VISIONIAS
INSPIRING INNOVATION

M^AIN^S 365

Environment

Classroom Study Material 2018
(September 2017 to June 2018)

ENVIRONMENT

SEPTEMBER 2017 – JUNE 2018

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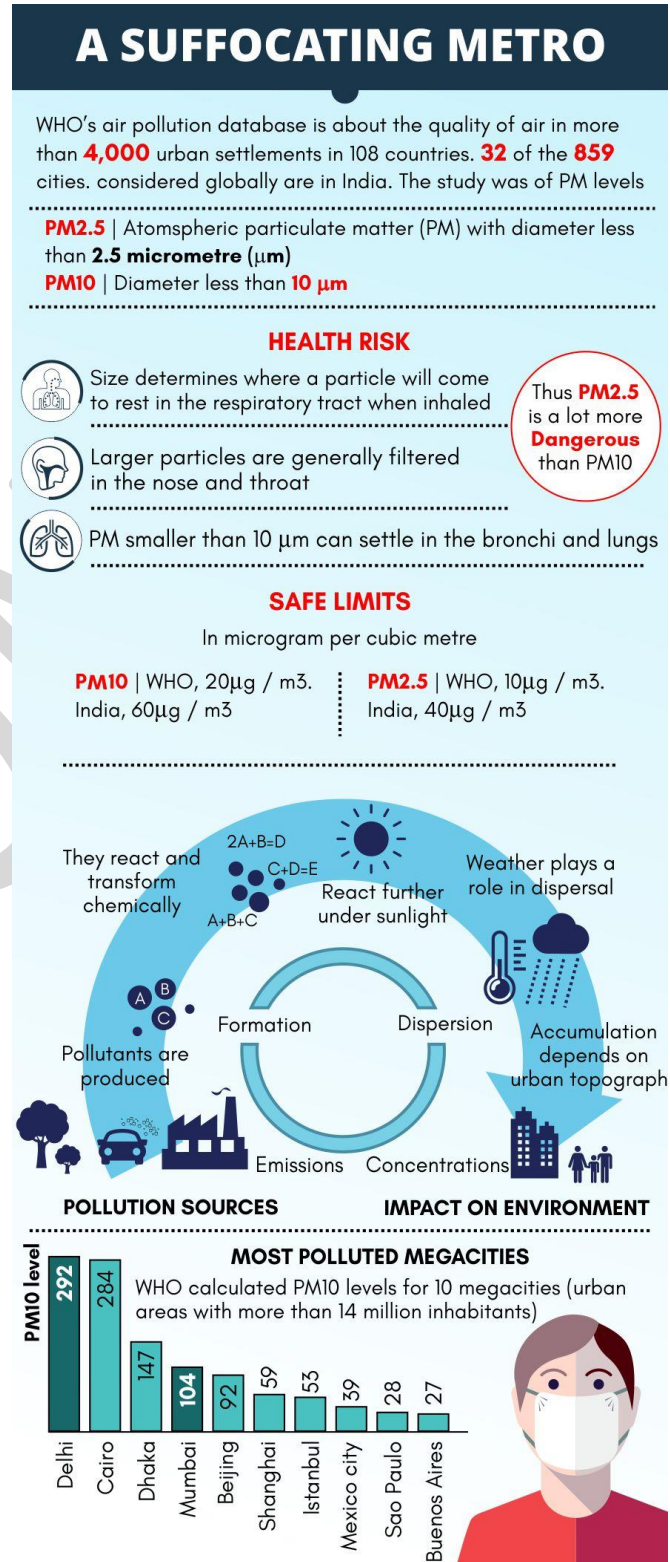Mains 365 – Environment

1. ENVIRONMENTAL POLLUTION

1.1. AIR POLLUTION

Why in News

According to the recent 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.

Types of Pollutants

- **Primary Pollutant**: They are a direct result of the process and can be caused by primary sources or secondary sources. Example: Sulfurdioxide emitted from factories.

- **Secondary pollutants** are the ones that are caused by the inter mingling and reactions of primary pollutants. Eg- Smog created by the interactions of several primary pollutants.
    - **Ground or Tropospheric Ozone:** It is formed through a chemical reaction between sunlight and gases like nitrogen oxides, carbon monoxide and volatile organic compounds (VOC). Ozone pollution is generally highest during the sunniest months of the year. Its harmful effects include:
        - ✓ **Health issues:** Short-term health issues immediately following exposure such as irritation to skin and the respiratory system, as well as long-term exposure which can lead to more serious health problems such as higher rates of pulmonary disease and worsen bronchitis, emphysema, and asthma.
        - ✓ **Environmental impact**: Ground level ozone can damage ecosystems and plant growth in forests, wildlife refuges
    - **Particle Pollution:** These are the sooty deposits in air pollution that blacken buildings and cause breathing difficulties. The size of particles is directly linked to their potential for causing health problems. Small particles less than 10 micrometers in diameter pose the greatest problems, because they can get deep into your lungs, and some may even get into your bloodstream.
        - ✓ According to **Central Pollution Control Board (CPCB),** 31 and 195 cities exceeded the prescribed PM2.5 and PM10 limit, standard respectively.
        - ✓ IIT Kanpur study on Delhi's air pollution in 2015 had identified road dust as one of the biggest sources of suspended particulate matter in the city.

A SUFFOCATING METRO

WHO's air pollution database is about the quality of air in more than **4,000** urban settlements in 108 countries. **32** of the **859** cities. considered globally are in India. The study was of PM levels

PM2.5 | Atmospheric particulate matter (PM) with diameter less than **2.5 micrometre (μm)**

PM10 | Diameter less than **10 μm**

HEALTH RISK

Size determines where a particle will come to rest in the respiratory tract when inhaled

Larger particles are generally filtered in the nose and throat

PM smaller than 10 μm can settle in the bronchi and lungs

Thus **PM2.5** is a lot more **Dangerous** than PM10

SAFE LIMITS

In microgram per cubic metre

PM10 | WHO, 20μg / m3. India, 60μg / m3

PM2.5 | WHO, 10μg / m3. India, 40μg / m3

They react and transform chemically

2A+B=D

C+D=E

A+B+C

React further under sunlight

Weather plays a role in dispersal

Pollutants are produced

A B C

Formation

Dispersion

Accumulation depends on urban topograph

Emissions

Concentrations

POLLUTION SOURCES

IMPACT ON ENVIRONMENT

MOST POLLUTED MEGACITIES

WHO calculated PM10 levels for 10 megacities (urban areas with more than 14 million inhabitants)

PM10 level — Delhi 292, Cairo 284, Dhaka 147, Mumbai 104, Beijing 92, Shanghai 59, Istanbul 53, Mexico city 39, Sao Paulo 28, Buenos Aires 27

Causes of Air pollution in India

- **Burning of Fossil Fuels**: Sulfur dioxide emitted from the combustion of fossil fuels like coal, petroleum and other factory combustibles is one the major cause of air pollution. Fossil fuel emissions contain the major greenhouse gases, including carbon dioxide, methane, nitrous oxide and fluorinated gases.
  - **Vehicle emissions** are also a source of fossil fuel emissions and air pollution. Incomplete combustion of Hydrocarbon generally leads to carbon monoxide emission from vehicles, which along with Nitrogen Oxides is a toxic cocktail.
  - **Industrial emissions**: Manufacturing industries release large amount of carbon monoxide, hydrocarbons, organic compounds, and chemicals into the air.
  - **Petroleum refineries** also release hydrocarbons and various other chemicals that pollute the air and also cause land pollution.
  - **Power Plants:** India is the world's second largest coal burner after China, generating 210 GW of electricity a year, mostly from coal.
- **Agricultural activities** like stubble burning increases air pollution in Delhi and NCR area. Ammonia is a very common by product from agriculture related activities and is one of the most hazardous gases in the atmosphere. Use of insecticides, pesticides and fertilizers in agricultural activities also emit harmful chemicals into the air and can also cause water pollution.
- **Mining operations**: Mining is a process wherein minerals below the earth are extracted using large equipments. During the process dust and chemicals are released in the air causing massive air pollution.
- **Indoor air pollution**: It is the degradation of indoor air quality by harmful chemicals and other materials. Household cleaning products, paints etc. emit toxic chemicals in the air.
- **Dust Storm:** They are one of the biggest contributors to air pollution and can carry harmful particles that increase the spread of diseases across the globe. For eg- Virus spores in the ground are blown in the air and spread through acid rain or urban smog.
- **Forest Fire:** Wild fires cause air pollution by releasing particulate matter into the air. These particles can become lodged in your respiratory system, causing irritation to tissues.
- **Deforestation:** Deforestation affects the atmosphere in several ways as forests act as sinks for carbon dioxide through a process called carbon sequestration.
- **Waste:** Landfills are also known to generate methane, which is not only a major greenhouse gas, but also an asphyxiant and highly flammable and potentially hazardous if landfills grow unchecked.
- **Electronic waste**: Large number of people in India are involved in improper disposal waste by burning of wires/waste electrical and electronic components emitting harmful gases in the atmosphere.

Impact of Air Pollution

- **Health effects**: The effects of Air pollution are alarming. They are known to create several respiratory and heart conditions along with Cancer, among other threats to the body.
  - Pollution was responsible for 9 million deaths in 2015 worldwide. One in six people die due to pollution globally and most of them occur in developing countries like India.
  - Mortality due to pollution was more than a high-sodium diet (4.1 million), obesity (4 million), alcohol (2.3 million), road accidents (1.4 million), and child and maternal malnutrition (1.4 million).
  - Particulate matter (PM 2.5) is a major reason behind air pollution in India from different sources like coal power plants, transport, household pollution, waste, shipping, agriculture and others.
- **Economic loss**: Financial cost from pollution-related death, sickness and welfare is **about 6.2% of the global economy.** Economic loss due to climate-related disasters in proportion to GDP is far greater in lower-income economies than higher-income countries.
  - An average of **5.3% fall in productivity for rural labour** has been observed globally since 2000 as a result of rising temperatures. In 2016 this manifested itself by effectively taking more than 920,000 people out of the workforce globally, with 418,000 of them in India alone.
- **Global warming**: Increase in greenhouse gas emission like CO_2 is slowly increasing the mean global temperature, causing the climate (the long-term pattern of our weather) to change, and producing a variety of different effects on the natural world, including rising sea levels.
- **Acid Rain:** When it rains, harmful gases like nitrogen oxides and sulfur oxides combines with the water droplets which becomes acidic and then falls on the ground in the form of acid rain. Acid rain can cause great damage to human, animals and crops.

- **Eutrophication:** It is a condition where high amount of nitrogen present in some pollutants gets developed on sea's surface and turns itself into algae and adversely affect fish, plants and animal species.
- **Effect on Wildlife:** Toxic chemicals present in the air can force wildlife species to move to new place and change their habitat.
- **Depletion of Ozone layer:** Earth's ozone layer is depleting due to the presence of chlorofluorocarbons, hydro chlorofluorocarbons in the atmosphere. As ozone layer will go thin, it will emit harmful rays back on earth and can cause skin and eye related problems. UV rays also have the capability to affect crops.

Steps taken by government to curb Air Pollution in India

- **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, SO2 and oxide of nitrogen. However, 90% of the coal fired TPPs have not complied with the norms. Thus, some have been given deadline extension in the wake of high cost to be incurred for retro fitting with flue gas desulfurization system. The need to curb emission from thermal plant includes:

  - **Increasing proportion of SO2:** Over the last 10 years, India's SO2 emissions have spiked by 50% and it could become the world's largest emitter of the toxic air pollutant.
  - **Citizen at risk:** Around 33 million Indians live in areas with substantial sulphur-dioxide pollution – a number which has doubled since 2013. This might also increase with growing demand of energy.
  - **Major reason:** India has been releasing the harmful pollutant by burning coal – which contains about 3% of sulphur – to generate electricity. The country produces more than 70% of its electricity from coal.

- **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

India is becoming a dumping ground of pet-coke from the US, which has banned its internal use because of pollution. Sulphur-heavy petcoke and other polluting fuels such as furnace oil are widely used by cement factories, dyeing units, paper mills, brick kilns and ceramics businesses.

About pet coke

- Petroleum coke or pet coke, is a solid carbon rich (90% carbon and 3% to 6% sulfur) material derived from oil refining.
- It is categorized as a "bottom of the barrel" fuel.
- It is a dirtier alternative to coal and emits 11% more greenhouse gases than coal.
- India is the world's biggest consumer of petroleum coke
- It is an approved fuel in many states such as Andhra Pradesh, Telangana, Gujarat and Karnataka.

About Furnace oil

- It is a dark viscous residual fuel obtained by blending mainly heavier components from crude distillation unit, short residue and clarified oil from catalytic cracker unit.
- It is one of the cheapest fuels available and used to generate power in industries to run boilers, turbines etc.

Reason for increased uses of Pet-coke and furnace oil:

- **Cheaper alternative:** Per-unit delivered energy for petcoke is much cheaper compared to coal making it attractive for buyers.
- **Favourable tax regime:** Though both these fuels are taxed at 18% under GST but the industries, which use these fuels for manufacturing, get entire tax on the fuels credited back. On the other hand on natural gas, which is not included in GST, the VAT is as high as 26 % in certain states.
- **Clean energy cess** of Rs. 400 per tonne levied on coal, further promote shift to pet-coke.
- **Zero Ash Content** in Pet coke is a big advantage over coal which has significant ash content. It also allows cement firms can use low grade limestone. This is a big advantage as almost 60 % of India's limestone reserves are low grade in nature.

Toxic Emissions
Petcoke's sulfur levels are higher than other fossil fuels

straw as feedstock to make materials that would find use in construction and packaging.

- **Ban on pet coke and furnace oil:** Recently, Supreme Court banned the use of furnace oil and pet-coke in Haryana, Rajasthan and Uttar Pradesh. Environment Protection (Prevention and Control) Authority (EPCA) in 2017 had asked for the ban on use of furnace oil and pet-coke in NCR region. However, there are various concerns associated with ban:
    - India is the second largest refiner of crude oil in Asia and it generated 13.94 million tonne of petcoke 2016-2017. Given that production of petcoke will continue in India for the foreseeable future, there is a clear need to find a way to dispose it in an environmentally friendly and cement kilns offer the best option.
    - Many public sector companies have just created petcoke capacity at significant cost on seeing rising demand for the fuel, the ban would be counterproductive to these companies.
    - There are challenges on the procurement front for domestic coal with linkages not available for the cement industry. Also coal available is of a grade which can be used only for captive power plants and is not suitable for use in kiln.
    - Ban could impact approximately 1,000 units directly and nearly 10,000 allied units indirectly and is expected to render over 25 lakh workers jobless.
- **Dust Mitigation Plan:** 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.
- **Other steps include**
    - Universalization of BS-IV by 2017; 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.
    - National Green Tribunal has imposed a fine ranging from Rs. 2,500 to Rs. 15,000 - depending on the farm size - on farmers who indulge in burning stubble
    - Ban on polluting fuel like petcoke usage in around NCR
    - Supreme Court ban on firecracker usage
    - **Encouraging Alternatives:** Promotion of public transport and network of metro, e-rickshaws, promotion of car pooling etc.
    - **Focus on short-lived climate pollutants (SLCP):** SLCP include a variety of gases that have short-term warming effects often in excess of CO_2, but don't stay in the atmosphere as long. These include methane, HFCs, black carbon (soot), tropospheric ozone etc. It has been estimated that SLCP mitigation has the potential to avoid up to 0.6°C of warming by mid-century while aggressive CO_2 mitigation in a comparable scenario leads to less than half as much near-term reduction in warming.

> **Highlights of Dust mitigation Plan**
> - **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 along with the use of **wet jet for grinding** and stone cutting.
> - **No uncovered vehicles** carrying construction material and waste would be permitted and roads must be **paved and blacktopped** (i.e. metallic roads).
> - **Wind-breaker** of appropriate height i.e. 1/3rd of the building height.
> - Dust mitigation measures shall be displayed prominently at the construction site for **easy public viewing.**
> - **Clean all vehicles** before leaving the construction site.

1.1.1. DELHI AIR POLLUTION

Why in news

In winter 2017, National Capital Region experienced **"severe" levels of pollution on Air Quality Index.**

Highlight

- PM2.5 concentrations in New Delhi reached more than 1,200 micrograms per cubic meter, 48 times the guideline value established by the World Health Organization

Air Quality Index (AQI)

Is a number used by government agencies to characterize the quality of the air at a given location.

| Air Quality Index Values When the AQI is in this range...	Levels of Health Concern ...air quality conditions are..	Colors ..as symbolized by this color
0 to 50	Good	Green
50 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

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- Indian Medical Association termed it as a **"medical emergency",** equating it to smoking 50 cigarettes a day.

Reasons behind Delhi's air pollution

- During winter season in Delhi, there are two winds — one carrying pollutants from stubble burning in Punjab and the other bringing in moisture from Uttar Pradesh — that collide and get locked, which leads to the formation of smog.

- **Burning of paddy stubble in Punjab and Haryana:** Approximately 35 million tonnes of crop are burn by the farmers in these states, which is increasing on year basis.

- In Delhi, the ground-level ozone and PM 2.5 play the most significant role in formation of smog.

- **Dust storm:** According to a study by the System of Air Quality and Weather Forecasting and Research (under the Ministry of Earth Sciences) and India Meteorological Department (IMD) **"multi-day dust storm" in Iraq, Kuwait and Saudi Arabia** was one of the main causes of Delhi's smog. Delhi-NCR came under a thick blanket of dust primarily due **to dust storms from Rajasthan** which is facing extremely dry weather conditions, with high temperatures and wind speeds.

- **Large scale construction activities in Delhi-NCR** are major source of dust particle in air.

About Smog
- It is a result of a photochemical reaction of sunlight with pollutants that have been released into the atmosphere.
- It is a **result of various factors**: geography of the place, sunlight, calmness of winds, firing of brick kilns, pollution emitted by vehicles and industrial activity.
- **Haze:** When pollution is high, nitrogen oxides and dust particles interact with sunlight to form ground-level ozone, leading to the building up of haze.
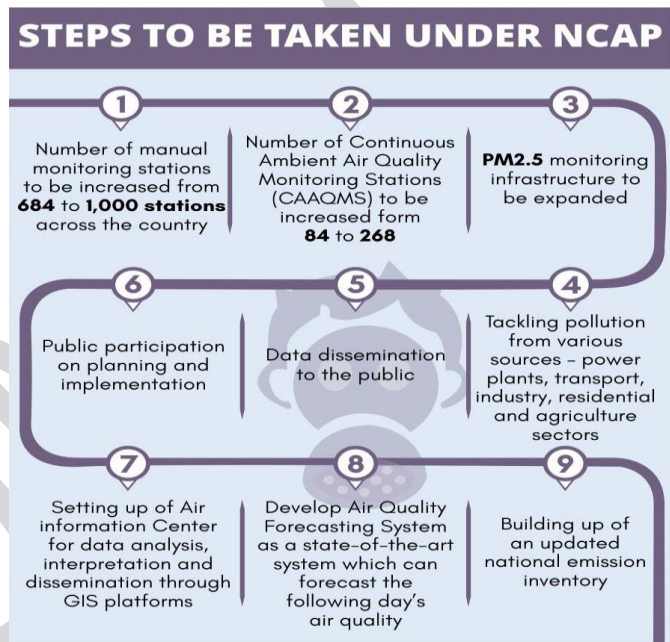
Health Impact

- There is **evidence that high pollution** can lead to premature birth, make pregnant women prone to miscarriage, and cause fetal growth problems.

- **Other impact:** Breathlessness, watering of the eyes and nose, burning sensation in the eyes, coughing, dizziness, headache, lethargy, sore throat, arthritis, increased risk of stroke etc.

- According to a study, if Delhi's air pollution could be lowered to the national standard, it would increase the life expectancy of Delhi's citizens by six years.
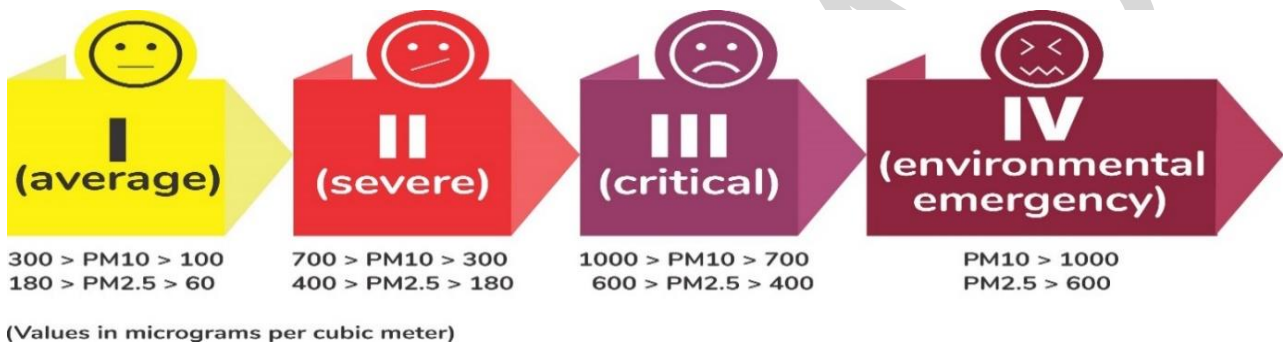
Steps taken to curb Delhi Air Pollution

- **National Clean Air Programme (NCAP)**

STEPS TO BE TAKEN UNDER NCAP

1. Number of manual monitoring stations to be increased from **684** to **1,000 stations** across the country
2. Number of Continuous Ambient Air Quality Monitoring Stations (CAAQMS) to be increased form **84** to **268**
3. **PM2.5** monitoring infrastructure to be expanded
4. Tackling pollution from various sources – power plants, transport, industry, residential and agriculture sectors
5. Data dissemination to the public
6. Public participation on planning and implementation
7. Setting up of Air information Center for data analysis, interpretation and dissemination through GIS platforms
8. Develop Air Quality Forecasting System as a state-of-the-art system which can forecast the following day's air quality
9. Building up of an updated national emission inventory

PRIME FOCUS

A high-level task force, headed by principal secretary to Prime Minister Nripendra Misra, has finalised "Air Action Plan" to improve air quality or Delhi and NCR. The Main action points or the plan:

CROP STUBBLE BURNING
- Chief Secretaries or Punjab, haryana and UP to fram a plan to curb stubble burning and monitor it to reduce stubble burning
- Department of science and technology to provide real-time data on stubble burning

POLLUTION MONITORING
A pollution app to be developed & an anti-pollution helpline to be set up to register complaints or specifec violations

MECHANISED SWEEPING OF ROADS
Delhi to increase mechnised road sweeping from **15%** to **40%**

POLLUTION FROM POWER PLANTS AND OTHER INDUSTRIES
- Environment ministry to develop a dashboard of all red category polluting units & ensure all these units install a certified pollution meter on their premises
- Enforce all brick kilns to switch to zigzag technology

SOLID WASTE MANAGEMENT
- Special focus on 100% solid waste collection in slums & Jhuggi clusters

MANAGEMENT OF LANDFILLS
- Municipal bodies to ensure there are no fires at landfills sites
- Municipal bodies to get special expertise to clouse landfills fires

IMPROVEMENT OF PUBLIC TRANSPORT
- Integrated ticketing system of DTC private buses and Metro within six months
- Procurement or additional buses to improve last mile connectivity
- Journey planner app to be developed to integrate Metro and bus services
- Non-destined trucks should not enter Delhi

- o The programme involves various steps to be taken by the government **(see figure)**
- o Environment ministry had announced its targets of 35% reduction of air pollution in the next three years and 50% reduction in the next five years for at least the 100 identified non-attainment cities across India.
- o A non-attainment city is considered to have air quality worse than the **National Ambient Air Quality Standards.**
- **Centre's "Air Action Plan - Abatement of Air Pollution in Delhi National Capital Region"**
  - o This is a draft action plan by a high-level task force, headed by principal secretary to Prime Minister, Nripendra Misra.
  - o The plan has 12 major actionable points (as given in infographic). It has underlined the need for "sustained and coordinated action" by state governments and central government ministries.
  - o Other important steps include conducting source-attribution studies for NCR every year. The lack of data has been a problem in implementation of pollution-control measures.
  - o **Criticisms:** The proposed action plan lacks clearly defined targets of absolute reduction in pollution levels by a fixed percentage year on year with fixed responsibilities and accountability at various levels.
- **NGT Action Plan to Combat Delhi Air Pollution:** The NGT divided air pollution into four categories:

I (average)	II (severe)	III (critical)	IV (environmental emergency)
300 > PM10 > 100 180 > PM2.5 > 60	700 > PM10 > 300 400 > PM2.5 > 180	1000 > PM10 > 700 600 > PM2.5 > 400	PM10 > 1000 PM2.5 > 600

(Values in micrograms per cubic meter)

The Plan of NGT is different from other plans in following respects:

- o **CPCB has formulated six categories**, which refers to different levels of pollution—good, satisfactory, moderately polluted, poor, very poor, severe and above severe. **EPCA's action plan, termed Graded Response Action Plan (GRAP),** has formulated five categories. These are severe plus or emergency, severe, very poor, moderate to poor and moderate.

> **Salient Features of GRAP**
> - The plan recommends measures like odd-even car rationing scheme and ban on construction activities to combat air pollution. During 'very poor' air quality, it recommends banning diesel generators and parking fee increased by three to four times.
> - It also lists a number of other measures such as closing brick kilns, stone crushers, hot mix plants and intensifying public transport services and increasing the frequency of mechanised cleaning and sprinkling of water on roads.

- o NGT has sought the implementation of odd-even in the third category, but the current GRAP calls for the move at the emergency or highest stringency levels. Terming as "critical" levels of pollution in the third category, the NGT said immediate steps, including a ban on construction and introduction of the odd-even scheme, should be implemented by the authorities.
- o When air pollution reaches environmental emergency levels, thermal power plants in Delhi should be shut down and sprinkling of water from the high-rise buildings should be done. There shall be complete prohibition on use of diesel generator sets. The trucks and heavy vehicles carrying material including trailers shall be prohibited from entering NCT of Delhi. Only the heavy vehicles carrying essential goods like medicine, food etc. would be permitted for the duration of environmental emergency.
- **Delhi Government Action Plan:** The Delhi Govt has proposed to take actions under three different categories of air quality. The measures listed would be implemented simultaneously with the Graded Response Action Plan (GRAP).
- **Other Steps Taken**
  - o Shift to compressed natural gas for commercial vehicles

- o Ministry of Environment's orders issued in 2015 under the Air (Prevention and Control of Pollution) Act, 1981 to comprehensively green Delhi's road margins and open spaces
- o Advancing Bharat Stage-VI norms to April 2018 from April 2020.
- o Closure of brick kilns and an increase in parking fees to encourage the use of public transport.
- o Nation Green Tribunal ordered construction to stop in the capital for a few days earlier this month.
- o Ban on petcoke & furnace oil in and around NCR, Odd and even policy, Ban on sale of fire crackers etc.

