by which organic material is microbiologically converted under anaerobic conditions to biogas. It involves fermenting bacteria, organic acid oxidizing bacteria, and methanogenic archaea.

Background

- According to **Ministry of New and Renewable Energy** estimates, the solid waste generated from cities/towns in India has a potential to generate power of approximately 500 MW, which can be enhanced to 1,075 MW by 2031 and further to 2,780 MW by 2050.
- **Current Capacity**: There are five municipal Waste to Energy plants operational in India, with a total capacity to produce 66.4 MW electricity per day, of which 52 MW per day is generated in Delhi.
- Currently, there are 40-odd WTE plants at various stages of construction.

Need of Waste to Energy Plants

- **Problems of unscientific Municipal Solid Waste (MSW) disposal:** Only about 75- 80% of the municipal waste gets collected and out of this only 22-28 % is processed and treated and remaining is disposed of

indiscriminately at dump yards. It is projected that by the year 2031 the MSW generation shall increase to 165 million tonnes and to 436 million tons by 2050.

- **Harmful emission from Landfills**: Organic decomposition of food waste mixed with municipal solid waste at landfill sites leads to high amounts of emissions which is also a public health issue.

Advantages of Waste to Energy (WtE) Plants

- **Net Greenhouse Gas Reducer**: Methane is a greenhouse gas which is mostly emitted from decomposing waste in landfills. WtE facilities avoid the production of methane while producing almost ten times more electricity from each ton of waste compared to landfills.
- **Resource savings and recovery greatly expanded:** Metals left in the municipal solid waste stream can be extracted from the ash resulting from incineration and the metals can be recycled.
- **24*7 Electricity**: WTE facilities, unlike wind and solar, are capable of providing 24*7 renewable electrical power.
- **Landfill usage and expansion greatly reduced**: Waste to energy facilities typically reduce waste volumes by 90%. Fewer and smaller landfills are needed to process.
- **Transportation of waste long distances** can be greatly reduced with a waste to energy facility in a community, resulting in less air pollution.

Challenges

- **Low Calorific Waste**: Municipal waste in India is often **not segregated properly**. It has a very high biodegradable (wet) waste content ranging anywhere between 60 and 70 per cent of the total, compared with 30 per cent in the West. This gives our waste a **high moisture content and low calorific value**. In Delhi, for example, only 12 per cent of the waste can be thermally treated through incineration technologies.
- **High Toxic Waste:** Incinerators develop toxic ash or slag, containing heavy metals and gas pollutants which are toxic (corrosive impact) and pollute underground water.
- **Expensive power:** Compared to Rs 3-4 per kWh from coal and solar plants, WTE plants sell electricity at about Rs 7/kWh.
- **Lack of Finance for Urban Local Bodies (ULBs)** affects institutional capacity necessary for integrated management of municipal solid waste, which requires investments for WtE projects.
- **Other Challenges include** irregular and inadequate quantity of supply; non-payment of agreed fee and non-marketability of waste processed projects, including power.

Way Forward

- **Improved MSW collection system**: Separate collection and transportation of domestic waste (including trade & institutional waste), inert wastes such as street sweepings, silt from surface drains and Construction & Demolition wastes should be ensured by the municipal authorities.
- **Encourage Private Partnership** in building WtE plants as recommended by Task force on WtE (2014) headed by K Kasturirangan.
- **Amendment to Electricity Act-2003** to include a provision for State Electricity Discoms to mandatorily purchase all power generated from municipal solid waste at a tariff decided through competitive bidding.
- **Strict enforcement** to ensure the waste is not mixed at the source of generation and then that the handling of waste is in unmixed streams.
- **Alternative to WtE Plants**: Since WtE technologies are being phased out in the West, they should not be allowed unless the waste offered meets the criterion specified by the Solid Waste Management Rules 2016. Other option could be explored like composting and bio-methanation.
- **Role of urban local bodies (ULBs): Standing Committee on Energy report on Power Generation** from Municipal Solid Waste suggested for increased grants to states and ULBs to maximise waste collection efficiency and also recommended to **integrate ragpickers and kabadiwalas** within the formal system.
    - **Setting up of Monitoring Committee**, consisting of representatives from all the central ministries along with the representatives of the state governments and ULBs, to coordinate efforts at each level, and suggest methods and technologies to be adopted to make the waste-to-energy plants successful.
- **Participation of civil society:** Municipal Authorities should make concerted efforts to involve civil society in managing their waste and motivate Resident Welfare Associations (RWA), Community-Based

Organisations/ NGO's to take up work of **community awareness** and door to door collection to facilitate resource recovery and **waste minimization** by implementing the **'5R' Concept:** reduce, reuse, recover, recycle and remanufacture.

Government Initiative

- NITI Aayog in its **Three-Year Action Agenda 2017-18 to 2019-20** has suggested that municipal solid waste be burnt to produce energy. **Some proposals are:**
  - **Composting and biogas are not sustainable** since they generate by-products or residues in large quantities. Only incineration, thermal pyrolysis and plasma gasification technologies offer sustainable disposal solutions.
  - **Incineration is preferable to pyrolysis** (which is unsuited for our municipal solid waste) and plasma technology (which is too costly).
  - Setting up **Waste to Energy Corporation of India**, under the Ministry of Urban Development, to speed up the process of cleaning municipal solid waste.
- **Program on Energy from Urban, Industrial and Agricultural Waste/Residue** for creating conducive conditions and environment with fiscal and financial regime to develop, demonstrate, and disseminate utilization of wastes and residues for recovery of energy.
  - **Central financial assistance (CFA)** in the form of capital subsidy and grants-in-aid will be provided for biogas production from industrial waste, sewage treatment plants, etc.
- **Swachh Bharat Mission (SBM),** 100% scientific processing and disposal of municipal solid waste is envisaged by 2019. WTE plants are key to Mission since they lead to the most scientific disposal of waste. Niti Aayog has, under the Swachh Bharat Mission, set a target of constructing 800 megawatt (MW) of WTE plants by 2018–19, which is ten times the capacity of all the existing WTE plants put together.
- **India's Solid Waste Management policy** requires that wet and dry wastes should not be mixed so that only non-compostable and non-recyclable wastes with at least 1500 Kcal/kg should reach WtE plants.

4.4. PLASTIC POLLUTION

4.4.1. PLASTIC WASTE

Why in news?

Recently, more than 25 states in the country have failed to submit their **respective action plans on systematic disposal of plastic waste** to the Central Pollution Control Board (CPCB) due till the deadline of April 30, 2019.

Background

- A 2017 report by the **Central Pollution Control Board (CPCB)** pegs the amount of plastic waste generated in India at 25,940 tonnes per day.
- India notified the **Plastic Waste Management Rules in 2016**, which replaced the earlier Plastic Waste (Management and Handling) Rules, 2011.
- As per the **Rule '17(3)'**of the rules, each State Pollution Control Board or Pollution Control Committee shall prepare and submit the Annual Report to the CPCB on the implementation of these rules by the **31st July of each year.** However, inaction on the states' part made the CPCB approach the **National Green Tribunal (NGT)** to enforce the implementation of plastic waste management rules by non-compliant states.
- The NGT in March 2019, ordered all states and UTs (**except for Andhra Pradesh, Sikkim, West Bengal, and Puducherry**) to submit action plans for implementing Plastic Waste Management Rules, 2016 by **April 30, 2019.** The court had also said that failure to do so would invite a **penalty of Rs 1 crore per month**.
- However, 25 states failed to send their action plans to the Central Pollution Control Board (CPCB) by the designated date.

Impact of plastic Pollution

- **Environmental Pollution:** According to a 2014 toxics link study on plastic waste, it contributed directly to ground, air and water pollution.
  - **Soil Pollution:** Toxic chemicals leach out of plastic through landfill site, is linked to decreasing crop productivity, impacting food security, birth defects, impaired immunity, endocrine disruption and other ailments

  - **Poisoning Ocean**: Every year, up to 13 million tons of plastic leak into our oceans, where it smothers coral reefs and threatens vulnerable marine wildlife. The plastic that ends up in the oceans can circle the Earth four times in a single year, and it can persist for up to 1,000 years before it fully disintegrates.
  - **Air Pollution**: Disposing of plastic waste by burning it in open-air pits releases harmful gases like furan and dioxin.
- **Health Impact**: Plastic bags often provide breeding grounds for mosquitoes and pests thus increase the transmission of vector-borne diseases like malaria.
- **Bioaccumulation**: Plastic bags are often ingested by animals who mistakenly taken them for food due to which toxic chemicals entered the human food chain.

Plastic Waste Management Rules, 2016 (as amended in 2018)

- **Defines minimum thickness of plastic carry bags** i.e. 50 microns. This would increase the cost and the tendency to provide free carry bags would come down.
- **Responsibility of different stakeholders-**
  - **Local Bodies-** Gram sabha will implement in rural areas.
  - **Producers and Brand owners-** have extended producer responsibility
  - **Waste Generator-** shall segregate and store their waste as per Solid Waste Management Rules, and handover segregated wastes to authorized waste disposal facilities
  - **Street Vendor-** Not to provide such carry bags or fine would be imposed. Only the registered shopkeepers on payment of a registration fee to local bodies would be allowed to give out plastic carry bags on charge.
  - **Producers-** are to keep a record of their vendors to whom they have supplied raw materials for manufacturing.
- **Promote the use of plastic** for road construction or energy recovery.
- **A Central Registration System** for the registration of the producer/importer/ owner.
- **Phasing out of Multi-layered Plastic (MLP) is applicable only to MLP** that are "non-recyclable or non-energy recoverable or have no alternate use".

- **Financial Loss**: The total economic damage to the world's marine ecosystem caused by plastic amounts to at least $13 billion every year.
- **Exuberating Natural Disaster**: Encroachment and clogging of city drainage with plastic and solid waste often leads to suburban flooding e.g. Mumbai's experience of annual flooding like situation during monsoon season due to water clogging etc.
- **Social Cost**: The social damage continuously being inflicted is inestimable as every sphere of life get affected by it like tourism, recreation, business, the health of humans, animals, fish and birds.

Challenges in addressing Plastic Pollution

- **Not prioritized by the state authorities-** Waste management is the last in the list of priorities of municipal corporations. Many States/UTs have not constituted **State Level Monitoring Committee (SLMC) Body** to monitor implementation of PWM Rules.
- **Lack of expertise-** among the state pollution control boards and the dearth of understanding of the scale of the plastic waste challenge.
- **Presence of a communication gap** between the state and central government officials.
- **Poor response of companies/ producers-** which are mandated to set up systems either individually or collectively in cities to ensure the collection of non-recyclable waste. They are supposed to submit their plans to states, which has been founding lacking till now.
- **Lack of accurate data-** Only 14 of India's 35 state pollution control boards filed information on plastic waste generation in 2017-18, as per CPCB. The states have been unable to gather real-time data on its generation.
- **Large-scale presence of informal sector-** Over 90 percent of the plastic industry is informal, thus trying to reach and work with these manufacturers becomes a challenge. It is further compounded due to presence of illegal units.

Way Forward

- The Centre and state should conduct **awareness programmes** and **capacity building exercises** to educate **state-level officials** to carry out necessary measures to segregate plastic and dispose it.
- To manage plastic waste, it is imperative for states to **devise plans based on real-time targets** and have companies and plastic manufacturers on in the loop.
- The **informal sector** needs to be given proper recognition, including adequate space, access to waste, storage and recognised plastic collection centres. States should plan to incentivise the informal sector to

collect single-use plastic and other plastics which have low or no value, so that they get properly disposed of.

- For **use of alternatives to plastics**, consumer awareness campaigns need to be devised. Further, the alternatives should be made available at lower prices for consumers to move away from plastics. For this, alternative industries should be promoted so as to reduce their prices.
- A **multi-stakeholder action plan** should be put in place by the states to consider reduction, focus on low value or no value of plastics and include the informal sector, enabling them to become entrepreneurs. The State Urban Development Authorities should incorporate PWM Rules, 2016 in Municipal Byelaws for its effective implementation.

Additional Information

- **Single-use plastics**: Also referred as disposable plastics, are commonly used for plastic packaging and include items intended to be used only once before they are thrown away or recycled. They have a higher carbon footprint and are more resource and water intensive to produce.
  - **Single use plastics are the most challenging to tackle**. Single-use plastics or disposable plastics are commonly used for plastic packaging, **accounting for 36% of 400 million tonnes of plastic produced annually**, and other items, grocery bags, food packaging, bottles, straws, containers, cups and cutlery.

Why single use plastic is a challenge?

- **Difficultly in collection:** Many times, the packaging is not effectively collected, ending up in landfills and drains in the cities and these single-use plastic items clog rivers, other water bodies and finally ending up in the ocean.
- **Higher cost of collection:** The design of plastics and plastic-containing products is often a barrier to higher rates of plastic collection and recycling.

Recent efforts to tackle the Single use Plastics

India has pledged to phase-out all single use plastics by 2022. However, India's efforts at piloting a resolution at the fourth United Nations Environment Assembly for a global phase-out of single use plastics by 2025 failed in the face of strong opposition from the United States.

4.4.2. OCEAN CLEANUP

Why in news?

Recently, the Ocean Cleanup project was started in the Pacific Ocean.

About Ocean Cleanup Project

- Ocean Cleanup is a non-profit organisation which is developing advanced technologies to rid the world's oceans of plastics.
- It is directed at cleaning The **Great Pacific Garbage Patch (GPGP)** which is a zone between Hawaii and California. About 1.8 Trillion pieces of plastic float the surface of the GPGP.

About Ocean Plastic Waste

- Of the 8.3 billion tonnes of plastic produced, 6.3 billion tonnes have been discarded. Every year, nearly 13 million tonnes of plastic waste are added to oceans. Given their durability, **plastics do not decompose.**
- The **main sources of marine plastic** are **land-based**, from urban and storm runoff, sewer overflows, beach visitors, inadequate waste disposal and management, industrial activities, construction and illegal dumping.
  - **Ocean-based plastic** originates mainly from the fishing industry, nautical activities and aquaculture.
- **Situation in India:** According **to Litterbase database**, seas near Mumbai, Kerala and the Andaman and Nicobar Islands are among the worst polluted in the world.
- Marine plastic gets trapped in the **gyres** (revolving water system in the world's oceans) which under the influence of solar UV radiation, wind, currents and other natural factors, breaks down into **micro-plastic** (particles smaller than 5 mm) or **nano plastics** (particles smaller than 100 nm) and becomes harmful for marine as well as human life.
  - The **Great Pacific Garbage Patch** is the largest collection of marine debris in the North Pacific Ocean gyre.
- **Financial cost:** US$13 billion a year is the cost of environmental damage as plastic wreaks havoc on fisheries, marine ecosystems and economies.

Impact of Increasing level of Plastics in Ocean

- **Bioaccumulation**: Many persistent organic pollutants (for example, pesticides, PCBs, DDT, and dioxins) float around the oceans at low concentrations, but their hydrophobic nature concentrates them on the surface of plastic particles. Marine animals mistakenly feed on the microplastics, and at the same time ingest the toxic pollutants. The chemicals accumulate in the animal tissues and then increase in concentration as the pollutants are transferred up the food chain.
- **Leaching of harmful chemical**: As the plastics degrade and become brittle, they leach out monomers like Bisphenol A which can then be absorbed by marine life, with relatively little-known consequences.
- **Threat to Biodiversity**: Beside the associated chemical loads, ingested plastic materials can be damaging for marine organisms, as they can lead to digestive blockage or internal damage from abrasion. There is still much research needed to properly evaluate this issue.
- **Source of vector borne diseases**: Being so numerous, microplastics provide abundant surfaces for small organisms to attach. This dramatic increase in colonization opportunities can have population-level consequences.

Microplastics

- **Microplastics or Microbeads** are plastic pieces or fibre which is very small, generally measuring less than 5 mm.
- They have a variety of use, most notably being personal care products like toothpaste, body creams, clothing and industrial use.
- They have an ability to spread easily and provide silky texture and colours to the product. Thus, adding visual appeal of the cosmetic products.

Challenges in Tackling Plastics Debris

- **Ubiquitous Transboundary Movement of marine plastics and microplastics:** It is becoming a major concern as their property of durability makes their debris remain intact for long period of time throughout the ocean.
- **Ineffective Waste Collection**: Greatest burden of plastic waste entering the sea is likely to arise where waste collection systems are ineffective or even non-existent.
- **Lack of resources with less developed countries:** Less developed and developing countries in particular may face challenges in managing the rapidly growing volume of plastic waste.

Other Steps taken for tackling Plastic Debris

- **Blue Flag Beach Certificate Standards**
  - Certificate is given to environment-friendly and clean beaches, equipped with amenities of international standards for tourists. These standards were established by the Copenhagen-based Foundation for Environmental Education (FEE) in 1985.
  - **Chandrabhaga beach on the Konark coast of Odisha** is the first in Asia to get the Blue Flag certification.
- **UN Environment launches #CleanSeas campaign**: Its objective is to eliminate major sources of marine litter, Microplastics in cosmetics and the excessive, wasteful usage of single-use plastic by the year 2022.
- **Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal:** It aims at preventing and minimizing the generation of wastes including those ending up in the ocean. Much of the marine liter and microplastics found in the sea may be determined as 'waste' as defined under the Convention.
- **Stockholm Convention on POPs:** It aims to protect human health and the environment from POPs (organic chemicals that persist in the environment, bio accumulate in humans and wildlife, have harmful effects and have the potential for long-range environmental transport). Plastics can adsorb POPs such as PCB, DDT and dioxins and these are frequently detected in marine plastic liter.
- **The Honolulu Strategy:** It is a framework for a comprehensive and global collaborative effort to reduce the ecological, human health, and economic impacts of marine debris worldwide.
- **G20 Implementation Framework for Actions on Marine Plastics Litter** is aimed at facilitating further concrete action on marine waste, though on a voluntary basis, after the G20 Hamburg Summit in Germany adopted the "G20 action plan on marine litter" in 2017.

G20 Implementation Framework for Actions on Marine Plastics Litter

- G20 members will promote a **"comprehensive life-cycle approach"** to prevent and reduce plastic litter discharge to the oceans through various measures and international cooperation.
- They will also **have to report their progress in tackling the problem**, and "share best practices, promote innovation and boost scientific monitoring and analytical methodologies".
- **Facilitate the implementation of the G20 members' actions in line with the G20 Action Plan on Marine Litter**, based

on respective national policies, approaches and circumstances, and in collaboration with Regional Seas Conventions and other relevant organizations and instruments

- **Promote cooperation among the G20 members** and with other partners to empower governments, communities, and the private sector to advance measures including through technical assistance for those who need technical capacity development.
- **Collaborate and cooperate with, and empower non-G20 countries, relevant international organizations, local governments, the private sector, civil society organizations, NGOs**, and academia to work in a multisector manner and invite them to take actions in line with this framework, including in collaboration with partnerships or networks focused on global marine litter issues.

5. CLIMATE CHANGE

Climate change refers to significant changes in global temperature, precipitation, wind patterns and other measures of climate that occur over several decades or longer**.** Various factors are responsible for it including-

- **Natural Factors**: such as continental drift, volcanoes, ocean currents, the earth's tilt, and comets and meteorites. The natural factors affect the climate change in long term and persist for thousand to millions of years.
- **Anthropogenic (Human Caused) Factors**: includes greenhouse gases, aerosols and pattern of land use changes etc.

Some facts highlighting the Climate Change

Climate Change with respect to the World	Climate Change with respect to the India
• **Warmest years:** The past four years—2015, 2016, 2017 and 2018—taken together are the four warmest years on record. In contrast to the other top warmest years, **2018 began with La Niña conditions**, which are typically associated with lower global temperatures. ○ Average global temperature reached approximately 1 °C above pre-industrial levels. • **CO_2 concentration and mean sea level** continued to increase in 2018. A new record high of fossil CO2 emission – 36.9 (+/-1.8) billion tons of CO2 was reached in 2018. • **Ocean acidification:** In the past decade, the oceans absorbed around 25% of anthropogenic carbon dioxide emissions and the **decrease in gobal ocean oxygen** has continued. **More than 90% of the energy trapped by greenhouse gases, goes into the oceans**. • **Glaciers and sea ice:** Arctic sea-ice extent was well below average throughout 2018. The Greenland ice sheet has been losing ice mass nearly every year over the past two decades. • **Ozone:** 2018 Ozone hole was 24.8 million km² as against 28.2 million km² in 2015. • **Natural Hazards:** In 2018, weather and climate events accounted for most of nearly 62 million people affected by natural hazards. The **report identified the floods in Kerala as one of the main indicators of extreme weather events** due to climate change. • **Population Displacement and Human Mobility:** Out of the 17.7 million IDPs (Internally Displaced People), over 2 million people were displaced due to disasters linked to weather and climate events as on September 2018. • As per the **Emission Gap Report** the current efforts imply global warming of about 3°C by 2100, with warming continuing afterwards. • **Sea Level Rise**- As per the World Meteorological Organization (WMO) says that the Global Mean Sea Level from January to July 2018 was around 2 to 3 mm higher than the same period in 2017. • **The IPCC Special report 2018** said that there is no safe level of global warming and sea levels would continue to rise for centuries even if we cap warming at 1.5°C above pre-industrial levels, prescribed in the lower limit of the Paris Agreement.	• India has been ranked 11th in the **Climate Change Performance Index (CCPI)** in 2019. • The **carbon stock** in India is roughly 7 billion tonnes, equivalent to 25.66 billion tonnes of carbon dioxide. Around 65% of carbon stock is stored in soil, and 35% in trees. • The **average temperatures** have increased by 0.6 ° C between 1901-10 and 2009-18. • The World Bank estimates that, if climate change continues unhindered, then average temperatures in India could reach as high as 29.1° C by the end of the century. • In 2018-19, as many as 2,400 Indians lost their lives to **extreme weather events** such as floods and cyclones, according to the environment ministry. • According to the 2017-18 Economic Survey, extreme temperatures and droughts **shrink farmer incomes** to the tune of 4-14% for key crops. The Survey had estimated the loss in **agriculture production** every year due to climate change is US$ 10 billion, or Rs 70,000 crore pushing the rural to urban migration. • 171 million people live in coastal districts who are at risk due to **sea level rise**, which is about 14.2% of India's population. • According to World Bank report in January 2019, by 2050, 148 million Indians will be living in severe **climate change hotspots**. Melting of glaciers in the Hindukush Himalayas will add to this apocalyptic scenario, making the entire Gangetic plains with its 300 million people unliveable by 2100.

Some Notable Observations in other reports

Report	Observations
Intergovernmental Panel on Climate Change Report titled **"Global Warming of 1.5°C"**	• Human-induced global warming has in 2017 already reached 1°C above preindustrial levels; **the current climate efforts of countries will take the world to 1.5°C between 2030 and 2052.** • **What happens at 2°C that does not happen at 1.5°C?** ○ Prevention of around 3.3 million cases of dengue every year in Latin America and the Caribbean alone.

	○ An additional 150 million people could be at risk from malaria ○ 25 million fewer undernourished people by the end of the century, if the 1.5°C goal was achieved ○ 1.5°C could prevent 153 million premature deaths due to air pollution by 2100, as compared to the 2°C scenario • **Thus, limiting global warming to 1.5°C should be targeted because** ○ It would **reduce challenging impacts** on ecosystems, human health and well-being, making it easier to achieve the United Nations Sustainable Development Goal. ○ Allowing the global temperature to temporarily exceed or 'overshoot' 1.5°C would mean **a greater reliance on techniques** that remove CO_2 from the air to return global temperature to below 1.5°C by 2100. ○ The **effectiveness of such techniques is unproven** at large scale, and some may carry significant risks for sustainable development.
Talanoa Dialogue Synthesis Report	**Progress of the world towards climate action-** • **Increased participation of countries-** ○ As of 18 November 2018, **184 Parties to the UNFCCC (over 90 per cent) had ratified the Paris Agreement**; 180 had formally recorded their NDC in the registry; 10 had communicated a long-term, low-emission development strategy; and 91 were working on a national adaptation plan. • **Climate-related laws come to a total of 1,500-** as the national governments have taken steps to strengthen national policy, regulatory and institutional frameworks to address climate change. Action under the UNFCCC and the Kyoto Protocol up to 2020 is also under way. • But, m**uch more of global effort is still required** to deliver the expected level of action and support. Major challenges which need to be addressed include- ○ **Perceived trade-offs** of the changes towards transition to low-emission development with competing national priorities (e.g. poverty alleviation, job security) or competitiveness, ○ Misalignments between national and sectoral policies, ○ Insufficient leadership as well as cultural and psychological barriers.
Global Energy & CO_2 status in 2018	• **Global trend:** India's energy demand outpaced global demand growth in 2018. China, US, and India together accounted for nearly 70 per cent of the rise in energy demand. • **CO_2 emissions: India saw emissions rise by 4.8%**, or 105 Mt, with the growth split evenly between power and other sectors such as transport and industry. Despite this growth, **per capita emissions in India remain low** at only 40% of the global average. ○ It found that CO2 emitted from coal combustion was responsible for over 0.3°C of the 1°C increase in global average annual surface temperatures above pre-industrial levels. This makes **coal the single largest source** of global temperature increase. • **Oil:** Global oil demand rose by 1.3% in 2018, led by strong growth in the United States. **Indian oil demand grew 5%** in 2018 compared to 2017. • **Natural gas** consumption grew by an estimated 4.6% in 2018, its largest increase since 2010. ○ **China the world's largest natural gas importer** in 2018, ahead of Japan, and was the second-largest contributor in volume to global demand growth after the United States

Brief picture of global efforts made towards Climate Change

Present Global Position on Climate Change Action Plan: At present there are 2 major agreements concerning the climate action plan. These are the Paris Climate Agreement and the Kyoto Protocol Phase II.

- **Kyoto Protocol Phase II:** In Doha, Qatar, on 8 December 2012, the **"Doha Amendment to the Kyoto Protocol"** was adopted. The amendment includes:
  - **New commitments for Annex I Parties** to the Kyoto Protocol who agreed to take on commitments in a second commitment period from 1 January 2013 to 31 December 2020;
  - A **revised list of greenhouse gases (GHG)** to be reported on by Parties in the second commitment period;
  - **Amendments to several articles of the Kyoto Protocol** which specifically referenced issues pertaining to the first commitment period and which needed to be updated for the second commitment period.
- **Paris Climate Agreement:** The Paris Agreement was adopted under United Nations Framework Convention on Climate Change (UNFCCC) in 2015. The **central aim of the agreement** is to strengthen the global response to the threat of climate change by keeping the global temperature rise, in this century, well below 2 degrees Celsius

above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius.