3-PRONGED STRATEGY

Category 1
(PM10 > 500 and PM2.5 > 300 micrograms per cubic metre)

Category 2
(PM10 > 800 and PM2.5 > 500 micrograms per cubic metre)

Category 3
(PM10 > 1000 and PM2.5 > 600 microgrms per cubic metre)

Steps To Be Taken Under Category 1

Ban on biomass & garbage burning

- ► Efforts to increase green cover
- ► Mechanised sweeping of main roads
- ► Covering construction meterial
- ► Regular checking of overloaded & polluted vehicles
- ► Checking use of unauthorised fuels
- ► Promoting biomass composting
- ► Promoting battery-operated vehicles
- ► Public awareness campaigns
- ► Ban on entry of non-destined goods vehicles

Under Category II (in addition to the steps listed under Category 1)

- ► Controlling fires at landfills sites | Wetting flyash ponds
- ► Intensify checking of overloaded and polluting vehicles | Ban on diesel gen sets
- ► Washing trees using water jets, dependent on the availability of tankers
- ► Water sprinkling on roads ► Activating vapour recovery system at petrol pumps

Under category III (in addition to those listed under Category 1 & 2)

- ► Ban on entry of trucks (except those carrying essential commodities)
- ► Education department to urge all parents to restrain their kids from indulging in outdoor activities
- ► Intensifying traffic management at all hotspots
- ► Civic agencies to intensify mechanical road sweeping
- ► Ban on civil engineering construction in delhi

DTC and transport department to intensify services

Increasing Metro frequency

Way forward

- **Robust and Reliable Weather Forecasting System:** There is a great need for better weather forecasts so that agencies have an advance notice of the measures that need to be taken. As all around the world, where such smog alert systems are in place, a robust and reliable weather forecasting system is essential for action.
- **Comprehensive road transport policy** whereby promotion of public transport is needed. Several studies have shown that public transport provides more than 65 % of Delhi's commuting needs but occupies less than 5 % of road space.
  - o This should be coupled with imposing disincentives to purchase private vehicles. In this a combination of pollution taxes, rationalizing licensing and registration of vehicles, congestion tax, car free areas etc. should be implemented.
- Urban planning should be long-term which should give enough space for non-motorised transport like cycling and walking.
- **Punitive measures for polluting industries** have to be stricter and clearly defined to fix accountability which seems to be very relaxed in the current plan.
- **Avoiding bureaucratic hurdle:** The PMO has to intervene at the national level to act on the rising air pollution and health crises and for proper implementation of a comprehensive plan.
- **Switching over to gas** from traditional sources of energy is required in vehicles power plants and industry. The second transition to natural gas and clean fuel is further required to **electric vehicles** and ensuring supply of power to stop the use of generator sets.
- Change in **the Solid Waste management system** to stop the burning of garbage.
- **Improved Health advisories** to people to take preventive action.
- **Learning best practice**: Delhi can emulate Singapore's example of setting a limit on the number of cars permitted on its roads.

1.1.2. BIOMASS MANAGEMENT

Why in news?

Recently, NITI Aayog released a report of Task Force on Biomass Management constituted under 'Cleaner Air Better Life' initiative, an initiative for 'improving the air quality of Delhi-NCR.

Background

- **Crop residue burning:** It has been intensifying over the years. Increased mechanization, declining number of livestock, long period required for composting and no economically viable alternate use of residues are some of the reasons for residues being burnt in field. This has implications for global warming, adverse impact on air quality, soil health and human health.

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- Unlike other crop residues, paddy straw is utilised to a very small extent outside the field. This is mainly due to its low calorific-value compared to other crop–residues and high silica content which limits its use in many applications.
  - This situation is further exacerbated by obsolete traditional uses of residue such as roof thatch, proliferation of mechanised farming and a very small window of transition for the farmers between harvesting paddy and sowing wheat.
- India is said to have an estimated 600 million tonnes of surplus agricultural biomass and roughly 39 million tonnes of paddy straw is burnt in Haryana, Punjab, Rajasthan and Uttar Pradesh.
- This report identifies solutions to address farm waste burning. In the long-run, recommended action would induce behavioural change in the farmers' community through adoption of in-situ and ex-situ options to utilise the crop residue.

Recommendation of Task Force

- **Immediate Action - Financial support to farmers** for in-situ treatment of paddy-straw using DBT system.
- **Medium and Long-Term Actions** –
  - **Create 'Impact Fund' for air pollution** - to support clean technologies and link it with the National Clean Energy Fund.

Biomass
- India has a potential of about **18 GW of energy from Biomass.**
- Biomass energy constitutes wood fuels (including charcoal, wood waste wood), crop residues (such as bagasse, rice husk and crop stalks) and animal dung (including biogas).
- About **32% of the total primary energy** use in the country is still derived from biomass and more than **70% of the country's population depends** upon it for its energy needs.
- **Economy based on Biomass**: Biomass power industry attracts **investments of over Rs.600 crores every year**, generating more than **5000 million units of electricity** and yearly **employment** of more than 10 million man-days in the rural areas.

Climate Resilience Building among Farmers through Crop Residue Management'
- It will be implemented under the National Adaptation Fund for Climate Change (NAFCC).
- To mitigate climate change impacts and enhance adaptive capacity, but will also counter the adverse environmental impacts that arise from burning.
- Along with awareness generation and capacity building activities, implementable and sustainable entrepreneurship models will be created in rural areas through upscaling successful initiatives and innovative ideas.

Scheme for Biomass Based Cogeneration Projects
- It aims to support Biomass based Cogeneration Projects in Sugar mills and Other Industries for power generation in the country.
- It will provide Central Financial assistance (CFA) for projects utilizing biomass like bagasse, agro-based industrial residue, crop residues, wood produced through energy plantations, weeds, wood waste produced in industrial operations, etc.
- **Municipal Solid Waste is not covered under the programme.**
- **Cogeneration:** Cogeneration – 'generating together' – refers to the process wherein we obtain both heat and electricity from the same fuel at the same time.

  - **Upscaling technologies with service-based shared economy and process-based incentives** - a shared economy could be created to cater the demand of all the farmers affordably for required machinery and it is also recommended that incentives are linked to performance in long-term to promote efficient utilisation of infrastructure.
  - **Rewarding and monitoring at local level** - with advanced remote sensing data and local monitoring by Block Development Officers (BDOs). Further, a financial reward for panchayats is suggested in order to catalyse the vision of zero-burning in rural areas.
  - **Regulatory support towards ex-situ treatment** - this is equally desirable given the limitations to ploughing all the straw back into the soil.
  - **Awareness tools** - this includes dedicated awareness campaigns involving State Agriculture Departments and Krishi Vigyan Kendras (KVKs) and recognition to farmers already following such practices

Solutions Proposed

- **Ploughing the residue back into the field or in-situ approaches**-
  - **Residue retention as straw mulch** - Mulch can increase yield, water use efficiency, and profitability, while decreasing weed pressure.

- o **Residue incorporation** - Wet mixing of chopped straw helps conserving nitrogen and other nutrients contained in the straw.
- **Extraction and usage for other purposes or ex-situ approaches** -
  - o **Pyrolysis (Biochar)** - Biomass is converted to biochar by pyrolysis (burning in the complete absence or limited presence of air) which can then be used as a soil conditioner, char briquettes and other value-added products such as home garden fertilizer.
  - o **Briquetting and/or Palletization** - For the purpose of efficiently using straw as fuel and to ease its transportation over larger distances, biomass can be transformed into briquettes and/or pellets of regular shape. These are easier to use, convenient to transport and store, and have higher calorific value (heat value).
    - ▪ Briquettes have good potential of being co-fired into industrial boilers along with coal and other high calorific crop residues. Pellets have good potential for being used as fuel in cooking stoves and heating applications in domestic as well as industry.
  - o **Other steps include** - conversion to BioCNG, bio-ethanol and other liquid fuels, setting up bio-power plant and dry fermentation biogas plant.

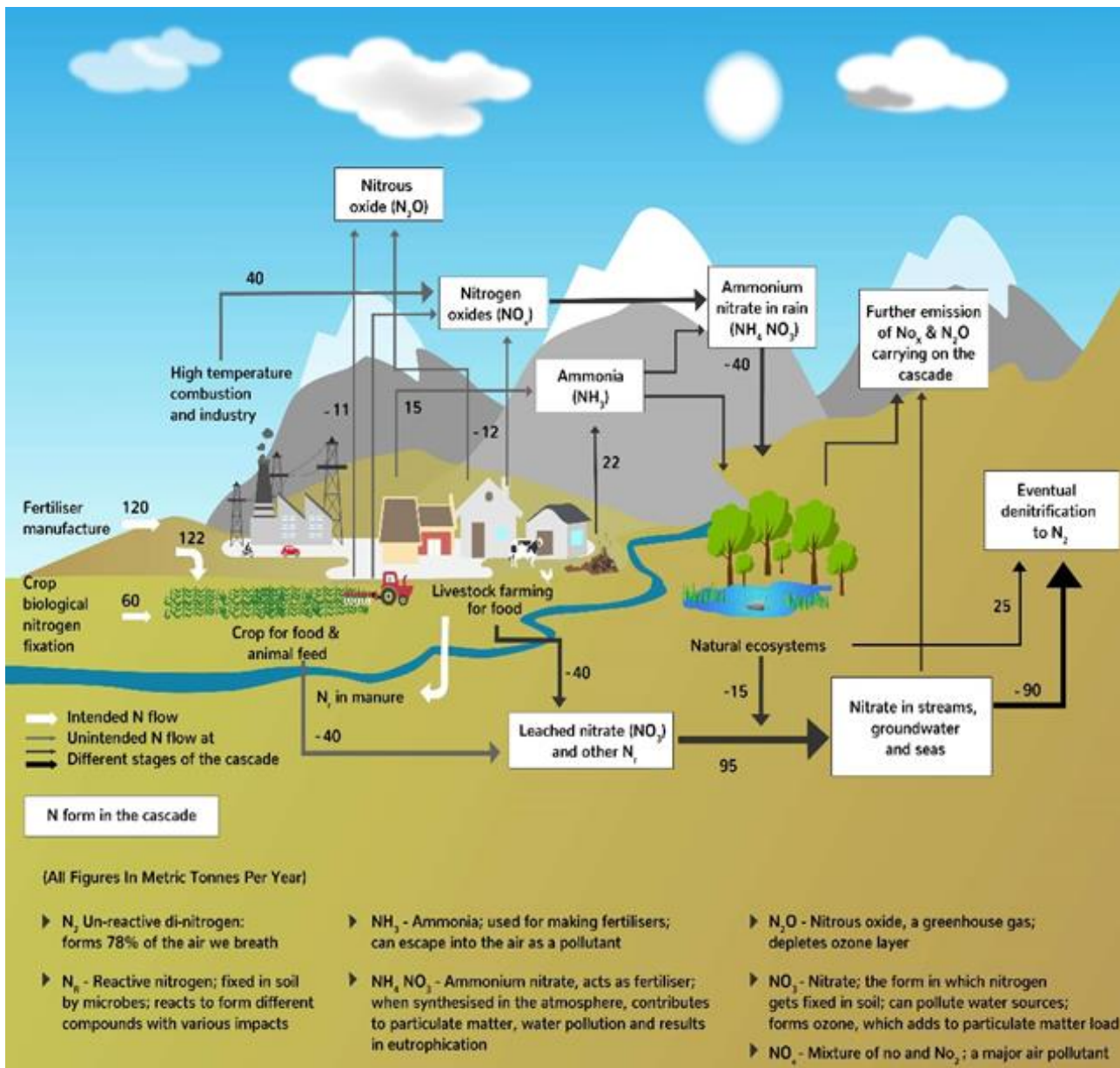## 1.1.3. NITROGEN POLLUTION

Why in news?

- Indian Nitrogen Assessment report was released by an NGO Society for Conservation of Nature (SCN).

Importance of Nitrogen

- Nitrogen is a naturally occurring element that is essential for growth and reproduction in both plants and animals. It comprises about 78% of the Earth's atmosphere.
- Agriculture is the main source of nitrogen pollution in India followed by Sewage and organic solid wastes.
- Ammonia concentration in the atmosphere over India is the highest in the world due to cattle population and excessive fertilizer use.

Highlight of the report

- **Reducing Food productivity**: Excessive and irrational usage of fertilizers has brought down the yield of crops, becoming counterproductive to the very purpose of its usage.
- **Inefficient intake of fertilizers by food crops:** Only 33% of the nitrogen applied to rice and wheat through fertilisers is taken up by the plants in the form of nitrates.
- **Polluting Groundwater:** Leaching of fertilizer has increased the nitrate concentration in groundwater of Punjab, Haryana and western Uttar Pradesh exceeding the limits prescribed by the World Health Organization (WHO).
- **Potent Greenhouse Gas (GHG):** Nitrogen in the form nitrous oxide (N_2O) is 300 times more potent as a GHG as opposed to CO_2.
- **Economic impact**: India loses nitrogen worth US $10 billion per year as fertiliser value (through subsidy), while its health and climate costs are pegged at US$ 75 billion per year.
- **Health impact:** Blue Baby Syndrome, reduced functioning of the thyroid gland, Vitamin A shortages etc.
- **Acid Rain:** Nitric acid with H_2SO_4 causes acid rain, which negatively affects crops and soils.
- **Eutrophication:** Due to large amounts of fertilizers run-off resulting in formation of a **dead zone.**
- **Ozone depletion:** Nitrous oxide (N_2O/ laughing gas) is considered as a dominant ozone-depleting substance emitted by humans**.**
- **Smog Formation:** Nitrogen Pollution emitted from industries aid in smog formation.

(All Figures In Metric Tonnes Per Year)

▶ N₂ Un-reactive di-nitrogen: forms 78% of the air we breath

▶ Nᵣ - Reactive nitrogen; fixed in soil by microbes; reacts to form different compounds with various impacts

▶ NH₃ - Ammonia; used for making fertilisers; can escape into the air as a pollutant

▶ NH₄ NO₃ - Ammonium nitrate, acts as fertiliser; when synthesised in the atmosphere, contributes to particulate matter, water pollution and results in eutrophication

▶ N₂O - Nitrous oxide, a greenhouse gas; depletes ozone layer

▶ NO₃ - Nitrate; the form in which nitrogen gets fixed in soil; can pollute water sources; forms ozone, which adds to particulate matter load

▶ NOₓ - Mixture of no and No₂; a major air pollutant

Steps taken to control Nitrogen pollution

- **Mandatory neem-coated urea production:** Neem-coated urea releases nitrogen at a slower pace giving plants time to absorb it, hence leading to an optimal usage
- **Soil Health Card:** It provides information to farmers on nutrient status of their soil along with recommendations on appropriate dosage of nutrients for improving soil health and its fertility. It has led to decrease in consumption of Nitrogen in agriculture.
- **Bharat Stage Norms:** It aims to regulate the harmful emission from vehicle. like carbon monoxide (CO), unburnt hydrocarbons (HC), Nitrogen Oxides (NOx) and Particulate matter (PM).
- **National Air Quality Index (NAQI)** has been implemented in which Nitrogen Dioxide is one of the eight pollutants to be controlled and monitored its emission.

International Initiatives

- **Gothenburg Protocol:** It aims to Abate Acidification, Eutrophication and Ground-level Ozone and is a part of is part of the **Convention on Long-Range Transboundary Air Pollution.**
  - ✓ **Objective:** To control and reduce emissions of sulphur dioxide (SO2), nitrogen oxides (NOx), ammonia (NH4), volatile organic compounds (VOCs), and Particulate Matter (PM) that are caused by human activities.
- **Kyoto Protocol:** It aims to reduce the emissions of the Green House Gases such as Methane (CH4), Nitrous oxide (N2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF6) and carbon dioxide (CO2).
- **International Nitrogen Initiative (INI) -** It is an international program, set up in 2003 under sponsorship of the Scientific Committee on Problems of the Environment (SCOPE) and from the International Geosphere-Biosphere Program (IGBP) to optimize nitrogen's beneficial role in sustainable food production.

Way Forward

- **Recycling of industrial and sewage waste** could decrease 40% of fertilizers usage in country. It could also lead to production of food more sustainably and open new economic opportunity in organic manure segment.
- **Increasing Nitrogen Use Efficiency (NUE):** It is a term used to indicate the ratio between the amount of fertilizer N removed from the field by the crop and the amount of fertilizer N applied. By applying fertilizers in the proper amount, at the right time of year and with the right method can significantly increase NUE. Relative improvement in current rates of NUE by 20% would have net economic benefits of US$ 170 billion per year globally.
- **Reducing fertiliser subsidy**: According to the report of the **Commission for Agricultural Costs and Prices (CACP),** subsidy on urea should be reduced, while increasing it on P&K to arrest the hugely adverse NPK ratio.
- **Promoting precision Agriculture**: Use of hi-tech approaches to use fertilizers in most efficient and effective manner.
- **Buffers:** Planting trees, shrubs and grass around fields, especially those that border water bodies, can help by absorbing or filtering out nutrients before they reach a water body.
- Other steps could also be taken like **Conservation tillage** (to reduce soil erosion), Managing livestock waste, Drainage water management etc.

1.1.4. FLY ASH

Why in news?

- The government of India has launched a web-based monitoring system and fly ash mobile application named ASH TRACK.

Facts on 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. It, thus, **poses hazards to environment** and health if not managed properly.

Broad Objective of Fly Ash Utilization

- To protect the environment, conserve top soil, prevent dumping and disposal of fly ash discharged from coal or lignite based thermal power plant on land.
- Restricting usage of top soil for manufacturing of bricks.

> **About the Platforms**
> - These platforms will enable better management of the ash produced by thermal power plants by providing an interface between fly ash producers (Thermal Power Plants) and potential ash users such as – road contractors, cement plants etc.
> - The ASH TRACK App would be managing 200 million tonnes of fly ash by tracking coal based power plants situated within 100 km and 300 km from given location and availability of fly ash, along with prospective users within the same radius.
> - The App gives plant-wise, utility-wise and State-wise ash utilization status in the country.
> - The thermal plants are required to regularly update fly ash generation, utilisation and stock on the web portal and the app.

Advantages of Fly Ash

- It is a proven resource material for many applications of construction industries and currently is being utilized in **manufacturing of portland cement, bricks/blocks/tiles manufacturing**, road embankment construction and low-lying area development, etc.
- It can be advantageously **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.
- India is still not able to match the potential of its fly ash use. As per Ministry of Power, only 63% of fly ash generated is being utilized. Following steps have been taken to utilize its potential:
  - 2009 notification of MoEF provided **guidelines on ash utilization** advocating its usage within 100 km radius of thermal power plants.

- o New and innovative uses are also taking place- especially initiated by power companies like NTPC in collaboration with Institutes like IIT-Delhi and IIT-Kanpur e.g. Manufacture of pre-stressed railway concrete sleepers.
- o **Maharashtra** became the first state in the country to adopt **the Fly Ash Utilization Policy** and has decided to come up with an export policy for fly ash in the light of demand from places like Singapore and Dubai**. Important Feature of Policy are:**
    - ✓ The government has announced **cluster development of ash-based industries**, such a cement, in the vicinity of all thermal power plants. The industries, in joint venture with the government, will be given land, ash and tax incentives.
    - ✓ Fly ash can be used for making cement, pre-fabricated building material, bricks, laying roads, housing and industrial buildings, dams, flyovers, reclaiming low-lying areas, wasteland development, stowing of mines and all other construction works. These uses will be suitably promoted.
    - ✓ The coal ash can be used in the **agricultural land to increase its productivi**ty and hence agriculture department has also been roped in to promote the fly ash among farmers.
    - ✓ The government has also decided to **export fly ash** after treating it with cenospheres, which is expected to generate revenue of Rs 1,500 crore.

Way Forward

- To achieve the target of 100% utilization of fly ash, following steps can be taken:
    - o Renovation and modernization of coal/lignite based Thermal Power Stations need to include the technological advancement required to ensure development of dry fly ash
    - o Renovation and modernization should also include a marketing strategy for the development of fly-ash based industries and making available fly ash and fly-ash based building products in the nearby markets.
    - o Use of fly ash in the construction of embankments for laying railway lines should also be encouraged for large scale utilization of fly ash.
    - o Improving Awareness about the usage of fly ash in Agriculture and waste land development.

1.2. WATER POLLUTION

India is home to 16% of World's population however, it holds only about 4% of global freshwater.

- Water pollution is a serious problem in India as almost 70% of its surface water resources and a growing percentage of its groundwater reserves are contaminated by biological, toxic, organic, and inorganic pollutants.
- 89% of ground water extracted is used in irrigation sector followed by domestic use (9%), industrial use (2%). 50% of urban water requirements and 85% of rural domestic water requirements are also fulfilled by ground water.
- In many cases, these sources have been rendered unsafe for human consumption as well as for other activities, such as irrigation and industrial needs.
    - o More than 100 million people live in areas with poor water quality.
    - o Water levels in more than half of 4,000 groundwater wells is decreasing.
- This shows that degraded water quality can contribute to water scarcity as it limits its availability for both human use and for the ecosystem. Inter-Governmental Panel on Climate Change (IPCC) in 2014 warned **that approximately 80% of the world's population suffers a severe threat to its water security.**

Major Issues related to Water Pollution in India

- **Lack of Coordination among States:** Interstate water disagreements are increasing, reflecting poor national water governance.
- **Lack of water data:** Data systems related to water in the country are limited in their coverage, robustness, and efficiency:
    - o **Limited coverage:** Detailed data is not available for several critical sectors such as for domestic and industrial use.
    - o **Unreliable data:** Available data can often be of inferior quality, inconsistent, and unreliable due to the use of outdated methodologies in data collection.

- o **Limited coordination and sharing**: Data in the water sectors exists in silos, thereby reducing efficiencies.
- **Climate change**: Hot summers and shortened winters are resulting in retreating Himalayan glaciers, erratic monsoons, frequent floods etc. which are further worsening the situation throughout.
- **Groundwater contamination**: Lack of proper wastewater treatment from domestic and industrial sources has led to progressive contamination of groundwater posing health risks
  - o Moreover, unscientific farming practice alongwith freebies given by government have led to unsustainable and exploitative usage of water resources. Ex: Groundwater in India depleted at 10-25 mm per year between 2002 and 2016.
  - o As per an official assessment of groundwater in India, of the 6,607 assessment units (blocks, mandals, talukas and districts), 1,071 are over-exploited (usually referred to as **'dark zones'**), 217 are critical, 697 are semi-critical, 4,580 are safe and 92 are saline.

NUMBER OF RIVERS POLLUTED WITH UNACCEPTABLE LEVELS OF HEAVY METALS

CONTAMINANT	PERMISSIBLE LIMIT	NO OF RIVERS
Lead	10 µg/L	69
Nickel	20 µg/L	25
Iron	300 µg/L	137
Copper	50 µg/L	10
Chromium	50 µg/L	21
Cadmium	3 µg/L	25

- **Toxicity in Indian Rivers**
  - o Recently, Central Water Commission report highlighted that **42 rivers in India** have at least **two toxic heavy metals** in quantities beyond the permissible limit.
  - o Ganga, the national river, was found to be polluted with five heavy metals—chromium, copper, nickel, lead and iron.
  - o It is an issue because a majority of Indians still use water directly from **rivers for their domestic use**. With an increase in population, the pressure on these rivers will only increase.
  - o According to the report, mining, milling, plating and surface finishing industries are the **main sources of heavy metal pollution** and the

Major Sources of River Pollution

- **Natural** – Rocks, Volcanic eruption, Wind-blown dust particle, Sea spray, Aerosols.
- **Agricultural** - Inorganic fertilizer, Pesticide, Sewage sludge & fly ash, Waste water, Fungicides.
- **Industrial** - Industrial waste, Thermal power, Coal & crude ore mining industry, Chemical industry, Various refineries
- **Domestic** - E-waste, Used batteries, Inorganic & organic waste, Used filters, Biomass burning.
- **Miscellaneous**- Incineration, Open dumps, Traffic and other emission, Landfills, Medical waste.

Health impacts of toxic metals

- Heavy metals pose a serious threat to humans and the environment because of its toxicity, non-biodegradability and bioaccumulation and may result in reduction of **species diversity**.
- It leads to physical, muscular, and neurological degenerative processes that are similar to Alzheimer's disease, Parkinson's disease, cancer etc.

concentration of such toxic metals has increased rapidly over the past few decades.

- **Increasing Frequency of Drought:** About 800 million of India's 1.3 billion people depends on agriculture for a living, with 53% of agriculture is rainfed, creating socio-economic distress for farmers.

Water scarcity in India

- The scarcity can be understood by the recent acute water shortage in Shimla where in the last week of May this summer, water almost dried up in the Nauti-Khad stream. 54% of the country faces high to extremely high water stress.
- **World Bank** indicates that by 2030, India's per capita water availability may shrink to half, which will push the country into **'water scarce' category** from the existing **'water stress' category**.
  - o **Water Stressed Condition:** When annual per-capita water availability is less than 1700 cubic meters.
  - o **Water Scarcity Condition**: When annual per- capita water availability is less than 1000 cubic meters.
  - o **Decreasing annual per capita availability of water:** It fell from 1,820 cubic meters in 2001 to 1,545 cubic meters in 2011, which may further fall to 1,341 cubic meters in 2025.
- With nearly **70% of water being contaminated**, India is placed at 120th amongst 122 countries in the **water quality index.**
- India is undergoing the **worst water crisis** in its history.
  - o 600 million people in India face high to extreme water stress in the country.
  - o 75% of the households in the country do not have drinking water at their premise.

- o 84% rural households do not have piped water access.
- o About 200,000 people dying every ye ar due to inadequate access to safe water.
- o 40% of India's population will have no access to drinking water by 2030.
- **Urban water scarcity** because of sharp **increase in urban water demand** due to Increasing and changing population patterns.

Its Impact

- **World Bank** in 2016, has cautioned the Indian government that countries that lack a sufficient amount of water could see their GDP decline by as much as 6% by 2050.
- **On Agriculture**: Low reservoir levels can delay planting of pulses, cotton, paddy and millets in western and central states which will invariably prove to be disastrous for agriculture and food security. It will also have serious impacts on the livelihood of sharecroppers and farm labourers.
- **On Industrial Sector**: Sector like textiles, food products and beverages, paper mills, cold storage facilities and ice production are likely to suffer in terms of production in view of water shortage.
- **Drinking water shortage**: As according to **UN-based projections**, Bengaluru city of India is "most likely" to be the first Indian urban settlement that will run out of drinking water.

1.2.1. WATER MANAGEMENT

Water is a State subject and its optimal utilization and management lies predominantly within the domain of the States. However, the central government can legislate on environmental matters including promotion of groundwater protection and promotion of sustainable use. Article 21 provides for access to drinking water and on the right to safe drinking water.

Government has taken various measures regarding water management:

- **National Rural Drinking Water Program.** It was launched under Bharat Nirman with an objective of ensuring safe and adequate drinking water supply through hand-pumps, piped water supply etc. to all rural households and persons. The **Sustainable Development Goal 6** talks about providing universal access to safe and affordable drinking water for all by 2030. (Har Ghar Jal)
- **Draft National Water Framework Bill 2016:**
  - o **Aim:** To decentralise water management and give more power to panchayats and gram sabhas to decide how water can be better used
  - o It promises to give every person the right to a minimum amount of "safe water", while making the state "obliged" to "protect" and conserve water
  - o Introduce a "graded pricing system" for domestic water supply, with full cost recovery pricing for high-income groups, "affordable pricing" for middle-income, and a "certain quantum of free supply" to the poor.
  - o Introduce binding national water quality standards for every kind of use.
  - o It asks governments to strive for rejuvenation of river systems by ensuring Aviral Dhara (continuous flow), Nirmal Dhara (unpolluted flow), and Swachh Kinara (clean and aesthetic river banks).
- **For Groundwater resources**
  - o Under the Schedule-I of the MGNREGA, the **water conservation and water harvesting structures** to augment **ground water constitute** a special focus area for MGNREGA works.
  - o **Easement Act, 1882:** provides every landowner with the right to collect and dispose, within his own limits, all water under the land and on the surface.
  - o **The Environment (Protection) Act, 1986** for the purpose of regulation and control of ground water development and management.
  - o **The Model Bill** for Ground Water Management 2011 seeks to implement the **principle of subsidiarity** which involves an aquifer situated entirely within a village will be under the direct control of the **Gram Panchayat**.
  - o **Central Water Commission (CWC):** It is in charge of surface water and creating storage structures such as dams and medium-scale reservoirs. It keeps a watch on 91 major reservoirs that feed hydropower plants and irrigate fields**, advises** the central and state governments on use of water for drinking, irrigation and industrial purposes.
- **For River Rejuvenation**
  - o **ASITA project:** It is a Yamuna River Front Development (RFD) being implemented by the **Delhi Development Authority (DDA)** to restore, revive and rejuvenate Yamuna floodplains and make

them accessible to the people of Delhi. Component of project includes Creation of **Green Buffer Area**, Greenways, Riverfront walks (to develop people relationship with Yamuna) etc.

o **Yamuna River Project**: It's an inter-disciplinary research program by The University of Virginia's whose objective is to revitalize the ecology of the Yamuna River in New Delhi.

o **Aim:**To be a catalyst for the urgent recovery of the Yamuna and its tributaries, building a publicly accessible body of information and expertise, and visions of what an alternative future would be.

o **Living Status:** Uttarakhand High Court in 2017 accorded the status of "living human entity" to Ganga and Yamuna rivers.

o **Yamuna Action Plan (YAP)**: It was started in 1993 under which various works related to sewerage/ interception and diversion of drains, sewage treatment plants (STPs), low cost sanitation/community toilet complexes, electric/improved wood crematoria were taken up. Currently **Phase -III of YAP** is being implemented.

o **Namami Gange program (2015)**: It's a comprehensive approach to **rejuvenate the river Ganga and all its tributaries** under one umbrella by consolidating the existing ongoing efforts and planning for a concrete action plan for the future.

> **Issues in river rejuvenation**
>
> The National Mission for Clean Ganga (NMCG) was established in August 2011 for project planning, management and implementation of activities related to river Ganga. However, a CAG report found following issues:
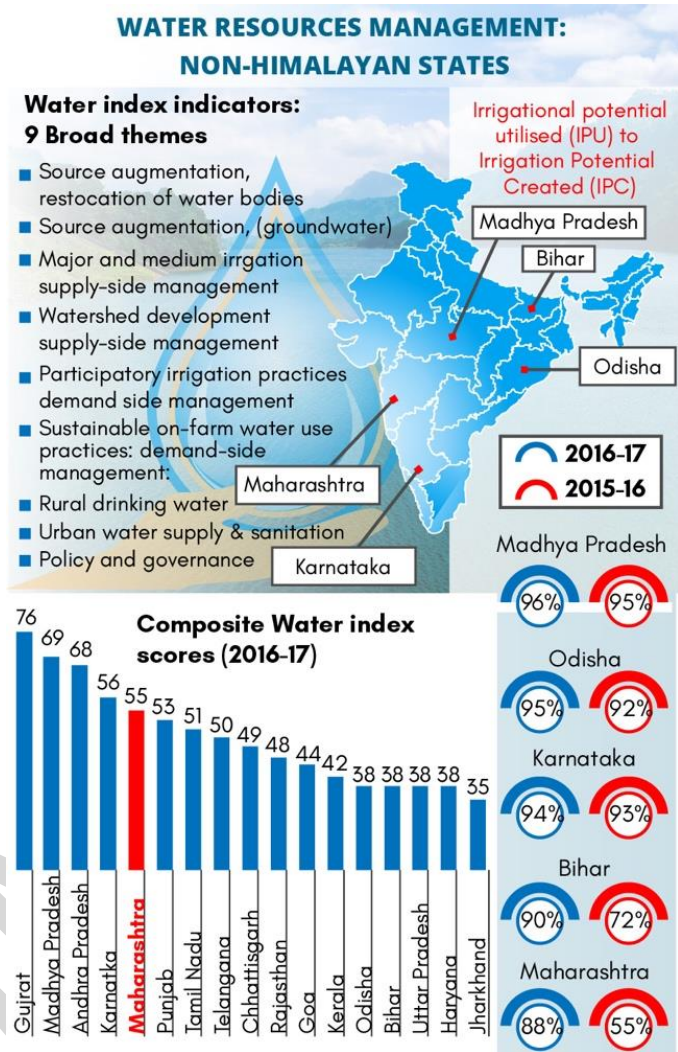>
> - **Under-utilisation of funds**: Only about a fifth of ₹20,000 crore allotted for the National Clean Ganga Mission (NCGM) have been utilised till March 2018, roughly the same proportion as last year.
> - **Delay due to non-finalisation of action plan:** Only 46% of the Detailed Project Reports between 2014-15 and 2016-17 were approved.
> - **Non-implementation of project**: Only 24 of the 65 'entry-level' projects — meant for cleaning the ghats and establishing new ones and cleaning the river front and the river surface — had been completed.
> - **No concrete steps** have been taken for **conservation of flora** and fauna and maintenance of ecological flow.
> - NMCG should also identify and declare River Conservation Zones. So far only Uttarakhand has undertaken initiatives to identify the River Conservation Zones.
> - **Other issues:** overall shortage of manpower, no regular monitoring meeting as prescribed, slow implementation of Bhuvan Ganga, a web portal to enable execution and monitoring of projects etc.
>
> **Issues specific to Yamuna floodplain**
>
> - **Detached citizens**: Delhi's citizens are now completely detached from their river, only part of a larger detachment from the formerly shared consciousness of public space.
> - **Encroached floodplains:** Bridges and other large infrastructures are creating obstructions in the river decreasing effective width of the floodplain. This in turn increases the speed of water during monsoon floods which harms crossing structures, embankments, dredges the river bottom and erodes riverbanks, accentuating the Yamuna's destruction.
> - **Environmental flow:** Yamuna River Project has not addressed the issue of environmental flow which is crucial to save a river.

- **Technical expertise:** Central water commission (CWC) has entered into a Collaboration Agreement with Google for better management of water resources and flood management. Under this, Google will share technical expertise in the fields of artificial intelligence, machine learning, geospatial mapping and analysis of hydrological observation data to collaborate on Improving flood prediction systems, High priority research, build online exhibitions on the Rivers of India etc.
- **National Water Policy (2012):** It advocates conservation, promotion and protection of water and highlights the need for augmenting the availability of water through rain water harvesting, direct use of rainfall and other management measures.
- **National Water Informatics Centre (NWIC)**
  o It would be a **repository of nation-wide water resources data** and provide latest and reliable water data **(other than classified data)** through web-based India Water Resources Information System (India-WRIS) on a **GIS platform** in Public Domain.
  o It will also **collaborate with leading national and international research institutes** to provide technical support to central and state organisations dealing with water emergency response of hydrological extremes.

- It is a component of **National Hydrology Project** and also in consonance with the **National Water Mission** which has an objective of "conservation of water, minimizing wastage and ensuring its more equitable distribution through integrated water resources development and management".
- **Composite water index by NITI Aayog** evaluates states on their water utilisation potential (see infographic). Worsening water crisis in Cape Town has highlighted the risks and challenges that lie ahead for many Indian cities. These crises have **increased the momentum** around effective water management,
  - Between 2015-16 and 2016-17, about 60% (15 out of 24) of the states included in the Index have improved their scores. Many water-scarce states have performed better in the Index like Gujarat, Madhya Pradesh, Andhra Pradesh, Karnataka, Maharashtra and Telangana.

WATER RESOURCES MANAGEMENT: NON-HIMALAYAN STATES

Water index indicators: 9 Broad themes
- Source augmentation, restocation of water bodies
- Source augmentation, (groundwater)
- Major and medium irrgation supply-side management
- Watershed development supply-side management
- Participatory irrigation practices demand side management
- Sustainable on-farm water use practices: demand-side management
- Rural drinking water
- Urban water supply & sanitation
- Policy and governance

Irrigational potential utilised (IPU) to Irrigation Potential Created (IPC)

2016-17 2015-16

Composite Water index scores (2016-17)

State	Score
Gujarat	76
Madhya Pradesh	69
Andhra Pradesh	68
Karnatka	56
Maharashtra	55
Punjab	53
Tamil Nadu	51
Telangana	50
Chhattisgarh	49
Rajasthan	48
Goa	44
Kerala	42
Odisha	38
Bihar	38
Uttar Pradesh	38
Haryana	38
Jharkhand	35

State	2016-17	2015-16
Madhya Pradesh	96%	95%
Odisha	95%	92%
Karnataka	94%	93%
Bihar	90%	72%
Maharashtra	88%	55%

Way forward

- **Urban Water Scarcity Management:** Recently, a report titled "Water Scarce Cities: Thriving in a Finite World" was released by World Bank Group that attempts to compile innovative approaches from the Water Scarce Cities (WSC) Initiative which offers a holistic perspective to urban water security in scarcity conditions. Five key principles for Resilient Urban Water Scarcity Management
  - **Shift culture of abundant water to rationalized demand**: Rationalizing water demand should target two potential problems - Inefficient water networks, and Profligate water consumption.
  - **Hedging against risks** through diversified and dynamic water resource portfolios: Adaptive Design and Operations: Detailed inventory of the city's water budget and corresponding vulnerabilities as baseline information for system planning and investments.
  - **Rely on solutions that are not vulnerable to climate change** (such as desalination and wastewater reclamation)
  - **Ring Fencing Water Systems** from External Competition, i.e., recognizing that water resources can, and should be harnessed within the city boundary
  - **Coping with Uncertainty** and Variability through Adaptive Design and Operations like network of dams to store excess water from desalination plan.
- **Nature-based Solutions:** Recently UN World Water Development Report 2018 was released titled **Nature-based solutions (NBS) for water.**
  - These are solutions that are inspired and supported by nature and use, or mimic, natural processes to address societal challenges effectively and simultaneously providing human well-being and biodiversity benefits.
  - NBS are designed to address major societal challenges, such as food security, climate change, water security, human health, disaster risk, social and economic development.
- **Administrative Measures**
  - **Planning:** Amendment in CWMI methodology to emerge as reliable planning tool, Index should also include water productivity, water-use efficiency, crop water demand, drinking water supply rates, quality of supply, health indicators and environmental impacts other than 9 indicators.

- o **Enable data-backed decision making**: States need to create robust water data systems with real-time monitoring capabilities to ensure that the data can be used to target policy interventions and enable innovation in the broader water ecosystem.
- o **Regulation**: Promotion of effective and **efficient implementation of water pollution control laws** and regulations.
- o **Governance:** Fostering Cooperative and competitive Federalism by formulating frameworks for national water governance, to improve Inter and Intra state cooperation across the broader water ecosystem.
- o **Mobilize community participation**: States should tap into the local knowledge base of problems and challenges surrounding water supply systems, while ensuring true representation through partnerships with NGOs and other relevant organizations.
- o **Provide adequate capacity building and technical support**: Community efforts should be supplemented by support in the form of adequate financing, technical know-how, financial management skills, etc.
- o **Leverage private sector expertise**: Private sector expertise, especially in the realms of technology and data, needs to be leveraged by governments to ensure the quick creation and efficient management of data and monitoring systems.
- **For River pollution**
  - o **Controlling runoff pollution** such as agriculture runoff, urban runoff and runoff from livestock farms through afforestation, sustainable agriculture practices and using wastewater for irrigation etc.
  - o **Adopting hydrological-basin approach**: For holistic river basin management (river basins cut across several state boundaries) instead of Administrative boundary approach.
  - o **Stringent Government policy and monitoring** for effluents discharged from agriculture and industries into the several Indian rivers. CWC has recommended that **quality of water should be monitored** at least four times a year.
- **Drinking Water Availability**
  - o Proper enforcement of Bureau of Indian Standards (BIS) and Indian Council of Medical Research (ICMR) **drinking water standards** for trace and toxic metals for humans as well as for livestock and irrigation use in India.
  - o **Augmenting sources of clean drinking water supply and treatment technologies** through watershed management, rainwater harvesting etc to sustain increasing urbanisation and economic growth in cities.
- **Usage optimisation**
  - o **Creating National Irrigation Management Fund (NIMF)**: To provide financial incentives to states to improve performance in irrigation management.

Role of NBS in addressing water problems:

- **Managing water availability** through ecosystem-friendly forms of water storage (natural wetlands, soil moisture, efficient recharge of groundwater) and environmental-friendly agricultural practices like conservation tillage rather than traditional grey infrastructure such as dams.
- **Managing water quality through proper management of forests**, wetlands, grasslands, soils and crops for reducing sediment loadings, capturing and retaining pollutants, and recycling nutrients and reduction of non-point (diffuse) source pollution from agriculture by rehabilitating ecosystem services that enable soils to improve nutrient management.
- **Managing water-related risks and disasters, such as floods and droughts:** NBS for flood management can involve water retention by managing infiltration and overland flow, and thereby making space for water storage through floodplains.
- **Enhancing water security:** by improving water availability and water quality while simultaneously reducing water-related risks and generating additional social, economic and environmental co-benefits.

Challenges and limitations

- There remains a historical inertia against NBS due to the continuing overwhelming dominance of grey infrastructure solutions.
- NBS often require cooperation among multiple institutions and stakeholders, something that can be difficult to achieve.
- There is a lack of awareness, communication and knowledge at all levels, from communities to regional planners and national policy makers, of what NBS can really offer. Lack of understanding of how to integrate green and grey infrastructure at scale, and an overall lack of capacity to implement NBS in the context of water.
- There are limits to how NBS can perform. For example, NBS options for industrial wastewater treatment depend on the pollutant type and its loading.
- While some small-scale NBS applications can be low- or no-cost, some applications, particularly at large scale, can require large investments.

Mains 365 – Environment

- o Implementing **Dr. M.S. Swaminathanan Report** on "More Crop and Income Per Drop Of Water". Some of its recommendations include:
  - ✓ **System of Rice Intensification technology (SRI)** which requires less quantity of seeds, less nursery area, saves water and labour and enhances yield covering rice and other crops like sugarcane, should be popularized.
  - ✓ **Micro Irrigation technology** e.g. drip and sprinkler irrigation including drip fertigation to increase productivity of crops with less water should also be popularized with adequate

> **Need for water resource management in North East**
> - **Hydropower** – at present there is only 7% of potential hydropower generation capacity that has been harnessed. Of the country's total capacity of 145,000 megawatt (MW), north-eastern states account for 58,000MW, with Arunachal Pradesh having a potential of around 50,064MW.
> - **Bio-diversity and conservation** – Being one of the biodiversity hotspots of the world, the region requires special attention towards conservation of flora, fauna and culture.
> - **Reduce flood damage erosion** – Some of the states such as Meghalaya have been badly effected due to heavy down pour and surface run off.
> - **Inland water transport** – River Brahmputra currently facilitates National Waterway 2 from Dhubri to Sadiya. The NER has about 1800km of navigable inland water ways that can be used for transportation.

  support from the Government. Needed credit facilities should be available to the farmers to pay for the equipments.
  - ✓ **Crop diversification** with high value but less water requiring crops and multiple uses of water to enhance crop yield and income of the farmers should be promoted.
- o **Crop planning** such as Refraining from growing rice in water scarce regions, promoting dryland farming etc. The North-eastern region is endowed with perennial water supply and favourable climate for horticulture which could be harnessed through proper planning and sowing pattern.
- o In fact, recently government has set up a committee for North- East India in the aftermath of destructive flood in the region to develop a strategy for management of region's water resources.

1.2.2. PRICING OF WATER FOR AGRICULTURE

Why in News?

- Central Water Commission (CWC) has released a paper on pricing of water for agriculture, their proposing methodology and principles.

Need for revision in pricing criteria

- **Subsidies**: Water subsidies provided through public utilities, amounted to 0.6% of global gross domestic product in 2012 while inequitable, disproportionately benefiting upper-income groups.
- **Archaic Pricing:** State governments tend to levy water charges on a crop-area basis, and the rates are unrevised for years, which contributing to water wastage.
- **Low receipts:** Physical and operational inadequacies of present system of pricing resulting in low and uncertain utility and consequent low collection of water charges.
- **Inefficient agricultural practices**: Present agricultural system is dominated by water intensive crop and water usage by famers is more than of global average to produce a kg of husked rice.
- **Sustainability:** Lack of incentives to farmers for sustainable use of water resulting into over utilisation of both the surface and ground water, which is shown in salinity of soil and depleting water table.

Recommendation

- **Methodology**
  - o Water Rates should be adequate to cover the fixed costs of irrigation works.
  - o The 14th finance Commission recommended that the basic tenets of both the quantity and timeliness (**volumetric basis**) of supply of water with periodic revision should be duly considered.
  - o The water rates should vary from one canal system to another canal system in the same State
  - o In canal commands where the State has to supply water by lifting it, water rates charged have to be kept higher than the rates for gravity flow and after take into account additional cost of lifting.

- **Legal & Institution**
  - Equitable access to water for all and its fair pricing, for drinking and other uses such as sanitation, agricultural and industrial, should be arrived at through independent statutory **Water Regulatory Authority.**
  - **Water Users Associations (WUAs)** should be given statutory powers to collect and retain a portion of water charges, manage and it should be given the freedom to fix the rates subject to floor rates.
  - The Water Rates should be such as to convey the scarcity value of the resource to the users and to foster the motivation for economy in water use.
- **Supportive measures**
  - Recycle, Reuse water should be incentivised through tariff system.
  - **National Water Policy 2012**, stated that the over-withdrawal of groundwater should be minimized by regulating the use of electricity for its extraction. Separate electric feeders for pumping ground water for agricultural use should be considered.
  - Efforts should be given to researching better seed varieties in order to disincentives water usage.
  - **Second Irrigation Commission 1972** suggested that Prevailing water rates in neighbouring States/UTs etc. also play an important role and have to be given due consideration in fixation of water rates.

Challenges

- **Hardship to Farmers:** Water pricing for farmers will be tough task as they are already reeling under severe economic hardship and agricultural distress.
- **Policy Action:** because the public procurement policies also promote cultivation of water-intensive crops, sometimes in those very states where the water usage is most inefficient.
- **Ownership**: It will rise to legal and economic distress to farmers because, the subsurface water resources belong to the property owner. The owner is within his rights to drain the entire aquifer that may extend far beyond the boundaries of his property.
- **Administration**: Lack of disintegrated approach, as water falls between several agencies for instance agriculture, the biggest bulk user, is outside the purview of the ministry of water resources.

Way forward

- **Watershed management**: It offers the scope to practise integrated water resource management program at a local level with participation of communities.
- **Efficient utilization of water resources** by regulating the unrestrained exploitation of groundwater and aggressive pursuit of water conservation for enhancing supply through increased access to water resources using modern irrigation methods; changes in design of irrigation infrastructure (reservoirs/dams, canal network); rain water harvesting and it's recycling; improved reservoir/dam operations; re-use of drainage water and wastewater; and transfer of water between river basins etc.

Conclusion

Water used for irrigation is an **economic good** and its logical pricing is a key to improving water allocation and encouraging conservation in order to deal with every stakeholder in water governance such as individual, community, Government, NGOs, a comprehensive **National Water Code (**mooted by National Commission for Integrated Water Resources Development), i.e. an integrated set of water laws is needed.

1.2.3. GROUNDWATER MANAGEMENT

The Standing Committee on Water Resources has given following recommendations for groundwater management:

- **Regular assessment of resources**: Assessment of ground water resources, last done in 2011, should be undertaken on a regular basis, preferably after every two years.
- **Study of Dark Blocks**: A study to assess land-use and proportion of agricultural land falling under dark blocks (over-exploited assessment units) should be initiated. This will help determine suitable cropping pattern in areas that are water stressed.
- **Ground water withdrawal for agriculture:** To prevent the over-exploitation, measured suggested include
  - on-farm water management techniques and adoption of improved irrigation methods
  - implementation of 'Master Plan for Artificial Recharge to Ground Water'

- o revamping agricultural power pricing structure, as flat rate of electricity adversely affects the use of ground water.
- **Formulation of policy:** A well-defined policy on ground water extraction should also be framed to ensure long-term sustainability.
- **Water under concurrent list of the Constitution**: It will help evolve a comprehensive plan of action. Consensus between the centre and states will result in better conservation, development and management of water, including ground water.
- **Master Plan for Artificial Recharge to Ground Water** was prepared by the Central Ground Water Board in 2013. A comprehensive review of the follow-up action taken by states/ union territories should be undertaken. A time-bound roadmap to achieve the objectives of the plan should be put in place.
- **Synergy between MGNREGS and ground water management**: Steps should be initiated to achieve optimised returns on works related to ground water conservation taken under the scheme.
- **Census of water bodies and installation of water meters**: An inventory of water bodies (including ponds) in the country should be undertaken and completed in a definite time-frame. To regulate over-use of ground water for irrigation and drinking purposes, installation of water meters in all tube-wells should be made mandatory on the principle of 'Beneficiary Pays'.
- **Institutionalize regular inspections of industries:** to ensure compliance of conditions.

Apart from the above following measures can also be taken:

- **Mihir Shah committee recommendation:** Creating **National Water Commission** by subsuming CWC and Central Ground Water Board (CGWB: managing groundwater resources), to encourage a shift in focus from the construction of dams to decentralised management and maintenance of water.
- **Implementation of Atal Bhujal Yojana (2018)** should be started.
  - o **Objective:** To recharge ground water and create sufficient water storage for agricultural purposes.
  - o **Focus** on demand side management of ground water i.e. how to meet requirements by minimum use of water.
  - o It would initially be implemented with community participation in 78 identified districts in Gujarat, Maharashtra, Haryana, Karnataka, Rajasthan, Uttar Pradesh and Madhya Pradesh
  - o Total outlay for central scheme is 6000 crore, out of which half will be supported by the World Bank as loan.
  - o **Encouraging Community Participation And Behavioural Changes**: By giving 50% of the money to states, including gram panchayats, as incentives for achieving targets in groundwater management.
- **Water conservation**
  - o **Encouraging Rainwater harvesting**, an age-old technique for capturing monsoon run-off, to provide country with reliable water supplies throughout the year.
  - o **Building check dams** on riverbeds to improve groundwater levels.
  - o Reviving ancient system of maintaining and managing water bodies by local communities themselves such as **Kudimaramath** practice in Tamil Nadu, **Jhalaras (rajasthan)**, **Ahar Pynes** (South Bihar), **Johads, Baolis** (secular structure), **Bamboo Drip irrigation System** (northeast India) etc.
  - o **Pricing of Irrigation Water** as advocated by the **Vaidyanathan Committee Report on Pricing of Irrigation Water (1992)** can lead to efficient use of irrigation water.

> **Key features of Model Bill for the Conservation, Protection, Regulation and Management of Groundwater**
> - **Right to water for life:** Acknowledgment of citizen's right to safe water with non-discrimination and equitable access
> - **Common pool resource**: Stringent rules on how corporations and large entities can extract ground water; ownership of land doesn't extend to ground water which is a community owned product. Groundwater would not be a free resource; even paid use will be allowed in a sustainable manner ensuring equitable availability to all.
> - **Principle of subsidiarity:** More say to end-users of water, Panchayats and local bodies
> - **Prioritisation of groundwater usage:** Top priority in the use of groundwater ought to be in meeting drinking, sanitation, food security, sustenance agriculture, the needs of women and only after that for industry.
> - **Institutions:** There would also be groundwater security boards and groundwater protection zones that would be overseen by State bodies
> - **Incentives:** There will be an incentive for those who cultivate less water-intensive crops.
> - **Penalty:** fines ranging from Rs.5,000 to Rs. 5,00,000 depending on the level of infraction and who the perpetrators were.

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- o **Water Literacy Movement:** CGWB has been organizing mass awareness programmes in the country to promote rain water harvesting and artificial recharge to ground water
- o **Water Banking and Virtual Transfers**- Surplus water from one year can be stored locally—to avoid evaporative losses—in an unconfined aquifer, withdrawn in subsequent years by the "**banker**," and transferred to supplement the water resources of the "**client**" when needed.

- o Other measures may include **inflatable rubber dams used to maximize groundwater infiltration** build infrastructure model to protect aquifer from saline intrusion.
- o Levying a new **water conservation fee** based on quantum of groundwater extracted per unit area (may vary from ₹1 to ₹ 6 per cubic metre where a cubic metre is 1,000 litres)
- o **Exemption** of government infrastructure projects, government water supply agencies and group housing societies/ private housing societies with only basic amenities, from the water conservation fee.