Progress since Paris Agreement, 2015

- **COP22@Marrakech:** The main thrust of COP 22 was to develop rules for operationalizing the Paris agreement and advance work on Pre-2020 actions.
  - The "**Marrakech Action Proclamation for our climate and sustainable development**" initiated work on Adaptation Fund to serve the Paris Agreement. The Pre-2020 action, including mobilization of $ 100 billion per year and other support to developing countries was a key element of the Proclamation.
  - The **Marrakech Partnership for Global Climate Action** aims to mobilize climate actions quickly and to reap the benefits in efficiency and effectiveness through partnerships and coordination between different actors. It lists out some of the **progressive steps taken and benefits of Climate action** in the Yearbook of Global Climate Action 2018-
    - ✓ About 60% of the initiatives are producing outputs that put them on a path to achieving their desired environmental or social outcomes.
    - ✓ The outputs from **cooperative initiatives** are increasingly being delivered in low- or middle-income countries. This reflects increased climate action in developing countries and increased international cooperation.
    - ✓ Climate action is **re-shaping the financial sector** to help transition to a net-zero carbon and resilient society. Businesses and investors are also reporting on and are managing climate risks and opportunities and implementing the Recommendations of the Task Force on Climate-related Financial Disclosures (TCFD
- **COP23@Bonn (chaired by Fiji):**
  - **Talanoa Dialogue:** Talanoa dialogue a facilitative dialogue in 2018, to take stock of the collective efforts of Parties in relation to progress towards the long-term goal referred to Paris Agreement and to inform the preparation of nationally determine contributions (NDCs) was launched.
  - **Pre-2020 implementation and ambition:** Parties agreed that there will be two stock-takes to discuss pre-2020 commitments - in 2018 and 2019 - before the Paris Agreement becomes operative in 2020.
  - **Gender Action Plan:** The first ever Gender Action Plan to the UNFCCC was adopted at COP23.
- **COP24 (discussed later)**

India's Climate Actions

India has continuously demonstrated its responsibility towards acknowledging the emerging threats from climate change and implementing the climate actions on the basis of the **principles of Equity** and **Common but Differentiated Responsibilities** for improving efficiency of the economy and its engines of growth. The **major policies and plans include:**

- **National Action Plan on Climate Change (NAPCC),** launched in 2008, formulated in the backdrop of India's voluntary commitment to reduce emission intensity of its GDP by 20 to 25 per cent by 2020 over 2005 levels. It was also meant to focus on key adaptation requirements and creation of scientific knowledge and preparedness for dealing with climate change.
- **State Action Plans on Climate Change (SAPCC)** in line with the NAPCC taking into account State's specific issues relating to climate change. So far, 33 States/ UTs have prepared their SAPCCs.
- **Climate Change Action Programme (CCAP)** has been launched in 2014 with the objective to build and support capacity at central and state levels, strengthening scientific and analytical capacity for climate change assessment, establishing appropriate institutional framework and implementing climate related actions in the context of sustainable development.
- **National Adaptation Fund on Climate Change** was established in 2015 to meet the cost of adaptation to climate change for the State and Union Territories that are particularly vulnerable to the adverse effects of climate change. The Scheme will continue till 31 March 2020.
  - Till date, **30 adaptation projects have been approved** at a total cost of ₹847 crore covering vulnerable sectors such as Water, Agriculture and Animal Husbandry, Forestry Ecosystems and Biodiversity.
- **Measures on Ozone reduction-**
  - Ozone has been classified and monitored as one of the eight pollutants under **National Air Quality index.**
  - **System of Air Quality and Weather Forecasting (SAFAR)**: ozone is monitored as one of the pollutants.
- Environmental Pollution (Prevention and Control) Authority enforce **Graded Response Action Plan (GRAP) for Delhi** and the NCR region, which comprises the graded measures for each source framed according to the Air Quality Index categories.

- National Institute of Rural Development and Panchayati Raj (NIRDPR) has launched a training programme- a certificate course for **Sustainable Livelihoods and Adaptation to Climate Change (SLACC)**. SLACC is funded by the Special Climate Change Fund, which was set up under the UNFCC for adaptation and capacity building projects
- India's **Second Biennial Update Report (BUR)** submitted to UNFCCC in December 2018. The report shows that
  - **Emission intensity of India's GDP came down by 21%** between 2005 & 2014 and its achievement of climate goal for pre-2020 period is on track.
  - A total of 2.607 billion tons of CO_2 equivalent of GHGs were emitted from all activities (excluding Land use, Land-Use Change, and Forestry (LULUCF)) in India. Energy sector accounted for 73%, Industrial Processes and Product Use (IPPU) 8%, agriculture 16% and waste sector 3%.
  - About 12% of emissions were offset by the carbon sink action of forestland, cropland and settlements.

Way Forward

- **Strict adherence to climate goals** as committed in National Contributions (NDCs) and various global forums such as Doha Amendment to Kyoto Protocol, Paris Agreement, Sendai Framework and 2030 Agenda for Sustainable Development.
- **Require a UNFCCC-plus approach:** Climate efforts cannot be restrictive to the UNFCCC and the Paris Agreement. The world needs to think and devise more forums and venues to address climate change.
- **Equity is essential and must be re-visited:** IPCC Report points out that "social justice and equity are core aspects of climate-resilient development pathways that aim to limit global warming to 1.5°C".
  - The world, however, requires a new formulation of equity in which every country must act now and actively raise its level of ambition. The **developed countries** must take the lead by rapidly **de-carbonising** their economies as well as reducing consumption. The **developing countries** will have to pursue **low-carbon pathways** more vigorously and should limit addition of fossil fuel assets going ahead.
- **Enhancing sinks in natural ecosystem:** which require **Carbon Dioxide Removal (CDR)** in the Agriculture, Forestry and Other Land Use (**AFOLU**) sector in varying degree. Sequestering CO_2 in AFOLU sector will require incentivising billions of farmers and forest-dwellers to pursue sustainable practices that enhance carbon sinks.
- **Keeping global warming within 1.5°C is very difficult but required:** because keeping the focus on 2.0°C target would be disastrous for the poor and for developing countries.
  - India must take the lead in forming a global coalition for a 1.5°C world to save its poor and vulnerable population.
  - Investments in low-carbon energy technologies and energy efficiency would need to approximately double in the next 20 years and investment in fossil-fuel extraction and conversion decrease by about a quarter.

5.1. KATOWICE COP 24

Why in news?

The 24th Session of the of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 24) was held in Katowice, Poland.

Agenda of COP 24: The conference focused on three key issues

- Finalization of guidelines/modalities/rules for the implementation of Paris Agreement
- Conclusion of 2018 Facilitative Talanoa Dialogue (to help countries implement NDC by 2020)
- The stocktake of Pre-2020 actions implementation and ambition

> **"Double counting"** means counted once by the country of origin when reporting its emissions inventory, and again by the receiving country (or other entity) when justifying emissions above their pledged climate effort, usually via "offsetting" provisions.
>
> Allowing trades to be double counted means that, in actuality, none of the reported emissions reductions are achieved.

Key outcomes in Katowice

Outcome	Features
Improved quantification of pledges made by countries	• All countries **"shall"** use the **latest emissions accounting guidance from the IPCC.** They were last updated in 2006, and now in the process of being reformed next year. • This will **guide the countries for their Climate pledges** ("nationally determined contributions", NDCs), will make it easier to compare pledges and to add them up as a global aggregate
Market Mechanisms	• This provides for the trading of carbon credits i.e. overachievement of NDCs (cooperative approaches and internationally transferred mitigation outcomes (ITMOs)), as well as individual projects generating carbon credits for sale. • **Following is the status on this front-** o **Accounting Rules** to prevent "double counting" of emissions reductions by the buyer and seller of offsets **could not be finalised**. o The schemes and methodologies for the implementation of **Sustainable Development Mechanism- SDM would be discussed in COP-25.** The SDM is intended to replace the Kyoto Protocol's "Clean Development Mechanism" (CDM) for carbon offsets. o **Overall Mitigation in Global Emissions** (**OMGE**): It is a central and critical new element under the Paris Agreement, that takes carbon markets beyond the offsetting approaches of the existing markets like the CDM. The primary purpose of OMGE is to deliver on cost-effectively reducing greenhouse gas emissions, rather than creating carbon markets for their own sake. ✓ Small island countries wanted a **mandatory** automatic cancellation or discounting for an **OMGE** applied to all the activities under **market mechanism. However, this option was removed from the COP decision and made voluntary.**
Climate finance reporting	• **Developed country Parties shall biennially** communicate indicative quantitative and qualitative information on programmes, including projected levels, channels and instruments, as available public financial resources to be provided to developing country Parties. • **Other Parties** providing resources are encouraged to communicate biennially such information on **a voluntary basis**. • The UNFCCC secretariat to establish a dedicated online portal for posting and recording the biennial communications.
Global stocktake	• Paris Agreement requires the **CMA** (Conference of the Parties serving as the meeting of the Parties to the Paris Agreement) to periodically take stock of the implementation of the Paris Agreement and to assess collective progress towards achieving the purpose of the Agreement and its long-term goals. This process is called the global stocktake. • The rules set the structure for the stocktake process, which is to be divided into three stages: Information collection, technical assessment and consideration of outputs.
Transparency	• To **provide a clear understanding of climate change action in the light of the objective of the Paris Convention**. This includes clarity and tracking of progress towards achieving Parties' individual NDCs, and Parties' adaptation actions, including good practices and gaps, to inform the global stocktake. • Moreover, it provides clarity on support provided and received by relevant individual Parties in the context of climate change actions, and, to the extent possible, to provide a full overview of aggregate financial support provided, to inform the global stocktake. • The final rulebook **applies a single set of rules to all countries**, however with **flexibility for "those developing country parties that need it in the light of their capacities"**, reflecting CBDR-RC principle.
Loss and damage	• Loss and damage caused by the unavoidable impacts of climate change was a touchstone issue for vulnerable countries, such as small island developing states. The rulebook mentions this issue, however, in a **diluted version**. o The **global stocktake rules do add loss and damage clause**. The stocktake rules now say it "may take into account, as appropriate, efforts to avert, minimise and address loss and damage associated with the adverse effects of climate change". o The **transparency rules also say** countries "may, as appropriate" report on loss and damage.
Other matters	• Rules were finalised in a number of other areas, including how compliance with the Paris Agreement is to be monitored • COP24 agreed to set up an **expert compliance committee** that is "facilitative in nature, non-adversarial and non-punitive". It will not impose penalties or sanctions. The committee will be able to investigate countries that fail to submit climate pledges. • COP decided that the **"adaptation fund"** – a financial mechanism set up under the Kyoto Protocol – should continue under the Paris Agreement.

	• **Talanoa Dialogue:** The final text simply "invited" countries to "consider" the outcomes of the Talanoa dialogue in preparing their NDCs and in efforts to enhance pre-2020 ambition. • The text also "welcomes" the 2018 stocktake on pre-2020 implementation and ambition and reiterates its decision to convene another stocktake next year. • **Pre-2020:** With respect to the "pre-2020" commitments –first agreed by developed countries in 2010 in Cancun – the COP called for developed countries to ratify the Doha Amendment so that it can enter into force. This would extend the Kyoto Protocol on developed country emissions till 2020. • The COP also **"strongly urges"** developed countries **to increase their financial support in line** with the promise to jointly mobilise $100bn per year in climate finance to poorer countries by 2020. It acknowledges that "the provision of urgent and adequate finance" will help developing countries in order to up their own pre-2020 action. • **'Welcoming' the IPCC 1.5°C report:** Despite the majority of countries speaking in favour of the report, four countries – the US, Saudi Arabia, Russia and Kuwait – refused to "welcome" the report. The COP welcome its "timely completion" and "invited" countries to make use of the report in subsequent discussions at the UNFCCC.

Analysis of the outcomes

- **Provision of finance by developed countries:** Rules on financial contributions by developed countries have been diluted making it very difficult to hold them accountable.
  - Now, developed countries have the choice to include all kinds of financial instruments, concessional and non-concessional loans, grants, aids etc., from various public and private sources, to meet their commitments.
  - The rules on ex-ante (forecasted) financial reporting and its review for adequacy has been significantly weakened**.**
  - Developed countries now have the freedom to decide the amount and the kind of financial resources they want to give to the developing countries and do this without any strong mechanism of accountability.

Comparing SDM and CDM building blocks	
SDM	**CDM**
Must contribute to overall emission reductions/**net mitigation**	Established as a p**ure offsetting mechanism**, shifting, not reducing, emissions
Must account for mitigation targets of all countries under the **Paris Agreement**, including their progression over time	Based on **Kyoto Protocol** where developing countries did not have a reduction target and did not take future climate commitments into account
Should promote ambition and encourage implementation of **climate friendly policies**	Created **perverse incentives** to continue business as usual practices and in some cases increase emissions beyond business as usual in order to be paid to reduce them
Must reflect and reinforce changing low emission technology and policy landscape	Credited many non-additional projects
Must contribute to real, measurable and long-term mitigation and sustainable development that contributes to **overall shift away from fossil fuel lock in**	Made **questionable contribution** to sustainable development, including a lock in of fossil fuels

- **Loss and damage:** The **Warsaw International Mechanism**, which has to deal with averting, minimizing and addressing loss and damage associated with the adverse effects of climate change, has no financial resources to support vulnerable countries. With **no financial provisions**, the countries are now left on their own to address the impacts of climate change.
- **Global stocktake (GST):**
  - The non- Policy prescriptive rulebook for GST ensures that the **process will neither give any recommendation to individual countries or a group of countries, nor will it give any prescriptive policy to everyone.** This would result in collection of a lot of technical information without any clear recommendation to increase ambition on mitigation or finance.
  - **Also, equity has been mentioned in the text, but there is no mechanism to operationalize it**.
- **Carbon market Mechanism:**
  - There has virtually been **no progress made on non-market mechanisms** (sub-article 6.8 of Paris Agreement) to reduce emissions and enhance sinks in forests and land.

- **There is no firm decision on OMGE mechanism.** Also, the **rulebook has different rules for different markets**, which is non-transparent and makes emissions reductions unverifiable. Trading is allowed for sectors which are not covered in a country's emissions targets, which will dilute the overall mitigation effect.

- **Countries are on their own:** The Paris Agreement had both bottom-up and top-down elements. Most of the top-down elements have been diluted in the rulebook. The Paris Agreement and its rulebook is now a totally 'self-determined' process. Countries are now on their own to mitigate, to adapt, and to pay the cost of climate impacts.

5.2. CARBON DIOXIDE IN THE ATMOSPHERE

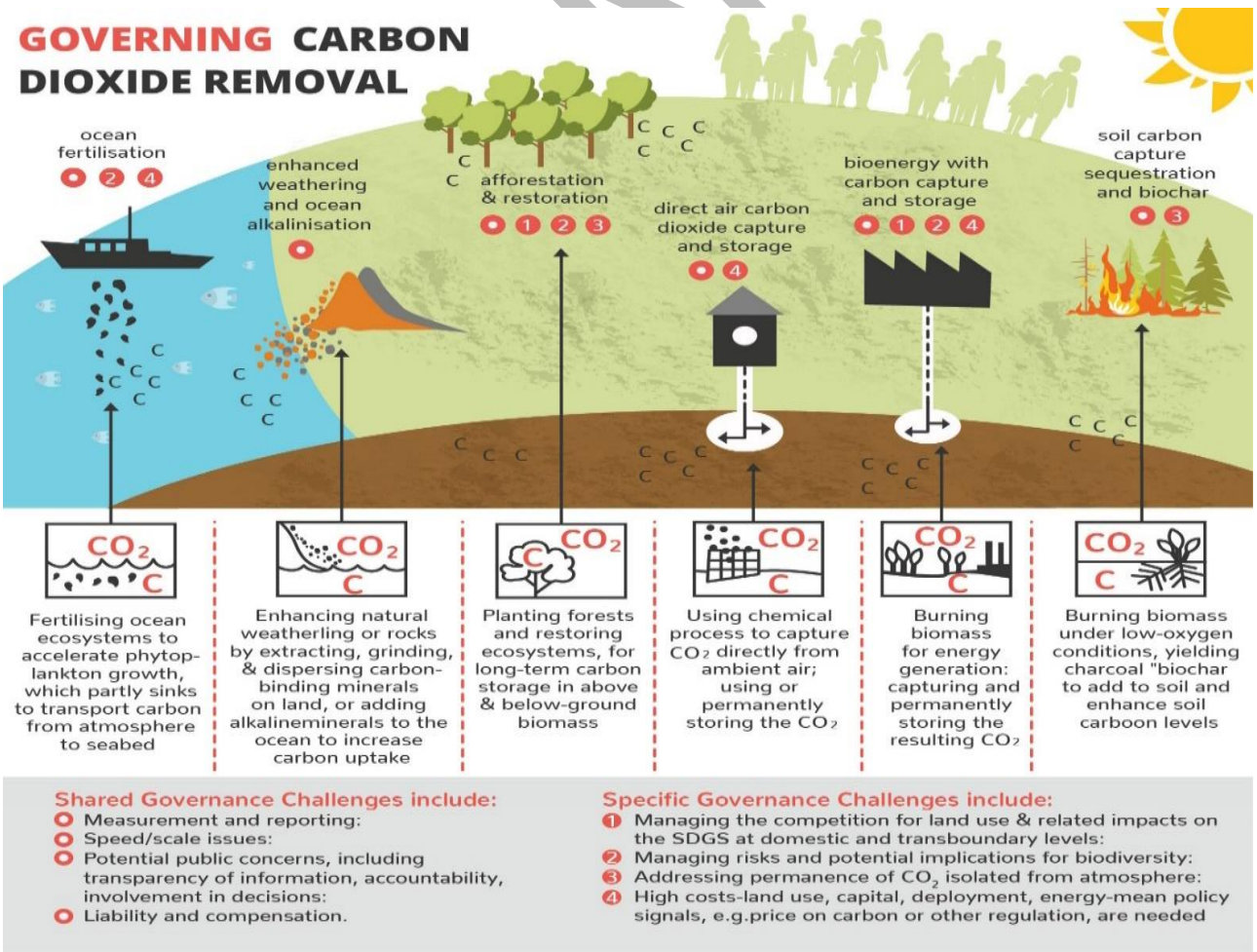
Why in News?

Recently, for the first time, global concentration of carbon dioxide in the atmosphere have crossed 415 parts per million (ppm) mark as per **Mauna Loa Observatory**.

Background

- **Paris Agreement 2015:** Parties to the United Nations Framework Convention on Climate Change (UNFCCC) agreed to limit global temperature increase to well below 2°C above pre-industrial levels and to pursue efforts to limit the increase to 1.5 C.
- In 2018, **the Intergovernmental Panel on Climate Change (IPCC) Special Report on Global Warming** of 1.5°C (IPCC SR 1.5°C) warned that the impacts of warming at 2°C would be significantly worse than those at 1.5°C.
- According to IPCC SR 1.5°C, to avoid or limit any overshoot of the 1.5°C temperature goal, CO2 emissions **will need to be phased out almost entirely by 2050.**

Steps to be taken to reduce Carbon dioxide in atmosphere



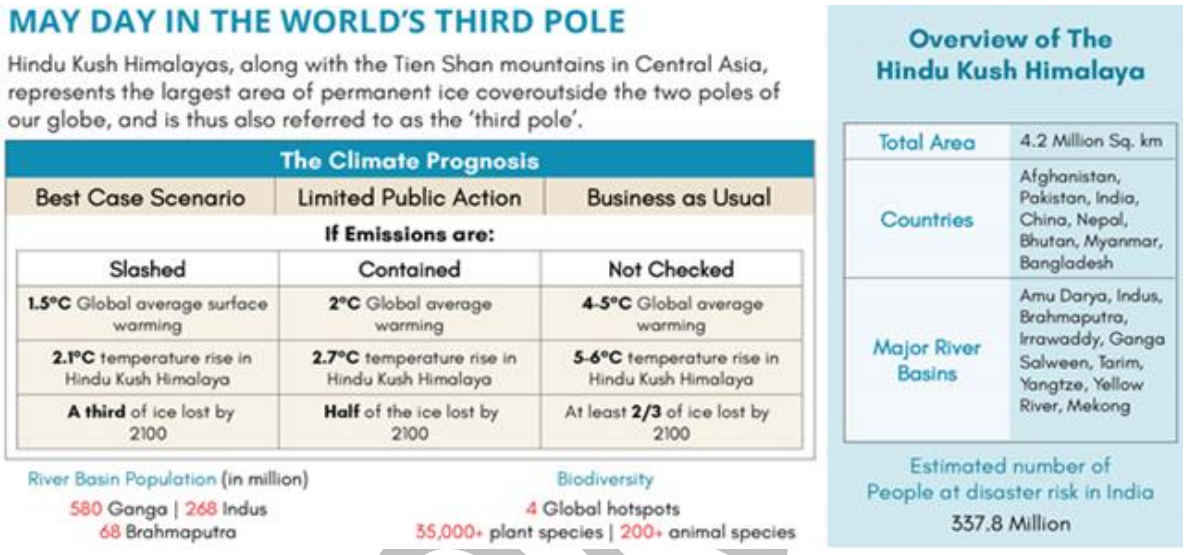
5.3. HINDU KUSH HIMALAYA ASSESSMENT REPORT

Why in news?

The Kathmandu-based International Centre for Integrated Mountain Development's (ICIMOD) "Hindu Kush Himalaya Assessment" reveals that more than one-third of the glaciers in the region could retreat by 2100, even if the global temperature rise is capped at 1.5°C.

Key Findings of the Assessment Report w.r.t Glaciers

Hindu Kush-Himalaya-Karakoram Glaciers: Since the mid-18th century, glaciers in the extended HKH have been, on average, in retreat. Since the 1950s, only **reductions in glacier area (or shrinkage)** have been observed.



- **Area Changes**
  - Since 1970s, nearly 15% of the glaciers in the HKH has disappeared. **Eastern Himalaya glaciers have tended to shrink faster** than glaciers in the central or western Himalaya.
  - In contrast to the Himalayan glaciers, on average, **glacier areas in the Karakoram have not changed significantly**. Given the context of glacier retreat throughout the rest of the extended HKH region, this behaviour has been designated the **'Karakoram anomaly'.**
  - **Area loss also leads to glacier fragmentation**; the number of glaciers in the Himalaya is reported to have increased over the past five decades.
  - **Mass Changes:** Glaciers in the extended HKH show **mass loss since at least the 1970s**.
- **Glacier Projections**
  - Glacier volumes are projected to decline by up to 90% through the 21st century **in response to decreased snowfall, increased snowline elevations, and longer melt seasons**.
  - Even if warming can be limited to the ambitious target of +1.5 °C (Paris Climate Deal), this will lead to a 2.1°C rise in the HKH region due to **elevation-dependent warming**. In such a scenario, the region will lose 36% of its glaciers, with more than half of glacier ice lost in the eastern Himalaya.

Impact of HKH Warming

- **River flows and water availability:** Melting glaciers will increase river flows, pushing up risks of high-altitude lakes bursting their banks causing floods (glacial lake outburst floods (GLOFs)). From 2060s, however, river flows will decline.
- **On Western Disturbances:** These are also likely to see increased variability.
- **Drying Springs**: As per the report of the NITI Aayog, 30% of springs in the Indian Himalaya have dried up due to reasons including receding glaciers.

Elevation-dependent warming (EDW)

- It is one of the expressions of global warming wherein there is an enhancement of warming rates with elevation.
- One of the possible reasons could be that reductions in mountain snow cover exposes the dark colored earth beneath. This reduces the surface albedo and increases the absorbed solar radiation that can lead to elevation-dependent amplification of warming via the **snow albedo feedback (SAF).**

- **Impact on Monsoon:** The HKH region is also crucial as it controls the monsoon system – which South Asia relies on for most of its rainfall. Shifting monsoon patterns will lead to intense precipitation which would increase the risk of floods, landslides and soil erosion.
- It may also cause **sea level rise** with its own consequences.

Other Major Findings of the Assessment Report: The HKH mountains **provide two billion people a vital regional lifeline via water** for food (especially irrigation), water for energy (hydropower), and water for ecosystem services (riparian habitats, environmental flows, and rich and diverse cultural values).

- **Global Warming and Climate Change:** The HKH have shown a **rising trend** of extreme warm events; a falling trend of extreme cold events; and a rising trend in extreme values and frequencies of temperature-based indices.
  - Climate change is further enhanced by **short-lived climate pollutants** such as black carbon, which is emitted in large quantities in regions upwind of the HKH (especially India and China).
- **Losing Biodiversity:** 70-80% of the region's original habitat has been lost and that may increase to 80-87% by 2100. A quarter of endemic species in the Indian Himalayas alone could be wiped out by 2100.
- **Energy insecurity:** More than 80% of the rural population relies on traditional biomass fuels for cooking and about 400 million people still lack basic access to electricity. The hydropower potential of nearly 500 GW remains untapped.

Way Forward

- **International agreements must mitigate climate change** through emission reductions to reduce and slow cryospheric change.
- To better monitor and model cryospheric change and to assess spatial patterns and trends, researchers urgently need **expanded observation networks and data-sharing agreements** across the extended HKH region. This should include in situ and detailed remote sensing observations on selected glaciers, rapid access to high-resolution satellite imagery etc.
- **Improved understanding of cryospheric change and its drivers** will help reduce the risk of high-mountain hazards.

Related Information

Recently Indian Scientists have developed a **common framework for Climate Change Vulnerability Assessment for the Indian Himalayan Region.**

About the Index

- The Index developed is based on **4 broad indicators**:
  - Socio-economic factors, demographic and health status
  - Sensitivity of agricultural production
  - Forest-dependent livelihoods
  - Access to information, services and infrastructure.

Key Takeaways

- **Assam** has the highest vulnerability index (0.72) followed by **Mizoram** (0.71) and **Sikkim** is the least vulnerable state (0.42).
- Assam is highly vulnerable to climate change because of factors like **low per capita income, deforestation, large number of marginal farmers, least area under irrigation, lack of alternative sources of income and high rates of poverty.** Less capacity to adapt make people vulnerable to climate change.
- The vulnerability assessments will be useful for officials, decision makers, funding agencies and experts to have a **common understanding on vulnerability and enable them to plan for climate adaptation.**

5.4. IMPACTS OF CLIMATE CHANGE

5.4.1. CLIMATE REFUGEES

Why in news?

In the recent times the issue of climate induced displacement has gained momentum.

Details

- With climate change, the number of 'climate refugees' will rise in the future. The International Organization for Migration (IOM) estimates that there could be as many as **200 million such refugees by 2050**.

- In 2018 alone, **17.2 million new displacements associated with disasters** in 148 countries and territories were recorded (IDMC) and 764,000 people in Somalia, Afghanistan and several other countries were displaced following drought.
- Most disaster displacement linked to natural hazards and the impacts of climate change is internal, with those affected remaining within their national borders. However, displacement across borders also occurs, and may be interrelated with situations of **conflict or violence**.
- Climate refugees are **now recognised in the 2018 global compact on safe, orderly and regular migration** under its objectives. However, there is a clear **protection gap** with regard to 'climate refugees', who are **neither clearly defined** as a category **nor covered by** the 1951 Convention relating to the Status of Refugees (the 1951 Refugee Convention).