> **Successful Case Study**
> - **Community Managed Water Supply Programme (Gujarat):** It aims to supply the village community with adequate, regular and safe water through household-level tap water connectivity, including households of people from backward communities.
> - **Madhya Pradesh's 'Bhagirath Krishak Abhiyan':** It has resulted in the construction of thousands of farm ponds to boost irrigation potential, through the efforts of local farmers, government officers, and financial institutions such as NABARD.
> - **Data for groundwater management: Andhra Pradesh's online water dashboard: Under it,** state has mapped 100% of its critical and over-exploited units and constructed recharge infrastructure across 96% of these, in addition to having created a regulatory framework for managing groundwater.
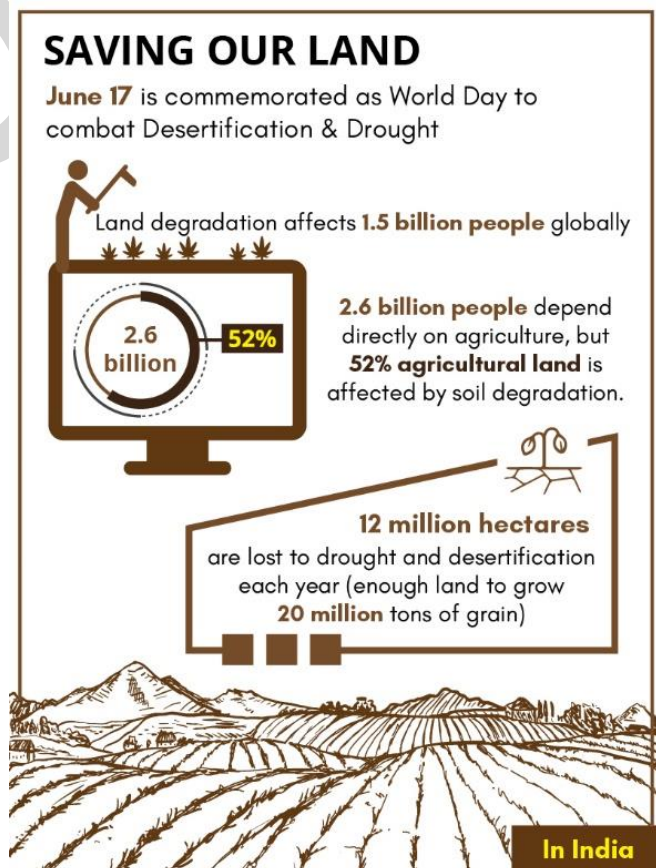
- **Water treatment**
  - o Using **Green remediation techniques** such as Phytoextraction for soils and wetlands contaminated with toxic metals. e.g. - Water hyacinth is used for cleansing polluted water by absorbing pollutants especially chromium.
  - o **Chemical and biological treatment** to industrial discharge from the tanneries, mining and other industries along with establishment of **common effluent treatment facilities** for smaller industries.

1.3. LAND DEGRADATION

Why in news?

- Recently, IPBES Assessment Report on Land Degradation and Restoration was released.

Background

- Land degradation manifests in many ways: land abandonment, declining populations of wild species, loss of soil and soil health, rangelands and fresh water, as well as deforestation.
- **Global Impact**: Globally, about 2 billion hectares of land are degraded and more than 3.2 billion people are affected by land degradation. By 2050, up to 143 million people could migrate within their countries to escape water scarcity and falling crop productivity due to climate change.
- **Increasing Pressure on Land**: India's land area is about 2.5% of the global land, and it supports more than 16% of total human population, along with 20% of global livestock population.
- The **Food and Agriculture Organization of the United Nations (FAO)** estimates the economic impact of land degradation at more than $40 billion annually.
- **The Bonn Challenge** launched a global effort in 2011 to restore 150 million hectares of deforested and degraded land by 2020.

SAVING OUR LAND

June 17 is commemorated as World Day to combat Desertification & Drought

Land degradation affects **1.5 billion people** globally

2.6 billion 52%

2.6 billion people depend directly on agriculture, but **52% agricultural land** is affected by soil degradation.

12 million hectares are lost to drought and desertification each year (enough land to grow **20 million** tons of grain)

In India

- **Agenda 21:** It recognizes the need to combat land degradation and desertification. It emphasizes preventive measures in vulnerable and slightly-affected areas and rehabilitation of moderate-to severely-affected areas. This would involve introduction of:
  - o Improved land-use policies; Appropriate environmentally sound and economically feasible technologies
  - o Improved land, water and crop management measures; Participatory management of natural resources.
- **10-Year Strategy of the UNCCD (2008-2018):** It was adopted in 2007 to forge a global partnership to reverse and prevent desertification/land degradation and to mitigate the effects of drought in affected areas in order to support poverty reduction and environmental sustainability.
- In 2015, the **Conference of the Parties to the UNCCD** endorsed its land degradation neutrality target setting process. Since then, more than 100 countries along with India have signed up to participate in this voluntary process **to achieve land degradation neutrality by 2030**.

Highlight of the report

- Land degradation through human activities is pushing the planet towards a sixth mass species extinction, driving species extinctions and intensifying climate change.
- Human activity has impacted more than 75% of the Earth's land surface and it is estimated to increase up to 90% by 2050, mostly in deserts, mountainous areas, tundra and polar areas unsuitable for human use or settlement now.
- **Wetlands** are particularly degraded, with 87% lost globally in the last 300 years; 54% since 1900.
- **Increasing GHG Emission:** Land degradation is a major contributor to climate change, with deforestation alone contributing about 10% of all human-induced greenhouse gas (GHG) emissions while release of carbon stored in the soil between 2000 and 2009 is responsible for annual global emissions of up to 4.4 billion tonnes of CO_2.

- Between 1970 and 2012, the **index of the average population size** of wild land-based species of vertebrates dropped by 38% and freshwater species by 81%.

- **Financial Loss:** Land degradation cost about 10% of the world's annual gross product in 2010 through the loss of biodiversity and ecosystem services.

Projections for 2050 by report

- An estimated 4 billion people will live in drylands and 50-700 million people will be forced to migrate.
- It would also reduce global crop yields by an average of 10%, and by up to 50% in some regions
- Most degradation will occur in Central and South America, sub-Saharan Africa and.
- The unprecedented growth in consumption,

What is Land Degradation Neutrality (LDN)
- UNCCD defines LDN as a state whereby **the amount and quality of land resources which is necessary to support ecosystem functions and enhance food security**, remains stable or increases within specified temporal and spatial scales and ecosystems.
- It is a unique approach that counterbalances the expected loss of productive land with the **recovery of degraded areas.**

Steps taken to achieve LDN
- Achieving land degradation neutrality by 2030 is one of the targets within **Sustainable Development Goals** adopted in 2015.
- 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 by 2030 through the **LDN Target Setting Programme** (TSP).
- An **LDN fund** promoted by UNCCD and managed by Mirova (a private Investment management firm) has also been created to **invest in bankable projects** on land rehabilitation and sustainable land management worldwide including sustainable agriculture, sustainable livestock management, agro-forestry, sustainable forestry, renewable energy, infrastructure development, and eco-tourism.
- UNCCD releases the **Global Land Outlook** to demonstrates the central importance of land quality to human well-being, 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.
- Schemes like Integrated Watershed Development Program, Per Drop More Cr op, Swachha Bharat Mission, National Afforestation Program, National Green Mission, etc. have components to tackle DLDD.
- 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.

demography and technology will roughly quadruple the global economy in the first half of the twenty-first century

- **Capacity of rangelands** to support livestock will continue to diminish in the future, due to both land degradation and loss of rangeland area.
- Biodiversity loss is projected to reach 38–46% by 2050.

Land Degradation and India

- According to **Desertification and Land Degradation Atlas report by ISRO**, nearly 30 % of the country's total geographical area is undergoing degradation.
- **Causes of Land Degradation:** Extension of crop cultivation to marginal and low potential lands or to lands vulnerable to natural hazards, improper crop rotations, overuse of agrochemicals, mismanagement of the irrigation system etc. is responsible for deforestation and the expansion of agriculture to less productive lands.
  - **Underlying causes** are believed to be poverty among agricultural households, land fragmentation, insecure land tenure, open access nature of some resources, and policy and institutional failures

Sustainable land and Ecosystem Management (SLEM) Programme

- It is a joint initiative of the Government of India and the Global Environmental Facility (GEF) under the GEF Country partnership Programme (CPP).
- Objective: to promote sustainable land management and use of biodiversity as well as maintain the capacity of ecosystems to deliver goods and services while taking into account climate change
- The Desertification Cell, MoEF is the national executing agency for the SLEM programmatic approach. ICFRE, Dehradun has been designated as the Technical Facilitation organisation for the SLEM programme.

Major Reasons For Desertification In India

Water erosion Responsible for **10.98%** desertification* Loss of soil cover mainly due to rainfall and surface runoff. Water erosion is observed in both hot & cold desert areas, across various land covers and with varying severity levels
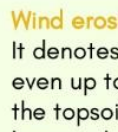
Wind erosion Responsible for **5.55%** desertification It denotes the spread of sand by various processes, even up to lofty altitudes of Himalayas. It removes the topsoil, which is rich in all plant nutrients and bacterial activites

Human-made/settlement Responsible for **0.69%** desertification All land degradation processes which are induced directly or indirectly by human intervention. It includes developmental activities such as mining and urbanisation
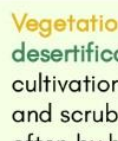
Vegetation degradation Responsible for **8.91%** desertification It includes deforestation, shifting cultivation and degradation in grazing, grassland and scrub land. Destruction of vegetation, most often by humans, accelerates desertification

Salinity Responsible for **1.12%** desertification Occures mostly in cultivated land, especially in the irrigated areas. Soil salinity refers to the water soluble salt present in soil. Salinity can develop naturally, or human-induced
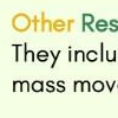
Other Responsible for **2.07%** desertification They include water logging, frost shattering, mass movement, barren and rocky land types

Suggestion to combat land degradation

- **Conservation of Land degradation in rangeland (**areas that consist predominantly of grasses, grass-like plants, and shrubs - encompass almost half the world's land surface**) through**
  - Land capability and condition assessments and monitoring.
  - Grazing pressure management, Pasture and forage crop improvement, Silvopastoral management, Weed and pest management
  - maintaining appropriate fire regimes and the reinstatement or development of local livestock management practices and institutions.
- Combating land degradation resulting from **invasive species** involves the identification and monitoring of invasion pathways and the adoption of eradication and control measures (mechanical, cultural, biological and chemical).

- **Conservation of Land degradation** f**rom mining areas** include:
  - On-site management of mining wastes (soils and water), reclamation of mine site topography and early replacement of topsoil
  - Restoration and rehabilitation measures to recreate functioning grassland, forest, wetland and other ecosystems
- **Conservation of Land degradation in wetland** include, controlling point and diffuse pollution sources, adopting integrated land and water management strategies and restoring wetland hydrology, biodiversity, and ecosystem functions through passive and active restoration measures, such as constructed wetlands
- **Increases farm productivity**, shifts towards less land degrading diets and less animal protein from unsustainable sources, and reductions in food loss and waste.
- Coordinated and simultaneous use of diverse policy instruments and responses at the institutional, governance, community and individual levels.
- Recognizing the **key role of Land managers,** including indigenous peoples and local communities in the design, implementation and evaluation of sustainable land management practices.
- Urban planning, replanting with native species, green infrastructure development, remediation of contaminated and sealed soils (e.g. under asphalt), wastewater treatment and river channel restoration.
- Eliminating perverse incentives that promote degradation – subsidies that reward overproduction, for example – and devising positive incentives that reward the adoption of sustainable land management practices.

Conclusion

Reversal of land degradation is important for countries for not just economic gains but also for the achievement of SDGs and Paris agreement goals. Reduction and reversal of land degradation could mitigate 1/3rd of greenhouse gas by 2030 through soil's carbon absorption and storage functions.

1.3.1. SOIL POLLUTION

Why in news?

Recently, Food and Agriculture Organization (FAO) released a report titled "Soil Pollution: A Hidden Reality".

Causes of Soil Pollution

- **Natural events** such as volcanic eruptions, forest fires, cosmic origin, meteorites etc. can also cause natural pollution when many toxic elements are released into the environment
- **Anthropogenic Sources:** Unsustainable farming practices, industrial activities and mining, untreated urban waste, transportation, spray drift from pesticide applications and incomplete combustion of many substances.
  - **Recycling industry** especially related to lead batteries have been identified as major sources of soil contamination around the world
  - **Military Activities and Wars:** use of non-degradable weapons of destruction and of chemicals has inflicted irreversible damage to soil health.
  - **Radionuclides in the soil** due to natural and mostly due to anthropogenic factor like Chernobyl Incident etc.
  - **Emerging pollutants**: It encompass chemicals such as pharmaceuticals, endocrine disruptors, hormones and toxins, among others, and biological pollutants, such as micropollutants in soils, which include bacteria and viruses.

About Soil pollution
- It refers to the presence in the soil of a chemical or substance out of place and/or present at a higher than normal concentration that has adverse effects on any non-targeted organism.
- **Status of the World's Soil Resources Report (SWSR)** identified soil pollution as one of the main soil threats affecting global soils and the ecosystems services provided by them.

Different Types of Soil Pollution
- **Point-Source Pollution**: Soil pollution caused by a specific event or a series of events within a particular area in which contaminants are released to the soil, and the source and identity of the pollution is easily identified. Anthropogenic activities represent the main sources of point-source pollution and is very common in urban areas.
- **Diffuse Pollution** is pollution that is spread over very wide areas, accumulates in soil, and does not have a single or easily identified source. It involves the transport of pollutants via air-soil-water systems.

Impact of soil pollution

- **Degrading natural resources:** Soil pollution severely degrade the major ecosystem services provided by soil like dwelling to soil microorganisms and larger soil-dwelling organisms.
- **Health Impact:** The World Health Organization (WHO) has estimated that two billion people are infected by soil-transmitted helminths worldwide
- **Food Contamination:** Contact with contaminated soils has been identified as a potential source of food contamination due to **bio-accumulation** of heavy metal, radioactive nuclei, persistent organic pollutant etc.
- **Reserve of Antimicrobial Resistant Bacteria and Genes:** Soil has become a reservoir of highly resistant pathogenic bacteria due to human activities like extensive use and misuse of antibiotics in human and veterinary medicine, livestock and in agriculture.
- **Impacting Food Security:** Soil pollution significantly impact food security scenario, by reducing crop yields.
- **Declining Agricultural productivity:** Soil degradation is estimated to be severely impacting 147 million hectares of cultivable land in India.
- **Leaching of nutrient** due to increase use of fertilizer, pesticide and microbial activity lead to **acidification of soil.**

> **International Cooperation**
> - **Global Symposium on Soil Pollution (GSOP18):** It aims to be a step to build a common platform to discuss the latest data on the status, trends and actions on soil pollution and its threatening consequences on human health, food safety and the environment.
> - **International Network of Black Soils** will promote the conservation and long-term productivity of black soils by producing analytic reports and serving as a platform for knowledge sharing and technical cooperation.
> - **World Health Organization's International Programme on Chemical Safety** had identified 10 chemicals or group of chemicals which pose major health risks and these include soil pollutants like cadmium, lead, mercury, dioxin and dioxin-like substances and highly hazardous pesticides.
>
> **Steps Taken by Government for Improving Soil Health**
> - **Soil Health Card Scheme:** It carry crop-wise recommendations of nutrients and fertilizers required for the individual farms. It aimed to help farmers to improve productivity through judicious use of inputs.
> - **Neem Coated Urea** is also being promoted to regulate urea use, enhance its availability to the crop and reduce cost of fertilizer application
> - **Paramparagat Krishi Vikas Yojana (PKVY)** is being implemented with a view to promoting organic farming in the country. This will improve soil health and organic matter content.

- **Soil as a Sink Hole:** Soil has been used as a sink for dumping solid wastes which according to an estimation is expected to be produced around 2.2 billion tonnes annually by 2025.

Way Forward

- **Institutional Framework:** FAO's World Soil Charter recommends that National governments must implement regulations on soil pollution and limit the accumulation of harmful nutrients to guarantee human health and wellbeing.
- **Promoting Sustainable Soil Management Practices** like Quantify nutrient source, Soil test to provide requisite amount of fertilizer, Cover crop to reduce soil loss and nitrate leaching, Minimum tillage to reduce nutrient loss etc. to limit pollution from agricultural sources.
- **Improving information gaps** in developing and least developing countries to improve sustainable soil management governance.
- **Promoting Research and Development:** To develop new methods for measuring, remediation monitoring and better understanding soil cycle.
- **Encouraging use of treated wastewater** for agricultural irrigation to address the issue of water deficit and to add nutrients, to increase crop productivity
- **Using Sustainable Techniques** like Composting and pretreatments to reduce the content of contaminants and pathogen organisms present in urban waste.
- **Promoting In situ Soil-remediation:** It can be done through bio remediation, phyto remediation, application of biochar, application of nanoparticles, enzyme-mediated bioremediation etc. to provide an economical and environmentally friendly approach for stabilizing animal waste and converting it into a worthy organic fertilizer.
- **Incentivising agrochemical industry** to invest in producing organic biological products that helps in improving soil health.

1.3.2. COASTAL EROSION

Why in News

- According to a study, Parali 1 island (part of Bangaram atoll), one of biodiversity-rich uninhabited islands part of Lakshadweep has disappeared due to coastal erosion and another four such islands in Lakshadweep sea are shrinking fast.

Coastal Erosion in India

- Like any other maritime country, India's long peninsular region constantly battles erosion. Developmental activities are often carried out without properly understanding the coastal dynamics, leading to long-term damage, particularly to local communities.

Coastal erosion and accretion: A complex process

- **According to MOEF&CC**, 40% of the Indian 8,414-km long coastline is subjected to coastal erosion (either high, medium or low).
- The **Earth Sciences Ministry,** monitors the shoreline changes along the Indian coast on an annual basis. Some of the recent finding are:
  o The Andaman and Nicobar Islands face the **most erosion,** with close to 89% of the shoreline eroded by the Bay of Bengal.
  o At the other end of the spectrum is Tamil Nadu, which has **gained the most new shoreline (Accretion: a gradual deposition by water of mud, sand to form dry land),** with 62% of its coast gaining land.
  o Goa has the highest percentage (52%) **of stable shoreline.**

Reason for coastal erosion

- **Wave energy** is the main cause of coastal erosion.
- **Climate Change:** induced global warming and the melting of ice sheets and continental glaciers continually **increase the sea level,** which leads the natural hazards such as Tsunami, storm surges, thermal expansion of sea water and cyclones; these hamper the natural rhythm and precipitate erosion.
- Coast is also subject to a **strong littoral drift** in India, causing an estimated 1.5 million tons of sand to move from the southwest to the northeast in a year.
- Construction of dams in catchment areas of rivers and ports, fishing harbors and jetties have sparked erosion and reduced the flow of sediment from river estuaries that contribute to coastal erosion.
- Sand and coral mining and dredging may affect coastal processes in various ways such as contributing to sediment deficit in the coastal system and modifying water depth that leads to altered wave refraction and longshore drift.

Measures to deal with coastal erosion:

- **Protect:**
  o Interventions such as **saline stone-packaging and breakwaters**, structures which are constructed on coasts are traditionally made as part of coastal defence.
  o To prevent erosion of the coast, **low walls called groynes** are built out into the sea.
  o **Geo-Synthetic Tubes**, a soft engineering technique, which has been used along Odisha coast.
  o **Vegetation:** Important for improving slope stability, consolidating sediments and providing some shoreline protection.

Mains 365 – Environment
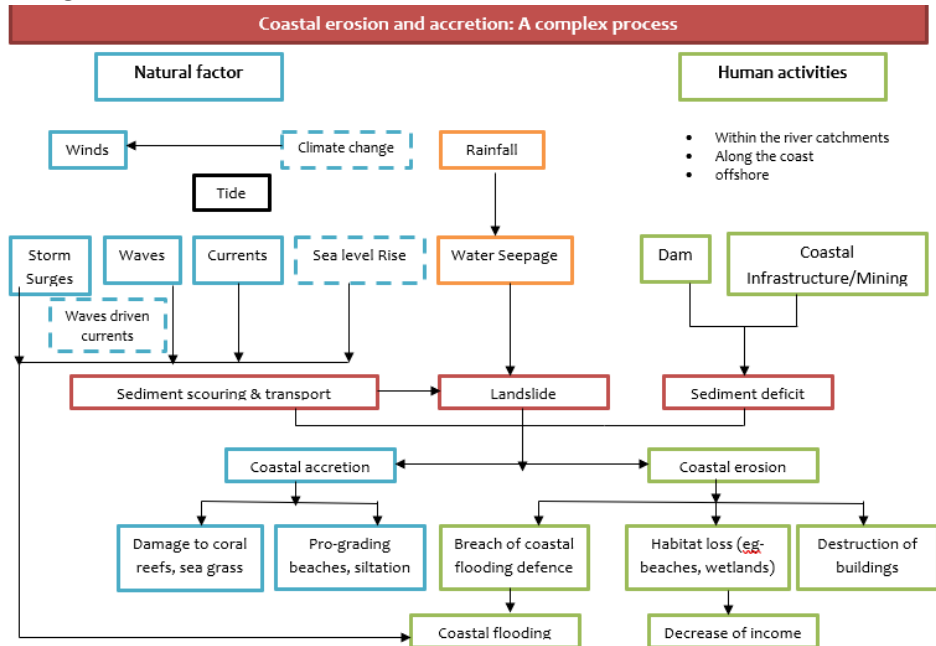
- **Coastal Green Belts:**
  - **Social forestry:** This should not be considered as a source of government or private sector revenue, but to support sustainable livelihood development among the coastal community.
  - **Eco-development:** This is beneficial for conservation activities, educational and recreational opportunities.
  - **Participatory planning, implementation and monitoring:** The indigenous knowledge of local communities should be used in decision-making so they receive benefits directly.

The UNEP Global Programme of Action (UNEP/GPA):

- It aims at preventing the degradation of the marine environment from land-based activities by facilitating the realization of the duty of States to preserve and protect the marine environment.
- It was created through the **Washington Declaration** on Protection of the Marine Environment from Land-based Activities, 1995.
- It is unique in that it is the only global initiative directly addressing the connectivity between terrestrial, freshwater, coastal and marine ecosystems.
- The GPA secretariat has established three global multi-stakeholder partnerships: the Global Partnership on Nutrient Management (GPNM), the Global Partnership on Marine Litter (GPML) and the Global Wastewater Initiative (GWI).
- **The Global Partnership on Marine Litter** (GPML) was launched in June 2012 at Rio + 20 in Brazil. It is a global partnership gathering international agencies, Governments, NGOs, academia, private sector, civil society and individuals to protect human health and the global environment by the reduction and management of marine litter as its main goal, through several specific objectives.

Other related initiatives

- **Honolulu Strategy** - a global framework for the prevention and management of marine debris.
- **Nairobi Convention**- is a partnership between governments, civil society and the private sector and part of UNEP's Regional Seas Programme. It works towards a prosperous Western Indian Ocean Region with healthy rivers, coasts and oceans.
- **The Blue Flag beach standards:** established by **Copenhagen-based Foundation for Environmental Education (FEE)** is an environmental award for beaches, sustainable boating tourism operators, and marinas. **Chandrabhaga beach** of Odisha's Konark coast was the first to complete the tag certification process will be **the first in Asia** to get the Blue Flag certification. Apart from it, **12 other beaches** across are also being developed as blue flag beaches in India.

1.3.2.1. COASTAL REGULATION ZONE

Why in News?

Recently, Ministry of environment, forests and climate change (MoEFCC) released draft Coastal Regulation Zone Notification, 2018 under Environment (Protection) Act, 1986.

Background

Highlights of the Shailash Nayak committee report on CRZ, 2011.

- The committee found that the 2011 regulations, especially with regard to construction, have affected the housing, slum redevelopment, redevelopment of dilapidated structures and other dangerous buildings.
- It proposes the devolution of powers to state and union territory governments along with local authorities.
- It suggests that both CRZ II and III zones (500 metres from the high-tide line that are developed and relatively undisturbed, respectively) should not fall under the environment departments of the State or Central Ministry, and instead be guided by the rules of State town and planning departments.
- It proposes to reduce the "no development zone" to just 50 metres from existing 200 metres for "densely populated" areas.

- India has a 7,500km coastline that supports about 30% of the country's population.
- While considerable progress has been made in Indian CRZ provisions through successive amendments such as resource conservation and pollution control, implementation of Integrated Coastal Zone Management (ICZM) programme in various coastal states and greater involvement of corporate sectors in CZM, there are several constraints, ranging from improper scientific basis and guidelines, lack of baseline information and weak social basis, ambiguity in project activities, ineffective implementation and enforcement.
- **Sailesh Nayak Committee** was formed with an objective to review the issues relating to Coastal regulation zone 2011, which submitted its report in 2015 (See Box).

Highlight of draft

- **Aims:** To conserve and protect the unique environment of coastal stretches and marine areas, besides livelihood security to the fisher communities and other local communities in the coastal areas and to promote sustainable development based on scientific principles taking into account the dangers of natural hazards, sea level rise due to global warming.

- **Define Coastal Regulation Zone**
  - The land area from High Tide Line (HTL) to 500 mts on the landward side along the sea front.
  - Land area between HTL to 50 mts or width of the creek whichever is less on the landward side along the tidal influenced water bodies.
  - **Intertidal zone** i.e. land area between the HTL and the Low Tide Line (LTL)
  - The water and the bed area between the LTL to the territorial water limit (12 Nm) in case of sea and the water and the bed area between LTL at the bank to the LTL on the opposite side of the bank, of tidal influenced water bodies.

- **Classification of the CRZ**
  - **CRZ-I** areas are environmentally most critical region, which are classified into
    - ✓ **CRZ-I A:** It will constitute the ecologically sensitive areas and the geomorphological features which play a role in the maintaining the integrity of the coast
    - ✓ **CRZ-I B**: The intertidal zone i.e. the area between Low Tide Line and High Tide Line.
  - **CRZ-II** constitutes developed land areas up to or close to the shoreline in municipal limits or in other existing legally designated urban areas.
  - **CRZ-III areas** — land that is relatively undisturbed such as in rural areas, and do not fall in areas considered close to shoreline within existing municipal limits — have been divided into two categories:
    - ✓ **CRZ-III A areas** where population density is more than 2,161 persons/sq km as per the 2011 census will be earmarked as 'No Development Zones' (NDZs) from the high tide line (HTL) up to 50 metres.
    - ✓ **CRZ-III B** refers to rural areas with a population density lesser than 2,161 people per square kilometre. Such areas shall continue to have an NDZ of 200m from the HTL.
  - **CRZ - IV** shall constitute the water area and shall be further classified
    - ✓ **CRZ- IV A** The water area and the sea bed area between the Low Tide Line up to twelve (12) nautical miles on the seaward side
    - ✓ **CRZ-IV B** areas shall include the water area and the bed area between LTL at the bank of the tidal influenced water body to the LTL on the opposite side of the bank.