India Specific Case: Climate change might result in two types of displacement and migration in India.

- First, increased migration is likely **within India** due to the effects of climate change such as, drought, desertification, sea level rise, water scarcity and low food productivity, and melting glaciers.
  - E.g. there is widespread displacement of lakhs of population in Assam every year due to flooding.
  - E.g. people from Marathwada region are moving to Mumbai due to drought.
- Second, climate change might lead to **increased flow of migrants from neighbouring countries** due to the accelerated effects of climate change.
  - **Bangladesh** is one of the world's most natural disaster-prone countries with an eroding Sundarban Delta, it is also seeing a constant rise in sea levels and incidents of salt-water intrusions. It is estimated that a mammoth **50-120 million migrants may end up becoming climate refugees of Bangladesh in India.**
  - Moreover, while India might be home to refugees from neighboring nations it is one of the few countries in the world that has refused to sign and ratify the 1951 Refugee Convention and the 1967 protocol.

Challenges in tackling the Problem of Climate Refugees:

- **Climate migration is mainly internal:** when migration is internal, people moving are under the responsibility of their own state, they do not cross borders and are not seeking protection from a third country or at the international level and hence no need for refugee status.
- It is **harder to identify the victims** of slower processes than those of sudden natural disasters. Thus, droughts often lead to slow response compared to cyclones and floods.
- **Isolating environment/climatic reasons is difficult**, in particular from humanitarian, political, social, conflict or economic ones. It can sometimes be an impossible task and may lead to long and unrealistic legal procedures.
- **Gender perspective:** As mostly the men migrate, women are left with the agricultural chores which affect them badly in the wake of disasters.
- **Conflicts and violence are inevitable** in the wake of such migration as there would be limited resources but more people. There has been **growing xenophobic tendencies** e.g. USA raising a wall on Mexico border to stop the migrants.
- **Creating a special refugee status for climate change related reasons** may lead to the exclusion of categories of people who need protection, especially the poorest migrants who move because of a mix of factors and would not be able to prove the link to climate and environmental factors.

Nansen Initiative (2012)

It's a state-led consultative process to build consensus on a protection agenda addressing the needs of people displaced across borders in the context of disasters and the effects of climate change.

Nansen Initiative Protection Agenda for Cross-Border Displaced Persons (2015)

- Aim: To enhance understanding, provide a conceptual framework, and identify effective practices for strengthening the protection of cross-border disaster-displaced persons
- Strategy: It supports an approach that focuses on the integration of effective practices by States and (sub-) regional organizations into their own normative frameworks in accordance with their specific situations and challenges.
- It identifies effective practices to manage disaster displacement risk in the country of origin to prevent displacement by
  - reducing vulnerability and building resilience to disaster displacement risk,
  - facilitating migration out of hazardous areas before disasters strike,
  - conducting planned relocation
  - responding to the needs of internally displaced persons.

Way Forward

Reducing the issue of migration in the context of climate change to the status of "climate refugees" fails to recognize a

number of key aspects that define human mobility in the context of climate change and environmental degradation.

- **Migration is not necessarily forced,** especially for very slow onset processes migration is still a matter of choice, even if constrained, so countries need to think first migration management and agreements rather than refugee protection.
  - The **Nansen Initiative** also concluded with a document that proposes a "toolkit" of migration policies rather than recommending the establishment of a new status for these people.
- **Climate migration discussions should not lose their focus on preventive measures:** the key objective is to invest in climate and environmental solutions so that people will not have to leave their homes in a forced way in the future. The Paris Agreement offers anchorage for climate action that considers human mobility to avert, minimize and address displacement in the context of climate change.
- **Encourage the full use of all already existing bodies of laws and instruments,** both hard and soft law in humanitarian, human rights and refugee law, instruments on internal displacement, disaster management, legal migration and others.
- **Regular migration pathways** can provide relevant protection for climate migrants and facilitate migration strategies in response to environmental factors.

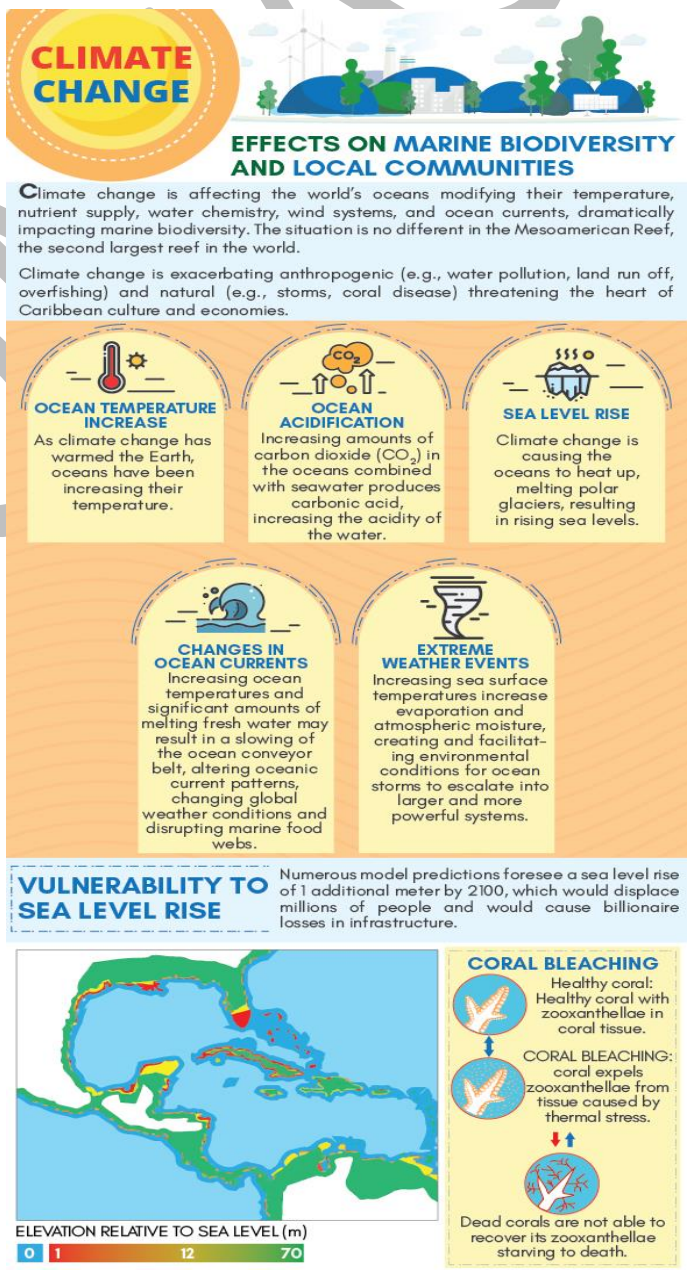
5.4.2. EFFECTS OF CLIMATE CHANGE ON THE OCEAN

Why in News?

- According to a recent study, all oceans in the world are heating up **60 per cent faster** than what IPCC had stated in its Fifth Assessment report.
- According to IPCC Fifth Report, world's oceans have absorbed 90% of the temperature rise caused by man-made carbon emissions, while only 1% in the atmosphere.

India's vulnerability to Sea Level Rise

- According to a new study published in Nature Climate Change, the **sea-level is rising at an average rate of 1.6-1.7 mm per year along the Indian coast, but it is not uniform.**
- It varies from 5mm in Sunderbans to less than a 1 mm per year in some of the areas in the west coast. **Sunderbans are most vulnerable,** not only because its low-lying, but also because the land is also sinking.
- **Reduction in Drinking Water:** Sea Level Rise will increase salinity in underground water in coastal areas, significantly reducing the available drinking water. Many areas in Chennai are facing the salinity of ground water due to sea water intrusion.
- **Impact on Food Security:** Due to flooding and saltwater intrusion into the soil, the salinity of agricultural lands near the sea increases, posing problems for crops that are not salt-resistant. Furthermore, salt intrusion in fresh irrigation water poses a second problem for crops that are irrigated. E.g. the under-sea paddy farming of Kerala has been facing the threat due to rising sea level.



- **Impact on India**: Mumbai and other west coast stretches such as Khambat and Kutch in Gujrat, parts of Konkan and South Kerala are most vulnerable to sea-l evel rise. Deltas of Ganga, Krishna, Godavari, Cauvery and Mahanadi are also threatened.

Global Impact

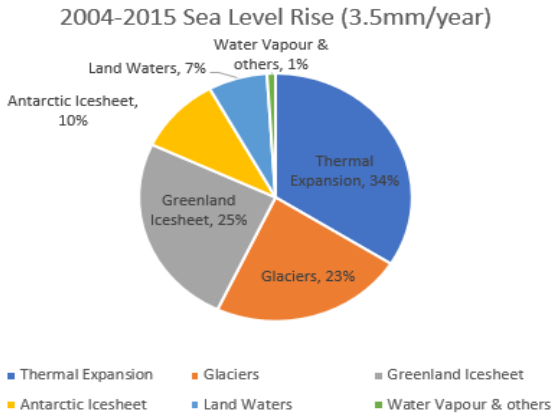
- **International Conflicts:** Sea Level Rise will change the exclusive economic zones of nations, potentially creating conflicts between neighboring nations.
- **Large-scale displacement:** A large population in the world lives along coastal areas (about 10% of world's population), a sea level rise will force a large population to migrate from coastal areas creating huge economic and social costs.
  - A disruption in socio-economic life and large scale internal and external migration may crate social strife across nations.
- **Impact on Island Nations:** Maldives, Tuvalu, Marshall Islands and other low-lying countries are among the areas that are at highest level of risk. At current rates, Maldives could become uninhabitable by 2100. Five of the Solomon Islands have disappeared due to combined effect of Sea Level Rise and stronger trade winds.

Sea Level Rise

It is caused primarily by **two factors** related to global warming:

- the added water from melting ice sheets; and glaciers
- the expansion of seawater as it warms.

Contribution in Sea Level Rise



Way forward

- **Arresting Climate Change:** Prime Source of Sea Level Rise is Global Warming caused by excess carbon dioxide in atmosphere. **2015 Paris Climate Agreement** to limit global temperature rise to 1.5° C should be implemented by Nations.
- **Evolving Adaptation Strategies:** All coastal & Island Nations should have comprehensive national adaptation plans involving both hard and soft options to deal with rising sea levels.
- **Acknowledging 'Climate Refugees':** A Global Convention on Climate Refugee should be seriously contemplated by the UN. Recently adopted **Global Compact on Refugees** recognized climate change as one of the possible reasons for migration but shied away from calling them 'Climate Refugees' or covering them under UN Convention on Refugees.
- **Limiting Coastal Settlements:** Keeping the future sea level rise in mind, countries should limit and regulate coastal settlements so that number of people at risk doesn't increase further.
- **Strengthening scientific research**: to measure and monitor ocean warming and its effects. This will provide more precise data on the scale, nature and impacts of ocean warming, making it possible to design and implement adequate and appropriate mitigation and adaptation strategies.
- **Protecting marine and coastal ecosystems**: to conserve and protect ecologically and biologically significant marine habitats. This will regulate human activities in these habitats and prevent environmental degradation.

5.4.3. KELP FORESTS

Why in News?

According to a recent study, **Climate change** could lead to **decline of underwater kelp forests**.

About Kelps

- They are large brown algae seaweeds. They grow in "underwater forests" (kelp forests) in shallow oceans.
- Kelps **live further from the tropics** than coral reefs, mangrove forests, and warm-water seagrass beds.

- Although kelp forests are unknown in tropical surface waters, a few species have been known to **occur exclusively in tropical deep waters.**
- Kelps and coral reefs are composed of algae that grow in the shallow parts of the ocean in warm and sunny waters. However, kelp forest grows in nutrient-rich waters while corals can develop in low nutrient waters.

- The environmental **factors necessary for kelp to survive** include hard substrate (usually rock), high nutrients, clear shallow coastal waters and light.
- The productive kelp forests tend to be associated with areas of significant **oceanographic upwelling**.
- They are known for their **high growth rate**. Some varieties grow as fast as half a metre a day, ultimately reaching 30 to 80 metres.
- Kelp forests are recognized as one of the most **productive and dynamic ecosystems** on Earth. Smaller areas of anchored kelp are called **kelp beds.**

Climate Change and Kelp Forest

- **Ocean warming** and **ocean acidification** can cause **changes in the microbiome on the surface** of Kelp, leading to disease-symptoms like blistering, bleaching and eventually **degradation of the kelp's surface.**
- This will affect the **Kelp's ability** to **photosynthesize and potentially survive.**
- This could impact kelp forests around the world and potentially putting the marine biodiversity at risk, which thrives on these forests.

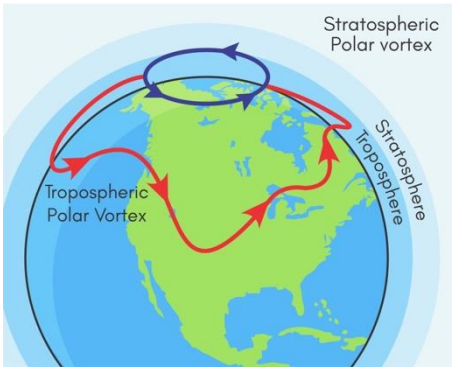
Importance of Kelp Forests

- They are **considered as Keystone Species** and their removal is likely to result in a relatively significant shift in the composition of the community and perhaps in the physical structure of the environment.
- It provides as an **important source of food** for many marine species. In some cases, up to 60% of carbon found in coastal invertebrates is attributable to kelp productivity. It may be consumed directly or colonised by bacteria that in turn are preyed upon by consumers.
  - Also, the rich fauna of mobile invertebrates in kelp beds makes this an important habitat in the diet of fish species. They provide a foraging habitat for birds due to the associated and diverse invertebrate and fish communities present.
- It increases productivity of the near shore ecosystem and dumps carbon into that ecosystem. Kelp primary production results in the **production of new biomass, detrital material** etc.
- **It slows down the flow of the water, which** is important in situations where animals are spawning and releasing their larvae.
- They are **natural breakwaters** and **prevent coastal erosion.**
- They can **influence coastal oceanographic patterns** and provide many **ecosystem services.**
- It is an important source of **potash** and **iodine.** Many kelps produce **algin**, a complex carbohydrate useful in industries such as **tire manufacturing**, **ice-cream industry**.

5.4.4. POLAR VORTEX

Why in news?

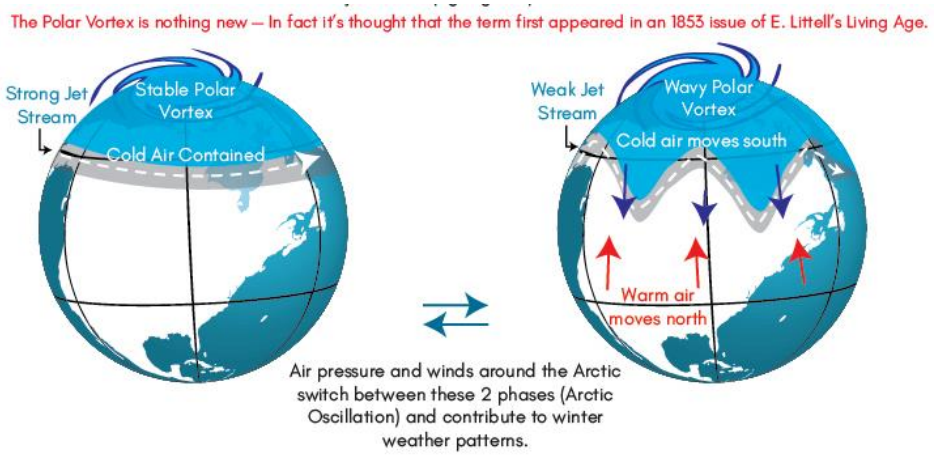
Recently, US mid-west experienced sub-zero temperatures due to a breakdown in the polar vortex.



What is a polar vortex?

- It is a large area of **low pressure and cold air surrounding the Earth's North and South Pole.**
- The term refers to the **counterclockwise flow (clockwise over south pole)** of air that helps keep the colder air close to the poles.
- There are not one but **two polar vortexes in each hemisphere.**
  - One exists in the lowest layer of the atmosphere, the **troposphere.** The tropospheric polar vortex is the one that affects our weather.
  - The other exists in the second lowest, called the **stratosphere.** It is much more compact than its tropospheric counterpart.
  - If the two polar vortexes line up just right, very deep freeze conditions may occur.

- The boundary of the polar vortex is really the boundary between the cold polar air to the north, and the warmer sub-tropical air (considering Northern Hemisphere). And that boundary is actually defined by the **polar front jet stream**- a narrow band of very, very fast-moving air, moving from west to east.
- But that boundary shifts all the time. It shrinks in summer, pole-ward while **in winter, the polar vortex sometimes becomes less stable and expands**, sending cold air southward with the jet stream. This is called a **polar vortex event** ("breaking off" of a part of the vortex).
- The break in polar vortex appears to be linked to the long and chilly winter in the north India this year.



Why cold air plunges south (in Northern Hemisphere)?

- Greenhouse gas emissions has **amplified Arctic warming** resulting into dramatic melting of ice and snow in recent decades, which exposes darker ocean and land surfaces that absorb a lot more of the sun's heat.
- Because of rapid Arctic warming, the north-south temperature difference has diminished. This **reduces pressure differences between the Arctic and mid-latitudes**, weakening jet stream winds which tend to meander.
- Large north-south undulations in the jet stream generate wave energy in the atmosphere. If they are wavy and persistent enough, the energy can travel upward and disrupt the stratospheric polar vortex. Sometimes this upper vortex becomes so distorted that it splits into two or more swirling eddies.
- These "daughter" vortices tend to wander southward, bringing their very cold air with them and leaving behind a warmer-than-normal Arctic.

6. CONSERVATION EFFORTS

6.1. DRAFT INDIA FOREST ACT (AMENDMENT) BILL

Why in news?

The Ministry of Environment, Forest and Climate Change has finalised the first draft of the comprehensive amendments to the **Indian Forest Act, 1927**.

Background

- The primary reason behind the enactment of the **Indian Forest Act (IFA), 1927** by the colonial government was to **extract maximum timber** from the forests in India.
- This act was enacted to '**consolidate the law** related to forest, the **transit of forest produce**, and the **duty liable** on timber and other forest produce'. As per it, all the **forest property** in the country was **under the state** and the rights of all such forest dwellers like Tribals could be extinguished at the behest of British administration.
- It led to mass displacement of people even in post-independence India. The **Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006** was enacted to correct this exploitation.
- Further, during this time various other national development aspirations and international commitments have come into existence. Many committees including **Justice Shah Panel** have recommended changes to the 1927 Act.

Need to amend the IFA, 1927

- To facilitate the increase in forest cover from about 24% now to 33% [a stated directive of government policy].
- To bring clarity on definition of forests and its stakeholders.
- To generate resources to fund forest ecosystem and promote forest-based industries.
- Involve more people and stakeholders in conservation and progress of forests.
- Enhance punishment for violators of the forest law to create a deterrent for offenders like timber smugglers.

Key Amendments proposed to the Act

- **Shift in focus-**
  - Earlier, the focus was on laws related to transport of forest produce and the tax on it.
  - Now, the amendment has increased the focus to "**conservation, enrichment and sustainable management** of forest resources and matters connected therewith to safeguard ecological stability to ensure **provision of ecosystem services** in perpetuity and to address the concerns related to climate change and international commitments".
- **Provides definition** of Forests, village forests as well as community.
- **Introduces new category of Production Forests-** These will be forests with specific objectives for production of timber, pulp, pulpwood, firewood, non-timber forest produce, medicinal plants or any forest species to increase production in the country for a specified period.
- **Powers to forest bureaucracy** including the power to issue search warrants, enter and investigate lands within their jurisdictions, and to **provide indemnity to forest officers using arms** to prevent forest-related offences. The bureaucracy would also have a **veto power** in some cases.

Concerns with the proposed act

- **Tribal People's Right:** The comprehensive amendments, if passed, will result in an **over-centralisation of state authority and power over forests** and also come into **conflict with the Forest Rights Act (FRA) of 2006**, which confers titles and rights to tribal communities and other traditional forest dwellers (OTFDs).
  - In the proposed amendments, the **Centre has arrogated to itself the right to declare any area a reserved forest.**
  - Besides, **State governments and Forest Settlement Officers (FSOs) are vested with more powers than gram sabhas**.
- **Management of Forests:** The amendments also propose to restrict the practice of shifting cultivation and bring part of such areas under "settled cultivation". In the proposed amendment, the **landowners will have no say** in the matter. The **State government can in the "public interest" take over the management of forests**.

- The 1927 Act stated that the government could take over the management of forests if there was "willful neglect or disobedience" but after taking into consideration objections from the landowner.

- **Private forests':** In a radical departure, the amendments provide for the creation of **"private forests"**, or privately-owned forests. They also envisage the constitution of a National Forestry Board headed by the Prime Minister with the Chief of the Army Staff as one of the members but **completely excluding gram sabhas. This may promote the commercialisation of forests depriving the TFDs of their own resources.**
- The amendments will also further centralise the management of forest, as the legislation takes away the State governments' discretion to manage forests even further.

Way Forward

- The concerns raised by the human rights activists, who view this act as a **backdoor tool** to subvert the **Forest Rights Act, 2006** are serious and should be addressed. Already, there is a case of massive rejection of claims under the Forest Rights Act pending in the court.
- The production forests should be developed with participation of local people and only an appropriate mix of native plant species should be used for reforestation/afforestation.
- Hence, it is necessary that the new Indian Forest Act is a balanced law as to promote conservation forest rights, climate mitigation and managing national aspirations all at the same time. It should not convert forest areas into a police state.

6.2. EVICTION ORDER OF FOREST DWELLERS

Why in news?

The Supreme Court recently stayed its previous order to evict forest dwellers in over 16 states, directing States to submit whether due process had been followed in rejecting claims.

Background

- A case was filed by various wildlife groups in the Supreme Court stating that all those Forest Dwelling Scheduled Tribes and Other Traditional Forest Dwellers, whose claims over forest land were rejected under the 2006 Forest Rights Act should be evicted by state governments.
- Under the law, only notified scheduled tribes and traditional forest dwellers, in bona fide occupation of the land, are entitled to cultivate and occupy the lands.
- But over the years, several non-Tribals and traditional forest dwellers had illegally occupied the forestlands, causing massive deforestation.
- On February 13, 2019, the Supreme Court ordered the forced eviction of nearly 1.89 million tribal and other forest-dwelling households from forestlands across 16 states.

Issues pertaining to rejection of claims under Forest Rights Act

- **Large number of cases in Left-Wing Extremism affected areas** where tribal population is high. The forest land claims of these tribes and forest-dwellers are mostly rejected by the States owing to the security concerns.
- **Lack of awareness of forest dwellers-** Being poor and illiterate, living in remote areas, they do not know the appropriate procedure for filing claims.
- **Inadequacy of Gram Sabha-** The gram sabhas, which initiate the verification of their claims, are low on awareness of how to deal with them. More than half the rejections in Chhattisgarh were found to be at the gram sabha level.
- **Administrative Callousness-**
  - In several states there have been reports on administrations going particularly slow on even accepting community-level claims.
  - The district administration is expected to assist the gram sabhas by providing forest and revenue maps. But this hasn't taken place as expected.
  - In some cases, one-line orders are being passed without following the procedure.
- **Hasty Rejections-** A large number of cases are rejected due to lack of evidence or incomplete evidence. Officials demand Tribals to furnish satellite imagery and non-existent 75-year-old records.
- **Other Illegalities done by authorities, which are alleged/ claimed by petitioners-** such as –

- Raising of frivolous objections. E.g. the summons and notices issued to 60 Bhil Tribals for encroaching on forest land in 2002 were used as evidence for evicting them under the Forest Rights Act, 2005.
- Range officers are not authorised to reject FRA claims; they can only provide recommendations to claims committees. However, many cases are decided by forest guards or patwaris.

Way Forward

- There is need to **collate proper data** which accurately indicates the status of a claim.
- Any rejection order should be passed after **observance of due process of law**; compliance with principles of natural justice and whether appeal mechanisms have been properly exhausted.
- The administrative machinery should focus on **increasing the awareness** of tribals and aiding these groups in finding evidences, rather than ignoring them.
- The Ministry of Tribal Affairs should **coordinate this drive** and take help of other non-state actors such as the Campaign for Survival and Dignity (CSD), a national organisation of several adivasi and forest dwellers' movement.

Forest Right Act 2006: It provides for a rights-based, democratic and decentralized governance of forests. Rights recognized under FRA.

- **Individual forest rights (IFR)** to legally hold forestlands that the forest dwelling communities have been residing on and cultivating prior to 13 December 2005.
- **Community rights (CRs)** of ownership, use and disposal of 'minor forest produce', also known as **non-timber forest produce (NTFP).** CRs include rights of grazing, collection of firewood, fish and other such products from water bodies, as well as rights to biodiversity and intellectual property, including those related to traditional knowledge.
- **Community forest resource (CFR)** rights under Section 3(1)(i) to protect, regenerate, conserve or manage forest resources for sustainable use, providing for community governance of forests.

About CFR

- **CFR rights** is the most empowering provision of the Act because it restores gram sabha's [village council] control over governance of forests from the forest department, thereby democratising the country's colonial forest governance as a whole.
- **CFR management committees (CFRMCs)** are created by Gram Sabha, which are expected to prepare a conservation and management plan for community forest resources in order to sustainably and equitably manage CFR areas.

Recently, People's Forests Report was released by Centre for Science and Environment (CSE) on Community Forest Resource (CFR) management. **Major Findings of report -**

- **Poor implementation:** Only seven states have formally recognized the rights of forest dwelling communities (Only 3% of potential areas) to manage and govern their forest resources with huge disparities among states.
- **Global Acceptance of CFR:** As of 2013, at least 15.5%, of the world's forests were under some form of community control.
- **CFR governance helping forest conservation:** Forest-dependent communities have adopted an innovative practice to manage their CFR areas, among which protection from forest fires and the protocols for sustainable harvest of NTFPs are common to most Gram Sabhas.
- **Improving Livelihood:** CFR has increased collective bargaining power of community which has helped in alleviating poverty and reverses the trend of migration from forest areas.
- **Increasing new employment opportunities in CFR areas:** A bottom-up approach plans by Gram Sabha for development plan is creating huge employment opportunity for its members in the CFR areas.
- **Strengthening PVTG Status:** Members from particularly vulnerable tribal group (PVTG) are benefitted from inclusive approach under Act, which provide them a sustain source of livelihood and mainstreaming in the development process of country.

6.3. COMPENSATORY AFFORESTATION

Why in news?

Recently Forest Advisory Committee (FAC) clarified that forestland **with crown density below 40 per cent (open forest) will be treated as degraded forest land** for compensatory afforestation (CA).