> **Prohibited activities within CRZ**
> - Setting up of new industries and expansion of existing industries, operations or processes.
> - Manufacture or handling of oil, storage or disposal of hazardous substances as specified in the notification of Ministry of Environment, Forest & Climate Change.
> - Setting up of new fish processing units.
> - Land reclamation, bunding or disturbing the natural course of seawater
> - Discharge of untreated waste and effluents from industries, cities or towns and other human settlements.
> - Dumping of city or town wastes including construction debris, industrial solid wastes, fly ash for the purpose of land filling.
> - Port and harbour projects in high eroding stretches of the coast.
> - Mining of sand, rocks and other sub-strata materials.
> - Dressing or altering active sand dunes.
> - In order to safeguard the aquatic system and marine life, **disposal of plastic into the coastal waters shall be prohibited.**
>
> **Related terms**
> - High Tide Line, defined as the line on the coastal land up to which the highest water line reaches during the spring tide.
> - Coastal zone management plan involves managing the coastal areas to balance environmental, economic, human health and related activities.

- **Projects that require MoEF's approval**
  - Projects located in CRZ-I (environmentally most critic al) and CRZ-IV (water and seabed areas) will require MoEF clearance while other will be considered by Coastal Zone Management Authorities (CZMAs) in the states and union territories.
  - **Temporary tourism facilities.** It's allowed in CRZ-III, if a national or state highway cuts through an NDZ.

- o Buildings will be permitted provided arrangements are made for proper management and disposal of solid and liquid wastes in accordance with the environmental standards, rules and statutes
- **Critical Vulnerable Coastal Areas (CVCA)**
  - o These regions will be managed with the involvement of coastal communities, including fisher folk who depend on coastal resources for their sustainable livelihood.
  - o Area includes Sundarbans in West Bengal and other ecologically sensitive areas identified under Environment (Protection) Act, 1986 such as Gulf of Khambat in Gujarat, Malvan, Achra-Ratnagiri in Maharashtra, Karwar and Coondapur in Karnataka, Vembanad in Kerala, Bhaitarkanika in Odisha, shall be treated as Critical Vulnerable Coastal Areas (CVCA).
- **Inland Islands & Backwater**: A **No Development Zone (NDZ)** of 20 meters has been proposed to be stipulated for all Islands close to the main land coast and for all Backwater Islands in the main land.
- **Duty of States:** To prepare detailed plans for long-term housing needs of coastal fisher communities in view of expansion and other needs, provisions of basic services including sanitation, safety and disaster preparedness.
- **National Centre for Sustainable Coastal Management (NCSCM)** has been authorized to demarcate the tide lines all along the coastline unlike earlier, when seven different agencies were authorised to do so.
- **Hazard Line** has been delinked from the CRZ regulatory regime, and will be used as a tool for disaster management and planning of adaptive and mitigation measures.
  - o **Floor Space Index (FSI) or the Floor Area Ratio:** It has been proposed to de-freeze it and permit FSI for construction projects according to the norms.
  - o **Mining:** Regulated limestone mining is permitted, subject to strict Environmental safeguards, in areas adequately above the height of HTL, based on recommendations of reputed National Institutes in the Mining field.

Concern

- Environmentalists say that the new regulations have been framed without a transparent public consultation process and proposed changes will promote commercialisation in the most protected zones, proving disastrous for the environment and coastal communities.
- According to **National Fishworkers Forum (NFF),** draft is based on the flawed demarcation of the High Tide Line by the National Centre for Sustainable Coastal Management and will **affect customary land use and traditional land** rights fishing communities,
- **Reduction in no development zone** in CRZ III from 200 metres to 50 metres ignored the plea from scientists for a coastal protection strategy by distancing all developmental activities and creating a buffer zone for the interplay of land and sea.

1.3.3. SAND MINING

Why in news?

Recently, Ministry of Mines has released a sand mining framework to assist the state governments in addressing the issues of the Sand mining sector.

Background

- Demand of sand in the country was around 700 million tonnes in FY-2017 and it is increasing at the rate of 6-7% annually.
- Government amended the Mineral Auction Rules 2015 in November 2017 to make the auction process less cumbersome and help states auction mineral blocks.
- According to the Central Statistics Office (CSO), the **construction sector** has grown at a Compound Annual Growth Rate of 6 % and because of rapid urbanization and infrastructure growth and government initiatives like Housing for all, the demand for Sand is set to rise.
- According to Ministry of Mines, in 2015-16, there were over 19,000 cases of illegal mining of minor minerals, which including sand **(impact of illegal mining in infographic).**
- Government in May, 2017, constituted a committee to study the existing system of sand mining in various States and suggest a comprehensive sand mining policy/ guideline as a model for replication by the States.

Features of the framework

- Mining will be done as per the guidelines laid down in the **Sustainable Sand Mining Management Guidelines 2016** by the MoEFCC.

- **Alternatives to sand:** To meet the growing pace of urbanization and infrastructure development alternatives should be explored like

  o **Manufactured sand (M-sand)** which is produced by crushing of rocks, quarry stones to a stipulated size of 150 microns. As compared to river sand, it is cheaper and has marginally higher bond strength and its mortar shows higher compressive strength

  o **Sand produced from coal overburden.**

  o **Importing sand** from other countries such as Malaysia and Philippines to meet the requirement of coastal states.

  o Encouraging alternative technologies in construction materials processing for reduced dependence on natural sand.

- **Affordability:** can be achieved by

  o Controlling the price from supply side rather than through administrative mechanism

  o Reducing illegal mining, closure of quarries and smuggling of sand to neighboring States.

  o Regulating transportation through use of GPS/ RFID enabled dedicated vehicles for better and efficient management of resource.

- **Business Model:** States should opt out of either of the two models depending upon their objective:

Sand

Under the **Mines and Minerals (Development and Regulation) Act, 1957** (MMDR Act), sand is a **minor mineral** and sand mining is **regulated by the respective state governments**.

About Sand Mining

- Sand mining is a practice that is used to extract sand, mainly through open pit mining.
- Main sources of sand are agricultural fields, riverbeds and floodplains, coastal and marine sand, lakes and reservoirs.
- Sand mining is also done on beach, inland dunes and dredged from ocean beds and river beds.
- It's done to extract minerals such as Rutile, Ilmenite and Zircon which contain useful elements Titanium and Zirconium.

Issues

- Loss of revenue for exchequer due to cartelisation among mining companies during auction.
- Higher prices of sand in many cities due to non-availability there and absence of robust monitoring mechanism or regulation by the Government.
- Mixing of low quality sand with usable sand leading to construction of weak buildings.
- **Desert sand and sea sand not suitable for construction:** In deserts, sand grains are too round because of the heavy winds, making them unable to stick together.
  o Sea sand is better, but its salt content result in corrosion of steel in reinforced concrete. River-sand thus become a highly demanded mineral.

Importance of sustainable sand mining

- To ensure the conservation of the river equilibrium and its natural environment by protection & restoration of the ecological system.
- To avoid aggradation at the downstream reach especially those with hydraulic structures such as jetties, water intakes etc. and to ensure the rivers are protected from bank and bed erosion beyond its stable profile.
- To ensure there is no obstruction to the river flow, water transport and restoring the riparian habitats.
- To avoid pollution of river water leading to water quality deterioration.
- To prevent ground water pollution by prohibiting sand mining on fissures where it works as filter prior to ground water recharge.
- To maintain the river equilibrium with the application of sediment transport principles in determining the locations, period and quantity to be extracted.

IMPACTS ON	DESCRIPTION
BIODIVERSITY	Impacts on related ecosystems (for example; fisheries)
LAND LOSSES	Both inland and coastal through erosion
HYDROLOGICAL FUNCTIONS	Change in water flows, flood regulation and marine currents
WATER SUPPLY	Through lowering of the water table and pollution
INFRASTRUCTURES	Damage To Bridges, River Embankments And Coastal Infrastructures
EXTREME EVENTS	Decline of protection against extreme events (flood, drought, storm surge)
CLIMATE	Directly through transport emissions
LANDSCAPE	Coastal erosion, changes In deltaic structures, quarries, pollution of rivers

- o **Market Model (Simple Forward Auction)** for revenue maximization by State.
- o **Notified/ Controlled Price Model** for keeping the prices and operations under control.
- **Classification of states:** as Sand surplus State, Sand sufficient State and Sand deficit State on the basis of analysis of **demand and supply situation** and to help them in framing policy and regulation according to the needs of the states.
- **Separate Sand Mining Policy and Rules:** for each state to better manage the sector and only the State Mining Department should be entrusted for regulating sand mining in the State.
- **District Survey Report (DSR):** shall be prepared by the State Government to estimate the annual quantity of sand available in a particular district and their usage.

Salient features of the Sustainable Sand Mining Management Guidelines, 2016:
- It allows environment clearances for up to five hectares of mine lease area for sand and minor minerals to be done at the district level by the District Environment Impact Assessment Authority headed by the District Collector.
- States will give clearances for mine lease areas up to 50 hectares, while the Centre would give permissions for areas larger than 50 hectares.
- It calls for use of technology for stringent monitoring of sand mining through tools such as bar coding, remote sensing etc.
- It calls for promotion of manufactured sand, artificial sand, fly ash and alternative technologies in construction materials and processes for reducing the dependence on naturally occurring sand and gravel.
- It also calls for training of architects and engineers, new laws and regulations, and positive incentives to initiate a shift for lowering dependency on sand.

Benefits of sand imports in India
- **Can fight sand shortage in most states:** In 2017-18, a survey of 14 major sand producing states by the Ministry of Mines (MoM) estimated that the demand of sand far outstrips supply in all the states, except Haryana, Uttarakhand and Madhya Pradesh. Imported sand though tends to be costly, is suitable for high deficit areas.
- **Addresses ban imposed by courts and NGT:** Bans by the courts or the National Green Tribunal (NGT) have led to the shortage of sand supply in many states, for instance, last year NGT banned sand mining in parts of Maharashtra and Uttarakhand High Court imposed a four-month state-wide ban on sand mining.
- **Tackling illegal quarrying:** there is rampant illegal mining going on in major river beds because of exploitation of legal loopholes, poor implementation of laws, absence of robust monitoring mechanisms and nexus between politicians and mafias. The 2017 report of the Comptroller and Auditor General (CAG) found that illegal sand mining cost the state exchequer of Uttar Pradesh a massive Rs 477 crore in 2015-16.
- **Can reduce the cost of sand** in long run in the domestic market, hence making affordable housing feasible.
- **Benefits for exporting countries:** Some south-east Asian countries such as Malaysia and Indonesia have ample sand available in their country, which if not removed could lead to floods. The sand could be imported to India.

- **Clearances and approvals:** Responsibility of seeking the clearances and approvals should be given to the lessee/contractors only and department should play the role of facilitator/ regulator only.

- **360-degree monitoring mechanism:** States need to create and establish a robust system to monitor and measure the mined-out mineral at each lease location and its transportation in the State.
- **Classification of the rivers:** States need to classify the rivers based on the stream orders i.e.

Steps taken by government to Promote Sustainable Mining
- **Pradhan Mantri Khanij Kshetra Kalyan Yojana (PMKKKY):** It's to be implemented by the funds collected under District Mineral Foundations (DMF) and utilised for the welfare and development of the mining affected areas.
- **Mining Surveillance System (MSS):** Ministry of Mines, through the Indian Bureau of Mines (IBM), has developed the MSS in collaboration with the Ministry of Electronics and Bhaskaracharya Institute of Space Applications and Geo-Informatics (BISAG) to use the space technology to check illegal mining.
- **Mining Tenement System (MTS):** It will facilitate end to end national scale accounting of all the minerals produced in the country through automation from the pithead to its end use, reducing the scope for illegal mining.

stream orders I, II, III, IV and above, where for stream I, II and III, sand may be allowed to be extracted by manual means for local use in villages or towns bordering the streams, while for order IV and above streams, bidding is done for sustainable commercial mining and usage.

Mains 365 – Environment

1.3.4. SEDIMENT MANAGEMENT

Why in news?

- The Ministry of Water Resources, River Development, and Ganga Rejuvenation recently released the draft Policy on Sediment Management.
- The draft Policy looks at the effect of sand mining and construction of dams and barrages on river sedimentation and recommends principles that should be adopted for sediment management.

Sedimentary Basins of India

- **Sedimentary basins** are regions where considerable thicknesses of sediments have accumulated (in places up to 20 km). Sedimentary basins are widespread both onshore and offshore.
- India has 26 sedimentary basins covering an area of 3.14 Million sq km spread over onland, shallow water and deep water out of which 48% of total sedimentary basin area does not have adequate geo-scientific data.
- Recently, Cabinet Committee on Economic Affairs gave its approval to acquire 48,243 Line Kilometer (LKM) **2D seismic data** for appraisal of **Indian sedimentary basins by 2019-20**, for prospecting of oil and natural gas reserves.
- **Importance**:
  o They are the location for almost all of the world's hydrocarbon reserves. Thus, it may help in boosting GDP by generating direct as well as indirect employment in Exploration and generation activities.
  o Other mineral: Include coal and uranium, large deposits of phosphate (an essential fertiliser mineral) and a host of industrial raw materials, including limestone for cement manufacture, kaolinitic clays, gypsum and salts.
  o Metalliferous deposits (in less amount) include ores of lead, zinc, iron and manganese, and there may also be some bauxite.

Salient features of the draft Policy

- **Factors responsible for the siltation/sedimentation are:**
  o Physical and hydrological characters of the catchment, such as slope, land use, land cover, urbanisation, agricultural practices, flooding, encroachment of river beds, deforestation etc.
  o Intensity of erosion in the catchment (sheet, rill, gully and stream channel erosion) including over-exploitation of minerals,
  o Quality, quantity and concentration of the sediment brought down by the river,
  o Size, shape and length of the reservoir and operation strategies impacting trap efficiency of the reservoir,
- **Effect of construction of structures on sedimentation:** Dams or barrages reduce the velocity of water and alter the equilibrium of flow of water and sediment in rivers , causing aggradation (increase in land elevation due to deposition of sediments). Although, they also reduce the risk of floods, encroachment of downstream floodplains by local population due to reduced risk of floods exposes them to higher risks of siltation and erosion.
- **Effect of sand mining on sedimentation:** When done at an optimum level, mining of sand removes excessive sediment deposit in rivers. However, unscientific sand mining depletes river minerals at rates which the river system cannot replenish. Excessive mining undermines the ability of riverbeds and riverbanks to support the infrastructure built on them.
  o Schemes which are backed by scientific studies should be used to identify suitable sites for mining, appropriate construction material, and take corrective measures for controlling dredging (cleaning out the bed of a river).
  o Sand mining can be done according to GSI guidelines and Sustainable Sand Mining Mangament Guidelines-2016 of Ministry of Environment, Forest and Climate Change.
- **Principles for sediment management:**
  o making sediment management a part of integrated river basin management.
  o evidence based removal of silt, using best practices to minimise damage to the river flow.
  o Annual Silt requirement at fast developing infrastructure project may be estimated and critically aggrading river reaches and their sections in the vicinity may be analysed in their physical mode for supplementing

Approach of Sediment Managements Of Rivers

- **Youthful stage**- In this stage, the rivers have steep slopes and high sediment transport capacity.
  o Sediments management practices that can be adopted are: **Catchment Area Treatment, Storage Reservoirs and Boulder/Gravel Mining.**
- **Mature stage**- In this stage, the river enters in plains and has wide river bed and flood plain. It is modified through human interventions in terms of huge quantities of water diversion/abstraction and subjected to high degree of pollutant loads from domestic, industrial and agricultural activities.
  o Following sediments management practices may be adopted: **River training works such as bank protection, spurs etc , Sand Mining , Desiltation/ dredging.**
- **Old stage**-In this stage, the river experiences considerable changes in the sediment transport and deposition, causes wide spread flooding, undergoes frequent changes in the channel path/ delta formation.
  o In these areas dredging/desilting works may be carried out to maintain the flow continuity and sediments transportation to sea.
- **Reservoir Sedimentation Management**: (see figure)
- **Solid Waste Management:** The disposal of solid waste needs to be controlled by the local municipal bodies and government bodies. Special care should be taken for solid waste generated out of industrial processes.
- **Flood Plain Management:** To maintain the hydrological and ecological balance, regulation and prohibition of different activities in the river bed and different zones of flood plain is essential. The River Regulation Zoning for demarcating necessary zones should be implemented as early as possible.
- **Institutional Arrangements:** There is need to establish **River Basin Authority** for all basins as per recommendation of **Doabia Committee**. Clearances from CWC or from River Basin Authority of the concerned basin need to be made necessary for any desilting work of more than one lakh cubic meter on any inter-state/ international river apart from other clearances.

1.4. PLASTIC POLLUTION

Why in News?

Recently, India committed to eliminate all single-use plastic in the country by 2022.

Background

- India was the global host of **2018 World Environment Day (June 5, 2018)** with **"Beat Plastic Pollution"** as the theme, reflecting world commitment to combat single-use plastic pollution.
- According to **United Nations Environment Programme (UNEP)** if current pollution rates continue, there will be more plastic in the sea than fish by 2050, as globally, only 14% of plastics is recycled.
- Only 24 States and Union Territories have complied with the **Centre's Plastic Waste Management (PWM) Rules, 2016,** to regulate manufacture, sale, distribution and use of plastic carry bags including those of compostable plastic, and plastic sheets for packaging or wrapping applications.
- **Single Use Plastic:** It account for 50% of the plastic we use, with none states in India have plans in place to tackle single use plastics.

WHERE THE PLASTIC LANDS UP AFTER WE THROW IT AWAY

Waterbodies and waterways Around 90% of the plastic being generated is making its way into oceans through rivers

Landfill sites Wher instead of decomposing, the plastic often catches fire due to high methane generation

Clogged drains Plastic bags in the soil and at landfil sites lead to toxic metals, such as lead and cadmium, leaching into groundwater

Roadside garbage dumps Where it is consumed by animals

- **90%** of this plastic not being recycled
- **690** tonnes is Delhi's daily share alone
- **500-1000** years it takes for plastic to degrade
- **15,342** tonnes of waste generated in India per day (5.6 million tonnes per annum)

- **Supreme Court in May 2012,** said that the next generation will be threatened with something more serious than the atom bomb unless a "total ban on plastic is put in place".
- National Green Tribunal has also called for a complete ban on "plastic carry bags" smaller than 50 microns in Delhi's markets.

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.
- **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.
- **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.**
- **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 experience annual flooding like situation during monsoon season due to water clogging etc.

> - **Plastic: It'**s a lightweight, hygienic and resistant material which can be moulded in a variety of ways and utilized in a wide range of applications.
>   - Unlike metals, plastics do not rust or corrode. Most plastics do not biodegrade, but instead **photodegrade,** meaning that they slowly break down into small fragments known as **microplastics.**
> - **Microplastics or Microbeads** are plastic pieces or fibre which is very small, generally measuring less than 1mm. They enter water bodies they accumulate as act as carriers for other pollutants. They carry carcinogenic chemical compounds in the food chain.
> - **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.

Steps taken to tackle plastic pollution

- **Plastic Waste (Management and Handling) Rules, 2016.**
  - **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 local bodies**: Rural areas are brought under the rules since plastic has reached rural areas as well. The gram sabhas have been given responsibility of implementation.
  - **Extended Producer Responsibility**: Producers and brand owners have been made responsible for collecting waste generated from their products.
  - Producers are to keep a record of their vendors to whom they have supplied raw materials for manufacturing. This is to curb manufacturing of these products in unorganised sector.
  - **Responsibility of waste generator**: All institutional generators of plastic waste shall segregate and store their waste as per Solid Waste Management Rules, and handover segregated wastes to authorized waste disposal facilities.
  - **Responsibility of street vendors and retailers**: 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.
  - Promote the use of plastic for road construction or energy recovery.
  - **New Central registration system**- shall be established by Central Pollution Control Board (CPCB) for the registration of the producer/importer/brand owner.
- **Ban by state governments:** Recently, Maharashtra Government enforced plastic ban in State. However, it raises various concerns
  - **Loss of jobs and revenue:** According to an study, state-wide ban in Maharashtra will result in loss of up to Rs 15,000 crore and nearly 3 lakh job.

o **Implementation Issues:** Uttar Pradesh Government has reintroduced plastic ban in state from July 15, 2018, third time since 2015, reflecting poor implementation of previous ban due to:
  - ✓ Confusion among manufacturer, business entity and consumer over what's banned and what's not.
  - ✓ Poor awareness among various stakeholder about the ban
  - ✓ Hasty decision taken, leading to poor planning and enforcement
  - ✓ Cases of smuggling and the rise of black markets for plastic bags leading to widespread availability of and demand for polythene bags.

o A blanket ban (on plastic bags) is not advisable. Plastic is inherently not a public health hazard, but the **inability to collect plastic waste** leads to health hazards.

o Initially plastic bags were introduced to check deforestation. So complete ban may lead to **cutting of more trees**.

o The maximum usage of plastic bags is to carry vegetables, fruit, meat and fish and they are used because they are convenient, easily available and cost-effective. Before banning we need to provide a **viable alternative** to plastic.

o In Nilgiri, it was not just a ban that made Nilgiris "plastic free", but a **"people's movement"** that ensured environmentally unfriendly habits along with the seized plastic bags lay buried in a nearby dumping yard.

- **Scheme for setting up of need based Plastic Parks**
  o Under the scheme, Government of India provides grant funding up to 50% of the project cost, subject to a ceiling of Rs.40 crore per project
  o Objectives: To increase competitiveness and investments, achieve environmentally sustainable growth and adopt the cluster development approach to consolidate the capacities in plastic sector.
  o Nodal office: Department of Chemicals and Petrochemicals under Ministry of Chemicals and Fertilizers.

ROADMAP FOR POLICYMAKERS

10 steps to consider when introducing bans or levies on single-use plastics

1 Know the Baseline
- Identify the most problematic single-use plastics
- Assess current causes
- Assess extent
- Assess impacts
- Evaluable consumers' willingness to pay

2 Evaluate Possible Actions
- Regulatory
- Voluntary
- Economic
- Combination

3 Assess Impacts of Preferred Option
- Social
- Economic
- Environmental

4 Engage Stakeholders
- Government (Central and Local)
- Industry
- Retailers
- Citizens
- Waste Management Authority
- Tourism Associations

5 Raise Awareness
- Education programmes
- TV Adverts
- Campaigns to explain:
  > Why is the policy being Introduced?
  > What are the expected benefits?
  > Are there punitive measures?

6 Promote Alternatives
- Eco-friendly
- Affordable
- Fit for purpose

7 Incentivize Industry
- Allow enough time for the transition
- Offer tax rebates
- Keep certain eco-friendly materials tax-free
- TAX FREE

8 Ringfence Revenues
In order to support:
- Waste minimization
- The recycling industry
- Environmental projects and to finance awareness initiatives
Communicate the chosen purpose!

9 Enforce
- Set roles and responsibilities
- Ensure sufficient human-power for enforcement
- Communicate the enforcement process
- Prosecute offenders in line with policy revisions

10 Monitor and Adjust Policy
- Audits
- Surveys
- Studies and Interviews
Keep the public updated on progress!

Way Forward

- **Enacting strong policies** that push for a more **circular model of design and production** of plastics, for achieving India's commitment to eliminate all single-use plastic in the country by 2022.(see infographic)
- **Encouraging Public-private partnerships and voluntary agreements** as an alternatives to bans as it would allow **citizens time to change their consumption patterns** and provide an opportunity for affordable and eco-friendly alternatives
- **Exploring Alternative** like biodegradable materials such as reused cotton or paper, jute bags, casein (main protein in milk) which can be used to make a biodegradable material for use in insulation, packaging and other products. According to Bloomberg, it is 500 times better than conventional plastics at protecting food from oxygen.
- **Promoting bioplastics** as they can be easily decomposed and have higher biodegrability.

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- **Achieving SDG**: Concerted effort on reducing the impact of plastic pollution will help in achieving number of SDG goal viz SDG-3, SDG-11, SDG-12 and SDG-14.
- **Promoting Green Social Responsibility** concept to sensitise citizen and encourage them to be more sustainable in their approach through **behavioural change** by shifting to a production and consumption system that is smart, innovative and sustainable based on efficiencies across the entire life cycle of the product.
- **Effective regulation of ban:** As many as 25 states in India have banned different types of plastics over the last two decades, but implementation of the ban has been bleak
- **Policy Push:** Implementing **UN Environment 10-step roadmap** for governments to curb Single Plastic Usage.

Overview of a circular Economy

Fewer Raw Materials are used

DESIGN
Products and packaging are designed to last longer and be more durable, using more sustainable materials that can be easily recycled at end of-life

RECYCLE
Improved, cost-efficient collection and treatment systems will lead to fewer and fewer materials ending up in landfill and support the economics of circular design

CIRCULAR ECONOMY
Government leadership, producer responsibility & consumer education, and awareness will enable market mechanisms that drive higher resource productivity, innovation and economic growth

PRODUCE
Businesses collaborate and coordinate across sectors to reduce greenhouse gas production and fossil fuel use

REUSE/REPAIR
Producers are fully responsible for recovering materials from their products and packaging throughout their lifecycle

DISTRIBUTE
Retailers offer products that can be easily reused and refurbished, offer end of-life take back or maintenance and repair services, and support producers in providing education and awareness to consumers

CONSUMER
There are many ways consumers can contribute to a circular economy, like making greener buying choices, sharing assets (e.g., cars, tools) and repairing them or offering them so others for reuse and refurbishing

1.5. WASTE MANAGEMENT

Indian cities generate a massive amount of waste that goes untreated. According to the World Bank, India's daily waste generation will reach 377,000 tonnes by 2025 due to rapid urbanization and industrialization.

It presents numerous social and environmental challenges such as

- **Effects on our health**: For e.g.- the apocalyptic scenes at the Ghazipur landfill site in Delhi, where waste burning is a major contributor to the air pollution crisis
- **Invisible plight of the thousands of informal ragpickers** who sustain their livelihoods by collecting, sorting, and trading waste. By some estimates, ragpickers save almost 14% of the municipal budget annually.