Background

- The **Forest (Conservation) Act of 1980** requires that afforestation is carried out in compensation for forest land diverted for non-forestry uses.
- Compensatory afforestation can be done over an **equivalent area of non-forest land or over degraded forest twice in extent of the area being diverted, if non-forestland is not available.**

More about Compensatory afforestation

- The government enacted **Compensatory Afforestation Fund Act 2016** to provide a proper institutional mechanism for compensatory afforestation matters
- The salient features of the Act include:
  - The Act **established National Compensatory Afforestation Fund (NCAF**) under the Public account of India **and State Compensatory Afforestation Funds** under public accounts of states.
  - The National Fund will receive 10% of these funds, and the State Funds will receive the remaining 90%.
  - The fund will be used for **compensatory afforestation**, additional compensatory afforestation, penal compensatory afforestation, **net present value**, catchment area treatment plan or any money for compliance of conditions stipulated by the Central Government while according approval under the provisions of **the Forest (Conservation) Act, 1980**.
  - Act provides **statutory status for two ad-hoc institutions**, namely
    - **National Compensatory Afforestation Fund Management and Planning Authority (NCAFMPA**) for management and utilisation of NCAF.
    - **State Compensatory Afforestation Fund Management and Planning Authority** for utilisation of State Compensatory Afforestation Fund.
  - The act also seeks to provide for constitution of a **multidisciplinary monitoring group** to monitor activities undertaken from these funds.
  - The act also provides for **annual audit of the accounts by the Comptroller and Auditor General**.

Forest Advisory Committee

It is the apex body under the Union Ministry of Environment and Forest and Climate Change (MoEFCC) for approving diversion of forest land in India.

Crown density or **canopy density**

It is the ratio between the cover formed by top branches of trees in a forest and the land area. **The Forest Survey of India (FSI),** which assesses India's forests, classifies forests on the basis of canopy/crown density.

- **Very Dense Forest:** (Canopy Density>70%)- **13.8 percent** of the total forest cover.
- **Moderately Dense Forest:** (canopy density is 40% to 70%)- **44.2 percent** of the total forest cover.
- **Open Forest:** (Canopy density 10% to 40%)- **42 percent** of the total forest cover.

Issues with the Act

- **Compromising community forest rights:** The land identified for compensatory afforestation would be under forest department's jurisdiction thus, having adverse consequences for the hard-won rights of tribals and forest dwellers.
- **Lack of monitoring mechanism for expenditure from funds** despite findings of Comptroller and Auditor General in 2013 about massive misutilization of funds by the forest department.
- **Scarcity of land** as land is a limited resource, and is required for multiple purposes, such as agriculture, industry, etc. The problem is compounded by unclear land titles.
- **Inadequate Capacity of state forest departments** for planning and implementation. Still utilisation of 90% of funds depend on it.
- **Low quality forest cover**: Compensatory afforestation cannot make up for the ecological value lost by cutting the existing forests. Also, computing the appropriate Net Present Value of a forest is a challenge.
- **Poor survival rate** of plantations raised under compensatory afforestation also raises serious questions about their effectiveness.
- **Diversion as land banks:** The creation of **land banks for CA** from revenue forests and degraded forests (on which communities have got traditional rights) further allows for takeover of community land.

Way forward

- **Primacy of Gram Sabha**: The **CAF Act needs to be integrated with the FRA and PESA** by centring the role of gram sabhas and incorporating land and forest rights guarantees.
- **Management of CA:** Emphasis should not only be on plantation but also on the maintenance of CA.

6.4. EARMARKING ECO-SENSITIVE AREA

Why in news?

Centre has released a draft notification for earmarking Eco-Sensitive Area (ESA) in Western Ghats.

Background information

- In 2010, the Central government began the process of declaring ESAs by constituting the **Madhav Gadgil committee**. The recommendations were not implemented after protest from all states, especially Kerala, saying that it hampered development and large habitations.
- Subsequently, a **High-Level Working Group (HLWG)** under former ISRO chairman K Kasturirangan gave a report in 2013 recommending 37 per cent (about 60,000 sq km) of the Western Ghats as ecologically sensitive areas. However, the states were still at loggerhead.
- Centre has issued **3 draft ESA notifications for consultation with states since 2014**. This is the 4th such draft proposing 56,825 sq km of Western Ghats as 'no go' zone which covers nearly 37% of Western Ghats and is in line with Kasturirangan Committee recommendations.
- The process to notify ESA delayed when Karnataka, Maharashtra and Tamil Nadu raised their objections on recommendation of the HLWG, leaving the ecologically fragile region in Western Ghats open for further exploitation.
- The NGT on August 24, 2018 directed the ministry to finalise the notification within a period of six months without making any alteration in the draft of February last year. However, **it could not be finalized yet**. Recently the NGT has directed the Ministry of Environment and Forests (MoEF) to submit a report on finalisation of eco-sensitive zone in the Western Ghats.

Eco Sensitive Zones (ESZ)/ Eco-Sensitive Area (ESA)

- ESZs are ecologically important areas **notified under the Environment Protection Act** to be protected from industrial pollution and unregulated development. According to the Environment (Protection) Act, 1986, the government can prohibit industrial operations such as mining, sand quarrying and building thermal power plants in sensitive areas.
- **To categorise an area as ecologically sensitive**, the government looks at topography, climate and rainfall, land use and land cover, roads and settlements, human population, biodiversity corridors and data of plants and animal species.
- As per orders of the Supreme Court, **no project can be allowed within 10 km of the boundary** of national parks and sanctuaries without the approval of the National Board of Wildlife (NBWL), the highest body on wildlife regulatory issues, unless a site-specific Eco-Sensitive Zone (ESZ) is notified around that park or sanctuary.
- **Purpose for declaring ESZ** around National Parks and Sanctuaries is to create some kind of "shock absorber" for the protected areas.
    - They would also act as transition zone from areas of high protection to areas involving lesser protection.
    - The activities in the ESZ would be of a **regulatory nature rather than prohibitive nature**, unless and otherwise so required.
- **Extent of ESZ:** The width of the ESZ and type of regulations would **differ from one protected area (PA) to other**. However, as a general principle the width of the ESZ could go up to 10 kms around a PA (may not be uniform all around it) as provided in the Wildlife Conservation Strategy-2002.
    - In case where sensitive corridors, connectivity and ecologically important patches, crucial for landscape linkages, are even beyond 10 kms width, these should be included in the ESZ.
- **Nature of Activities in ESZ:** While some of the activities could be allowed in all the ESAs, others will need to be regulated/ prohibited. However, which activity can be regulated or prohibited and to what extent, would have to be PA specific. There are 3 categories of activities-
    - **Prohibited-** commercial mining, polluting industries, major hydroelectric projects etc.
    - **Restricted with safeguards (Regulated) -** 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 Practices etc.

Problems associated with ESZ

- States like Tamil Nadu, Andhra Pradesh, Jharkhand and Goa etc. kept the mining areas out of ESZs, irrespective of their ecological value. Besides, **no ground investigation** has been done in most proposals. The areas are randomly marked on topographic sheets.
- Most proposals **do not follow ecological aspects** of the objective of this exercise. In most of the proposals, distance from the PA boundary is made the only criterion for defining ESZ and factors such as habitat connectivity and ecological integrity of the region are rarely considered for identifying the zones.

- States hesitate to finalize ESZ as it might **hamper their finances** due to closure of industries and tourism activities.
- There are **no quantifiable criteria** defined for including or excluding an area in the ESZ, leaving it to the forest officials to arbitrarily take decisions.
- People who are living in biodiversity rich areas are **mostly excluded from the consultation process** to identify the ESZ. However, they are the one who will be directly affected by regulated or restricted activities.
- Though ESZ does not affect the ownership rights of people on land resources, it **restricts land-use change**. The tribal people who mostly reside in these areas are affected as their livelihood mostly depend on forest products.

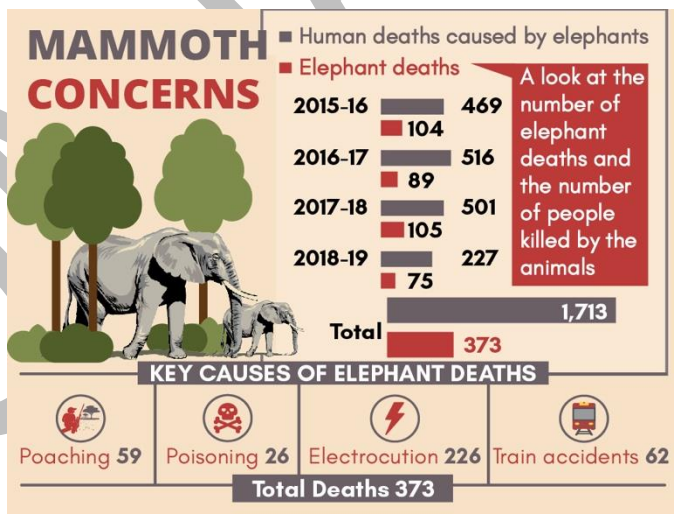
Way Forward

- As the experts are attributing the recent catastrophic floods in Kerala to the exploitative activities in Western Ghats, the issue of ESZ gains prominence. There needs to be a balance between the development and biodiversity conservation.
- Centre should take all the states on board along with due representation from the local population in deciding the ESZ.
- The declaration of ESZ should be in line with the rights given to tribal population under Forest Rights Act-2006 and The Provisions of the Panchayats (Extension to the Scheduled Areas) Act, 1996(PESA-1996).

6.5. HUMAN- WILDLIFE CONFLICT (HWC)

Why in news?

There are regular incidents of human- wildlife conflict in various parts of the country.



Background

- In India, human-animal conflict is seen across the country in a variety of forms, including monkey menace in the urban centres, crop raiding by ungulates and wild pigs, depredation by elephants, cattle lifting and human death and injury by tigers, leopards and other wild animals.
- In the Monsoon session (2019), the Union Environment Ministry informed the Lok Sabha that 2398 people in India were killed by elephants while tigers claimed 224 lives in the last five years.
- Human-animal conflict occurs both inside Protected Areas as well as outside Protected Areas. The intensity of the conflict is generally more in areas outside Protected Area network than inside.

Reasons for Human-Wildlife Conflicts:

- **Habitat loss and fragmentation-** thereby increasing the chances of wild animals moving out of natural habitat and encountering cultivation and people. E.g. there exist clear evidence for conflict between Asian elephants and agriculture. At the same time, **local overabundance** of elephants may also cause them to move into human production landscapes as seen in parts of southern India.
- **Increasing Population:** The substantial recovery of once dwindling populations of ungulates such as **black buck and nilgai** has also resulted in increased conflict with agriculture in northwest and central India. The increase of tiger, leopard and elephant population across the country also increases the chances of an increase in human-wildlife conflicts in the fringe areas of forests across the country.
- Presence of a large number of animals and birds **outside the notified protected areas**. For e.g. around 29% of tigers are outside tiger reserves and 67% of elephants are outside protected areas.
- **Land Use Changes:** Land-use change outside forest areas, with irrigation from tube wells and canals aiding the cultivation of crops for longer time periods may also attract animals such as elephants. **Highly productive crop fields that provide more palatable and nutritious forage** also promote conflicts with herbivores

- **Adverse climatic events** such as droughts have been implicated in increased conflicts between lions and people as well as elephants and people.
- **Adaptability:** Many wildlife species have adapted to the changing landscape through behavioural changes for crop raiding. This is true of elephants and of certain commensal wildlife species such as black buck, nilgai, rhesus macaque of northern India, as well as the bonnet macaque of southern India.
  - Even non-commensal animals such as leopard have adapted to surviving in human-inhabited areas.
- Another reason why animals move to new geographical areas is the government's **practice of translocating** them.
- Wildlife species are also impacted by accidental **deaths due to development of infrastructures**, such as railway lines, roads, electricity wires etc.

Effects of Man-Animal Conflict: Such conflict situations generally lead to **growing antipathy among the people towards wildlife conservation** resulting in retaliatory killings or injuries to animals. Conflict-related mortality of wildlife does not bode well for conservation. Moreover, **loss to agricultural production and livestock** adds to the farmer's distress.

Government initiatives

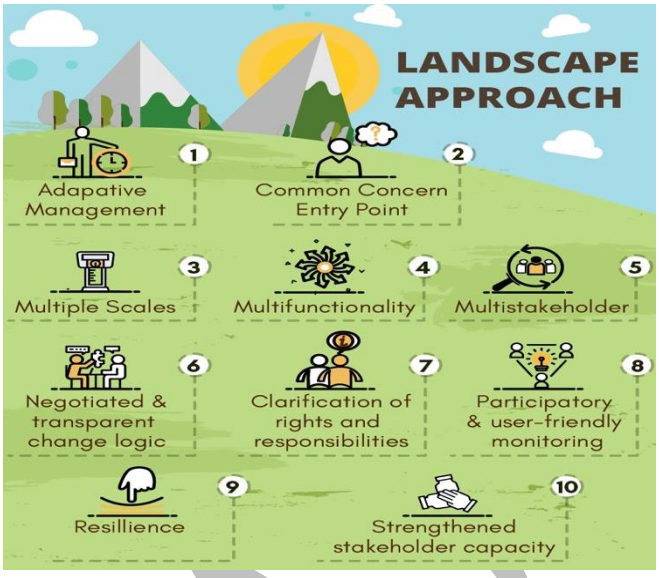
- **Governance framework-**
  - The management of human-animal conflict is handled by **State Government.**
  - The Union Government has issued **guidelines** in context of human-wildlife conflict to the Chief Wildlife Wardens of all the State Governments/Union Territory Administrations in 2014 and 2015.
  - The **National Tiger Conservation Authority (NTCA)** has brought out several Standard Operating Procedures (SOPs) to deal with various challenges of the human-tiger interface.
- **National Wildlife Action Plan (NWAP-3) (2017-2031)** prescribes guidelines to mitigate the Human- Wildlife Conflict (HWC).
  - These include creation of **national, regional and state level database of HWC, scientific management** of wildlife populations as well as land-use practices **and** comprehensive, species- and region-specific **conflict-mitigation plans**.
  - It further talks about encouraging **community participation** in the HWC mitigation through extensive **education and awareness programmes** by well-trained and adequately equipped workforce.
  - It provides for a **Centre of Excellence (CoE) on HWC mitigation**, under the aegis of the MoEFCC, to address, develop and implement long-term and short-term measures to reduce the adverse impacts of HWC.
  - **Draft National Forest Policy, 2018** also reasserts the objectives and guidelines of **NWAP-3.**
- **Provisions for culling of errant animals-**
  - The Wildlife (Protection) Act, 1972 empower the concerned authorities to deal with problematic animals including **declaring any protected species as vermin and to be culled**. E.g. Monkeys in Himachal Pradesh and Nilgai and Wild Boar in Bihar were declared vermin in recent times.
  - **Mass sterilisation** drive is conducted to control the faster population growth of monkeys and boars as seen in Himachal Pradesh.
- A scheme to **Augment Fodder & Water in Protected Areas/Forest Areas** for augmenting the availability of forage and water for wild herbivores in Protected Areas (PAs)/Forests where poor habitat is known as the cause of significant human-wildlife conflict has been initiated by the MoEFCC.
- Uttar Pradesh government has given its in-principle approval to bring man-animal conflict under listed disasters in State Disaster Response Fund to ensure better coordination and relief during such incidents.
- The National Green Tribunal (NGT) has asked the Ministry of Environment, Forests and Climate Change (MoEF&CC) to consider **declaring all elephant corridors in India as eco-sensitive zones.**
- **Indo-German Human-Wildlife conflict mitigation project** with an objective to frame guidelines and standard operating procedures (SOPs) so that humans and wildlife could co-exist.
  - It also **provides technical support** at the national level and in selected states for effective implementation of conflict mitigation measures so that both human and animal lives could be saved by **shifting from 'conflict' to 'co-existence' mode.**

Landscape-Level Approach to Address Human-Elephant Conflicts

- A study involving close monitoring of elephants on daily basis for two years in Karnataka has concluded that landscape-level management is necessary for mitigating human-elephant conflicts.
- As per the Food and Agricultural Organisation (FAO), Landscape level strategy deals with large-scale processes in an integrated and multidisciplinary manner, combining natural resources management with environmental and

livelihood considerations.

- It can be used as a viable solution for minimising the Human-Elephant conflicts, such as-
    - **Scientific management of Monoculture Plantations:** Since elephants prefer to stay in monoculture plantations (for example **monoculture plantations of Acacia, Eucalyptus**), forest departments should think strategically when to clear-fell these plantations. If these places are not available, elephants will start using **agriculture habitats** more frequently which may aggravate human-elephant conflict situation
    - **Regular Monitoring of land-use practices:** Proper planning needs to be done before making any change in the land –use practices in habitats such as coffee, agriculture or forest patches as it may have **negative effects on elephant conservation** or **aggravate human-elephant conflict.**



    - **Preserving Forest remnants and monoculture refuges:** These refuges are vital for elephants and helpful in containing conflicts as most of the forest is fragmented

Way Forward

- It is imperative to understand that wildlife-human conflicts are largely a **human-induced phenomenon** combined with the **specific behavioural ecology of animals, and external environmental factors**.
- Any long-term conservation measures such as taking a landscape approach to integrate Protected Area management with outside lands are only possible through **people's cooperation**. Thus, all conflict mitigation measures should be developed on the basic premise of engagement of all primary stakeholders, especially local communities.
- **24×7 monitoring** using technology, management of corridors, building up the frontline capacity, creating village teams for reporting wild animal presence, and, an intersectoral portfolio at the landscape level akin to the "**master plan**" envisaged for an eco-sensitive zone should all be employed for HWC mitigation.
- Alternative and unconventional ways such as re-creating a fear barrier for monkeys and boars, one- shot contraception and keeping dead animals on jungle tracts for wild carnivores, bio-fencing using cactus etc.

6.6. 'CULTURAL MODEL' OF CONSERVATION

Why in news?

Idu Mishmi tribe of Arunachal Pradesh is protesting the declaration of Dibang Wildlife Sanctuary (DWS) as Tiger Reserve.

More on news

- In recent times **road connectivity** to higher elevations of Mishmi Hills has been improved. It is expected to increase number of tourists in higher reaches and illegal poaching. **National Tiger Conservation Authority is thus considering declaring the area as tiger reserve**.
- However, Declaration of an area as tiger reserve **prohibits many types of work** like cutting trees, collecting wood for fuel and agricultural and tourism activities for the indigenous Idu Mishmi people.
- The Idu Mishmi people traditionally follow an animist and shamanistic faith and believe that tigers are their elder siblings. Tigers are never hunted by Idu Mishmi and even If a tiger is killed in self-defense, it will receive the same burial as a human being.
- Thus, Idu Mishmi are protesting against the creation of Tiger Reserve and instead asking for a **Cultural Model of Conservation**.

Colonial versus Cultural model of conservations

- **Colonial Model of Conservation:** In this model, human presence is taken as threat to nature.

- This model **denies indigenous peoples' rights** and provoked long-term social conflict.
- This model is **not suitable for India** as many indigenous communities are believed to be in co-existence with nature.

- **Cultural model of Conservation**
  - This is based on a **respect for the rights of indigenous peoples** and other bearers of "traditional knowledge" and prevents social conflicts.
  - It involves forest dwellers in forest management and governance and acknowledges traditional rights of tribal over minor forest produce and provisions for making conservation more effective and more transparent.
  - The **Kinshasa Resolution of 1975** (under IUCN) provides international recognition to cultural model of conservation. It acknowledges the importance of traditional ways of life and land ownership and called on governments to maintain and encourage customary ways of living.

Application by Cultural model of conservation in different tribes of India

- **Bishnoi Tribe of Rajasthan:** Bishnois consider **trees** as sacred and protect the **entire ecosystem** including animals and birds that exists in their villages. Tribe has organized their own **Tiger Force** which is a brigade of youth actively pursue wildlife protection.
- **Chenchu Tribe of Andhra Pradesh:** They are involved in tiger conservation at Nagarjunasagar Srisailam Tiger Reserve (NSTR). Tribe has been coexisting with **tigers and wild animals** for long without disturbing the ecological balance, which ensures enough water and fodder for the herbivores.
- **Maldhari Tribe in Junagadh (Gujarat):** The success of lion conservation in Gir forest area is due **to peaceful coexistence** of tribe with lions.
- **Bugun Tribe of Arunachal Pradesh:** The tribe using Community-led conservation initiatives **and traditional knowledge helped to protect the critically endangered bird Bugun Liocichla.** For its efforts Singchung Bugun Community Reserve won the India Biodiversity Award 2018.
- **Nyishi tribe of Arunachal Pradesh** in conserving hornbills in the **Pakke**/Pakhui Tiger Reserve. Recently, government of Arunachal Pradesh declared the Pakke Paga Hornbill Festival (PPHF)–the **state's only conservation festival**, as a **'state festival'.**

6.7. WETLAND CONSERVATION

Why in news?

India has designated Sundarban Reserve Forests as **Wetlands of International Importance**, making it the 27th site in India.

Ramsar Convention on Wetland

- The Convention on Wetlands, signed in Ramsar, Iran, in 1971, is an international intergovernmental treaty for conservation of wetlands.
- India is a party to the treaty.
- It provides framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.
- **Major obligations of countries which are party to the Convention are:**
  - Designate wetlands for inclusion in the List of Wetlands of International Importance.
  - Promote, as far as possible, the wise use of wetlands in their territory.
  - Promote international cooperation especially with regard to transboundary wetlands, shared water systems, and shared species.
  - Create wetland reserves.

Wetlands

- According to Ramsar Convention, **wetland is defined as**, "areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed 6 metres".
- Wetlands can be defined as lands transitional between terrestrial and aquatic eco-systems where the water table is usually at or near the surface or the land is covered by shallow water.

Importance of Wetlands

- Wetlands are highly productive and support exceptionally large biological diversity.
- They provide services such as waste assimilation, water purification, flood mitigation, erosion control, ground water recharge, micro climate regulation.
- They support many significant recreational, social and cultural activities besides being a part of the cultural heritage.
- It is source of livelihood through fishing and rice farming to travel, tourism and water provision.
- Wetlands protect our coastlines, provide natural sponges against river flooding and store carbon dioxide to regulate climate change.

Problems associated with Wetlands

- Wetlands are under threat of **disappearing because of ongoing human activities** like encroachment, pumping out of water from the wetland, conversion of the wetland into agricultural land, pollution due to agricultural runoff and lack of educational and environment awareness among locals.
- **Restoration and conservation of wetlands becomes impossible** once they are destroyed, as these are neither identified nor categorized.
- States, in coordination with the central government, **failed to perform their statutory duty of identifying** all wetlands in their respective jurisdiction as per the Wetlands (Conservation and Management) Rules, 2010.
- Presently, only notified wetlands are given protection. **Small wetlands get ignored in the process**.

National Plan for Conservation of Aquatic Eco-systems (NPCA)

- It was launched in 2013 by merging two Centrally Sponsored Schemes (CSS), namely the National Wetlands Conservation Programme (NWCP) and the National Lake Conservation Plan (NLCP).
- **Objective of NPCA** is to conserve aquatic ecosystems (lakes and wetlands) through implementation of sustainable Conservation Plans, and governed with application of uniform policy and guidelines.
- While the conservation and management of wetlands rests with the state governments, their plans are approved by the central government

- The process of notification is initiated by the State government. So no avenue is available to the local people or bodies who are the major stakeholders.
- **No data bank** is available on wetlands except on the Ramsar sites. Without data the extent of wetlands is not ascertained and thus encroachment becomes easier.
- The Municipal bodies that are currently responsible for implementation of the rules related to wetlands lack technical expertise to identify a wetland.

Suggestions

- There is need for scientific criteria for identifying wetlands- an independent authority can help with respect to this.
- Use this method to create a data bank on wetlands apart from Ramsar sites.
  - The Maharashtra Environment Department has created a mobile application to create a database on all the wetlands in the state.
  - In 2011 a National Wetlands Atlas prepared by the Space Applications Centre (SAC) of Indian Space Research Organisation (ISRO) was released which categorised wetlands into 19 different classed.
  - The Atlas identifies a total of 201,503 wetlands covering 14.7 million hectares across the country.
- Proper checks and balances- both on part of central government and citizens is required.
- The rules should be people-centric; involvement of town and country planning Board in identification of wetlands. More role to locals like fishing community, farming and pastoral community in managementthey have experience as well as interest in their protection.
- Mass awareness campaigns should be undertaken to educate stakeholders from all walks of society, particularly local communities on the value of wetland ecosystems

6.8. PEATLAND

Why In news?

Recently, **United Nations Environment Assembly** in Nairobi, Kenya, has adopted its **first ever resolution on peatlands.**

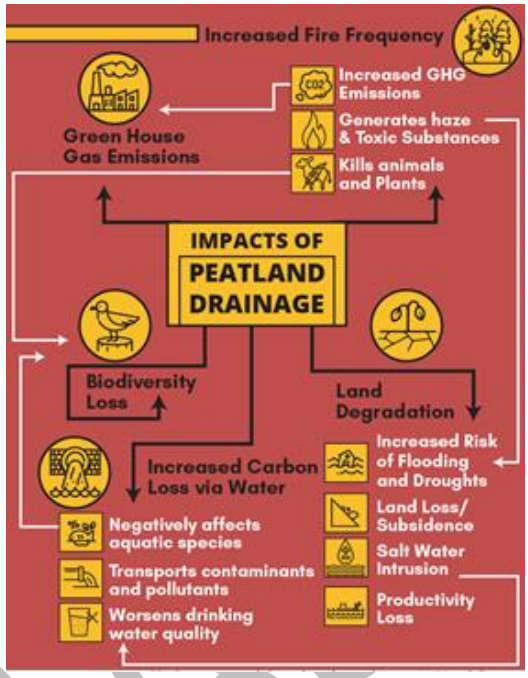
More on News

- The adoption of the **global resolution on the Conservation and Sustainable Management of Peatlands** urges member States and other stakeholders to give greater emphasis to the conservation, sustainable management and restoration of peatlands worldwide.
- However, it **is not legally binding.**

What are Peats?

- Peats are a **heterogeneous mixture of plant material** (vascular plants, mosses and humus) that had accumulated in a **water-saturated area** and are only **partially decomposed** due to absence of oxygen.

- The natural areas covered by peat are called peatlands. Various types of peat are – swamp forests, fens, bogs or mires.
- They are **mostly found in permafrost regions** towards the poles and at high altitudes, **in coastal areas**, beneath **tropical rainforest and in boreal forests**. **Countries with largest peatland areas are** – Russia, Canada, Indonesia, USA, Finland etc.
- Several multilateral conventions take peatland into consideration such as UNFCCC, Ramsar Convention on Wetlands, Convention on Biodiversity and United Nation Convention to Combat Desertification.
    - **Brazzaville Declaration** was signed to promote better management and conservation of Cuvette Centrale Region in Congo Basin in the backdrop of the 3rd Conference of Partners of the Global Peatlands Initiative (GPI), 2018.
    - **Global Peatlands Initiative** is an effort by leading experts and institutions to save peatlands as the world's largest terrestrial organic carbon stock and to prevent it being emitted into the atmosphere. It is led by UN Environment.