The government in recent years has given due importance to the issue of sanitation under flagship Swachh Bharat Abhiyan programme. It has helped achieve the following outcomes on waste management front:

- 100% door-to-door waste collection in 51,734 out of 82,607 wards.
- Almost 88.4 megawatts (MW) of energy is generated from waste-to-energy (WTE) projects.
- Under the Swachh Bharat Mission (Urban), Government has also adopted "Mission ZERO Waste" which aims at sound management of the solid wastes generated in the country with special focus on Reduce, Reuse and Recycle (3Rs).
- Recently, Ministry of Housing and Urban Affairs organized the 8th Regional 3R Forum where the **Indore 3R Declaration of Asian Mayors on Achieving Clean Land, Clean Water and Clean Air in Cities** was adopted

More on Regional 3R forum
- **The United Nations Centre for Regional Development (UNCRD)** has been organizing International Regional Forum on 3Rs since 2009 with the support of **Government of Japan** to promote the concept of Reduce, Reuse, Recycle in industry, service and agriculture sector.
- It is a **legally non-binding and voluntary document** which aims to provide a basic framework for Asia-Pacific countries to develop measures and programs to promote 3Rs including a set of 3R indicators for monitoring specific progress.
- Through this forum India aims to further strengthen this focus through its 'Mission Zero Waste' approach thereby encouraging cities, industries and other stakeholders to see waste as a resource.

- As India's own economy grows faster, the country will face an insurmountable waste crisis. Thus, the government must put a high priority on waste management. In this regard, South Korea model of waste management can be of use as it is the only OECD country that has reduced Municipal Solid Waste by 40% while seeing 5-fold rise in its nominal GDP.
- South Korea implemented a volume-based waste fee system—a paradigm shift focused on controlling waste generation and achieving maximum rates of recycling while raising additional resources to finance waste management. Along with this, it also provides budgetary and technical support to local governments to expand Waste-to-Energy facilities which accounts for 60% of new and renewable energy produced.

1.5.1. SOLID WASTE MANAGEMENT

Solid waste management (SWM) is a major problem for many urban local bodies (ULBs) in India, where urbanization, industrialization and economic growth have resulted in increased municipal solid waste (MSW) generation per person **due to inadequate waste collection**, transport, and treatment and disposal facility.

India generates over **150,000 tonnes of municipal solid waste (MSW) per day**, with Mumbai being the world's fifth most wasteful city. Yet, only 83% of waste is collected and less than 30% is treated.

Municipal solid waste management (MSWM) is a critical element towards sustainable metropolitan development. It comprises segregation, storage, collection, relocation, carry-age, processing, and disposal of solid waste to minimize its adverse impact on environment. Unmanaged MSW becomes a factor for propagation of innumerable ailments

Challenges to effective SWM

- **Segregation:** There is no organized and scientifically planned segregation of MSW either at household level or at community bin. Sorting of waste, is mostly accomplished by unorganized sector and seldom practiced by waste producers. Segregation and sorting takes places under very unsafe and hazardous conditions and the effectiveness of segregation is reasonably low as unorganized sector segregates only valuable discarded constituents
- **Disposal:** In India, almost every city, town, or village adopted unscientific disposal of MSW .
- **Issues with Landfill management:**
  - Violations of rules with respect to the scientific requirements for the location of a landfill and the mandatory security-set up like compound walls, CCTV cameras, firefighting equipment and water tanks, and regularization of rag pickers .
  - Occasional fires drawing on air quality and health. (due to methane production)
  - Many Landfills have been functioning beyond the stipulated timeline.
  - With the expansion of cities old land fill need to be reclaimed and new sites should be identified.
  - The demand for alternate sites gets entangled in the tussle between the Municipal Corporations and the State governments as the matter rests with the latter.
- **Processing Facility**
  - The composting and waste to energy plants run at under-capacity.
  - Many of the new projects for garbage processing facility are stuck
  - The facilities of composting of wet waste is not present everywhere
  - Indifference of citizens/ Lack of community participation towards waste management due to lack of awareness
- **Characterization of municipal solid waste:** limited source of information available about waste hinder an appropriate solutions for the kind of waste produced for a particular region.
- **Failure of waste-to-energy projects**: India is still struggling to make waste-to-energy project a success story. There is a need to import economically feasible and proven technologies. Apart from this, suitably characterized and segregated waste needs to be provided to waste-to-energy plants as per its requirement.
- **Lack of coordination among Centre and State:** Such lack of coordination for specific action plan and poor strategy at implementation level by ULBs are main hindrance.
- **Urbanization and lack of appropriate level funding**: Most of the landfill sites are running beyond their capacity in metropolitan cities. Inadequate financial support to cater to waste management problem aggravates it. Due to financial crunch ULBs do not have adequate infrastructure to provide suitable solutions.

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Way forward

- **Viable decentralized composting plants** should be installed to reduce the load on ULBs for collection and transportation of MSW, which subsequently culminates in reduction of the pressure exerted on the landfills.

- **Characterization of waste at collection** and also at disposal point should be made and be available in public domain. It can also help to select suitable waste-to-energy technologies for particular regions.

- The **waste should be treated as resource** and formal recycling sector/industries be developed to recycle non-biodegradable recyclable component from the waste thereby providing employment to rag-pickers and absorb them in mainstream.

- **Protection of groundwater contamination** from leachate percolation from open dump/landfill site should be made compulsory. Appropriate technological solution should be adopted to achieve this goal.

- The Kasturirangan report by Planning Commission has also highlighted the need for an integrated approach to combat Solid waste through:

  o Principle of **Reduce, Reuse, Recover , Recycle and Remanufacture (5Rs)** should be adopted

  o Motivate Resident Welfare Associations (RWA), CBO / NGO's to take up work of community **awareness and door to door collection**.

  o It emphasizes **setting up centralised** (for incineration, gasification, pyrolysis) or decentralised (for biomethanation, vermicomposting) **waste processing facilities** keeping in view the quantity and quality of waste generated and financial viability of the processing technology.

  o **Standard protocols for landfill management** to prevent accidents: Set up **Common Regional Sanitary Landfill Facility**, to reduce the land requirement. Cities above a population of one million should set-up their own landfill and permit all cities and towns within 50km periphery of the city to use the facility for disposal of their waste.

- **Fecal Sludge Management (FSM) System**: FSM involves collecting, transporting and treating fecal sludge and septage from pit latrines, septic tanks or other **onsite sanitation systems.** This waste is then treated at septage treatment plants, which can be later reuse or disposed sustainably. It has following significance:

Steps taken by government

Solid Waste Management Rules, 2016

- Rules have mandated the source segregation of waste in order to channelise the waste to wealth by recovery, reuse and recycle.

- Waste generator will have the responsibility of segregating the waste into wet, dry and Hazardous . They will have to pay user fine to the waste collector and spot fine for littering around; the amount will be decided by the local body.

- Waste processing facilities will have to be set up by all local bodies having 1 million or more population within two years.

- Rules have mentioned about the integration of rag pickers, waste pickers and kabadiwalas from the informal sector to the formal sector by the state government.

- Developers of Special Economic Zone, industrial estate, industrial park to earmark at least 5 % of the total area of the plot for recovery and recycling facility.

Star Rating Protocol for Garbage Free Cities

- It aims to enthuse the cities with a spirit of healthy competition to improve their overall cleanliness and allow multiple cities to be awarded the same star rating.

- The major focus in the ratings will be on waste storage and litter bin.

- An online database was also launched in order to capture the progress of states and cities on their SBM components, thereby **enhancing the robustness and transparency of Mission monitoring.**

Recently, recognizing the urgent need for abatement of odour from **municipal solid waste (MSW)** disposal facilities in urban India, the **Central Pollution Control Board (CPCB)** has proposed guidelines to tackle it.

- **Centre's Solid Waste Management Rules, 2016**, identified odour as a **public nuisance.**

- India has regulatory frameworks to control air pollutants but, "no regulation has been made for abatement and control of odour which is now becoming **cause of major problem** with increasing urbanization and industrialization.

Highlight of the Guidelines

- **Green Belt Around Landfill Sites:** Developing barriers at landfill sites by creating a green boundary with suitable species of plants/trees as natural media for reduction of odour pollution and restriction of odour in and around landfill sites.

- **Tapping LFG (Landfill Gases) Efficiently:** MSW Landfill system designed to mitigate fugitive odorous emissions.

- **Integrated with the Urban Development Planning:** Selection of landfill site should be so, that expansions of city in next two or three decades will not encompasses the selected MSW site.

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o **Alternative disposable system:** FSM is an effective alternative to traditional sewerage (coverage 32% in India) networks — both in terms of **construction costs and time-taken.**

o **Improved public health**: Cleaner water bodies mean reduced incidence of water-borne diseases and reduced mortality linked to diarrhoeal diseases.

o **Empowerment of manual scavengers**: With appropriate training, sanitation workers can be empowered to own and run FSM businesses.

o **Economic benefit**: As sludge is nutrient-rich, it can be used as **organic compost**. It can even be treated and used for **biogas,** or to manufacture **fuel pellets or ethanol.**

o **Source of water**: Once pathogens and bacteria are removed, the water can be used for irrigation, construction, by industry in cooling plants, by RWAs and housing societies for gardens and flushing and by government agencies for parks.

o **Preventing Pollution**: FSM alleviates the problem of **waste management,** without polluting groundwater.

o It is a tool to achieve **Swachh Bharat Mission objective of safe sanitation for all by 2019.**

Sludge Management in India

- Nearly 80 % of the sludge — a human excreta and water mixture that bears disease-carrying bacteria and pathogens — remains **untreated** and is dumped into drains, lakes or rivers, posing a serious **threat to safe and healthy living.**
- As per the **2011 Socio Economic and Caste Census,** 1,82,505 households in rural areas are reported as **manual scavengers.** They face serious health hazards due to absence of proper disposal system or safety regulations in place.
- More than 70 % households with safe sanitation facilities are based on such onsite systems, and in a majority of cities there are no sewered networks or sewage treatment plants

National Policy on Faecal Sludge and Septage Management (FSSM)

- **To set the context, priorities, and direction** for, and to facilitate, nationwide implementation of FSSM services in all ULBs such that safe and sustainable sanitation becomes a reality for all in each and every household, street, town and city.
- **Enable and support synergies** among relevant Central Government programs such as SBM, AMRUT and the Smart Cities Mission to realise safe and sustainable sanitation for all at the earliest, possibly by the year 2019.
- **Mitigate gender-based sanitation** insecurity directly related to FSSM, reducing the experience of health burdens, structural violence, and promote involvement of both genders in the planning for and design of sanitation infrastructure.
- **Define the roles and responsibilities** of various government entities and agencies, and of other key stakeholders such as the private sector, civil society organisations and citizens for effective implementation of FSSM services throughout the country.

CAPTURE ▷ CONTAINMENT ▷ EMPTYING ▷ TRANSPORT ▷ TREATMENT ▷ SAFE REUSE OR DISPOSAL
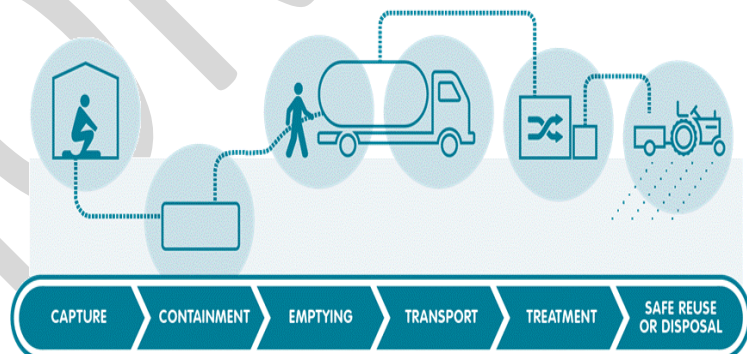
1.5.2. E-WASTE

Why in News?

- Recently, Ministry of Environment, Forest and Climate Change (MoEF&CC) amended the earlier E-Waste Management Rules, 2016.

Fact about E-Waste (Global E-waste Monitor 2017)

- E-waste has **increased by 8% from 2014 to 2016** and expected to rise again by 17% by 2021.
- A mere **5 per cent of India's total e-waste gets recycled** due to poor infrastructure, legislation and framework which lead to a waste of diminishing natural resources, irreparable damage of environment and health of the people working in industry.
- The reasons for increase in e-waste are increasing personal disposable income at global level, falling prices of electronic devices and shorter replacement cycle mobile phones and computers.
- Continent wise ranking in term of E-waste production; Asia (18.2 Mt), followed by Europe (12.3 Mt), the Americas (11.3 Mt), Africa (2.2 Mt), and Oceania (0.7 Mt).

- India produced 1.95 million tonnes of e-waste last year. The report has also warned about the health and environmental dangers from processing of e-waste by informal sector in India without proper safeguards.
- **E-waste Legislations:** presently 66% of the world population is covered by national e-waste management laws, an increase from 44% that were covered in 2014.
- **E-waste and SDG** are closely associated due to its impact on environmental protection (Goals 6, 11, 12, and 14), health (Goal 3) and employment (Goal 8).

Highlights of E-Waste (Management) Amendment Rules, 2018 rules

- It aims to **formalise the e-waste recycling sector** by channelizing the E-waste generated towards authorized dismantlers and recyclers.
- **Phase wise Collection:** It introduced the phase-wise collection targets for e-waste, which shall be 10% of the quantity of waste generation as indicated in the EPR Plan during 2017-18, with a 10% increase every year until 2023. After 2023 onwards, the target has been made 70% of the quantity of waste generation as indicated in the EPR Plan.
- Separate **e-waste collection targets** have been drafted for new producers, i.e., those producers whose number of years of sales operation is less than the average lives of their products.
- **Reduction of Hazardous Substances (RoHS):** Under this, cost for sampling and testing shall be borne by the government for conducting the RoHS test and if the product does not comply with RoHS provisions the cost will be borne by the Producers.

What is E-waste?

- It refers to electrical and electronic equipment (EEE) and its parts which have been discarded by its owner as waste without the intent of re-use.
- Common hazardous materials found in e-waste are: **heavy metals** (such as mercury, lead, cadmium etc.) and **chemicals** (such as CFCs/chlorofluorocarbon or various flame retardants).
- India is 5th largest producer of e-waste.
- The main sources of electronic waste in India are the government, public and private (industrial) sectors, which account for almost 71% of total waste generation.
- Over 95% of e-waste generated is managed by the unorganised sector and scrap dealers who dismantle the disposed products instead of recycling it.
- **E-Waste Import:** According to Assocham, US & China account for 70% of India's e-waste imports in 2016.

Producer Responsibility Organisation: It is an organisation that helps producers meet their EPR targets through various recyclers and dismantlers.

Extended Producer Responsibility (EPR): It is a strategy designed to promote the **integration of environmental costs associated with goods** throughout their life cycles into the market price of the products. Three basic objectives of EPR:

- Manufacturers shall be incentivised to improve the environmental design of their products and the environmental performance of supplying those products.
- Products should achieve a high utilisation rate.
- Materials should be preserved through effective and environmentally-sound collection, treatment.

About E-waste (Management) Rules, 2016

- It is applicable to all the stakeholders such as Producer Responsibility Organisations, Consumers, Dismantlers, Recyclers, Dealers, Manufacturers etc.
- It adopted **collection mechanism-based approach** which includes collection centre, collection point, and take back system etc. for collection by Producers under EPR.
- It covered even components and spare parts of electric & electronic equipments. Mercury containing lamps like CFLs were also included.
- It has the **interest-bearing Deposit Refund Scheme** charged by the producer to the consumer at the time of purchase.
- It introduced Pan India EPR Authorization by CPCB replacing the state wise EPR authorization.

- **Producer Responsibility Organizations (PROs)** shall apply to the Central Pollution Control board (CPCB) for registration to undertake activities prescribed in the Rules.

Suggestion to reduce e-waste

- **Statistics** should be collected at the international level and organised for comparison to ensure that data is frequently updated, published, and interpreted.
- **Move away from Take-Make-Dispose:** Countries should come up with legislation to promote circular economy models in which the e-waste is treated as resource rather than waste.
- **3-R strategy:** Countries should promote the Reduce, Reuse Recycle. As according to report, the value of recoverable precious materials from e-waste like gold, silver, copper, platinum and palladium was $55 billion in 2016.
- **Legislation-**on e-waste should encourage a better product design at the production stage.

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1.5.3. BIO-MEDICAL WASTE

Why in news?

Recently, Ministry of Environment, Forest and Climate Change released the amendments to Bio-medical Waste Management Rules.

What is Bio-medical Waste?

- Bio-medical waste consists of any waste which is generated during diagnosis, treatment or immunisation of human beings or animals or in research activities.
- It includes syringes, needles, cotton swabs, vials that may contain bodily liquids and spread infections.
- It has been found that only 15% of the bio-medical waste that is generated is hazardous. However, all the waste needs to be treated.

Context

- Government had notified Bio-medical Waste Management Rules in 1998 under the **Environment Protection Act 1986** which were later amended twice in 2000 and 2003.
- In 2016 government notified revamped **Bio-medical Waste (BMW) Management Rules 2016** to enhance, widen and bring a comprehensive regime for **bio-waste management**.
- The latest amendments have been further introduced to improve compliance and strengthen the implementation of environmentally sound management of biomedical waste.

> **Features of Bio-medical Waste Management Rules 2016**
> - **Widened jurisdiction** – The ambit of the rules was widened to include vaccination camps, blood donation camps, surgical camps etc.
> - **Pre-treatment of waste –** Waste generated in laboratories, microbiological waste, blood samples and blood bags to be pre-treated through disinfection or sterilisation on-site in the manner as prescribed by WHO or NACO.
> - **Better segregation –** Bio-medical waste has been classified into 4 categories instead of 10 namely – Untreated human anatomical waste, Animal anatomical waste, Soiled waste and Biotechnology waste.
> - **Bar-code system** for bags or containers to be established containing bio-medical waste for disposal.
> - **Training and Immunisation –** Regular training to all its health care workers and immunising all health workers.
> - **Stringent pollution norms** for incinerator to reduce the emission of pollutants in environment including the emission limits for Dioxins and furans.
> - Phasing out of use of chlorinated plastic bags, gloves and blood bags **within 2 years**.
> - **Procedure of Disposal** –The biomedical waste must be segregated in **coloured bags according to the category of the waste.** It can be **stored up till 48hrs** after which it is either needed to be t**reated at in-situ site** or collected by the worker from CBMWTF.

Features of Bio-medical Waste Management (Amendment) Rules 2018

- Bio-medical waste generators i.e. hospitals, clinics, vaccination camps etc. will now be required to phase out the use of **chlorinated plastic bags** and gloves by **March 2019**.
- Common biomedical waste treatment facility (CBMWTF) shall **establish GPS and Bar coding facility** in accordance with guidelines issued by the **CPCB**.
- **Pre-treatment of Bio-medical waste** – Every occupier of health care facility needs to pre-treat the laboratory waste, microbiological waste, blood samples etc. on-site in accordance with **guidelines on safe management of wastes from health care activities by WHO** and **WHO Blue Book 2014** and then send it to CBMWTF for final disposal. This will ensure that the toxic discharge such as infectious liquid waste is not discharged into the sewerage network.
- All healthcare facilities shall provide **annual report on its website** within two years of the publication of the amended rules.

1.6. MISCELLANEOUS

1.6.1. PERSISTENT ORGANIC POLLUTANTS

Why in news?

- Recently, the environment ministry has notified new Regulation of Persistent Organic Pollutants (POP) Rules, 2018.

Details about the notification

- It bans the manufacture, trade, use, import and export of the seven toxic chemicals listed under the **Stockholm Convention**.

- The notification held that industrial units or persons, "shall not drain or discharge or dispose the chemicals directly or indirectly in effluent treatment plant, sewage treatment plant, onto any land, in public sewers, in inland surface water or in marine coastal areas".

- It further held that the waste containing these chemicals "shall be disposed of as per the provisions of the **Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016**".

> **What are POPs?**
> - POPs are **organic chemical substances—toxic to both humans and wildlife**—which once released into the environment **remain intact for years on end.**
> - They become widely distributed throughout the environment as a result of natural processes and accumulate in **the fatty tissues (thus they have to be fat soluble)** of living organisms including humans.
> - POPs are recognized by the International Agency for Research on Cancer as Group 1 carcinogens or cancer-causing substances.
> - Specific effects of POPs can include **cancer, allergies and hypersensitivity, damage to the central and peripheral nervous systems, reproductive disorders, and disruption of the immune system.**
>
> **Stockholm Convention on Persistent Organic Pollutants**
> - It is a **legally binding** global treaty that aims to protect human health and the environment from the effects of persistent organic pollutants (POPs).
> - The Convention sought initially 12 chemicals, for restriction or elimination of the production and release. Now, it **covers 23 chemicals.**
> - The **Global Environmental Facility (GEF)** is the designated interim financial mechanism for the Stockholm Convention.
> - India has ratified the Convention and its 12 initially listed chemicals.

- These rules apply to hazardous and other wastes like metal and metal bearing wastes, wastes which may contain either inorganic or organic constituents. They do not apply to wastes covered under other acts such as waste-water and exhaust gases, radio-active wastes, bio-medical wastes and municipal solid wastes.

1.6.2. POLLUTER PAYS PRINCIPLE

Background

The Polluter Pays Principle is one of the three key principles upon which the National Green Tribunal (NGT), India's green court, relies for delivering decisions.

- As per Section 20 of the NGT Act, 2010, while passing any order, decision or award, the Tribunal shall apply three core principles, including the **'principles of sustainable development, precautionary principle, and the polluter pays principle'**.

What is polluter pays principle?

The 'polluters pays' principle is the commonly accepted practice in environmental jurisprudence.

- It states that those who produce pollution should bear the costs of managing it to prevent damage to human health or the environment and also for compensating victims of environmental damage.
- For instance, a factory that produces a potentially poisonous substance as a byproduct of its activities is usually held responsible for its safe disposal.

> **Carbon Tax**
> The polluter pays principle can be **applied to greenhouse gas emitters** through a so-called carbon price. A carbon tax is a **fee imposed** on the burning of carbon-based fuels (coal, oil, gas). It imposes a **charge on the emission** of greenhouse gases equivalent to the corresponding potential cost caused through future climate change – thus forcing emitters to internalise the cost of pollution. In this way, a **financial incentive** is created for a factory, for instance, to minimise its pollution costs by reducing emissions.
> The carbon price can make the polluter pay through **two different policy instruments**.
> - The first is a straightforward price-based mechanism in the form of a carbon tax, where the price of pollution is determined by the rate of the tax for each tonne of greenhouse gas emitted.
> - The second form is through a quota-based system, often referred to as a cap-and-trade, or emissions trading system. This sets a cap, or limit, on the maximum level of emissions for a given time period, and distributes permits or allowances for each unit of greenhouse gas among firms that

Importance of Polluter Pays Principle

- The Polluter Pays Principle is important for determining punitive costs of damages from environmental violations caused by industries or individuals.
- The principle is applied to ensure that the costs of mitigating environmental damage are internalized by the industry or the individual found liable, and not externalized.
- It is also an important means for tackling public health hazards that result from environmental pollution.
- The principle has the potential to play an important role in shaping the performance of industries/commercial enterprises and make them adopt environmentally responsible practices.

Instances of Uses of Polluter Pays Principle

- NGT has used the principle in variety of cases including violating requirements of statutory clearances and permits causing environmental harm, violations of clearance conditions and permits, pollution from industrial activities and non-compliance with specified pollution standards, impact on communities and other matters related to pollution.

> **Precautionary principle:** it is an Environment management rule which says that if a threat of serious or irreversible damage to the environment or human health exists, a lack of full scientific knowledge about the situation should not be allowed to delay containment or remedial steps if the balance of potential costs and benefits justifies enacting them. In other words, "prevention is better than cure." Also called preventative principle.

- The Tribunal has used this primarily in three ways—to impose a direct penalty on the polluter after the incident, to draw out a structure of fines and taxes for future pollutions and, in a few instances, to direct the state to more long-term policy instruments to internalize the costs of environmental pollution.

Concerns regarding NGT decisions:

The Principle remains the cornerstone for adjudicating on environmental violations. However, important concerns remain about the decisions of the NGT. The key concerns are as follows:

a. **In determining penalties, clarity and consistency is lacking:** There remains a lack of clarity on how the penalty amount has been determined.
   - **No scientific method** how an amount has been arrived at. The lack of such clarity can render the NGT's order subjective.
   - **Reliance on Guesswork** makes the Tribunal's orders seem arbitrary. For eg in the matters of Ganga pollution from industrial sources, the lump-sum penalties imposed is peanuts when compared to company turnovers.
   - **Reliance on inappropriate case-precedent** Even in cases where it was noted how the specific amount was determined, the derivation remains inappropriate due to reliance on inappropriate case precedents.
   - **No consistency in using a rationale for determining penalty:** For instance, while the NGT has sometimes used 5 per cent of the project cost to determine the penalty amount for the company, similar criteria have not been used when the Western bench of NGT observed EC violations for Adani's port activities in Hazira.

b. Inconsistency in complying with orders ensures that the purpose of Principle is not achieved
   - **Delayed payments** due to various reasons viz decision challenged in Supreme court etc
   - **Low deterrence value of penalties** There also remains uncertainty about the adequacy of the penalty amount. This is clearly evident from the analysis of Ganga pollution cases caused by sugar and distillery units.

Recommendations to tighten application of the Polluter Pays Principle

The recommendations for the NGT to employ to better realize the objectives of the Polluter Pays Principle are divided into the following four categories:

I. **Methods for determining compensation**
   - Arbitrariness needs to be avoided in determining compensations
   - An increasingly consultative approach should be used in determining compensations.
   - Experts should be relied upon to help calculate penalty.

II. **Factors to be considered for calculating compensation**
   - **Technical factors should be used:** Given the type of cases the Tribunal typically has to deal with, general benchmarks can be developed as precedent for different cases.

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- Quantitative estimate of damages should be undertaken
- Penalties should be sufficient to deter industries from polluting

III. **Utility of centralized payments and monitoring of fund utilization**
- **Compensation amounts should be deposited in ERF.** As mandated by the NGT Act, all compensations should be deposited with the Environment Relief Fund (ERF). A centralized repository to deposit the money is important for proper accounting and audit purposes of fund disbursement and utilization.
- **Orders should be clear and comprehensive** Clear directions need to be given as to *how* and *by when* the money is to be paid into the fund. Further, clear direction must be provided about the *manner* and *purposes* for which the money is to be used.
- **Oversight mechanisms need to be introduced** to ensure that polluters make payments. a system could be introduced whereby the designated fund manager is required to remind polluters to deposit the required amounts in the ERF.