Importance of Peatland

- **Carbon Storage**: Although they cover less than 3% of the global surface, estimates suggest that peatlands contain twice as much carbon as in the world's forest.
- **Supporting water cycle:** They regulate water flow, exert a cooling effect during hot periods through evaporation and cloud formation, play an important role in retention of pollutants and nutrients and water purification, counteract eutrophication of water bodies and also prevent intrusion of saltwater.
- **Supporting unique and critically threatened biodiversity**: The tropical peatlands are home to a number of endangered species, including Sumatran tigers, gorillas and orangutans.
- **Supporting livelihood**: They are source of berries, mushrooms and medicinal plants in boreal and temperate regions and of non-timber forest products in tropical regions. Even the peat itself is used as fuel.
- **As a cultural landscape and archive:** They hold some of the most evocative archeological discoveries of last decades such as 4th millennium BCE footpath **sweet tracks**. They also record environmental changes.

Threats to Peatlands

- **Drainage for agriculture**: Drained peatlands are mainly used for agriculture and forestry, and peat is extracted for horticulture and energy production. CO_2 emissions from drained peatlands are estimated at 1.3 gigatonnes of CO_2 annually. This is equivalent to 5.6% of global anthropogenic CO_2 emissions.
- **Commercial Forestry**: It is the second greatest cause of land-use changes in peatland mostly prevalent in Scandinavian countries, UK, Russia, South-East Asia etc.
- **Peat extraction and usage:** Peat as a source of energy is being used on a large scale by households. It is also used as raw material for producing growing media for professional horticulture and for home gardening.
- **Infrastructure Development**: Conversion of peatlands in coastal areas to meet the urban development, waste disposal needs, development of roads and other infrastructure.

Way forward

- A **landscape approach is vital and good practices** in peatland management and restoration must be shared and implemented across all peatland landscapes to save these threatened ecosystems and their services to people.
    - **Rewetting:** It is an essential step in the restoration of Peatlands as they rely on waterlogged conditions for their survival.

- **Plaudiculture and sustainable management techniques**: It is a practice of crop production on wet soils, predominantly in peatlands. Other sustainable techniques could be cultivation of fish or pursuit of ecotourism.

- **Legal and Fiscal environment and Polices:** Various policies that have been put in place both at global as well domestic levels should be implemented properly.
  - **Local communities should receive support** to sustainably manage their peatlands by preserving traditional non-destructive uses and introducing innovative management alternatives.
- **Creating a market to finance peatland management:** Using Funding mechanism such as Green Bonds, private capital (equity and debt), funding from government sources etc.
- **Institutional framework** for coordinated action: Integrated global partnerships should be established.
- **Restricting new agriculture & industrial activities** that threaten their long-term viability and developing long-term land use policies which favour conservation and protection of peatlands.
- **Capacity building:** Focused action is required with support from developed countries for capacity building, outreach and awareness raising.
- A **comprehensive mapping of peatlands worldwide** is essential to better understanding their extent and status, and to enable us to safeguard them.

6.9. GLOBAL ASSESSMENT REPORT ON BIODIVERSITY AND ECOSYSTEM SERVICES

Why in news?

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) released its global assessment report on biodiversity and ecosystem services.

What is the IPBES Global Assessment Report?

- The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) is an independent intergovernmental body established in 2012 with now over 130 member states around the world.
- The report by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) is the **most comprehensive scientific evaluation ever made** of the state of our nature, and gives a detailed account of health of the species that inhabit this earth, and the condition of habitats that they live in and depend upon.

Notable Observations and Significance of the Report: The IPBES Global Assessment Report on Biodiversity and Ecosystem Services is the **most comprehensive ever** completed. It is the **first intergovernmental Report of its kind** and builds on the landmark Millennium Ecosystem Assessment of 2005, introducing innovative ways of evaluating evidence.

- **State of Biodiversity:** The Report concluded that the **second-fastest mass extinction event in planetary history is underway**; the current rate of extinction is 100 to 1000 times greater than historical background rates. Over one million species are at risk of extinction within the next few decades.
- **Significance of Indigenous People and knowledge:**
  - The **Report highlighted the importance of indigenous community in conservation**. It notes, "Nature managed by Indigenous Peoples and Local Communities is under increasing pressure but is generally declining less rapidly than in other lands." This is significant since **"at least" a quarter of the world's land area is "traditionally owned, managed, used or occupied by indigenous peoples".**
  - This is important especially when there are pressures on these communities due to increasing commercialisation of forests. E.g. **India is in the process to amend the Indian Forest Act** which is being seen as going against the rights of traditional forest dwellers.
- **Drivers of Change:**
  - **Direct Drivers:** the **five direct drivers of change** -(1) changes in land and sea use; (2) direct exploitation of organisms; (3) climate change; (4) pollution and (5) invasive alien species.
  - **Indirect Drivers:**
    - ✓ **Key indirect drivers include** increased population and per capita consumption; technological innovation, which in some cases has lowered and in other cases increased the damage to nature; and, critically, issues of governance and accountability.

- ✓ A pattern that emerges is one of **global interconnectivity** and **'telecoupling'** – with resource extraction and production often occurring in one part of the world to satisfy the needs of distant consumers in other regions.

- **Status of Global Conservation Efforts:** Despite progress to conserve nature and implement policies, global goals for conserving and sustainably using nature and achieving sustainability **cannot be met by current trajectories.** Goals for 2030 and beyond may only be achieved through **transformative changes** across economic, social, political and technological factors.
- **Recommendations: Five key interventions** can generate positive transformation by tackling the underlying indirect drivers of nature deterioration:
  - Developing incentives and widespread capacity and eliminating perverse incentives
  - Reforming sectoral and segmented decision-making to promote integration across sectors and jurisdictions
  - Taking pre-emptive and precautionary actions in regulatory and management institutions and businesses
  - Managing for resilient social and ecological systems in the face of uncertainty and complexity
  - Strengthening environmental laws and policies and their implementation, and the rule of law more generally.

Linkages between Biodiversity and the SDGs: Going far beyond the scope of SDG 14 and 15 that respectively address life below water and life in land,

- Biodiversity and healthy ecosystems provide the essential resources and ecosystem services that directly support a range of societal sectors and economic activities, such as agriculture, forestry, fisheries, and tourism. Biodiversity is thus immediately relevant to the achievement of **SDG 1 on ending poverty** and S**DG 8 on decent work and economic growth**.
- The **recognition of rights to sustainable management of natural resources for indigenous peoples**, local communities, and women, and implementation of the CBD objective on fair and equitable benefit-sharing has the potential to improve socioeconomic and political inequality among countries and social groups **(SDG 10)**.
- **Biodiversity is key for food security and nutrition**, and contributes to the achievement of **SDG 2 on zero hunger**. Agricultural genetic diversity, including crop and livestock, is crucial for the resilience and adaptation of agricultural systems to pests and changing environmental conditions. All food systems depend on biodiversity and the ecosystem services that support agricultural productivity, soil fertility, and water quality and supply.
- As more and more deaths globally are attributed to environmental factors, the links between **biodiversity and health (SDG 3)** are increasingly recognized. Healthy ecosystems help to mitigate air, water, and soil pollution, and are the source of both modern and traditional medicines.
- They underpin the delivery of water supplies, water quality, and protect against water-related disasters **(SDG 6)**; they are the source of energy **(SDG 7);** they can provide reliable and cost-effective natural infrastructure **(SDG 9);** and in general provide basic services to cities, and nature-based solutions to challenges related to urban well-being **(SDG 11)** and to climate change **(SDG 13).**
- **All these are however undermined** by current unsustainable production and consumption patterns **(SDG 12),** as well as illegal wildlife trade, fishing, and timber trade **(SDG 16).**
- The potential of biodiversity to contribute to sustainable development features in many of the decisions that CBD Parties adopted at the **latest UN Biodiversity Conference**, held in November 2018, in Sharm El-Sheikh, Egypt.

6.10. POLLINATORS

Why in News?

According to a recent study, high levels of pollution is having negative effects on plants and insects, resulting into **decline of pollinator species.**

- **Pollination:** It's a process based on the ecological principle of species inter-relationship known as **protocooperation**, between plants and pollinators.
- **Pollinator**s are external agents which help in the transfer of pollen grains from one flower to another of the same or another plant of the same species.

Importance of pollinators and pollination

- **Regulating ecosystem service in nature**: Globally, nearly 90 per cent of wild flowering plant species depend, at least in part, on the transfer of pollen by animals.
- **Food Security**: Pollinator-dependent crops contribute to 35 per cent of global crop production volume.
- **Health:** Pollinator-dependent food products are important contributors to healthy human diets and nutrition.

- **Cultural Importance:** Pollinators serve as important spiritual symbols in many cultures. Sacred passages about bees in all the worlds' major religions highlight their significance to human societies over millennia.
- **Economic Importance:** According to **Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)**, pollinator contributed $0.831-1.5 billion annually for just six vegetable crops in India.

Sources of Threats to Pollinators

- **Environment pollution**: Pollutants in the air, water and land affect the physiology and behavior of the insects.
- **Anthropogenic factor** like disturbance, degradation, fragmentation, shrinkage, and the loss of habitat
- **Impact of introduced species**: Alien invasive plants may impact negatively on insect biodiversity by changing habitat quality, outcompeting native host plants, and interrupting vital ecological interactions.
- **Increase in mono-cropping**: The transformation of agriculture from traditional mixed crop farming to high value cash crop farming has led to an increase in monocrop agriculture, resulting in reducing the food sources for natural insect pollinators.
- **Forest fires:** It destroy the habitat, food sources and pollinators nesting in the area.
- **Honey hunting**: An increase and ruthless hunting of the nests of wild honeybees is contributing to the decline in the population of indigenous honeybees.
- **Pesticides:** Use of pesticides, including insecticides and herbicides, is detrimental to a healthy community of pollinators.

Way Froward

- **Enabling policies and strategies**: Develop and implement coherent and comprehensive policies that enable and foster activities to safeguard and promote wild and managed pollinators, to be integrated into the broader policy agendas for sustainable development
- **Protect and promote indigenous and traditional knowledge,** innovations and practices related to pollinators and pollination and support participatory approaches to the identification of diagnostic characteristics for new species and monitoring.
- **Control the trade and movement of managed pollinators**: Monitor the movement and trade of managed pollinator species, sub-species and breeds among countries and within countries to Prevent and minimize the risk of introducing invasive alien species.
- **Promote connectivity, conservation, management and restoration of pollinator habitats** by preserving pollinators and habitats distributed in natural areas, including forests, grasslands and agricultural lands, urban areas and natural corridors, to enhance the availability of floral resources and nesting sites over time and space.
- **Promote sustainable beekeeping and bee health**: By promoting better availability and husbandry of floral resources, therefore improving pollinator nutrition and immunity to pests and diseases.
- **Practicing Sustainable Agriculture Practices**: Exposure of pollinators **to pesticides can be decreased** by promoting **Integrated Pest Management** supported by educating farmers, organic farming and policies to reduce its overall use.
    - **Ecological Intensification**: Managing nature's ecological functions to improve agricultural production and livelihoods while minimizing environmental damage.
    - **Strengthening Existing Diversified Farming Systems**: to foster pollinators and pollination through practices validated by science or indigenous and local knowledge (e.g., crop rotation).
    - **Investing in ecological infrastructure by protecting**, restoring and connecting patches of natural and semi-natural habitats throughout productive

6.11. MEASURING NATURAL CAPITAL

Why in news?

Envistats India 2018 report by the **Ministry of Statistics and Programme Implementation (MOSPI**), it had revealed that India's economic growth took a toll on its natural assets like forests, food and clean air.

More on news

- The average growth rate of gross state domestic product (GSDP) during 2005-15 for almost all the states was around 7-8 per cent but **11 states registered a decline in their natural capital.**

Why does natural capital matter for economic growth?

- **Inadequacies with GDP-**
  - GDP only looks at **one part of economic performance output** but tells us nothing about income in the long term, thus is an incomplete assessment of country's economic wellbeing. For example, when a country exploits its minerals, it is actually using up its finite mineral wealth.
  - It ignores natural capital. In forestry, for example, timber resources are counted, but forest carbon sequestration is not. Other services, like water regulation that benefits crop irrigation, are hidden and the value is (wrongly) attributed to agriculture in a country's GDP.
- A full picture of a country's wealth obtained through a methodology called **'wealth accounting' (including natural capital accounting)** includes all assets that contribute to our economic wellbeing, from buildings and factory machines, to infrastructure, human and social capital, and natural capital.
- Natural capital is **especially important to many developing countries** because it makes up a large share of their total wealth (some 36 percent) and the livelihoods of many subsistence communities depend directly on healthy ecosystems.
- Several countries are compiling **natural capital accounts (NCA)** to make economic decision making on natural resources an informed process. They want to use NCA as the basis for compiling indicators to monitor progress of sustainability policies.
- India is participating in the **Natural Capital Accounting and Valuation of Ecosystem Services project**.

How are natural capital accounts used?

- **Support inclusive development and better economic management:** For example, land and water accounts can

Natural Capital

- It includes those elements of the nature that provide valuable goods and services to humans, such as the stock of forests, food, clean air, water, land, minerals, etc.
- It incorporates a broad perspective on the set of services provided by ecosystems assets.
- It is essential for economic growth, employment, and, ultimately, prosperity.

Natural Capital Accounting, or environmental-economic accounting

- It is a tool that can help to gain an understanding of the interaction between the economy and the environment.
- It can be used to measure the state of ecosystems, flows of ecosystem services as well as changes in stocks and flows of natural resources in relation to economic changes.

System of Environmental-Economic Accounting (SEEA)

- It is a **statistical system** that brings together economic and environmental information into a common framework to measure the condition of the environment, the contribution of the environment to the economy and the impact of the economy on the environment.

Natural Capital Accounting and Valuation of Ecosystem Services

- The United Nations Statistics Division, UNEP, the Secretariat of the Convention on Biological Diversity, and the European Union have launched this project.
- The project is funded by the European Union, aims to assist the five participating partner countries, namely **Brazil, China, India, Mexico and South Africa**, to advance the knowledge agenda on environmental and ecosystem accounting.
- The project review policy demands, data availability and measurement practices in order to advance and mainstream natural capital accounting and initiate pilot ecosystem accounts in each of the five strategic partner countries.

Related news

Inclusive Wealth Report: The inclusive wealth of **one-third of the countries in the world has declined**, but their **gross domestic product (GDP) has increased**, finds the Inclusive Wealth Report 2018 presented by the UN Environment.

- **Global Structure of Capital:** As of 2014 has composed of **produced capital** (21%), **human capital** (59% of which 26% education induced human capital and 33% is health induced human capital), and **natural capital** (20%).
- **Growth rate:** The global level growth of each of the three capitals over the study period indicate that produced capital was growing at an average rate of 3.8% per year and health and education induced human capital was growing at 2.1%. Contrary, natural capital was decreasing at a rate of 0.7% per annum.

help countries interested in hydropower to assess the value of competing land uses and find the optimal solution.

- **For Economic Growth:** Ecosystem accounts can help biodiversity-rich countries manage the tradeoffs between ecotourism, agriculture, subsistence livelihoods, and ecosystem services like flood protection. In this way, ecosystem accounting is a tool for maximizing economic growth while identifying who benefits and who bears the cost of ecosystem changes, helping governments gauge whether their growth is inclusive.

6.12. COASTAL REGULATION ZONE (CRZ) NOTIFICATION 2018

Why in news?

The Union Cabinet has approved the Coastal Regulation Zone (CRZ) Notification, 2018.

Classification of the CRZ

- **CRZ-I** areas are environmentally most critical
- **CRZ-II:** The developed land areas up to or close to the shoreline, within the existing municipal limits or in other existing legally designated urban areas.
- **CRZ-III:** Land areas that are relatively undisturbed (viz **rural areas** etc.) and those do not fall under CRZ-II.
- **CRZ- IV:** It **constitutes the water area**

Background

- **To conserve** and **protect the coastal environment**, and to promote sustainable development based on scientific principles Ministry of Environment and Forest and Climate Change (MoEFCC), **under the Environment (Protection) Act, 1986**, notified the CRZ Notification in 1991, subsequently revised in 2011.
- Various Coastal States/UTs, besides other stakeholders, were demanding for a comprehensive review of the CRZ Notification, 2011, particularly related to the management and conservation of marine and coastal eco-systems, development in coastal areas, eco-tourism, livelihood option and sustainable development of coastal communities etc.
- In June 2014, **Shailesh Nayak Committee** was constituted by the MoEFCC to review the the CRZ Notification, 2011.
- Government in April 2018 released a **draft notification on coastal regulation** zone taking inputs from states/UTs and recommendations of Shailesh Nayak Committee.

Salient Features

- **Easing FSI norms: This notification de-freezes the restrictions imposed on** Floor Space Index (FSI) or the Floor Area Ratio (FAR) under CRZ, 2011 in accordance to 1991 Development Control Regulation (DCR) levels.
- **No development zone (NDZ) reduced for densely populated areas**
- **Tourism infrastructure for basic amenities to be promoted:** The notification allows for temporary tourism facilities such as shacks, toilet blocks, change rooms, drinking water facilities etc on beaches at a minimum distance of 10 metres from HTL. Such temporary tourism facilities are also now permissible in the NDZ of the CRZ-III areas.
- **CRZ Clearances streamlined:**
  - CRZ clearances are needed only for projects located in CRZ-I and CRZ IV.
  - States to have the powers for clearances w.r.t CRZ-II and III with necessary guidance.
- **NDZ of 20 meters has been stipulated for all Islands:** in the wake of space limitations and unique geography and to bring uniformity in treatment of such regions.
- **All Ecologically Sensitive Areas have been accorded special importance: Through** Specific guidelines related to their conservation and management plans.
- **Pollution abatement has been accorded special focus**
- **Defence and strategic projects have been accorded necessary dispensation.**

Benefits

- **Enhanced activities in the coastal regions** thereby **promoting economic growth** while also respecting the conservation principles of coastal regions.
  - **Boost tourism** in terms of more activities, more infrastructure and more opportunities in creating employment opportunities.
  - greater opportunities for **development of densely populated rural areas** in the CRZs.

- CRZ, 2018 is also **in sync** with the thrust being given to **port-led industrialisation** and the Coastal Economic Zones projects.
- **Additional opportunities for affordable housing** which will benefit not only the housing sector but the people at large looking for shelter.
- It is expected to **rejuvenate the coastal areas** while reducing their vulnerabilities.

CRZ helps in reducing the ecological vulnerability through:

- **Regulated activities in ecologically most sensitive areas (CRZ-I A)**
  - Regulate activities such as Eco-tourism subject to approved Coastal Zone Management Plans (CZMPs), exceptional construction of public utilities in the mangrove buffer etc.
  - Construction of roads and roads on stilts, by way of reclamation shall be **permitted only in exceptional cases** for defence, strategic purposes and public utilities, subject to a detailed marine/terrestrial environment impact assessment, to be **recommended by** the Coastal Zone Management Authority and **approved by** the MoEFCC.
  - **compensatory plantation of mangroves (Minimum three times** the mangrove area affected/destroyed/ cut).
- **Areas requiring special consideration in the CRZ**
  - **Critically Vulnerable Coastal Areas (CVCA)**: the ecologically sensitive areas identified as under Environment (Protection) Act, 1986 such as Gulf of Khambat and Gulf of Kutchchh in Gujarat, shall be treated as CVCA and **managed with the involvement of coastal communities** including fisher folk who depend on coastal resources for their sustainable livelihood.

Concerns

The new notification has **done away with or diluted many stringent restrictions** in place at coastal areas. The emphasis of the new CRZ norms is on promotion of tourism facilities, quicker dispensation of defence and strategic projects and liberal licensing for the installation of treatment plants.

Integrated Coastal Zone Management (ICZM): This concept was born in 1992 during the Earth Summit of Rio de Janeiro. This was a World Bank assisted project with the objective of building national capacity for implementation of comprehensive coastal management approach in the country and piloting the integrated coastal zone management approach in states of Gujarat, Orissa and West Bengal.

- The project's **multi-sectoral and integrated approach** represents a paradigm shift from the traditional sector-wise management of coastal resources where numerous institutional, legal, economic and planning frameworks worked in isolation, at times with conflicting aims and outputs.
- The project puts equal emphasis on conservation of coastal and marine resources, pollution management, and improving livelihood opportunities for coastal communities.

- Eco-sensitive regions could see **flurry of construction activity** thereby **hampering the coastal eco system** and biodiversity.
- The notification **violates the balance between ecosystem and development.** The mandatory 50 m buffer zone for mangrove forest in private land with an expanse of more than 1,000 sq m has been done away with.
- The **fishermen are worried** that the entry of the tourism sector will attract the real estate lobbies, who will eventually displace the coastal community and deny them the access to the seas.
- Further, the **reduction of NDZ** is done without taking consideration of sea level rise. The coastline is already vulnerable due to erosion, freshwater crisis and loss of livelihoods. The new changes will only increase this vulnerability and promote commercialisation of the coast.
- The **Hazard Line, mapped by the Survey of India has, however, been de-linked from the CRZ regulatory regime** and will be used only as a tool for disaster management and planning of adaptive and mitigation measures.
- The **treatment facilities, allowed in CRZ-I** to reduce coastal pollution, means several ecologically fragile areas will have sewage treatment plants transferring pollution from land to sea.
- The **notification permits activities** like reclamation of land for commercial activities, interference with sand dunes, large scale recreation and drawing of ground water within the 200-500 metres from the HTL, which is detrimental to the coastal ecology and that will displace the local communities and affect the bio-diversity.

Conclusion

The sustainable management depends on the nature of the social system, comprising political, economic and industrial infrastructure and its linkages, with the knowledge about coastal systems as well as local communities. **India need to move from a purely regulatory approach towards an Integrated Coastal Zone Management (ICZM).**

7. RENEWABLE ENERGY AND ALTERNATIVE ENERGY RESOURCES

Renewable Energy Targets: India has set an ambitious goal of installation of 175 GW of renewable energy by 2022. This is to be achieved by Solar (100 GW), Wind (60 GW), Biomass (10 GW) and Small hydro projects (5 GW).

Status of Renewable Energy
- Total Installed Capacity- 357.87 GW
- Share of Renewables- 79.4 GW (22%)
  - Solar Power- 29.4 GW
  - Wind Power- 36.1 GW
  - Small Hydro Power (≤25 MW)- 4.6 GW
  - Bio-Power- 9.3 GW

Progress

- **Solar Energy:** Despite impressive start, the growth hasn't matched the continuously increasing annual targets to meet the target of 100 GW.
  - After the initial spurt in 2015-16, where the installed capacity surpassed the target for the year by 2 GW, there has been a consistent difference of 6 GW between the yearly target and achievement in the following two years. As a result, by March 2018, Solar had a 12 GW lag against the target.
  - The rooftop sector has been specially lagging with only 2.5 GW of installation as of March 2018 against the set target of 40 GW.
  - Most of the growth has been **from the public sector driven installations and commercial entities**. The residential segment remained virtually untouched by the solar rooftop.
- **Wind Energy:** Despite losing grounds to solar energy in recent past, the wind auctions have fared better in 2018, with 6.9 GW allocated.
- **Biomass and small hydro**: The more modest targets set for biomass and small hydro has already been achieved as of 2018.
- **Affordable renewable energy:** As the viability of renewable energy has improved drastically in the recent times, tariff discovery is made through reverse auctioning process. The solar tariff has come down from around Rs. 18/kWh in 2010 to Rs. 2.44/ kWh in bids conducted in 2018. Similarly, for wind power, the tariff has declined from an average of Rs. 4.2/kWh in 2013-14 to Rs. 2.43/ kWh in December 2017.
- **Transmission Infrastructure Support:** Additional transmission infrastructure is necessary to remove evacuation bottlenecks and enable greater transmission between states with excess renewable energy and those that require it.
  - The **Green Energy Corridor- I**, conceived in 2012, aims to add 11,700 circuit kilometres (ckm) of transmission lines for renewable energy only. However, it is far behind its schedule.
  - The **second phase of Green Energy Corridor** that looks specifically at constructing evacuation system for Ultra Mega Solar Parks (totaling 20 GW in capacity) commenced in 2015.
- **Finance:** As of July 2018, over 100 GW of renewable capacity installation was pending requiring an estimated capital of over 6 lakh crores. This translates to nearly $ 25 billion annually which is much higher than $ 10 billion per annum being received by the sector between 2015-17.

7.1. LOW CARBON STRATEGY FOR RENEWABLE ENERGY INTEGRATION

Why in News?

Recently NITI Aayog, International Energy Agency (IEA) and Asian Development Bank (ADB) released a report titled "**Low Carbon Strategy for Renewable Energy Integration**".

Why do we need renewable Energy Integration?

- Renewable Energy sources are characterized by inherent issues like variability, intermittency etc. which impose a **threat on effective management of the system operation and management.**
- The **need to effectively integrate** such large-scale Renewable Energy in the Grid has been one of the key concerns for all stakeholders including the policy makers, planners and regulators.

Challenges in integrating Variable Renewable Energy Sources

- **Technical Challenges**
  - **Flexibility of the Conventional Plants:** Current conventional sources are old and are technological incapable of responding to quick ramp up and back down emerging from fluctuations in RE generation.

- **Forecasting and Scheduling**: Solar and wind are dependent on highly variable weather conditions and shall lead to high fluctuations in the power injected. Forecasting (both Load, RE generation as well as Net Load) is therefore essential for ensuring resource adequacy during operation and grid security. These fluctuations can only be predicted fairly accurately up to a few days in advance and forecasts improve greatly if they are only for a few hours ahead.

> **Variable Renewable Energy**
> It is renewable energy source that is **non-dispatchable due to its fluctuating nature**, like wind power and solar power, as opposed to a controllable renewable energy source such as hydroelectricity, or biomass etc.

- **Improved Market Operations**: As the renewable sources are concentrated in some of the States, adequate market operations and support services needs to be put in place which would encourage inter-state trading of the RE. Currently, there are significant barriers for such inter-state trading of RE including lack of reserve sharing between control areas / States, absence of products / markets for primary etc.

- **Lack of Regulatory and Policy framework:** The current market rules and regulations needs to be modified to achieve operational efficiency in system with increasing penetrations of variable RE. **Electricity being a concurrent subject, limited initiatives have been undertaken at the State level**. Not many states have undertaken adequate steps for aligning the state regulations with the central regulations.
- **Other Challenges:** They are more modular and are deployed in a much more **distributed fashion.** Unlike fossil fuels, wind and sunlight cannot be transported and locations with the best resources are frequently **at distance from load centres**.

Steps that needed to be taken for integration of renewable power within the synchronized Indian grid

- **Upgrading grid technology**
  - **Ensuring effective scheduling and dispatch** at the state level in all states and enhance power exchanges with neighboring states for better access of least cost generation.
  - **Deploy sensors for real-time data** on grid conditions coupled with sophisticated analytical tools to provide necessary information for grid operations.
- **Improved market design and renewable energy procurement**
  - Create **model Power Purchase Agreement** for renewable that move away from must -run status and employ alternative approaches to limit financial risk.
  - Allow buying/selling of power at rapid speed at power exchange to manage sudden ramping up and down.
  - Enable fair price discovery and compensation of flexible resource providers.
- **Promote flexible demand and balancing resources system with a high share of renewable require access to sufficient flexible resources**
  - Create policy and regulatory incentives to access the full capabilities of existing coal, gas turbine, hydro and pumped storage generators.
  - Improve the flexibility associated with conventional generating units to accommodate the variability and uncertainty of generation from renewables.
  - Address integration issues on the distribution grid, including rooftop PV and utility-scale wind and solar that are connected to low-voltage lines.

7.2. RENEWABLE ENERGY CERTIFICATES

Why in news?

Recently, the Renewable Energy (RE) companies have moved the Delhi High Court, seeking an exemption for **Renewable Energy Certificates (RECs**) under the goods and services tax (GST).

About Carbon Market in India

- India currently has **two carbon market-based trading schemes** in place-
  - **The Perform, Achieve & Trade (PAT),** which is designed to accelerate implementation of cost-effective measures in energy efficiency in large energy-intensive industries.
  - **The Renewable Energy Certificate (REC)**, which is designed to promote generation of renewable energy (RE) within the country.

Need for Carbon Markets in India

- **Commitment for climate change mitigation actions:** Under the Paris climate agreement, India plans to reduce its emissions intensity by 33 – 35% below 2005 levels by 2030. A nationwide carbon market could help **attaining a low-carbon path.**
  - By putting a price on carbon emissions, carbon market mechanisms help to internalize the environmental and social costs of carbon pollution, encouraging investors and consumers to choose lower-carbon paths.
- **Economic rationale: Emission Trading System** have been shown to lower the cost of reducing emissions by internalizing environmental externalities, which incentivizes efficient low-carbon investment. Embracing a cleaner, low-carbon pathway—including investment in renewable energy—can lead India to a healthier and more vibrant economy.
  - **Carbon markets** can complement other policy instruments such as **carbon taxes** and **energy-efficiency standards.**
- **Sense of obligation to the international community** as India today is a major contributor of greenhouse gases thus efficient handling of its carbon emissions will overall advance the idea of social development.
  - A carbon market could align India's economic and social objectives under the United Nations' Sustainable Development Goals.

PARAMETER	PAT	REC
NODAL BODY	Bureau of Energy Efficiency (BEE), under the aegis of the Ministry of Power (MOP)	Ministry of New and Renewable Energy (MNRE)
TIMEFRAME	Launched in 2012; Currently in its 3rd Cycle, with each cycle being for 3 year	Launched in 2010; no definite cycle designed, but implementation is designed for annual cycles based on notification of RPOs.
METRIC	Energy Saving Certificates (ESCert) are measured in ton of oil equivalent (TOE) value; 1 ESCent- 1 TOE sav	REC Certificates are measured in Mwh value; 1 REC - 1 MWh
COVERAGE	Till date, 11 energy-intensive sectors have been notified for PAT- Aluminum, Cement, Chlor- Alkali, Fertilizer, Iron & Steel, Paper & Pulp, Thermal Power Plants, Textile, Railways, Refineries & Electricity Distribution Companies	2 categories of RECs; solar RECs and non-solar RECs. The following categories are included: Electricity distributors /suppliers such as Distribution Licensees, Captive Consumers, Open Access users
REGULATORY BODY	Central Electricity Regulatory Commission (CERC)	Central Electricity Regulatory Commission (CERC)
REGISTRY	Power System Operation Corporation Limited (POSOCO)	Power System Operation Corporation Limited (POSOCO)
TRADING PLATFORM	Indian Energy Exchange (IEX) and Power Exchange India Limited (PXIL)	Indian Energy Exchange (IEX) and Power Exchange India Limited (PXIL)

Renewable Energy Certificates

- A Renewable Energy Certificate (REC) is a **market-based instrument** that certifies the bearer owns **one megawatt-hour** (MWh) of electricity generated from a renewable energy resource.
- Once the power provider has fed the energy into the grid, the REC they **receive can be sold in the open market as a commodity.** A pan-India market has been created for trading in RECs through two Power Exchanges namely, **Indian Energy Exchange** (IEX) and **Power Exchange of India** (PXIL).
- The price of RECs is determined by market demand and contained between the **'floor price'** and **'forbearance price'** specified by the **Central Electricity Regulatory Commission (CERC).** These tariffs are reviewed periodically to reflect the average tariffs quoted in the latest RE Power Purchase Agreement (PPA).
- There is a **concentration of RE potential in a few** states, which means that the same level of **Renewable Purchase Obligation** compliance cannot be expected from all states. These leads to following implications-
  - The low potential states have to resort to **expensive cross-border procurement,** accompanied with many regulatory hurdles and additional charges.
  - The State distribution companies (DISCOMS) with large shares of subsidised consumers end up bearing **disproportionately high costs.**
- So, this mechanism provides a **means to address the dispersed availability of renewable energy sources across various States in the Country.**

Renewable Purchase Obligation (RPO)

- Launched in 2010, RPOs make it obligatory for DISCOMs, open-access consumers and captive power producers to meet part of their energy needs through green energy.
- Pre-defined RPO target for all states currently ranges from 3% to 10% of the total energy requirement of the states. **RPO is divided in two parts- solar RPO and non-solar RPO.**
- The Ministry of New and Renewable Energy (MNRE) introduced incremental annual RPO targets amounting to 21% in 2022.

Challenges of REC Market

- **Voluntary in nature** hence, creating a demand for RECs is a challenging task which leads to a supply-demand mismatch in the market.
- **Lack of awareness** among corporates, individuals and NGOs for the RECs.
- **Regulatory Challenges-** The obligated entities prefer to continue to buy renewable power directly rather than using RECs, to comply with their RPOs owing to uncertainties in trading of RECs.
- **Low Solar REC trading** which was affected following CERC's decision to reduce the floor and ceiling price of solar and non-solar RECs in March 2017.

Way Forward

- The REC mechanism holds potential in promoting renewable sources of energy and development of market in electricity, leading to the sustainable development of the country. It also provides avenue for voluntary buyers to go green and contribute to the sustainable development of the country.
- There is a need to sensitize voluntary buyers like industries and corporate about their contribution to green energy & environment.
- Capacity building of all the stakeholders should be done including the state agencies and project developers.

7.3. PRADHAN MANTRI JI-VAN (JAIV INDHAN- VATAVARAN ANUKOOL FASAL AWASHESH NIVARAN) YOJANA

Why in news?

Recently Cabinet Committee on Economic Affairs approved Pradhan Mantri JI-VAN yojana.

Background

- **Ministry of Petroleum & Natural Gas (MoP&NG)** has targeted to achieve **10% blending percentage of Ethanol in petrol by 2022.**
- Additionally, **an alternate route** viz. **Second Generation (2G) Ethanol from biomass and other wastes** is being explored by MoP&NG to bridge the supply gap for EBP programme.
- In this direction**, "Pradhan Mantri JI-VAN Yojana"** is being launched as a tool to create 2G Ethanol capacity in the country and attract investments in this new sector.

Ethanol Blended Petrol (EBP) programme

- Government of India launched Ethanol Blended Petrol (EBP) programme in 2003 for undertaking blending of ethanol in Petrol to address environmental concerns due to fossil fuel burning, provide remuneration to farmers, subsidize crude imports and achieve forex savings.
- **Under EBP programme, OMCs are to blend upto 10% of ethanol in Petrol.**
- Presently, EBP is being run in 21 States and 4 UTs of the country.
- The present policy allows procurement of ethanol produced from molasses and non-food feed stock like celluloses and lignocelluloses material including petrochemical route.

Details of the scheme

- The scheme under the **MoP&NG** will provide **financial support to Integrated Bioethanol Projects** using lignocellulosic biomass and other renewable feedstocks.
- 12 commercial scale and 10 demonstration scale **Second Generation (2G) ethanol projects** will be provided **viability gap funding support over the next six years** in two phases: Phase-I (2018-19 to 2022-23) and Phase-II (2020-21 to 2023-24).
- It also seeks to **increase Research & Development** in this area.
- The ethanol produced by the scheme beneficiaries will be **mandatorily supplied to Oil Marketing Companies (OMCs)** to further enhance the blending percentage under Ethanol Blended Petrol Programme.
- **Centre for High Technology (CHT),** a technical body under the aegis of MoP&NG, will be the implementation Agency for the scheme.

Benefits of the scheme

- **Reducing import dependence** by way of substituting fossil fuels with Biofuels.
- **Achieving the GHG emissions reduction targets** through progressive blending/ substitution of fossil fuels.

- **Addressing environment concerns i.e. air pollution** caused due to burning of biomass/ crop residues and thus improving the health of the citizens.
- **Improving farmer income** by providing them remunerative income for their otherwise waste agriculture residues.
- Indigenizing of Second-Generation Biomass to Ethanol technologies.
- **Creating rural & urban employment opportunities** in 2G Ethanol projects and Biomass supply chain.
- **Contributing to Swacch Bharat Mission** by supporting the aggregation of non-food biofuel feedstocks such as waste biomass and urban waste.

Related News

BIO JET-FUEL: Recently, a Russian-origin AN-32 transport plane was formally fleet certified by DRDO to fly with the 10% bio-jet blended ATF (aviation turbine fuel) made **from Jatropha oil**.

Significance of Bio jet fuel

- Aviation sector is **one of the largest emitters of Green House Gas** worldwide. So, the sector's transition to sustainable and renewable fuels is crucial **to meet** international climate targets set **in 2015 Paris Agreement.**
- **Green Aviation biojet-fuels** contribute around **80% reduction** in the carbon footprint of the aviation industry and are a potential offset for CO_2 emissions.
- Regular use of such bio-fuels can help the IAF **cut down some costs in buying huge quantities of ATF** every year and reduce fossil fuel use.
- Bio-Fuel are produced only from non-edible oils that **grow well in arid lands**, in states like Gujarat, Punjab, Haryana, Chattisgarh, Uttarakhand and Telangana.

Related Information - National Policy on Biofuels-2018

- The National Policy on biofuels-2018 tries to address supply-side issues by encouraging alternative feedstocks with an aim to reduce the cost of producing biofuels and improve affordability for consumers as well as developing biofuel production.
- **Salient Features of the National Policy on biofuels, 2018**
  - **Categorisation of biofuels** to enable extension of appropriate financial and fiscal incentives under each category. The two main categories are:
    - ✓ **Basic Biofuels-** First Generation (1G) bioethanol & biodiesel
    - ✓ **Advanced Biofuels** - Second Generation (2G) ethanol, Municipal Solid Waste (MSW) to drop-in fuels, third Generation (3G) biofuels, bio-CNG etc.
  - **Expands the scope of raw material for ethanol production** by allowing use of Sugarcane Juice, Sugar containing materials like Sugar Beet, Sweet Sorghum, Starch containing materials like Corn, Cassava, Damaged food grains like wheat, broken rice, Rotten Potatoes, unfit for human consumption for ethanol production.
  - **Allows use of surplus food grains for production of ethanol** for blending with petrol to ensure appropriate price to farmers during surplus. However, it needs the approval of National Biofuel Coordination Committee.
  - **Thrust on Advanced Biofuels**: Viability gap funding scheme for 2G ethanol Bio refineries of Rs.5000 crore in 6 years in addition to additional tax incentives and higher purchase price as compared to 1G biofuels.
  - **Encourages setting up of supply chain mechanisms** for biodiesel production from non-edible oilseeds, used Cooking Oil, short gestation crops.

7.4. ELECTRIC VEHICLES IN INDIA

Why in news?

The Union Budget 2019, has announced various incentives for the Electronic vehicles sector to promote electric- driven mobility in India.

Incentives Announced

- Additional income tax deduction of Rs. 1.5 lakh on interest paid on electric vehicle loans.
- Customs duty exempted on certain parts of electric vehicles e.g. on lithium–ion cells**.**
- Outlay of Rs. 10,000 crores for 3 years approved for Phase-II of **FAME** Scheme.

Prospects of EVs in India

- In India, **transport sector is the second largest contributor to CO_2 emissions** after the industrial sector. **Road transport** accounts for around 90% of the total emissions in the transport sector.
- **Increasing vehicle ownership** has led to increased demand for the fossil fuels. Given the **large import dependence** of the country for petroleum products, it is imperative that there be a shift of focus to alternative fuels to support our mobility in a sustainable manner.
- High **availability of skilled manpower and technology** in manufacturing and IT software.

- **Shared mobility in India** with the coming up of Taxi aggregators such as Ola and Uber increasing exponentially. This **has increased a) Vehicle utilisation,** which plays to the economic advantages of EVs, and **b) Natural and large-scale purchases of EVs.**
- The **climate commitments coupled with the increasing awareness of the consumers on environmental aspects** are likely to enhance the share of electric vehicles in the future demand of automobile sector. **According to NITI Aayog,** if India reaches an optimum EV sales penetration by 2030, a saving of 846 million tons of net CO_2 emissions and oil savings of 474 MTOE can be achieved.
- It also provides an opportunity to grow **India as a manufacturing hub for EVs (Detroit of EVs),** provided policies are supportive.

Challenges with the faster adoption of EVs

- **Charging infrastructure:** The market share of EVs increases with increasing availability of charging infrastructure. This is primarily due to the **limited driving range of batteries** in the EVs. In India, the limited availability of charging infrastructure seems to be a major impediment to increased adoption of EVs.
- **Battery Technology:** Since the **battery is the heart of any EV**, development of appropriate battery technologies that can function efficiently in the high temperature conditions in India need to be given utmost importance.
- **Charging time:** Compared to conventional vehicles, **even fast chargers can take around half an hour to charge an electric car while slow chargers could take even 8 hours**.
- **Funding:** Assuming a moderate level of adoption, India needs about **$6 billion** for charging infrastructure, **$4 billion** in incentives and a further **$7 billion** to build battery capacity, according to estimates by Goldman Sachs Group Inc.
- **Cost to Consumer:** Even if the charging issue was adequately addressed, EVs are currently priced nearly double the cost of comparable range diesel/petrol cars. Currently, **Indian market share of electric cars is a meagre 0.06%** when compared to 2% in China and 39% in Norway.
- **Multiple Agencies:** Currently, EV makers, have to deal with the Ministry of Heavy Industries and Ministry of Road Transport for guidelines, the Ministry of Power on charging infrastructure, as well as the Ministry of Finance and GST Council over taxation issues.

Government Efforts in Promoting EVs:

- **"National Electric Mobility Mission Plan 2020 (NEMMP)"** was conceived with an objective to achieve sales of 60-70 lakh units of total EVs by 2020.
- In 2015, the **Faster Adoption and Manufacturing of Electric vehicles (FAME) scheme** was launched to fast-track the goals of NEMMP with an outlay of Rs. 795 crores. The initial outlay was for a period of 2 years, commencing from 1 April 2015, which was extended up to 31 March, 2019.
- **FAME India Phase II** has been launched, with effect from 1 April 2019, with a total outlay of Rs. 10,000 Crore over the period of three years. Emphasis in this phase is on electrification of public transportation.

National Mission on Transformative Mobility and Battery Storage

- Recently, Prime Minister had outlined the vision for the future of mobility in India based on **7C's** which are **Common, Connected, Convenient, Congestion-free, Charged, Clean and Cutting-edge mobility**. This mission has been launched in this backdrop.
- It will have an **inter-ministerial steering committee, chaired by CEO, NITI Aayog** that will coordinate among key stakeholders to integrate various initiatives to transform mobility in India.
- It will support and implement **Phased Manufacturing Programme (PMP)** for large scale, **export competitive integrated batteries** and **cell-manufacturing Giga plants in India**.
- The PMP will be launched to localize production across **entire Electric vehicle value chain**.
- The Mission will have **'Make in India' strategy** for Electric Vehicle components and battery technologies.

- Recently approved **"National Mission on Transformative Mobility and Battery Storage"** which will drive **mobility solutions** that will bring in significant benefits to the industry, economy and country.
- **States 'Initiatives:** Several states, including Karnataka, Kerala, Telangana, Maharashtra and Andhra Pradesh, Uttar Pradesh, Uttarakhand, have drafted EV policies to complement the national policy and address state-specific needs
- Ministry of Power has issued a **policy on charging infrastructure** and has issued a notification clarifying that charging electric vehicles will be a service, not a sale of electricity.

- The **Indian Space Research Organisation (ISRO) has commercialized indigenously developed lithium ion battery technology** and has selected 14 companies for transfer of technology.
- Ministry of Housing and Urban Affairs has made amendment in the Urban and Regional Development Plans Formulation and Implementation (URDPFI) guidelines to **provide for electric vehicle charging stations in private and commercial buildings.**

Highlights of Charging Infrastructure Guidelines

- **Objective:** To enable faster adoption of EVs in India, promote an affordable tariff system for EV owners and operators of charging stations, generate employment and income opportunities for small business owners and support the creation of EV charging infrastructure.
- **Ease of Setting:** No license will be required for setting set up a public charging station.
- **Location of Public Charging Station**: Charging station must cater to slow as well as fast-charging requirements
- **Rollout plan**: Phase I (1-3 years) will cover all mega cities with population above forty lakhs, and the associated expressways and highways**. Phase II** (3-5 years) will cover state and UT capitals.
- **Open access**: Charging station has been allowed to source electricity from any power generation company through open access.
- **Promoting Private Participation in charging Infrastructure.**

Way Forward

- **Providing Charging infrastructure** has to be at the centre of any policy push. Charging points can be rolled out on a city-by-city basis. **Recently, Government released guideline on Charging Infrastructure for Electric Vehicles.**
- **Increasing efficiency of vehicles:** Incentivising developments to increase vehicle efficiency, thereby reducing energy consumption, can enable to a vehicle to travel the same distance on a smaller battery pack.
- **Import Duty and Make in India:** Finished electric cars and chargers should have highest import duty; sub-systems like batteries, air-conditioners, power-modules and drive-trains will have lower than this highest import duty; and subsystems like battery-cells, motors, controllers, ICs, magnets, and connectors will have zero duty.
- **Standard for Chargers:** Department for Science and Technology (DST) should develop indigenous standards through the grand challenge method through active participation of industry, academia and other stakeholders.
- **Focus on small and public vehicles to make early impact:** While encouraging the sale of private EVs, India's focus, at least in the first few years, should be on **small, public and rural transportation.** It is possible for India to have a unique impact and scale early with two-wheelers and three-wheelers, including three-wheeler goods vehicles. Special attention is needed to get these vehicles to become economically viable and flourish.
  - Simultaneously, **India needs to ensure that electric buses become viable**. India could use both charging and swapping to get these vehicles scale early.
- **Research and Development (R&D):** It is imperative that India quickly develops strong R&D capacity leading to commercialization in EV subsystems.
- **Power Electronics Industry:** Finally, EVs use power-electronics extensively. India would need a new power-electronics industry which can help develop and produce high-efficiency sub-systems for EV industries.

7.5. ENERGY EFFICIENCY IN INDIA

Why in news?

Bureau of Energy Efficiency (BEE) has developed a national strategy document titled **UNNATEE (Unlocking National Energy Efficiency Potential)** towards developing an energy efficient nation (2017-2031).

UNNATEE Implementation Strategy

- **Favorable Regulations** - through an overarching energy efficiency policy, which includes targets, incentives and penalties.
- **Institutional Framework** - through strong enforcement mechanism at state levels, which would lend further strength to the national and local level program.
- **Availability of Finance** - in the form of a revolving fund, risk guarantee, On-bill financing, Energy Savings Insurance, Energy Conservation Bonds.

- **Use of technology** - including **Internet of Things** and **Block chain** have the ability to bring an energy revolution across sectors. E.g. in agriculture (smart control panels), municipal (Centralized Control Monitoring System-CCMS), commercial (building management systems), domestic (electric cook stoves).
- **Stakeholder Engagement** would result in faster adoption and smoother implementation. E.g. for adoption of electric vehicles, it is important to first have policies for promotion and adoption of EVs, institutional framework to train new breed of engineers to make the transition to EVs, ecosystem players to provide services like EV charging and consumers to buy the vehicles.
- **Data Collection**- Setting up of a Nodal Agency that advocates data collection and dissemination, covering the entire energy value chain of the country.
- **Setting State wise targets**- Mandatory reporting of sector wise energy consumption, status of all EE programmes and the target of the same and energy efficiency roadmap.
- **Center of Excellence for industries** to increase R&D in specific sectors.

Energy Efficiency in India

- **Energy efficiency essentially means** using lesser amount of energy while producing a given amount of output. This not only means **less cost** incurred to produce a commodity, but also implies **lower emissions** of **greenhouse gases.**
- While India focuses in increasing its energy production- consumption, ensuring access to electricity for all and improving living standards, it also **strives to ensure sustainable development** through various **energy efficiency measures.**
- India had realised the importance of energy rationing long back, with the launch of the **Environmental Conservation Act in 2001.**
- It had further directed its policies to focus specifically on energy efficiency by setting up the **Bureau of Energy Efficiency (BEE)** and then initiating **National Mission for Enhanced Energy Efficiency (NMEEE)** in 2008.

Challenges

- **Cross-subsidized electricity prices** leading to wastage in residential and agricultural sectors;
- **Limited information** about the benefits of energy efficiency investments and technologies;
- **Lack of enforcement** of standards, codes, and labelling;
- **Difficulty of measuring 'megawatts'** (or efficiency savings) in the context of project cash flows;
- **Asymmetric risk/reward distributions** (mostly in the building sector for owner/investors versus tenants);
- **Competing objectives** in complex planning situations involving new investments and development;
- **Inadequate investment** in supportive institutional mechanisms and human resources;
- **High transaction costs** from legal, technical, and transactional complexities, like non-standardized deal structures and substantial technical content of project appraisal, development, and monitoring, etc.
- MSME Sector: The **micro small and medium enterprises sector is** one of the most important segments where **overall energy consumption is quite high** due to
  - System inefficiency and less technology intervention.
  - Lack of energy efficiency implementation and compliance due to its unorganized nature, lack of awareness, lack of capital for upfront cost and lack of baseline data.

Initiatives and Innovations in achieving energy efficiency:

- **Energy efficiency**
  - **Star labelling program:** Formulated by the **Bureau of Energy Efficiency (BEE)** with a key objective is to provide the consumer an informed choice about the energy saving and thereby the cost saving potential of the relevant marketed product.
  - **Energy efficiency measures through PAT** in large industries.
  - **Energy Conservation Building Code** for energy efficient buildings launched in 2017.
- **Electric vehicles**
  - No licence required for charging stations

Impact of Energy Efficiency Programmes

- According to a BEE study the energy efficiency programmes led to a total cost savings worth nearly Rs.53,000 crore in 2017- 18 and contributed in reducing 108.28 Million Tonnes of CO_2 emission.
- The contribution is largely from three **major programmes – PAT, UJALA and Standard & Labelling.**
- The **primary energy intensity of India's GDP has followed a falling trend** over the years. India's primary energy intensity of GDP has fallen from 0.0004 toe in 1990 to 0.0002 toe in 2017.

- Procurement of 10,000 e-vehicles for Government institutions

- **Smart Metering**
  - Procurement of 50 lakh smart meters.
  - 1 crore prepaid meters under procurement
- **Digital initiatives**
  - e-Bidding and e-Reverse Auction for short- and medium-term procurement of power.
  - Enabling payments through NPCI platforms such as BHIM, BBPS, Bharat QR etc.
- **For Fuel Efficiency**
  - Corporate Average Fuel Efficiency/Economy (CAFE) Regulation to curb the vehicular pollution has become a concern amongst automobiles industry: In India, **CAFE regulations come into force into 2017**, under which, **average corporate CO_2 emission from vehicle must be less than 130 gm per km till 2022 and below 113 gm per km thereafter**.

7.6. INTERNATIONAL SOLAR ALLIANCE

Why in News?

Recently, Bolivia became the 74th country to sign the framework agreement of the **International Solar Alliance (ISA)**.

About ISA

- It is an initiative **jointly launched by India and France in 2015** on the sidelines of COP-21 of UNFCCC in Paris.
- It was officially established on 6 December 2017, on the entry into force of the Framework Agreement.
- It is a first **treaty based international intergovernmental organization** headquartered in India.
- The membership is open to those solar resource-rich States, which lie **fully or partially between the Tropic of Cancer and the Tropic of Capricorn** and are members of the United Nations.
  - The First Assembly at Delhi adopted the proposal made by India to **expand the scope of membership** of the ISA to **all members of United Nations.** This has **not** yet entered into force.
- Through this initiative, the countries share the collective ambition:
  - to **address obstacles** that stand in the way of rapid and massive scale-up of solar energy;
  - to undertake innovative and concerted efforts for **reducing the cost of finance and cost of technology** for immediate deployment of competitive solar generation; and
  - to **mobilise more than 1000 Billion US Dollars** of investments by 2030.
  - accelerate the development and **deployment of over 1,000GW** of solar generation capacity in member countries.
- The ISA has established **five key programmes** of action:
  - scaling up solar applications for agricultural use
  - affordable finance at scale
  - scaling up solar mini grids
  - scaling up solar rooftop
  - scaling up solar e-mobility and storage
- All costs relating to the running of the ISA will be

Related news

- India is reaching out to the **'Lithium Triangle'** in South America which consists of Chile, Argentina and Bolivia.
- Khanij Bidesh India Ltd., (KABIL) consortium of three PSU companies including: National Aluminum Company (NALCO), Hindustan Copper (HCL) and Mineral Exploration Corp Ltd., (MECL) visited these countries recently.

Significance of ISA

- **Ensure Energy Security**
- **Integration of Global South and Global North**
- To **Solve Global Energy Poverty** as according to International Energy Association (IEA), there are more than "600 million people without access to electricity" in **Sub-Saharan Africa.**
- Creation of an **Alternative Electricity Energy Grid Based** on solar energy among various countries, to overcome a financial constraint in tapping solar energy.

funded through voluntary contributions of member-countries, partner countries, partner organisations and Strategic Partners.
    - Funding under ISA is also been exempted to be treated as a foreign source of funding for Indian NGOs and other entities under the FCRA.
- The **ISA Secretariat** has launched
    - a Solar Technology Application and Resource – Centre (iSTAR-C) to support capacity building efforts in the ISA member countries.
    - the ISA Solar Award (Kalpana Chawla Solar Award) to recognize solar scientists doing extraordinary work across ISA member countries.
- ISA has also been developing a **Common Risk Mitigating Mechanism (CRMM)** for de-risking and reducing the financial cost of solar projects in the ISA member countries.