IV. **Employing an activist approach to create alternative systems that can pre-empt potential pollution:** The courts in the process should adopt an activist role in pre-empting and therefore preventing damage to the environment.
- This includes introducing long-term solutions that achieve the purpose of the Polluter Pays Principle by discouraging polluting activities.
- These may be done by passing orders that lay down guidelines that indicate how polluting entities will compensate victims of pollution based on a reference or standard based on proportionality. Security instruments may also be laid down and market-based instruments introduced.

Conclusion

The Polluter Pays Principle is important for determining punitive costs of damages from environmental violations caused by industries or individuals. To enforce this principle in its true spirit, there is a need to evolve a scientific criterion to arrive at the compensation amount as discussed above. Also administrative systems need to be in place to enforce the NGT decisions on ground.

2. CLIMATE CHANGE

According to NASA, **Climate Change** is a broad range of global phenomena created predominantly by burning fossil fuels, which add heat-trapping gases to Earth's atmosphere. These phenomena include the increased temperature trends described by global warming, but also encompass changes such as sea level rise, ice mass loss in Greenland, Antarctica, the Arctic and mountain glaciers worldwide, shifts in flower/plant blooming and extreme weather events.

According to **UN Emission Gap report, 2017**, the rate of growth of GHG has decreased over the past few years, though the total GHG emissions continue to increase.

World Meteorological Organisation (WMO) gave the **State of Global Climate Report 2017** which highlighted following observations:

- **2017** was **2nd warmest year** on record after 2016, and **the warmest non-EL Nino year**.
- The 2013-17 was the **warmest five-year average** on record.
- Total global disaster losses from climate-related events in 2017 stood at **US$ 320 billion making 2017 the most expensive year on record.**
- **Global sea surface temperatures** were ranked as the third warmest, as they were somewhat below the levels of 2015 & 2016.
- **Cryosphere** continued to shrink, with Artic and Antarctica sea ice well below average.
  - Cryosphere is the frozen water part of the Earth which includes the continental ice sheets found in Greenland and Antarctica, as well as ice caps, glaciers, and areas of snow and permafrost. It also includes frozen parts of the ocean, such as waters surrounding Antarctica and the Arctic and frozen rivers and lakes, which mainly occur in polar areas.
- **Ocean acidification** continued with seawater pH progressively falling from values above 8.10 in the early 1980s to between 8.04 and 8.09 in the last five years.
- **Trends in GHG concentrations:**
  - **Atmospheric CO_2** are now 145% of pre-industrial (before 1750) levels.
    - ✓ The increase is because of a combination of human activities and a strong El Nino event.
    - ✓ The other reason is **growth in Chinese emissions**, which is projected to grow by 3.5 per cent in 2017 after two years with declining emissions.
    - ✓ Global CO_2 emissions from fossil fuel use and cement production remained stable for the second year in a row in 2016.
  - **Atmospheric methane** reached a new high and is now 257% of the pre-industrial level.
  - **NO_2 atmospheric concentration** in 2016 was 328.9 parts per billion which is 122% of pre-industrial levels.

Factors affecting Climate Change

- **Natural Factors:** The Earth's climate can be affected by a number of natural factors. The prominent ones are 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:** Anthropogenic or manmade factors result in short term climatic changes. It involves the changes in the energy balance of the Earth - atmosphere system leading to changes in weather and climate. The anthropogenic change may occur through increased GHG emissions or changing land use through deforestation, irrigated farming in drylands etc.

Climate Change and India

- According to **IPCC (International Panel on Climate Change)** India is most vulnerable to the impact of climate change adversely impacting the health, economic development and food security.
- India has been ranked **14th in Climate Change Performance Index (CCPI) out of 56 countries in 2017,**
  - It noted that with **low per capita emissions** and adopting more clean sources of energy, India's emissions level is well-below-2℃ target. However, **overall emissions** have increased relatively strongly over the last year, holding back India's further improvement in Index.
- India has also been ranked at 177 out of 180 in **Environmental Performance Index**, indicating strain population pressures and rapid economic growth impose on the environment.
- **CO_2 emission trend in India**

- o India's CO$_2$ emissions will grow only about 2% this year, compared with an average 6% per year over the past decade.
  - o This reduced growth rate is likely to be short-lived, as it was linked to reduced exports, lower consumer demand, and a temporary fall in currency circulation attributable to demonetisation.
  - o India is also among the small group of countries that are on track to achieve their self-declared climate targets under the Paris Agreement with their current policies in place.
- 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.

2.1. SOUTH ASIA'S HOTSPOTS

Why in News?

Recently, the World Bank has released its report titled **"South Asia's Hotspots: The Impact of Temperature and Precipitation changes on living standards"**.

More about report

- It estimates how changes in temperature and monsoon patterns will **affect GDP and living standards in South Asian region.**
- The report identifies **"hotspots"** as the states /districts where these changes will have **a notable effect on living standards**.
- It observed six countries in South **Asia Nepal, Afghanistan, India, Pakistan, Bangladesh and Sri Lanka** for the study.
- The report looks at two scenarios: **climate-sensitive**

> **Climate-sensitive**
> - It represents a future in which **some collective action is taken to limit greenhouse gas emissions** and global annual average temperatures increase to **2.4°C by 2100** relative to pre-industrial levels.
> - It will be the scenario **if the Paris Agreement is implemented,**
>
> **Carbon-intensive**
> - It represents a future in which **no actions are taken to reduce emissions** and global annual average temperatures will increase **4.3°C by 2100** relative to pre-industrial levels.

and carbon-intensive. Both show rising temperatures throughout the region in coming decades, with **the carbon-intensive scenario showing greater increases.**
- It will be useful for **designing social welfare programmes** by accounting for local socio-economic characteristics and climate-related risks and **reorient strategies and policies** targeted to hotspot inhabitants, the hidden victims of climate change.

Main finding of report

Overall region related findings

- Almost **half of South Asia's population** now lives in areas that are projected to become **moderate to severe hotspots** under the carbon-intensive scenario by 2050.
- It has found that living standards in s**ome currently cold and dry mountain areas could improve marginally.** India, Bangladesh, Pakistan and Sri Lanka will be adversely affected by these changes, while Afghanistan and Nepal will benefit as they are relatively cold.
- The report finds that most of the expected hotspots are currently characterized by **low living standards, poor road connectivity, uneven access to markets, and other development challenges**.
- Most of the hotspots included in the report are in inland areas. i.e. there will be **more warming in inland and less warming in coastal areas** beyond 2050.
- Average household consumption in the region will **decline after average temperature exceeds a peak**. Majority of the region's population lives in areas where temperature is already above the said peak.

India specific findings

- Approximately **600 million people in India** today live in locations that would become **moderate or severe hotspots by 2050** under the carbon-intensive scenario.
- India's average temperature is predicted to increase by **1.5-3°C if no measures are taken and by 1-2°C if preventive measures are taken along the lines of the Paris Agreement** by 2050
- Rising temperatures and changing monsoon rainfall patterns from climate change could cost **India 2.8% of GDP, and depress the living standards of nearly half the country's population by 2050**.
- States in the **central, northern and northwestern parts of India** emerge as the most vulnerable. **Chhattisgarh and Madhya Pradesh**, which are predicted to experience a decline in living standards of

more than 9%, are **the top two 'hotspot' States in India**, followed by Rajasthan, Uttar Pradesh, and Maharashtra.

- Of the top 10 most affected hotspot districts, **7 are in Vidarbha, Maharashtra and the remaining 3 in Chhattisgarh and MP.**
- In the absence of major climate mitigation, **nearly 148 million Indians** will be living in these severe hotspots in 2050.

Recommendations

- No single set of interventions will work in all hotspots. Targeted Policies and actions to address **the specific needs based on local conditions** are required for effective mitigation. **Targeting resources efficiently to the most vulnerable communities and groups** should be a priority.
- **Investing in skills, health, knowledge, better infrastructure, and a more diversified economy** will reduce climate hotspots at the household, district, and country levels.
- **Boosting research and development on new technologies, such as drought-resistant crops,** and other Technological advances, coupled with expanded irrigation systems, will work to make **agriculture less sensitive to climate change** in the long-term.
- Governments should promote private actions on adaptation of new skills for building resilience by policies like **providing weather forecasts and climate risk assessments.**
- For **India specific measures**, targeted interventions for **improving educational attainment, reducing water stress, and improving nonagricultural employment opportunities** can act as a game changer.

2.2. CLIMATE CHANGE AND AGRICULTURE

Introduction

Agriculture and fisheries are highly dependent on the climate. India's agricultural sector faces a significant threat from climate change and directly impacts the daily lives of farmers in India. However, Agriculture sector also contributes up to 25% of the total anthropogenic emissions.

Impact of Climate change on Agriculture

- **Decline in agricultural productivity**
  - Agricultural productivity is sensitive to two broad classes of climate-induced effects. The first one is its **direct effect** due to changes in temperature, precipitation and carbon dioxide concentrations; and the other is the **indirect effect** through changes in soil moisture and the distribution and frequency of infestation by pests and diseases.
  - According to IPCC, Agricultural productivity in India was estimated to decrease by 2.5 to 10 % by 2020 to 5 to 30 % by 2050.
  - **Nutritional Security**: Rising levels of atmospheric carbon dioxide reduce the concentrations of protein and essential minerals in most plant species, including wheat, soybeans, and rice.
- **Impact on Livestock**
  - Heat waves, which are projected to increase under climate change, could directly threaten livestock by increasing their vulnerability to disease, reducing fertility, and declining milk production.
- **Impacts on fisheries**
  - Changes in temperature and seasons can affect the timing of reproduction and migration. Some marine disease outbreaks have also been linked with changing climate.
- **On Economies of Agriculture**: According to Economic Survey of 2018, India incurs losses of about $9-10 billion annually (Rs 62,000 crore) due to extreme weather events. It also noted farmers' income losses from climate change would be between 15 % and 18 % on an average.
- **Farmer Suicide**: A study conducted at the University of California – Berkeley estimated that climate change could have contributed the deaths of 59,300 farmers or farm workers over the last 30 years.

Measures for Reducing the Impact of Climate Change

- **Adaptation measures:** Enhancing the resilience of agriculture to cope with the climate change and the climate variability is imperative to sustain production and improve the livelihood security of farmers through various adaptation and mitigation strategies.
  - Recently, Government of India, Government of Maharashtra and the World Bank signed a US$ 420 million loan for **Maharashtra Project for Climate Resilient Agriculture.**

Mains 365 – Environment

- **Adoption of permaculture:** It is the conscious design and maintenance of agriculturally productive ecosystems which have the diversity, stability, and resilience of natural ecosystems.
  - o It is the harmonious integration of landscape and people — providing their food, energy, shelter, and other material and non-material needs in a sustainable way.
  - o It discourages uses of chemical and pesticide and promotes the uses of eco-friendly means to maintain soil health and increase productivity.
  - o Increasing area under permaculture from current 108 million acres to 1 billion acres by 2050 could result in a total reduction of 23.2 gigatons of CO2, from both sequestration and reduced emissions.
  - o It incorporates traditional farming practices with modern technological and scientific knowledge to create efficient systems. It can also reduce the dependency of farmers on multi-national companies for genetically modified seeds.
  - o Instead of monoculture, permaculture uses polyculture where a diverse range of vegetation and animals are utilised to support each other to create a self-sustaining system.
- **Resource conservation technologies:** any method, material or tool which enhances the input use efficiency, crop productivity and farm gate income is termed as resource conservation technology. It includes:
  - o crop establishment system (zero tillage, minimum tillage or reduced tillage etc.);
  - o water management (adoption of laser land leveller technique); and
  - o nutrient management (use of site-specific nutrient management, slow release fertilizers etc.)
- **Enriching soil organic matter:** by applying Farm yard Manure, compost or by practising organic farming we can improve the soil organic matter which can help in improvement of soil health.
- **Adoption of Zero Budget Natural Farming (ZBNF):** It is a natural farming technique in which farming is done without use of chemicals and without using any credits or spending any money on purchased inputs. It has been developed by Subhash Palekar.

Food and Agricultural Organization of the United Nations (FAO), defines CSA as "agriculture that sustainably increases productivity, enhances resilience (adaptation), reduces/removes GHGs (mitigation) where possible, and enhances achievement of national food security and development goals".

Three Pillars Of CSA

- **Productivity:** CSA aims to increase agricultural productivity and incomes from crops, livestock and fish, food and nutritional security through sustainable intensification.
- **Adaptation:** CSA aims to reduce the exposure of farmers to short-term risks and strengthening their resilience by building their capacity to adapt and prosper in the face of shocks and longer-term stresses.
- **Mitigation:** CSA helps to reduce and/or remove greenhouse gas (GHG) emissions by avoiding deforestation from agriculture managing soils and trees in ways that maximizes their potential to acts as carbon sinks and absorb CO2 from the atmosphere.

Other features of CSA

- **CSA maintains ecosystems services:** Ecosystems provide farmers with essential services, including clean air, water, food and materials. It adopts a landscape approach that builds upon the principles of sustainable agriculture but goes beyond the narrow sectoral approaches that result in uncoordinated and competing land uses, to integrated planning and management
- **CSA has multiple entry points at different levels:** it goes beyond single technologies at the farm level and includes the integration of multiple interventions at the food system, landscape, value chain or policy level.
- **CSA is context specific:** It consider how different elements interact at the landscape level, within or among ecosystems and as a part of different institutional arrangements and political realities.
- **CSA engages women and marginalised groups:** It involve all local, regional and national stakeholders in decision-making to identify the most appropriate interventions and form the partnerships and alliances needed to enable sustainable development.

National Innovations on Climate Resilient Agriculture (NICRA)

- It's a network project of the Indian Council of Agricultural Research (ICAR) launched in 2011.

Objectives

- To enhance the resilience of Indian agriculture covering crops, livestock and fisheries to climatic variability and climate change through development and application of improved production and risk management technologies.
- To demonstrate site specific technology packages on farmers' fields for adapting to current climate risks.
- To enhance the capacity building of scientists and other stakeholders in climate resilient agricultural research and its application.
- The project consists of **four components** viz. Strategic Research, Technology Demonstration, Capacity Building and Sponsored/ Competitive Grants.

- o ZBNF reduces the cost of production down to zero due to utilisation of all the natural resources available in and around the crops. Farmers use earthworms, cow dung, urine, plants, human excreta and other biological fertilizers for crop protection.
- o **Features of ZBNF:**
  - ✓ **Inter-cropping:** Under this, combination of various crops is grown simultaneously to produce greater yield on given piece of land by making use of resources that may be utilised by single crop.
    - ▪ E.g. farmer grow combination crops such as pearl millet, red gram, foxtail millet, along with chillies and tomatoes or multiple crops with groundnut as main crop.
  - ✓ **Use of Bio-Fertilizers and elimination of chemical fertilizers and pesticides –** Farmers have a practice named **Jiwamrita** in which they apply fertilizers made of local cow dung and cow urine.
  - ✓ **Utilization of soil moisture:** Farmer of drought-prone areas adopt **mulching and Waaphasa** to reduce the loss of natural moisture of the soil, increase soil aeration, enhance soil health and fertility and ensure favourable microclimate in the soil

FOUR PILLARS OF ZERO BUDGET NATURAL FARMING

FIRST WHEEL **1** Bijamrita (Seed treatment)

SECOND WHEEL **2** Jiwamrita (No fertilizers No Pesticides)

THIRD WHEEL **3** Mulching (Soil, straw & live)

THIRD WHEEL **4** Waaphasa (Soil moisture)

  - ✓ **Reduce input cost of agriculture:** ZBNF through reduced expenditure on expensive inputs such as fertilizers and pesticides cuts down on input cost and increases farmer income.
  - ✓ **Contours and bunds:** to preserve rain water as it promotes maximum efficacy for different crops.
  - ✓ ZBNF also includes **replenishing water bodies** such as farm ponds to ensure water availability during dry spells.
  - ✓ Farmers also practice replenishing local species of earthworms on the farm to increase the organic matter in the soil which in-turn increases soil's capacity to retain moisture.
- **Establishing Agro-Ecological Zones and Farms**, establishing weather-based insurance programs, and leveraging Internet and Communication Technologies (ICTs) to disseminate information to farmers will be helpful in identifying and scaling up sustainable agricultural practices in different agro-climatic zones, to address the food security and for tackling climate change.
- **Other steps** like implementation of effective land use and management practices, such as the conservation reserve programme, forestry incentive programme, integrated nutrient management and conservation tillage, crop diversification help in increasing above ground carbon sequestration and mitigate climate change.

2.3. STEPS TAKEN GLOBALLY

2.3.1. PARIS CLIMATE DEAL

The Paris Agreement sets a roadmap for all nations in the world to take actions against climate change in the post-2020 period. It seeks to enhance global action against climate change and limit global warming while reflecting the principles of equity and common but differentiated responsibilities and respective capabilities (CBDR-RC), in the light of different national circumstances.

Salient features of the Paris Agreement

- **Aim:** to limit the increase in the global average temperature to well below 2°C above pre- industrial level and on driving efforts to limit it even further to 1.5°C.
- **Comprehensive and not just mitigation-centric:** It covers all the crucial areas identified as essential for a comprehensive and balanced agreement, including mitigation, adaptation, loss and damage, finance, technology development and transfer, capacity building and transparency of action and support.

- **Acknowledgement of the development imperatives of developing countries** by recognizing their right to development and their efforts to harmonize it with the environment, while protecting the interests of the most vulnerable.
- **Climate action plans:** Countries are required to communicate to the UNFCCC climate action plans known as Nationally Determined Contributions (Ndcs) every five years.
- **Finance by developed countries:** Developed countries are urged to scale up their level of financial support with a complete road map towards achieving the goal of jointly providing US$ 100 billion by 2020 and subsequently US$ 100 billion per year till 2025. Other Parties may also contribute, but on a purely voluntary basis.
- **Climate neutrality:** The balance between emissions and sinks should be reached in the second half of 21st century.
- **Performance evaluation:** Starting in 2023, a global stocktale covering all elements will take place every five years to assess the collective progress towards achieving the purpose of the Paris Agreement and its long-term goals.
- **Monitoring:** The Paris Agreement establishes a compliance mechanism, overseen by a committee of experts that operates in a non-punitive way, and is facilitative in nature.

Positive outcomes of the agreement

- **Universal nature of Agreement**: Previous agreements put all the responsibility for reducing emissions on rich countries. In the Paris Agreement, all 196 signatories agreed that every country must take action, while acknowledging that richer countries should start immediately and cut emissions more steeply, while poorer countries' contributions will depend on their individual situations.
- **Ratchet mechanism** i.e. the technical term for the agreement to submit new pledges by 2020. Most INDCs set goals through 2030, but if we don't improve upon them, it will be impossible to stay below 1.5°C and almost impossible to stay below 2°C. The ratchet mechanism requires countries to return to the table in 2020 and spell out their plans for 2025 to 2030. This creates the opportunity for the world to potentially put itself on a course to stay below 2°C.
- **Differential responsibility for finance:** Richer developing countries have started contributing to climate finance. At Paris, richer developing nations, in particular China, refused to accept formal responsibility to contribute, but they agreed to do it on a voluntary basis.
- **Developing Nation:** The developing countries were able to take heart from the fact that the all-important principle of 'differentiation' viz CBDR – has been retained, even though in a diluted form.
- **Role of Civil Society**: Agreement was reached against the backdrop of a remarkable groundswell of climate action by cities and regions, business and civil society. Countries at Paris recognized the enormous importance of these initiatives, calling for the continuation and scaling up of these actions as an essential part in the rapid implementation of the Paris Agreement.
- **Move towards Alternative sources of Energy**: The targets that nations have submitted ahead of the Paris conference show that demand for wind, solar and hydro will grow.

Concerns

- **Conflict between developed and developing countries**
  - **On 'transparency':** Developed countries want a 'common and unified' system to compare the climate actions undertaken under INDCs. Developing countries, however, want the CBDR-RC principle to be reflected in the transparency provision.
  - **'Stocktale' provision** for estimating the progress in the implementation of INDCs in 5 years. However, the developed countries want to put mitigation aspect specific and hold everyone accountable for that but not the finance and technology transfer provision.
- **The principle of 'historical responsibility' is conveniently ignored**, only current emissions are the basis of comparing mitigation strategies. So even if China uses more coal than India, it is ignored because there is an incremental decline even though from a very large base. This is not equity.

> **India's INDC**
> - Reduce emissions intensity of its GDP by 33 to 35% by 2030 from 2005 level.
> - Achieve about 40% electric power installed capacity from non-fossil fuel based energy resources by 2030 with help of transfer of technology and low cost international finance.
> - Create an additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent through additional forest and tree cover by 2030.

- **Voluntary nature of INDC**: commitments are voluntary, which means there is no penalty for failing to meet them. And even if they are met, they will not put the world on a path to less than 2°C of warming. Under the most optimistic assumptions, the INDCs still set us on a path to 2.7 to 3.5°C of warming.
- **Lack of Action on Fossil Fuel**: The U.N. approach has been to get countries to offer cuts in emissions and increases in renewable energy deployment, energy efficiency, or carbon sinks, but it has not called for restraining fossil fuel development.
- **Ignorance of Traditional Rights**: Indigenous rights of people suffering due to activities like fossil fuel extraction are mentioned in the preamble, but left out entirely of the operational text.
- **Non-compliance by the biggest emitter**: INDCs of rich countries are not enough to meet their historical obligations. Recently, U.S. withdraws from Paris Agreement poses threat to the very foundation of deal.
- **Unmet financial commitments**: The promise of contributing $100 bn annually to the Green Climate Fund by developed countries is still unmet. Although, the contribution has been increased, yet it is enormously short of what is actually needed.

2.3.2. BONN CLIMATE CHANGE CONFERENCE (COP-23)

Recently, the 23rd meeting of the Conference of the Parties **(COP-23)** of the United Nations Framework Convention on Climate Change **(UNFCCC)** concluded in Bonn, Germany. It is the first set of negotiations since the US withdrawal from the Paris deal.

Highlights

- **Adoption of Fiji Momentum for Implementation**: It set the stage for negotiation in 2018. It is divided into three parts which deals with:
  - **Completion of the Work Programme under Paris Agreement**: Parties have requested the Secretariat to develop an online platform to provide an overview of the work programme of the Paris Agreement being carried by different stakeholders.
  - **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 at the CoP 23.
  - **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.
- **Agriculture**: After six years, a decision was taken to deal with climate actions in agriculture. Parties are required to submit the following -- reporting on climate actions in agriculture; adaptation assessment methods for improvement of soil health, soil carbon and soil quality, as well as considerations for the improvement of nutrient use and manure management; and reporting on socio-economic and food security dimensions.
- **Gender Action Plan**: The first ever Gender Action Plan to the UNFCCC was adopted at COP23 (role of gender in climate actions had earlier been included in **the Lima work programme**). It lays five priorities areas:
  - capacity building.
  - knowledge sharing and communication
  - gender balance and women's leadership
  - coherence
  - gender responsive implementation of the convention and the Paris Agreement

- Post-2020 Actions are meant for all countries as per their nationally determined contributions (NDCs) under 2015 Paris Agreement.
- Pre-2020 Actions refer to existing obligations of small group rich and developed nations to take mitigation actions under Kyoto Protocol.
- Lima Work Programme on Gender (COP-2014): It aims to advance implementation of gender-responsive climate policies and mandates across all areas of the negotiations.

Other Initiative Started during the COP-23
- **Powering Past Coal alliance:** It is initiated by the UK and Canada. 15 countries have joined an alliance to phase out coal-based power by 2030.
- **Below 50 initiative:** It was launched by World Business Council for Sustainable Development (WBCSD. The goal is to create the demand and market for those sustainable fuels that produce at least 50% less CO_2 emissions than conventional fossil fuels.

- **Local communities and indigenous people's platform**: It is a new platform to include indigenous people's voices in the implementation of the Paris Agreement. The platform shall undertake activities to educate, build capacity and facilitate the incorporation of the diverse and traditional knowledge systems in international and national climate action policies. A full operationalisation is slated for April-May 2018.
- **Loss and damage**: No financial commitments was agreed upon between the negotiating parties on the issue of loss and damage.

2.3.3. SUVA EXPERT DIALOGUE ON LOSS AND DAMAGE

Why in news?

Recently Suva Expert Dialogue on loss and damage was held at Bonn to furthering collective understanding of approaches to address loss and damage, associated finance needs, and sources of support.

Loss and damage in UNFCC

- **1991:** Proposed by Vanuatu on behalf of Alliance of Small Island States (AOSIS) for the international community to provide "assurance" that climate change would not endanger their survival;
- **2010**: Establishment of the **Subsidiary Body of Implementation (SBI)** Work Program on loss and damage in Cancun (COP 16);
- **2013:** Establishment of the **Warsaw International Mechanism (WIM**) under the Cancun Adaptation Framework;

How to deal with Loss and Damage:

- **Effectively Addressing Slow Onset Processes** through developing a lowland drainage system, creating vegetative buffers and setback Areas, developing mobile marine protected areas Map flood zones and mapping flood zones etc.
- **Tackle Migration and Displacement especially from Small Island Developing States** through
  - Improved disaster risk reduction and management, climate change adaptation measures and developing a policy on "migration with dignity".
  - International collaborations such as Platform on Disaster Displacement and Global Compacts for safe, orderly and regular migration and on Refugees
- **Plugging Legal gaps for cross border movements** and development of the issue in the international and United Nations Framework Convention on Climate Change (UNFCCC) policy sphere.
- **Comprehensive Climate Risk Management which includes:**
  - Risk reduction through **structural measures** (e.g. engineering techniques to achieve hazard resistance structures), non-structural measures (e.g. knowledge, practice or agreements to reduce risks and impacts), legislative measures (such as building codes and standards) or early warning systems;
  - **Financial risk transfer** through climate risk insurances, catastrophe bonds or climate bonds;
  - **Risk retention** through contingent credits, contingency and reserve funds, contingency budgets and social protection;

WHAT IS LOSS AND DAMAGE

There is no specific definition of loss and damage. However, most people think of it as "liability and compensation.

"Loss" refers to complete loss such as loss of live, habitats, species, etc. "Damage" refers to something that can be repaired such as road and other infrastructures. These are due to climate change impacts countries can no longer adapt to.