8. DISASTER MANAGEMENT

8.1. DISASTER RESILIENT INFRASTRUCTURE

Why in news?

India has pledged Rs 480 crore to setup global **"Coalition for Disaster resilient Infrastructure"**.

Second International Workshop on Disaster Resilient Infrastructure

It was organised at Delhi by the National Disaster Management Authority (**NDMA**) in collaboration with **United Nations Office for Disaster Risk Reduction (UNISDR),** and in partnership with the **Global Commission on Adaptation, United Nations Development Programme and the World Bank.**

Background

- India announced the **creation of a Coalition for Disaster Resilient Infrastructure (CDRI)** after the **Asian Ministerial Conference on Disaster Risk Reduction** (2016), held in New Delhi.
- At the **International Workshop on Disaster Resilient Infrastructure (2019)** held at New Delhi, agreement was reached among representatives from 33 countries to establish a **Coalition for Disaster Resilient Infrastructure**.
- The CDRI is envisaged as **a knowledge exchange and capacity development partnership**. It will work towards developing **common standards** in infrastructure building, financial and compliance mechanisms, appropriate governance arrangements, and invest in R&D that will also determine funding from multilateral banks onwards future investments by countries. We can delete this last leg.

What is Disaster Resilient Infrastructure?

Infrastructure that can stand any huge damage from any kind of natural disaster is known as **Disaster Resilient Infrastructure.** It encompasses **structural and non-structural measures**:

- **Structural Measures** involve adjusting engineering designs and standards to reflect disaster risk such as flood control systems, protective embankments, seawall rehabilitation, and retrofitting of buildings.
- **Non-structural measures** refer to risk-sensitive planning, enabling institutional frameworks, hazard mapping, ecosystem-based management, and disaster risk financing.

Need for DRI:

- **Disaster related losses**: India suffered losses of $80 billion during the 20-year period. Globally, disaster losses are estimated at $520 billion per annum, pushing more than 26 million people into poverty every year.
- **Stepping up investment:** An estimate suggests that India needs about $1.5 trillion investment in the infrastructure sector in the coming 10 years which is going to pose a challenge since the country is prone to many disasters like earthquakes, floods, cyclones, etc.
- **International commitments: Sendai Framework for Disaster Risk Reduction (2015-2030)** identifies investing in Disaster Risk Reduction (DRR) for resilience and to **"build back better"** in reconstruction as priorities.
  - **SDG Goal 9** recognizes disaster resilient infrastructure as a crucial driver of economic growth and development.
- **National agenda:** PM's **10-point agenda** announced during **Asian Ministerial Conference on Disaster Risk Reduction (2016),** talks about 'working to ensure that all development projects are built to appropriate standards and contribute to the resilience of communities they seek to serve."

Measures/Way Ahead:

Primarily, there needs to be efforts in **four broad thematic areas** which include:

- **On Disaster Risk Assessment**: It would require good, time-series data on past hazards patterns (e.g. wind speeds, high flood levels) and capability to analyse this data to generate probabilistic risk assessments that can guide investment in disaster resilient infrastructure.
- **On standards of design & implementation**: The national frameworks for design and construction standards must reflect the evolving understanding of natural hazards as well as advancements in engineering technologies.
- **On financing new infrastructure and mechanisms for covering risks**: Disaster Risk Financing strategy could include budget reserve funds as well as disaster risk transfer instruments like catastrophic bonds.

- **On reconstruction and recovery of infrastructure after disasters:** The "Build Back Better" principle must be followed not only for the structural design of the infrastructure but also in terms of management systems around it.

8.2. DISASTER PROOFING OF TELECOMMUNICATIONS

Why in News?

The recent Kerala floods witnessed a large-scale failure in communications services, calling for adequate preparedness measures in dealing with the aftermath of disasters on the part of all the stakeholders involved in disaster management.

How Communications Infrastructure Fails During a Disaster?

- **Physical damage to devices or components:** Cyclones, floodwaters, and seismic activity can create physical disturbances significantly damaging the communications equipment. These have the potential to be incredibly costly and time consuming to restore, as they require maintenance or sometimes replacement of complex network hardware to re-establish communications.
- **Damage to Wireless systems:** as different wavelength signals can be cut off by heavy rain, snow, or fog. The transmitter itself can also receive damage or be knocked out of alignment with its receiver.
- **Network Congestion:** During disasters, the communications networks often become congested with exceptionally high levels of data traffic. When this happens, communications can be severely limited or even cut off completely, and important messages are often lost.

Consequences of Communications infrastructure failure:

- **Preventing Emergency Response:** In the immediate hours following disaster, relief efforts can be paralyzed or severely delayed if the responding agencies are unable to communicate with one another.
- **Effective coordination becomes further complicated**: the lack of an overarching command structure can create miscommunications and delays in action. This may further impact information sharing and quick decision making in such crucial times.
- **Significantly reduces the resilience of communities exposed to risk** due to lack of well-designed communications and information infrastructure, as observed during Uttarakhand, Mumbai and Chennai floods in recent past.
- **Spread of false information and confusion:** Without an organized flow of information, there may be spread of misinformation and panic at a time when organization and level-headedness are key to carrying out rescue operations as quickly and efficiently as possible.

Standard Operating Procedure (SOP) prescribed by Department of Telecom (DoT):

- **Telecommunication equipment** should be installed at suitable locations in disaster prone areas to be able to withstand impacts of any disaster, e.g. in flood prone areas location of exchanges/ critical equipment to be preferably at higher altitude area to avoid inundation of water.
- **Critical equipment** should not be concentrated in one building, also, **earthquake-proofing towers** in known risk areas and developing a satellite-based system to provide back-up communications and data connectivity.

Additional Information
The new **digital telecommunication policy** also talks about developing a comprehensive plan for network preparedness, disaster response relief, restoration and reconstruction.

- Novel **traffic deluge management techniques**, which differentiate urgent and delay-tolerant services, can provide connectivity for urgent services while delay-tolerant services may be redirected to a temporary facility.
- Telecommunication Service Providers (TSPs) to **identify vulnerability** of their respective telecom infrastructure and accordingly prepare plan for emergency situations with the **provision of sufficient backups** of network.
- Priority needs to be given to **designated users engaged in relief operations**. Public is also required to be made aware to use **alternate mode of communications** such as SMS or internet media.
- TSPs shall have a **Disaster Response Task Force (DRTF)** at State level and **Rapid Damage Assessment Team** (RDAT) to determine the precise nature and extent of damage so that the planning for restoration of telecommunication services can be done in the efficient and effective manner.
- **Geographically dispersed servers** and use of **cloud-based platforms** to make data services more accessible.

Way Forward

> **About National Disaster Communication Network (NDCN)**
>
> NDCN is a proposed network of networks created by leveraging existing communication networks, including NICNET, SWANs, POLNET, DMNET (ISRO) and connecting them to various Emergency Operation Centers (EOCs) which will be established at National (NEOC), State (SEOCs) and Districts (DEOCs) Level.

- Value added information along with data must be sent to the right people at the right time by establishing a reliable, dedicated and latest technology based **National Disaster Communication Network (NDCN),** with particular emphasis on **last-mile connectivity** to the affected community during all phases of disaster continuum.
- **Network path diversity** is one of the most effective tactics to reduce the risk of communications failure during a disaster. This is accomplished by establishing two or more network connections that use either a different type of technology or follow a different physical path, minimizing the chance that both connections will be knocked out at the same time.
- Reconstruction and recovery in infrastructure sectors must follow the **"Build Back Better" principle** for multiple hazards.

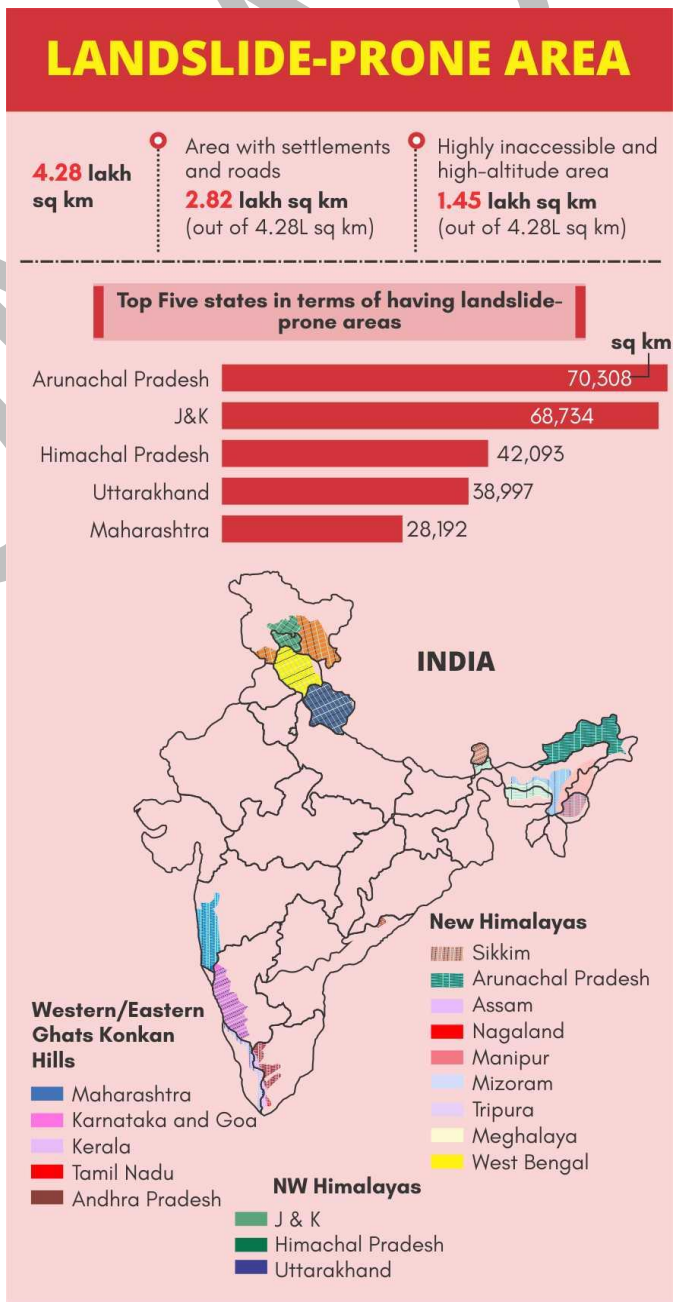
8.3. LANDSLIDE WARNING SYSTEM

Why in news?

Recently, a **real-time landslide warning system** has been set up in the Sikkim-Darjeeling belt of north-eastern Himalayas.

Background

- According to **Global Fatal Landslide Database (GFLD),** Asia was found to be the most-affected continent where 75% (India -20%) of landslides occurred, with a substantial number reported along the Himalayan Arc.
- As per global database on landslides, the world's top two **landslide hotspots exist in India:** the southern edge of the Himalayan arc, and the coast along south-west India where the Western Ghats are situated.
- According to **Geological Survey of India (GSI**), about 12.6 % of the total land mass of India falls under the landslide-prone hazardous zone.



About Warning System

- It will help in **saving lives and loss to property** by issuing advance alerts by 24 hours.
- The warning system **consists of over 200 sensors** that can measure geophysical and hydrological parameters like rainfall, pore pressure and seismic activities.
- Earlier, a landslide warning system was installed **in Kerala's Munnar district**.

About Landslide

- **Definition:** Landslides are downward and outward movement of slope materials such as rock debris and earth, under the influence of gravity.

- **Major reason:** Landslides are triggered by natural causes like vibrations from earthquakes and the build-up of water pressure between soil layers due to prolonged rainfall or seepage.
  - In recent decades, manmade causes have become significant in triggering landslides, including removal of vegetation from the slopes, interference with natural drainage, leaking water or sewer pipes, modification of slopes by construction of roads, railways, buildings etc.
- **Economic Cost:** Landslides are the third most deadly natural disasters on earth with $400 billion being spent annually on landslide disaster management. About 70 hydropower projects in Himalayas at risk of quake-triggered landslides.

National Disaster Management Guidelines on Management of Landslides and Snow Avalanches

- Developing and continuously **updating the inventory of landslide incidences** affecting the country.
- **Landslide hazard zonation mapping** in macro and meso scales after identification and prioritisation of the areas in consultation with the Border Roads Organisation, state governments and local communities.
- Taking up pilot projects in different regions of the country with a view to carry out **detailed studies and monitoring of selected landslides** to assess their stability status and estimate risk.
- **Complete site-specific studies** of major landslides and plan treatment measures and encourage state governments to continue these measures.
- **Setting up of institutional mechanisms** for generating awareness and preparedness about landslide hazard among various stakeholders.
- **Enhancing landslide education, training** of professionals and capacity development of organisations working in the field of landslide management.
- **Capacity development and training** to make the response regime more effective.
- **Development of new codes and guidelines** on landslide studies and revision of existing ones.
- **Establishment of an autonomous national Centre** for landslide research, studies and management.

Other related initiatives

National Landslide Susceptibility Mapping (NLSM), 2014

- GSI initiated the national programme to complete generation of **Landslide Susceptibility Maps** covering an area of about 1.71 lakh sq km.
- Project will offer seamless landslide susceptibility maps and landslide inventory maps of the entire landslide-prone areas of India, which can be utilised by the architects of disaster management groups and perspective planners.

A National Landslide Risk Mitigation Project (NLRMP) is being run at NDMA. Under this project a landslide site in Mizoram has been selected.

8.4. GLACIAL LAKES OUTBURST FLOODS

Why in news?

Disaster managers and scientists in Sikkim are siphoning out excess water from lake to prevent it from **Glacial Lakes Outburst Floods.**

More on News

- **Glacial Lakes Outburst Floods (GLOFs)**, are a subject of concern in the Sikkim Himalayan region as several lakes have been formed due to melting of scores of glaciers in the region.
- Sikkim has installed a **Lake monitoring and information System** (water level Sensor) at South Lhonak lake. The sensor gives the water level of the lake and also monitored the lake level when there is sudden fluctuation in water level

What is Glacial Lakes Outburst Floods?

- Glacial lakes form when a **glacier retreats**, leaving the debris mass at the end of the glacier – the end moraine – exposed.
- The moraine wall can act as a natural dam, trapping the meltwater from the glacier and leading to the formation of a lake. The **moraine dams are composed of unconsolidated boulders, gravel, sand, and silt.** As with landslide dams, they can eventually break catastrophically, leading to a glacial lake outburst flood or GLOF.

- **The formation of moraine-dammed glacial lakes and glacial lake outburst flood (GLOF) is major concern in countries such as Bhutan, Tibet (China), India, Nepal and Pakistan.**
- The Himalayan states, Uttarakhand, Himachal Pradesh and Jammu and Kashmir, are surrounded by about 200 potentially dangerous glacial lakes formed by glacial melt but till date no early warning system is in place to evacuate people in case these lakes breach their thin walls of debris and loose soil.

Factors triggering GLOFS

- **Rapid slope movement** into the lake and melting of ice incorporated in dam are both directly and indirectly linked to glacier retreat which have increased due to anthropogenic factors.
- Retreat of glaciers in the wake of **global warming** increases the number of glacier lakes and also expand the size of the existing ones.
- The **entire Himalayan region and the surrounding areas lies in the Earthquake Zone V and Zone IV** which are seismically the most active region. Earthquakes trigger the dismantling of lake walls and unconsolidated deposits triggering the sudden flow of water.
- **The radiative balance-** the balance between the amount of energy received by the earth from the sun and the energy it emits back has changed in the Himalayas in recent years due to human activities. This imbalance "directly or indirectly results in the common incidents of **fast glacier melting**, glacial lake outbursts floods.
- In recent years, increasingly erratic and **unpredictable monsoon rainfall patterns** and increased climate variability have led to severe and frequent flood disasters.
- The contributing **human activities** include mass tourism; developmental interventions such as roads and hydropower projects; and the practice of slash and burn type of farming in certain pockets of the Indian Himalayan region.
- **Black carbon** also plays important factor which melts the ice on the mountain due to albedo effect.
- **Other Factors** like Cascading processes (flood from a lake situated upstream), Earthquake, melting of ice incorporated in dam/forming the dam, blocking of subsurface outflow tunnels, Long-term dam degradation also trigger GLOFS.

Impact

- **Catastrophic Societal Impacts:** The sudden and intense flooding that results can be catastrophic for nearby communities. Fatal GLOFs have been documented in the Andes and in the Hindu Kush-Himalaya region.
- **Impact on Ocean Circulation:** Major Glacial lake outburst floods from ice dammed lakes into oceans are considered to change circulation patterns by reducing the salinity of the surface layer of the ocean and influence the global climate.
- **Impact on Geomorphology:** GLOFs, have significant potential to influence erosion-accumulation interactions and sediment dynamics like bank and depth erosion of the stream/river channel, meander shift, and, in some cases, replacement of existing channels and formation of new ones or formation of erosional terraces.

Measures

- **Access to early warning systems and timely information** is key to minimizing the adverse impacts of floods and improve the efficiency of the response.
- **Continuous monitoring** is needed to **understand changing dynamics of Himalayan glaciers.**
- Indian Space Research Organisation (ISRO) among many other organisations, is also engaged in **glacial lake monitoring** and water bodies in the Himalayan region of Indian River Basins.
- To identify hazardous lakes, **remotely sensed data-based methods** can be installed.
- Prevention or mitigation of the magnitude of the flood by **dam remediation like artificial dams, tunnels, open cuts, concrete outflows, flood protection walls.**
- Mitigation measures are important including **community preparedness, GLOF hazard mapping, vulnerability assessment, hazard zone demarcation, and identification of GLOF safe evacuation sites, alternate community based early learning warning systems and identifying vulnerable communities**

Conclusion

Glacial lakes are an important potential natural resource for water supply, which has yet to be effectively investigated. Glacial lakes may offer considerable benefits to local community. They can provide a **natural**

storage facility for water as water supplies becoming increasingly scarce, they are a **focus for tourist activities**, and they often have a high **cultural significance**. Thus, they need to be looked after and managed in a controlled way that reduces any threat while helping the potential benefits to be realised.

8.5. INDUSTRIAL DISASTERS IN INDIA

Why in news?

Recently, 9 people died in blast and fire in the gas pipeline during maintenance work in SAIL's Bhilai plant.

Industrial Disasters- A background

- The ever-growing **mechanisation, electrification, chemicalisation and sophistication** have made industrial jobs more and more **complex and intricate** leading to increased dangers to human life in industries through accidents and injuries.
- India has continued to witness a series of industrial disasters during the last 3 decades after the **Bhopal gas tragedy**, including a **chlorine gas leak in Vadodara (2002**) that affected 250 people, a **toluene fire at Mohali** (2003**), a chlorine gas leak at Jamshedpur** (2008), and more recently, **boiler furnace explosion at the NTPC Unchahar power plant (2017)** which killed 43 people.
- A study by the **British Safety Council based on ILO data** found that 48,000 people on average die in the country per annum due to work-related hazards. It observed that as many as **38 fatal accidents take place every day in the construction sector** in the country.

Reasons for Industrial disasters

On part of Industries

- **Low awareness:** Most companies are not aware of the safe practices in terms of what is a safe machinery, or what environment it will be used in.
- **Unsafe practices:** For eg- quarrying leading to roof collapse in coal mines, workers working without masks in areas prone to poisonous gas leakage, contract workers **not given adequate personal protection equipment (PPE)** etc.
- **Lack of regulations**: **Storing and handling hazardous chemicals** by factories in unorganized sector poses serious and complex risks to people, property and the environment.
- **Poor management systems:** Due to poorer reporting systems, many accidents and deaths go unreported.
- **Unawareness about disaster management**: Industries do not regularly inform the larger public about the disaster management plan in case an accident occurs.

On part of Government

- **Lack of centre-state coordination**: Labor falls in the concurrent list, so the Centre frames the laws while the states have the responsibility of implementing them. But the multiplicity of legislations and changing regulations from state to state often pose compliance problems.
- **Relaxation of Industrial Regulations:** Industrial regulation has, unfortunately, come to be viewed as a barrier to ease of doing business in India. This is a result of inefficiency and corruption.
- **Safety audits:** Owing to poorly staffed labour departments, safety audits of hazardous manufacturing units still remain a distant dream although the Factories Act prescribes a mandatory annual examination.
- **Capacity building at state level:** The inability of states to strengthen their labour bureaus and environment protection units caused unsafe factories to mushroom to meet the growing demand for industrialization.

On part of workers and public

- **Lax attitude of workers:** Even if workers are provided with PPEs they are generally reluctant to use them as they feel it hinder their comfort while on work. Also, most of the workers are inattentive while safety trainings.
- **Lack of Public awareness:** Public outside the premises are unaware of the nature of industry and the hazards it poses to health and life. They are also not aware of what to do when an accident occurs around.

Government/Judicial Actions taken to tackle Industrial Disasters

- **Environment Impact Assessment**: It introduced the concept of environmental appraisal of all projects and incorporating ecological and safety conditions while approving new ventures. Also, it has provisions for management of hazardous waste.
- **Extended Risk scope:** In 1987, the Factories Act, 1948, was amended to extend the scope of risk from hazardous industries. What used to be a narrowly defined scope covering only workers and the premises of the factory was extended to the general public in the vicinity of the factory. The changes also provided for appraisal when hazardous industries were being set up or expanded.
- **Handling hazardous chemicals & wastes**
  - Manufacture, Storage and Import of Hazardous Substances Rules, 1989**,** details and catalogues chemicals deemed "hazardous" entering the country, the port of entry and the quantity imported.
  - The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008, provide for means of safe storage and disposal of "hazardous waste" with the help of central and state pollution control boards.
- **Addressing chemical disasters**
  - The **Chemical Accidents (Emergency Planning, Preparedness, and Response) Rules, 1996**, addresses gas leaks and similar events.
  - The **National Disaster Management Agency (NDMA) guideline on chemical disasters** was published in 2007 for a "proactive, participatory, well-structured, failsafe, multi-disciplinary and multi-sectoral approach" to tackle chemical disasters.
- **Compensation liability**
  - **Concept of Absolute Liability:** As defined by the Supreme Court in 1986, the enterprise owes an absolute and non-delegable duty to the community to ensure that no harm results to anyone on account of hazardous or inherently dangerous nature of the activity which it has undertaken. Compensation needs to have a "deterrent effect" and must reflect the "magnitude and capacity of the enterprise".
  - **Public Liability Insurance Act (1991):** It was supposed to provide for immediate and interim relief to disaster victims till their claims of compensation were finally decided. Owners of industries dealing in hazardous substances are required to take out insurance policies under this Act.
  - The NGT Act provides for the **"principle of no-fault liability"**, which means that the company can be held liable even if it had done everything in its power to prevent the accident.
  - **The Civil Liability for Nuclear Damage Act, 2010,** is the most recent law that has provision for compensation of more than Rs.100 crore, which could reach up to Rs.1,500 crore, depending on severity.
- **For worker safety: ILO's Promotional Framework for Occupational Safety and Health Convention, 2006**, ratified by India in 2017, aims at promoting a preventative safety and health culture and progressively achieving a safe and healthy working environment.

Way Forward

- **Creation of Buffer zone:** It is essential for government to ensure an adequate buffer zone and not permit people to stay around in that zone or allow any business shops or constructions therein. Sufficient space must be kept in the buffer zone so that if something goes wrong or an accident occurs, the people are not affected.
- **Location of Industry:** The EIA regulations mandated under Environment Protection Act must be strictly enforced. Local authorities especially Gram Sabha must be given adequate weightage for their inputs in regards to EIA assessment.
- **Disaster Management Plan:** Industries should have an **updated disaster management plans** that local authorities—which include hospitals, fire stations and the like—will know and should communicate to the local people what they are supposed to do in the event of a disaster.
- **Consolidation of rules and laws:** India should formulate and implement a comprehensive safety legislative framework in accordance with the current industry best practice and community expectations.
- **Enhance monitoring standards**: India needs a single national authority to monitor workplace standards and increasing inspection as recommended by a Labour Working Group constituted by the Government back in 2008-09.

- **Safety Audit reforms:** At present, safety audits are primarily focused on occupational safety and health issues and lack sufficient technical rigour. The audit scope and methodology should be expanded to include auditing of major incident event scenarios and controls identified and assessed for each scenario. The audits should seek evidence on performance assurance of safety controls.
- **Institutional capacity building:** Investigative and technical rigour should be enhanced in the inspections that are being undertaken by the inspectorate.
    - There should be a **national capacity building programme** for inspectors in process safety, incident investigation, and auditing and inspections.
- **Strict implementation of safety norms**: Every factory management should set up a **statutory safety committee** responsible for ensuring the strict implementation of occupational safety norms.

8.6. RAT-HOLE MINING

Why in News?

Recently, the collapse of a coal mine in Meghalaya's East Jaintia Hills in which 15 workers were trapped, has thrown the spotlight on a procedure known as "rat-hole mining".

About rat-hole mining

- It involves **digging of very small tunnels**, usually only 3-4 feet high, **without any pillars** to prevent collapse, in which workers (often children) enter and **extract coal**.
- The National Green Tribunal **(NGT) banned it in 2014** on grounds of it being **unscientific and unsafe** for workers. However, the **state government appealed the order** in the Supreme Court.
- Even after ban, it remains the **prevalent procedure for coal mining in Meghalaya** as **no other method would be economically viable in Meghalaya**, where the coal seam is extremely thin.

Negative impacts of Rat Hole Mining

- **Environmental Degradation**: For instance, it has caused the water in the Kopili river (flows through Meghalaya and Assam) to turn acidic.
- **Pollution:** Roadsides used for piling of coal leads to air, water and soil pollution.
- **Exploitation of workers:** Maximum mining in Meghalaya is from rat hole mining where workers put their lives in danger but benefits are cornered by few private individuals.
- **Risk to Lives:** Rat-holes mines without adequate safety measures pose high risk to miner's lives. According to one estimate, one miner dies in these rat-holes mines every 10 days.
- **Fueling illegal activities:** Illegal money earned from these unlawful mines also end up fueling insurgency in the state.
- **Encouraging Child Labor:** According to a Shillong based NGO, rat-hole mining employs 70,000 child laborers.

Advantages of Rat-hole mining

- **Less Capital Intensive:** This type of mining when done in a scientific way, with suitable equipment is less capital intensive.
- **Less Polluting:** Unlike big mine fields which leave the nearby area nearly uninhabitable, rat-hole mines are less polluting to soil, air and water.
- **Easy self-employment:** rat-hole mining provides easy self-employment to people.

Why does it continue?

- **Political Influence:** Maximum politicians are either owners of mines or have stakes in the largely unregulated coal mining and transportation industry.

Coal Mine Safety in India

- In India, the operations in Coalmines are regulated by **the Mines Act 1952, Mine Rules – 1955, Coal Mine Regulation-1957** and several other statutes framed thereafter.
- **Directorate-General of Mines Safety (DGMS)** under the Union Ministry of Labour & Employment (MOL&E) is entrusted to administer these statutes.
- One of the reasons why the **Coal Mines (Nationalization) Act** was enacted in **1973**, taking over private sector mines, was their poor safety records. Yet, work at public sector mines remains highly dangerous.
- The frequency of incidents has increased in the recent years, as flagged by the **National Human Rights Commission (NHRC)** in its 2014 report titled **'Views on Mine Safety in India',** while official statistics show otherwise.
- However, in a bid to attract private players, the Coking Coal Mines (Nationalization) Act, 1972 and the Coal Mines (Nationalization) Act, 1973 were repealed on 8 January 2018.
- When it comes to coal mining accidents, India has a higher proportion of deaths resulting from **strata fall** than from the use of explosives, which account for the bulk of the accidents in countries such as China and the US.

- **Populism:** Directly and indirectly about 2.5 lakh people are dependent on rat-hole mining economy, having influence on 16 out of 60 assembly seats.
- **Lack of Adequate Policy:** The NGT finds The Meghalaya Mines and Mineral Policy, 2012 inadequate. The policy does not address rat-hole mining and instead states: "Small and traditional system of mining by local people in their own land shall not be unnecessarily disturbed".
- **Use of Violence by Mining Mafia:** Anyone who reports on these illegal mining activities is met with violence.
- **Lack of alternative Employment opportunities**: It forces people to work in these dangerous mines.
- **Lack of Monitoring:** Mining activities are spread across too vast an area spreading over four districts.
- **Legal Framework:** Mining activities are a state subject, but safety of mine workers is a central subject which creates problems in implementation of safety policies.
- **Misuse of Sixth Schedule Provisions:** The 6th Schedule of the Constitution intends to protect the community's ownership over its land and the community's autonomy and consent over its nature of use. Coal mining currently underway in Meghalaya was a corruption of this Constitutional Provision wherein private individuals having private interests in earning monetary benefits from minerals vested under the land are engaging in coal mining.

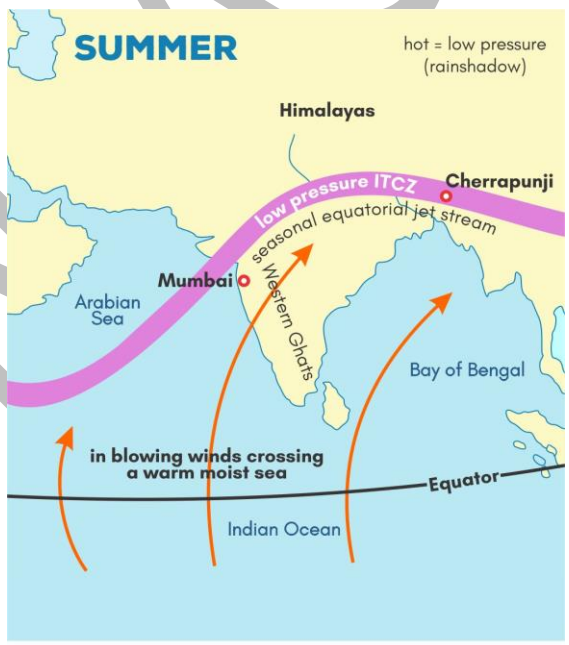
8.7. CYCLONE FANI

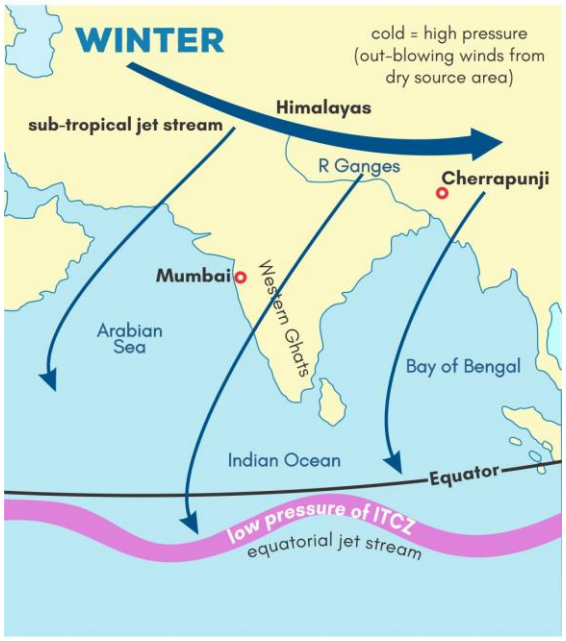
Why in news?

Extremely severe cyclonic Fani recently hit the Odisha coast.

More in news

- India Meteorological Department issued **yellow warning,** which indicates **severely bad weather,** warning people who are at risk to take preventive action.
- With sustained winds of 240 kmph, the storm was the equivalent of a **Category 4 hurricane on the Saffir-Simpson Hurricane Wind Scale**.
    - The **Saffir-Simpson Hurricane Wind Scale** is a 1 to 5 rating based on a hurricane's sustained wind speed.
    - This scale **estimates potential property damage**.
    - **Hurricanes reaching Category 3 and higher** are **considered major hurricanes** because of their potential for significant loss of life and damage.





What makes Fani unique?

- **Place of origin**: The in situ cyclonic systems in the Bay of Bengal usually originate around latitude 10°, in line with Chennai or Thiruvananthapuram. **Fani, on the other hand, originated quite close to the Equator, around latitude 2°,** well below the Sri Lankan landmass.
- **Lifespan**: Tropical cyclones over the Bay of Bengal have a lifespan of four-seven days, whereas Fani traveled long which allowed it to gather a lot of moisture and momentum, resulting in strong winds.
- **Route**: Fani was **initially headed north-westwards,** towards the Tamil Nadu coast but **changed its course midway** and moved northeast away from the coastline to reach Odisha. The **recurve** it has taken gave it more time over the sea and has ensured that it has **gathered unusual strength.**

- **Strength:** Most cyclones that generate exclusively in the Bay of Bengal become relatively weaker by the time they reach the Indian landmass. Cyclone Fani made a landfall in Odisha with **wind speeds of more than 170 km/h.**

Naming of cyclone in Indian Ocean

- World Meteorological Organisation (WMO) and the United Nations **Economic and Social Commission for Asia and the Pacific (ESCAP)** started the tropical cyclone naming system in 2000.
- Eight north Indian Ocean countries — Bangladesh, India, the Maldives, Myanmar, Oman, Pakistan, Sri Lanka and Thailand, gave eight names each which was combined into a list of 64 names.

- **Timing:** It started developing in April, a month that has historically seen very few cyclones that were categorised as extremely severe. Cyclone Fani was only the second storm to form in April and cross the mainland.

Cyclones

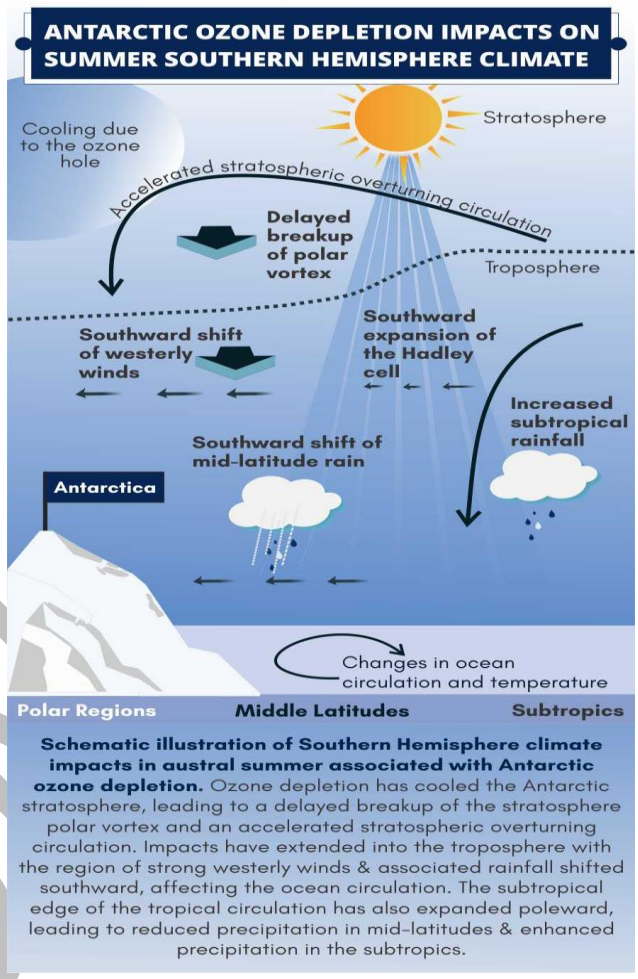
- Tropical cyclones—also called typhoons or hurricanes—are intense water-rotating systems formed by strong winds around low-pressure areas.
- **Conditions required:**
  - The temperature of the top layer of the sea, up to a depth of about **60 metres, need to be at least 28°C** to support the formation of a cyclone.
  - Low level of air above the waters needs to have an **'anticlockwise' rotation (in the northern hemisphere; clockwise in the southern hemisphere).**
- This explains why the April-May and October-December periods are conducive for cyclones.
- During these periods, there is a **ITCZ in the Bay of Bengal** whose southern boundary experiences winds from west to east, while the northern boundary has winds flowing east to west. This induces the anticlockwise rotation of air.
- Once formed, **cyclones in this area usually move northwest.** As it travels over the sea, the cyclone gathers more moist air from the warm sea, and adds to its heft.
- **Cyclones emerging in April-May usually are much weaker than those during October-December.**
- The Indian subcontinent experiences **cyclones from two basins**: The Bay of Bengal basin and the Arabian Sea basin.
- Of the two, **more cyclones are generated in the Bay of Bengal and cyclones here have also been more severe than the one generated over the Arabian Sea.**
  - The Bay of Bengal receives higher rainfall and constant inflow of fresh water from the Ganga and Brahmaputra rivers. This means that the Bay's surface water keeps getting refreshed, making it impossible for the warm water to mix with the cooler water below, making it ideal for a depression.
  - On the other hand, the Arabian Sea receives stronger winds that help dissipate the heat, and the lack of constant fresh water supply helps the warm water mix with the cool water, reducing the temperature.

9. MISCELLANEOUS

9.1. MONTREAL PROTOCOL ASSESSMENT

Why in news?

The quadrennial (four-yearly) review of the Montreal Protocol reveals a healing ozone layer, global warming reduction potential, and options for more ambitious climate action.



Key findings of the Scientific Assessment of Ozone Depletion: 2018

- **Actions taken under the Montreal Protocol** have led to **decreases in the atmospheric abundance of controlled ozone-depleting substances (ODSs)** and the start of the recovery of stratospheric ozone.
- The atmospheric abundances of both **total tropospheric chlorine and total tropospheric bromine** from long-lived ODSs controlled under the Montreal Protocol have continued to decline since the 2014 Assessment.
- Outside the Polar Regions, upper stratospheric ozone layer has **recovered at a rate of 1-3% per decade** since 2000.
- The **Antarctic ozone hole is recovering**, while continuing to occur every year. As a result of the Montreal Protocol much more severe ozone depletion in the Polar Regions has been avoided.
- At projected rates, Northern Hemisphere and mid-latitude ozone is scheduled to **heal completely** (i.e. equivalent to 1980 values) by the 2030s followed by the Southern Hemisphere in the 2050s and Polar Regions by 2060.
- The **Kigali Amendment** is projected to reduce future global average warming in 2100 due to hydrofluorocarbons (HFCs) from a baseline of 0.3–0.5 degree Celsius to less than 0.1 degree Celsius.

Ozone change and its influence on climate

Ozone is important in the climate system and its changes can influence both the troposphere and the stratosphere.

- **Influence on stratospheric climate:** Decreases in stratospheric ozone caused by ODS increases have been an important contributor to observed **stratospheric cooling**.
  - New studies find that ODSs thereby contributed approximately one third of the observed cooling in the upper stratosphere from 1979 to 2005, with two thirds caused by increases in other GHGs.
- **Influence on surface climate and oceans:** Lower stratospheric cooling due to ozone depletion has very likely been the dominant cause of late 20th century changes in Southern Hemisphere climate in summer. These changes include the observed pole ward shift in Southern Hemisphere tropospheric circulation, with associated impacts on surface temperature and precipitation.
  - Changes in tropospheric circulation driven by ozone depletion have contributed to recent trends in Southern Ocean temperature and circulation; the impact on Antarctic sea ice remains unclear.

Future Global Ozone changes: The key drivers of future ozone levels continue to be declining ODS concentrations, upper stratospheric cooling because of increased GHGs, and the possible strengthening of the **Brewer-Dobson circulation** (a model which attempts to explain how tropical air has less ozone than polar air, even though the tropical stratosphere is where most atmospheric ozone is produced) from climate change.

- **CO_2, CH_4, and N_2O will be the main drivers** of 60°S–60°N stratospheric ozone changes in the second half of the 21st century. These gases impact both chemical cycles and the stratospheric overturning circulation, with a larger response in stratospheric ozone associated with stronger climate forcing.
- Given that ODS levels are expected to decline slowly in coming years, a large **enhancement of stratospheric sulphate aerosol in the next decades** would result in additional chemical ozone losses. Possible sources of additional stratospheric sulphate aerosol include volcanic eruptions (like Mt. Pinatubo in 1991) and geoengineering.

Why Montreal Protocol Worked?

The Montreal Protocol is one of the most successful and effective environmental treaties ever negotiated and implemented. No single factor led to its success.

- **Approach of Cooperation:** From the start, negotiation relied heavily on leadership and innovative approaches. Much negotiation was held in small, informal groups. This enabled a genuine exchange of views and the opportunity to take some issues on trust, such as the subsequent development of the **Multilateral Fund.** The people negotiating the treaty also included scientists, which lent credibility.

Vienna Convention for the Protection of the Ozone Layer [1985]:
- It acts as a framework for the international efforts to protect the ozone layer.
- It paves the way for a legally binding treaty through protocol called Montreal protocol.

Montreal Protocol [1987]
- It aims at reducing the production and consumption of ozone depleting substances (ODS).
- It has been ratified by 197 parties making **it universally ratified protocol** in United Nations history.

Kigali agreement to amend the Montreal Protocol [2016]
- Its aim is to phase out Hydrofluorocarbons (HFCs), a family of potent greenhouse gases by the late 2040s.
- It will be binding on countries from 2019.

Gothenburg Protocol:
- It aims to abate Acidification, Eutrophication and **Ground-level Ozone** and is part of the **Convention on Long-Range Transboundary Air Pollution**

- **Principles based:** The **"precautionary principle",** and the **concept of common, but differentiated, responsibility took root in the Montreal Protocol** when developing countries were given longer time to phase-out ODS.
- **Flexibility to accommodate newer information:** This flexibility meant the protocol could be amended to include stricter controls: more ozone-depleting substances added to the control list and total phase-out, rather than partial phase-out, called for. Starting out modestly also encouraged a greater confidence in the process.
- **Trade Provisions and restrictions:** These limited the signatories to trade only with other signatories. This increasingly limited the supplies of CFCs and other ozone-depleting substances (ODS) to non-signatories countries which forced them to ratify the Protocol.
- **Clear List of Targeted Sectors:** The chemicals and sectors (refrigeration, primarily) involved are clearly articulated. This let governments prioritise the main sectors early.
- **Incentive to Industry:** The Montreal Protocol also provided a stable framework that allowed industry to plan long-term research and innovation. Transitioning to newer, reasonably priced formulations with lower- or no-ozone depleting potential benefited the environment and industry.
- **Institutional Support:** Another feature of the protocol has been the expert, independent **Technology and Economic Assessment Panel** (and its predecessors). These have helped signatories reach solid and timely decisions on often-complex matters. They have given countries confidence to start their transition.
    - The **Multilateral Fund** has been another reason for the protocol's success.
        - ✓ It provides **incremental funding for developing countries** to help them meet their compliance targets.
        - ✓ Significantly, it has **also provided institutional support.** This helps countries build capacity within their governments to implement phase-out activities and establish regional networks so they can share experiences and learn from each other.
- **Compliance Procedure:**
    - This was designed from the outset as a **non-punitive procedure.** It prioritised helping wayward countries back into compliance.
    - Developing countries work with a UN agency to prepare an action plan to get themselves back into compliance. If necessary, resources from the Multilateral Fund are available for some short-term projects.

- It is telling that all 142 developing countries were able to meet the 100% phase-out mark for CFCs, halons and other ODS in 2010.

Way Forward: The Assessment, which is intended to add to the scientific basis for decisions made by the Parties to the Montreal Protocol, also presents updated scenarios for hastening ozone recovery through:

- Complete elimination of controlled and uncontrolled emissions of substances such as carbon tetrachloride and dichloromethane.
- Bank recapture and destruction of chlorofluorocarbons (CFCs), halons, and hydrochlorofluorocarbons (HCFCs).
- Elimination of HCFC and methyl bromide production.
- Mitigation of nitrous oxide emissions.
- Focus on achieving the Kigali Targets.

9.2. ENVIRONMENTAL RULE OF LAW

Why in News?

United Nations Environment Programme (UN) has released its first ever **global assessment of environmental laws titled "Environmental Rule of Law".**

What is Environmental Rule of Law?

- The **United Nations** defines rule of law as having three related components –
  - law should be consistent with fundamental rights;
  - law should be inclusively developed and fairly effectuated;
  - law should bring forth accountability not just on paper, but in practice—such that the law becomes operative through observance of, or compliance with, the law.
- **Environmental Rule of Law incorporates above components and applies them in environmental context.**
- It is **emphatically multidimensional**. It cuts across many forms of law and norms—from social and customary norms of villages to statutory laws of nations to voluntary standards adopted by companies.
- Following the 1992 United Nations Conference on Environment and Development (Rio Earth Summit), many countries made a concerted effort to enact environmental laws.

Reason behind poor Implementation of Environmental laws:

- Many agreements on the environment fail to work because governments are also signing other agreements on trade or the economy that consistently ignores environment.
- **Lobbying by Powerful Companies** who just ignores national and international environmental laws and agreements.
- **Failure to ratify signed agreements:** Many countries sign agreements at international conferences but then quietly fail to ratify them or pass them into domestic law.
- **Impunity by Developed Countries:** In the case of climate change, Canada ratified Kyoto but its cabinet did not agree to reduce emissions "in the national interest". The failure of developed countries to join treaties or to ignore them undermines global environmental protection.
- **Inadequate implementation of Judicial orders:** For e.g. in India, the judiciary's order failed to curb illegal rat hole mining and miners in Meghalaya paid price for that.

Major Observations and Recommendations of the Report

- **Poor Implementation of Laws:** The world fares poorly on implementation of environmental laws and regulations even though 38 times more green laws have been framed and approved in the last four decades.
  - According to the report, we now have **"treaty congestion".** World leaders have signed up to 500 internationally recognized agreements in the past 50 years. The **international community's efforts** should focus on fostering improved implementation of environmental rule of law along with regular global assessment.
- **Immature Institutions:** While laws and institutions addressing environmental issues have expanded, they are still maturing.
  - Investing in **information collection and management systems** is vital to building strong institutions.
  - **Engage with customary institutions** as they have developed customs over centuries to manage natural resources.
- **People's Participation:** Public and community groups need to be seen as critical stakeholders in environmental protection.

- The governments can focus on **fostering a culture of civic engagement** through steps such as making information readily available on websites, collecting citizen monitoring data and complaints, responding to citizen inquiries with speed and efficiency etc.

- **Focus of environmental laws is more on environmental duties rather than rights:** A rights-based approach can strengthen environmental rule of law by elevating the importance of environmental protections.
  - Governments should **publicize the rights** available to the public and ensure a robust, free civil society able to help citizens actuate these rights
- **Understanding of Interlinkages:** Laws have best taken hold where countries have understood the **linkages between the environment, economic growth, public health, social cohesion, and security.**

9.3. DELAY IN MONSOON

Why in news?

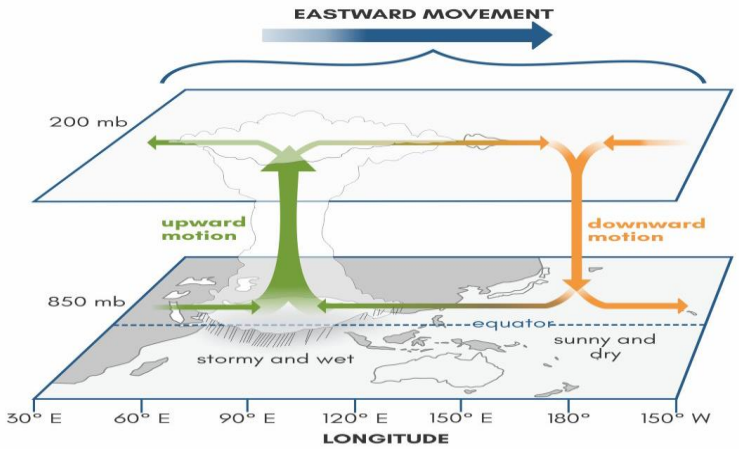
The monsoon made a delayed onset over the Kerala coast on 8 June (1-week delay) and had been advancing at a sluggish pace over the mainland.

Atmospheric circulations affecting Monsoon

- **El Nino/La Nina**
  - El Nino is the **abnormal warming of sea surface temperature (SST)** of the Pacific Ocean off the coast of Peru in South America, while La Nina is the opposite, an abnormal cooling of SST.
  - While **El Nino leads to deficit rainfall, La Nina brings an above-average monsoon.**
- **Madden-Julian Oscillation**
  - The **location and strength of the Madden-Julian Oscillation (MJO)** wave play an important role in the development of monsoon over India.
  - It can **modulate the timing and strength of monsoons, influence tropical cyclone ,result in jet stream changes** that can lead to cold air outbreaks, extreme heat events, and flooding rains over the United States and North America.
- **Indian Ocean Dipole (IOD)**
  - It is also referred to as the Indian Niño, is a condition when the **SST of the western region of Indian Ocean alternately becomes abnormally colder and then abnormally hotter than the eastern region.**

Madden-Julian Oscillation (MJO)

- The MJO wave is a global band of **low-pressure area moving periodically from West to East** and determines the initiation and intensity of low-pressure areas/depressions/cyclones and also oversees monsoon onsets under its footprint.
- It is disturbance of clouds, rainfall, winds, and pressure that traverses the planet **in the tropics (between 30° N and 30°S)** and returns **to its initial starting point in 30 to 60 days**, on average.
- There can be multiple MJO events within a season, and so the MJO is best described as **intra-seasonal tropical climate variability** (i.e. varies on a week-to-week basis).
- MJO **influences the ENSO cycle**. It does not cause El Nino or La Nina, but can **contribute to the speed of development and intensity of El Nino and La Nina episodes.**
- The MJO consists of two parts, or phases:
  - One is the **enhanced rainfall (or convective) phase** and the other is the **suppressed rainfall phase**.
  - In the **enhanced convective phase**, winds at the surface converge, and air is pushed up throughout the atmosphere. At the top of the atmosphere, the winds reverse (i.e., diverge). Such rising air motion in the atmosphere tends **to increase condensation and rainfall.**
  - In the **suppressed convective phase**, winds converge at the top of the atmosphere, forcing air to sink and, later, to diverge at the surface. As air sinks from high altitudes, it warms and dries, which **suppresses rainfall**.
- When **MJO is over the Indian Ocean** during the Monsoon season, it generally brings **good rainfall over the Indian subcontinent**. On the other hand, when it witnesses a **longer cycle and stays over the Pacific Ocean**, MJO brings **bad news for the Indian Monsoon.**



- The Indian Niño can **neutralise or worsen the impact of El Niño/La Niña** depending on which phase it is in.
- **A 'positive' IOD phase**, which means higher-than-usual temperatures in the western Indian Ocean, **brings more rain** to India than the 'neutral' or 'negative' (cooling) phase.

- **Cyclonic formations**
  - Cyclones are sustained by **very strong low-pressure areas at their core**. Winds in surrounding areas are forced to rush towards these low-pressure areas.
  - **Similar low-pressure areas,** when they develop near or over land, are instrumental in pulling **the monsoon winds over the country as well**.
  - The **cyclones that develop in the Arabian Sea impact the monsoon more** than those in the Bay of Bengal because the monsoon winds enter the Indian Peninsula from the western coast along the Arabian Sea.
- **Jet streams**
  - Currents of strong winds blowing west to east about five to seven miles above the surface of the earth, **jet streams cause changes in wind and pressure in the atmosphere,** pushing air mass around and affecting the world's weather.
  - It is believed that there is a **direct connection between the movement of subtropical jet streams and the Indian monsoon.**
- Due to all these factors getting the forecast right for monsoon remains a challenge and still poorly understood.

Factors which affected delay in Monsoon recently

Impact of MJO

- In month of June, MJO was in **suppressed phase over Indian Ocean** due to which the cloudiness quotient and rainfall activity over India have diminished.

Impact of Cyclonic formations

- The **cyclonic storm Vayu** that formed over the Arabian Sea impacted the advancement of monsoon into many parts of India.
- **It interfered with normal progression, by sucking all the moisture from the monsoon winds towards itself.**
- This phenomenon of delayed monsoon due to the emergence of cyclonic system was also seen **in 2015 when Cyclone Ashobaa had delayed the monsoon.**

Impact of warming waters

- According to US agency, unusually warm waters in the Arabian Sea have set up a rare band of easterly winds over the Indian Ocean, which has significantly delayed the monsoon onset over the Kerala coast.
- Unfavourable cross-equatorial flow over the Arabian Sea that aids in the progress of the monsoon is also the other reasons for its delay.

Models of monsoons prediction

- **Until about the 2010,** the only method employed by the India Meteorological Department (IMD) to forecast the monsoon was **statistical models**.
  - These essentially involved **identifying climate parameters linked to the performance of the monsoon** — for instance, the sea surface temperature gradient between North Atlantic and North Pacific, the volume of warm water in the equatorial Pacific, the Eurasian snow cover.
  - This has, however, **proved wrong and the IMD missed its mark on forecasting** major droughts and rain-deficits — particularly 2002, 2004 and 2006.
- **Around 2015** IMD started **testing a dynamical system**. This simulates the weather at a chosen set of locations on a given day — the land and ocean temperature, moisture, windspeeds at various heights, etc — and **powerful computers calculate how these weather variables will change over days, weeks, months** by solving physics equations that show how each of these weather variables is related to each other.
  - IMD uses a new **Ensemble Prediction Systems (EPS)** to provide probabilistic weather forecasts up to the next 10 days.
  - Rather than long-range forecasts that only give a broad tenuous picture of the likely performance of the monsoon, these **shorter forecasts are far more reliable and help farmers make decisions about sowing.**