IN A NUTSHELL...

In more simple terms, loss and damage is a concept where rich countries, who have historical responsibility for climate change, are asked to be liable to developing countries, who are already facing climate change impacts. Developing countries are asking for finance for loss and damage, which rich countries oppose.

Suva expert Dialogue
- It is an expert dialogue decided at COP23 in Bonn due to demands of developing nations for a **separate agenda item on loss and damage**.
- The **dialogue aims for facilitating the mobilization and securing of expertise, and enhancement of support, including finance, technology and capacity-building, for addressing loss and damage associated with the adverse effects of climate change.**

Warsaw International Mechanism on Loss and Damage
- It was established in COP 19 under UNFCCC in 2013
- It deals with Climate Change Impacts (Loss and Damage Mechanism), including extreme events and slow onset events, in vulnerable developing countries through-
  - Enhancing knowledge and understanding of comprehensive risk management approaches to address L&D;
  - Strengthening dialogue, coordination, coherence and synergies among relevant stakeholders;
  - Enhancing action and support, including finance, technology and capacity-building.
- It is also anchored in the Article 8 of the 2015 Paris agreement which emphasizes the "importance of averting, minimizing and addressing loss and damage associated with the adverse effects of climate change".

- o **Resilient recovery** after a disaster to "build back better" to prevent or reduce future L&D;
  - o **Transformational approaches** (e.g. diversification of livelihoods and migration) to address residual L&D
- **Climate Risk Insurance** through initiatives such as G7 "InsuResilience Initiative and G20 "Global Partnership for Climate and Disaster Risk Finance and Insurance Solutions"
- **Loss and Damage Finance** needs to be made available after a scientific assessment of L&D, developing financial instruments and plugging gaps in existing institutional arrangements within and outside of the UNFCCC including making GHG emitters accountable.

Concerns

- **Fair and just redressal mechanism which address communication gaps,** effectively targets financial support to make it reach to those who require it the most and addressing the technological gaps regarding risk assessment and reduction is yet to reach fruition.
- **Current mechanisms and financial instruments for managing climate have been inadequate in terms of lack of technical capacity and access to finance.**
- **Doubt over feasibility of climate-based insurance system due to** lack of terms of affordability of premiums by small and marginal farmers and the access of payouts (following an extreme event or weather-related disaster).
- **Gaps in current loss and damage mechanisms like slow speed of action** to address climate issue.

Conclusion

Small Island Developing States (SIDS) and Loss and Damage

Small Island Developing States (SIDS) and Loss and Damage
 	
- They are a group of 57 small island countries that tend to share similar sustainable development challenges, including small but growing populations, limited resources, remoteness, susceptibility to natural disasters etc.
- They were first recognized as a distinct group of developing countries at the United Nations Conference on Environment and Development in June 1992.
 	
Impact of Loss and Damage on SIDS
 	
The Intergovernmental Panel on Climate Changes 5th Assessment Report (AR5) describes the particular affectedness of SIDS to be mostly defined by:
 	
- **Sea level rise (SLR):**
  - o **Immediate effects** of SLR include saltwater intrusion of surface waters, increasingly severe storm surges, submergence and increased flooding of coastal land.
  - o **Longer-term effects** of SLR are increased erosion, saltwater intrusion into groundwater and a decline of coastal wetlands (saltmarshes, mangroves etc.)
  - o SLR **endangers freshwater supplies** (through salinization), food yields (through loss of arable land) and physical safety (through damages to coastal infrastructure such as roads, housing and sanitation systems), in several low-lying Small Island States and leads to the displacement of people
- **Tropical (and extra tropical) cyclones** cause various risks including certain vector, food- and water-borne diseases, deterioration of water quality and quantity, destruction of infrastructure and loss of productive farmland, loss of livelihoods, coastal settlements, ecosystem services and economic stability to the decline and possible loss of coral reef ecosystems. For some SIDS, their **very existence could be threatened** by SLR.
- **Ocean acidification,** which result in reduced coral growth and coral skeleton weakening which will have impacts on coastal protection and marine biodiversity.

- The Suva dialogue is expected to help in furthering collective understanding of approaches to address loss and damage and identify finance needs for addressing the gaps that exist in meeting these needs in developing countries.
- Further, the areas where finance approaches have not yet been matched like, addressing slow onset events or for recovery and rehabilitation from climate-related events can be better addressed through such forums in future.

2.3.4. INTERNATIONAL SOLAR ALLIANCE (ISA)

Why in news?

Recently ISA members met at its first summit in India.

What is international solar alliance?

- It is an alliance of countries, which come either completely or partly between the Tropic of Cancer and the Tropic of Capricorn.
- These countries are known as **Sunshine countries** and include India, France, Australia, Bangladesh, Comoros, Fiji, France etc.

Mains 365 – Environment

- It is a **treaty-based** intergovernmental organization. Of the 121 prospective countries, So far 61 countries have signed the ISA agreement and 32 of them ratified it.
- It was jointly launched by **India and France in November 2015 in Paris** on the side-lines of the UN Climate Conference (COP-21).
- Headquartered in India, its secretariat is located at **National Institute of Solar Energy, Gurugram, Haryana.**

What is its significance?

- Its main aim is to **harmonize and aggregate demand for solar finance, solar technologies, innovation, research and development, and capacity building.**
- It expects to facilitate the addition of **1,000 GW of solar energy by 2030**.
- It aims to mobilize **USD 1000bn** in to solar energy by 2030 and facilitating and accelerating the **large-scale deployment of solar energy in developing countries** in order to meet **soaring energy demand and help fight climate change.**
- It is first **specialized intergovernmental body on solar energy** expected to drive R&D on solar energy (from electricity generation to storage capacity).
- It will **mobilize investments** from various sources for deployment of solar energy. It has already got **multilateral agencies like the World Bank, the Asian Development Bank (ADB) and the European Bank** etc. on board.
- It stresses the **importance of reducing costs through financial mechanisms**, promoting universal energy access and helping the creation of common standards to ensure proper quality of products use by member countries.
- Most of the countries that are part of the ISA are from Asia, Africa, South America and the Pacific, are **hydrocarbon-deficit with high energy demand** and are grappling with issues ranging from **lack of infrastructure, lack of manufacturing capacity and high energy tariffs**. Therefore, it is increasingly important for these countries to get access to renewable energy (RE) at affordable prices.

Importance for India

- It is the **first international organization to be permanently headquartered in India**. This will give India the opportunity to position itself in **a key global leadership role** in the arena of climate change, RE and sustainable development.
- During the Summit, India kicked off **27 projects in 15 countries** enabling it to **increase the scale and reach of its global engagements.**
- It will make India more **attractive destination for investments** in solar energy.
- It will help India in achieve its **renewable energy** targets. Thus, it reflects India's commitment to fulfilling i**ts global commitment on addressing climate change in a time-bound manner** and help boost global confidence in India's capacities.
- It is expected to **spur innovation** in the Renewable Energy and help develop **independent manufacturing capabilities** of **RE equipment like solar panels** through initiatives like 'Make in India'.

> The **short-term priorities** that have been identified as **action points for the ISA** are as follows:
> - Assisting member countries in drafting solar policies;
> - e-Portal to offer 24/7 real time suggestions for solar projects;
> - Creating **expert groups for development of common standards**, test, monitoring and verification protocols;
> - Working with ISA member countries to strive for **universal access to solar lighting;**
> - **Exchanging best practices** and work with member countries in designing financing instruments to mitigate risk and catalyse partnerships to boost investment;
> - Encourage **collaboration in solar resource mapping** in member countries and in deployment of suitable technologies;
> - Facilitating **preparation of plans for solar energy development** and deployment;
> - Encouraging **industry cooperation** among ISA member countries;
> - Forging cooperative linkages on development of Centre of Excellence for R&D in ISA member countries;
> - **Designing training programs** for students/engineers/ policy makers, etc. and organizing workshops, focused meetings and conferences.

- It is expected to address key lacunae in the use of solar technology including **lack of systematic information about the on-ground requirements, capacity building and a shortage of suitable financing to make new technologies affordable.**

Programmes and initiatives launched by ISA

Since 2016, the ISA has launched many initiatives:

- **Scaling the Solar applications in Agriculture**
  - It aims to bring **reliable, affordable and tailored-to-needs solar applications** within the reach of all farmers in ISA countries.
  - It is expected to serve the farming communities in the ISA member countries on several fronts **including storage of agro-produce, space and water heating, crop drying, creation of livelihood opportunities in rural areas.**
- **Affordable finance at scale** for mobilizing low cost capital in solar power sector.
- **Scaling solar mini grids** for improving solar generation capacity of ISA nations especially island nations.
- The ISA is planning two further programs: **a rooftop solar program for scaling up residential installations across member countries, and Scaling Solar E-mobility and Storage**.
- The alliance has also introduced a **Common Risk Mitigation Mechanism (CRMM)** feasibility study to mitigate financial risks in global solar markets. This instrument will help diversify and pool risks on mutual public resources and unlock significant investments.
- The ISA has also invited several financial institutions to form a $ 300 billion **global risk mitigation fund.**

Challenges

- Securing **adequate financing will continue to remain a challenge** from individual countries, international organisations, non-governmental organisations and multilateral development banks.
- While the cost of solar installations has been decreasing worldwide, it still remains high in many of the ISA countries. **Most African countries** have high tariffs for photo voltaic (PV) cells, modules and semi-conductor devices. **The Pacific island countries** have the highest tariff rates for solar products, with some going **as high as 30-40 per cent.**

2.4. STEPS TAKEN BY INDIA TO COMBAT CLIMATE CHANGE

2.4.1. NATIONAL ACTION PLAN ON CLIMATE CHANGE (NAPCC)

Government of India has launched eight Missions as part of the National Action Plan on Climate Change (NAPCC) in specific areas which include assessment of the impact of climate change and actions needed to address climate change.

- **National Solar Mission:** The NAPCC aims to promote the development and use of solar energy for power generation and other uses with the ultimate objective of making solar competitive with fossil-based energy options.
- **National Mission for Enhanced Energy Efficiency:** NMEEE consist of four initiatives to enhance energy efficiency in energy intensive industries which are as follows:
  - **PAT (perform, achieve & trade) scheme:** Improving efficiency in energy intensive sector.
  - **Energy Efficiency Financing Platform (EEFP):** provides a platform to interact with financial institutions and project developers for implementation of energy efficiency projects
  - **Framework for Energy Efficient Economic Development (FEEED):** focuses on developing appropriate fiscal instruments to promote energy efficiency financing

> **Issues related to NAPCC**
>
> - **Structural weaknesses** – It is a collection of independent plans, lacking an integrated vision. Several ongoing schemes such as AMRUT are aligned with the mission objectives, but no convergence is attempted.
> - **Performance issues:** Some missions are too broad, have long gestational periods (e.g. Green India Mission) and lack quantifiable targets, hampering their progress.
> - **Lacks expertise:** Low R&D, lack of skilled manpower and expertise has slowed missions like NMSKCC, NMSA, NMSHE.
> - **Lack of efficient functional decentralization** is compounded by poor capacity building at the state/local level.
> - **Lack of market-based investments** resulting in sole dependence on limited budgetary resources.
> - **Ineffective monitoring mechanism:** Progress has to be reported to the PM's Council on Climate Change, but the council has met only once since its reconstitution.
> - **Other impediments** – delays in project clearance, conflicting policy issues (e.g. delays in renegotiation of power purchase agreements).

Mains 365 – Environment

- o **Market transformation for Energy Efficiency (MTEE):** Accelerating shift toward energy efficient appliances.
- **National Mission on Sustainable Habitat:** To promote energy efficiency as a core component of urban planning, the plan calls for:
  - o Extending the existing Energy Conservation Building Code;
  - o A greater emphasis on urban waste management and recycling, including power production from waste;
  - o Strengthening the enforcement of automotive fuel economy standards and using pricing measures to encourage the purchase of efficient vehicles; and
  - o Incentives for the use of public transportation.
- **National Water Mission:** With water scarcity projected to worsen as a result of climate change, the plan sets a goal of a 20%improvement in water use efficiency through pricing and other measures.
- **National Mission for Sustaining the Himalayan Ecosystem:** The plan aims to conserve biodiversity, forest cover, and other ecological values in the Himalayan region, where glaciers that are a major source of India's water supply are projected to recede as a result of global warming.
- **National Mission for a "Green India":** Goals include the afforestation of 6 million hectares of degraded forest lands and expanding forest cover from 23% to 33% of India's territory.
- **National Mission for Sustainable Agriculture:** The plan aims to support climate adaptation in agriculture through the development of climate-resilient crops, expansion of weather insurance mechanisms, and agricultural practices.
- **National Mission on Strategic Knowledge for Climate Change:** To gain a better understanding of climate science, impacts and challenges, the plan envisions a new Climate Science Research Fund, improved climate modelling, and increased international collaboration. It also encourages private sector initiatives to develop adaptation and mitigation technologies through venture capital funds.

Significance of NAPCC

- It played a key role in **mainstreaming mitigation and adaptation** measures across the policy agenda of the government.
- Introduction of **innovative market-based mechanisms** and policies – PAT Scheme, Solar Rooftop Investment Program etc.
- **Establishment of databases** in public domain such as Water Resource Information System (WRIS).
- Development of **institutions and partnerships** at both national and international levels – E.g. India-led International Solar Alliance.
- **Mission specific successes** -
  - o National Solar Mission - Solar tariff achieved grid parity. Many initiatives have been launched such as Ultra Mega Solar Power Projects, Green Energy Corridor etc.
  - o National Mission on Sustainable Habitat – It promoted sustainable urbanization. Many related initiatives are Adoption of Energy Conservation Building Code, AMRUT, Smart Cities etc.

2.4.1.1. PAT SCHEME

About PAT (perform, achieve & trade) scheme

- It was launched by **Bureau of Energy Efficiency (Ministry of Power)** under the **National Mission for Enhanced Energy Efficiency (NMEEE)** to save energy in eight energy intensive sectors (eg- Steel, cement, textile etc.), under the Energy Conservation Act, 2001.
- It is a **market-based mechanism** in which sectors are assigned efficiency targets. Industries which over-achieve target get incentives in the form of **energy saving certificates (ESCert).**
- These certificates are tradable at two energy exchanges viz. **Indian Energy Exchange and Power Exchange India,** where it can be bought by other industries which are unable to achieve their targets.
- **PAT cycle I (2012-13 to 2014-15),** was applicable on **eight energy intensive sectors**. There are about **478 numbers of Designated Consumers in these 8 sectors** which account for about 165 million tonnes oil equivalent of energy consumption annually (**33% of India's primary energy consumption**).
- **PAT cycle II (2016 2018-19):** includes **8 sectors of PAT I and 3 new sectors** viz, railways, discoms and petroleum refineries.
- **PAT cycle III (2017-20):** Under it, 116 new units have been included and given a reduction target of 1.06 million tonnes of oil equivalent.

Outcome of PAT scheme

- It shows that energy-intensive industries in India have reduced their carbon emissions by 31 million tonne, or 2% of India's total annual emissions and saved over Rs 9,500 crore through more efficient energy use in the three years between 2012 and 2015.
- It also indicates towards **gradual greening of Indian industry,** as 5,635 MW of electricity generation was avoided, accounting to monetary savings of Rs 37,685 crore.

2.4.2. ENVIRONMENT IMPACT ASSESSMENT (EIA)

Government in 2017 had issued a draft notification to amend the Environment Impact Assessment (EIA) notification, 2006.

What is Environment Impact Assessment (EIA)?

- It's a process of evaluating the likely environmental impacts of a proposed project or development, taking into account inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse.
- It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment and present the predictions and options to decision-makers.
- It is notified under **the Environment (Protection) Act 1986**. It is used by Environment Ministry, as a major tool for minimizing the adverse impact of rapid industrialization on environment and for reversing those trends which may lead to climate change in long run.

> **Highlights of Proposed Amendments**
> - **Increases the ambit of state government authorities** to grant environmental clearances (ECs) particularly related to mining projects involving non-coal minerals and minor minerals, as well as river valley/irrigation projects.
>   - Central authority will grant clearance only to those non-coal mining projects requiring 100 or more hectares of land lease against earlier criteria of 50 or more hectares.
> - **Special circumstances** such as for river valley projects falling in more than one state, the Central government would be the appraising authority.
> - **Relaxation of Environment Clearance (ECs):** For the project involving changes in irrigation technology (having environmental benefits) which might lead to an increase in CCA (cultural command area) but no increase in dam height or submergence, ECs will no longer be required.

Strategic environment assessment

- It is the process by which environmental considerations are required to be fully integrated into the preparation of Plans and Programmes and prior to their final adoption.
- State Environment Agency represents a proactive approach to integrating environmental considerations into the higher levels of decision-making.
- **Process for EIA (infographic)**

Limitations Of EIA

- **Lack of Expertise: A**gencies involved neither have the capacity to handle increased work load, nor the system of accountability is in place to ensure some transparency.

- **Conflict of Interest:** it has been found that majority of EIA process is funded by agencies whose interest lie in the faster ECs which may raise the question about credibility of EIA.
- **No Accreditation** - of experts who conduct the EIA, which might lead to fraudulent EIA and fudging of data for the private gains.
- **Involvement-** Limited involvement of public and government agencies in the initial phases hampers the EIA acceptability among the public.
- **Alternatives** of project, which are going to have lesser impact on environment, have not been suggested in majority of cases.
- **Local Knowledge-**Most reports of EIA do not heed to local knowledge or local input. Moreover majority of reports are not translated to local languages.
- **Lack of comprehensive data** - the data collection exercise is restricted to one session of the year and conclusion of EIA on the same data would be erroneous.

- **Decentralization** of powers to state authority might lead to corrupt practices e.g. project developers may divide the big projects into phases, to avoid scrutiny at central level.

Way forward

- **Independent oversight authority-** should be constituted at central level, for checking the credibility of EIA.
- **Simplification:** of technical details in the EIA and more transparency in various clauses such as definition of **adverse impact of project** must be made clear.
- **Prior informed consent:** of local stakeholders such as villagers, urban local bodies, Panchayat body should be made compulsory clause while granting the ECs.
- **Robust Mechanism:** such as; Grievance Redressal Mechanism, Advisory Experts Committee and capacity building approach involving all the stakeholders is the need of the hour.

2.4.3. GREEN FINANCE ECOSYSTEM IN INDIA

Why in news?

Recently, establishment of green finance ecosystem in our country has been stressed upon by various experts.

Need for green finance

- According to UNEP, costs of adapting to climate change in the developing countries by the year 2030 would escalate to US$ 140 billion to US$ 300 billion per year.
- India is the **world's fourth-largest carbon emitter.** Green finance is needed to achieve our Intended Nationally Determined Contributions (**INDCs**).
- The country needs about $4.5 trillion in infrastructure funding by 2040. Nearly $200 billion will be required to generate 175GW renewable energy by 2022, $667 billion for electric vehicles programme and about $1 trillion for affordable green housing.

> **What is Green Finance?**
> Green finance is a broad term that can refer to financial investments flowing into sustainable development projects and initiatives, environmental products, and policies that encourage the development of a more sustainable economy.

Climate Finance Architecture in India

Union Budget (including budgetary support to National Missions and other climate strategies) **State Budget**	Climate Funds - NCEF, NAF, NDRF, CAMPA (funded by union budget & cesses)	Private climate Finance - CDM, Debt finance, Private equity, venture capital	International Climate Finance Multilateral Funds Bilateral Funds International Private finance

> **Major global Initiatives**
> **The Green Climate Fund (GCF)**
> - It is a global fund created to support the efforts of developing countries to respond to the challenge of climate change.
> - It was set up by the 194 countries who are parties to the United Nations Framework Convention on Climate Change (UNFCCC) in 2010, as part of the Convention's financial mechanism.
> - It aims to deliver equal amounts of funding to mitigation and adaptation.
> - These funds come mainly from developed countries and also from some developing countries, regions, and one city (Paris).
>
> **The Global Environment Facility**
> - It was established on the eve of the 1992 Rio Earth Summit to help tackle our planet's most pressing environmental problems.
> - The GEF also serves as financial mechanism for the conventions like CBD, UNFCCC, UNCCD, Stockholm convention and Minamata convention.
>
> **The Clean Development Mechanism (CDM)**
> - It is one of the mitigation instruments under the Kyoto Protocol. The CDM allows emission-reduction projects in developing countries to earn certified emission reduction (CER) credits, each equivalent to one tonne of CO2. These can be traded and sold and used by industrialized countries to meet a part of their emission reduction targets under the Kyoto Protocol.

Current scenario in India

- **Banks and NBFCs have been the primary sources** of green infrastructure funding in India.
- India is also implementing a dedicated National Adaptation Fund for Climate Change **(NAFCC) under NABARD.**
- India's first green bonds were issued in 2015. India has raised over $6 billion via green bonds, of which one third were issued in 2017. (**China was the top green bonds issuer** in 2017 with a 22% share, followed by the US (13%) in the $120 billion global market).

- India INX of GIFT City recently listed Indian Railways Finance Corporation's **(IRFC's) first green bond** on its global securities market (GSM).
- BSE's has also launched a green index called **BSE Greenex.**
- The Reserve Bank of India has included **renewable energy project financing as a part of priority sector** lending category.
- **International Solar Alliance led by India has targeted to mobilise $1 trillion** in financing and deploy solar capacities of 1,000 GW by 2030 as part of the strategy for the mitigation of climate change.

Challenges in India

- **Asset-liability mismatch in banks:** Indian banks have a limited scope for providing long-term debt due to high NPAs.
- **Longer gestation period** and capacity constraints involved in green projects.
- **Lack of developed Green finance trade market** in developing countries. Also, the implementation of green financing requires financial institutions to conduct environment due diligence of the projects which may be costly and tedious.
- The current regulatory restrictions allow insurance companies and pension funds to invest **only in AAA-rated bonds.**
- Green finance is currently focussed on investment in renewable energy and there is lack of emphasis on **greening coal technology despite** coal based power accounting for around 60% of installed capacity.
- An international agreed definition of green financing must be arrived at to prevent **over accounting**.
- The mobilization of private green finance is still lacking.
- The **GST subsumed the three environment-related cesses**: Swachh Bharat Cess and Clean Energy Cess and the Water Cess delivering a big blow to clean energy financing.
- **Lack of clarity in government policy**: As of now a clear policy which guide and incentivise financial institutions on green financing is not there. Also, implementation is a problem. Only 10% of renewable energy investors have received promised government subsidies.

Suggestions for India

- The regulatory framework should be eased in order **allow investments in lower rated bonds too.**
- The government should **consider making green bonds tax-free.**
- **Smart Cities project** can attract huge capital from these bonds.
- **Sovereign funds** like GIC, Abu Dhabi Investment Authority, and **multilateral agencies** such as International Monetary Fund, International Finance Corp. and ADB among others, are proactively channelling funds to invest in green sustainable projects.
- We should **not confine the "green projects" status only to solar or wind energy** and rather expand to Sustainable land use, water and urban waste management, green buildings, clean transportation, pollution prevention and control systems, and energy efficiency projects, etc.
- Companies undertaking CSR activities ensuring environmental sustainability may be given priority in credit allocation. A mandatory certification body may be set up to screen green applications and sanction loans
- NGOs may be united and roped in to sensitize ordinary customers and create a nudge effect for banks to undertake green financing
- Innovations like the Solar Investment Trusts that provide equity funding to multiple small-scale projects, and Sustainable Energy Bonds that channel finances from impact investors through NBFCs can propel the market
- There is need to mainstream green finance so as to incorporate the environmental impact into commercial lending decisions while simultaneously balancing the needs of economic growth and social development.

2.4.4. GREEN SKILL DEVELOPMENT PROGRAMME

Why in news?

The government is expanding the Green Skill Development Programme (GSDP) to an all-India level.

More on news

- Utilising the vast network and expertise of ENVIS Hubs/RPs, the Ministry of Environment, Forests & Climate Change (MoEF&CC) has taken up an initiative for skill development in the environment and

forest sector to enable India's youth to get gainful employment and/or self-employment, called the **Green Skill Development Programme** (GSDP).

- After a pilot project in 2017, now ministry has taken following steps to expand it:
  o **Increased budget allocation** for ENVIS in budget 2018-19 by 33%. Out of this, the training courses under GSDP will be funded.
  o **Increased target:** A total of 5 lakh 60 thousand people will be imparted training between 2018-19 and 2020-21.
  o **More green skills now:** The government has identified 35 courses including pollution monitoring (air/water/noise/soil), effluent treatment plant operation, forest management, water budgeting etc.

Why important?

- **Skilling the unskilled:** By 2022 India will need around 10.4 crores of new workforce in various sectors and hence skill development is prerequisite to meet the demand.
- The trainees of this programme can also be exposed for the **expertise on wildlife conservation**, nurseries, horticulture etc. and can be absorbed with Department of Environment and Forests of the State Governments as well
- **Focus on equity:** the programme aims to train youth who have not been able to continue higher education due to different financial or social constraints but has an urge to learn new things and do something fruitful.

> **Green Skills:** Green skills are those skills needed to adapt products, services and processes to climate change and the related environmental requirements and regulations. They include the knowledge, abilities, values and attitudes needed to live in, develop and support a sustainable and resource-efficient society. (OECD definition)
>
> These skills are required in areas such as such as Renewable energy, Waste water treatment, Climate resilient cities, Green construction, Solid waste management etc.

- The green skilled workforce having technical knowledge and commitment to sustainable development will help in **attainment of SDGs, INDCs and National Biodiversity Targets**.
- Green skill is crucial for making **a transition from energy and emission intensive economy to cleaner and greener production** and service patterns.

2.5. OTHER DEVELOPMENTS

## 2.5.1. INCREASING CARBON SINK

Why in news?

Ministry of Environment and Forest is working on a **landscape-based catchment treatment plan** to achieve its commitment under INDC.

Catchment treatment plan & its significance

- **Catchment area** (area from which all precipitation flows to a single stream or set of streams) can act as a **natural carbon sinks** that can sequester substantial amounts of atmospheric CO2 in the form of organic carbon in the soil.
- Improving catchment of water can be done through
  o **Biological Intervention** through afforestation drive and increasing soil porosity through vermiculture

WHY CARBON SINKS MATTER

If It Weren't For The Oceans, Soils and Plant CO₂ Concentrations Would be Over 500ppm

etc. as porous soil is able to hold more water than compacted soil.
  o Employing **mechanical means** such as check dams, underground reservoirs or cement slabs that can channelise the rainwater
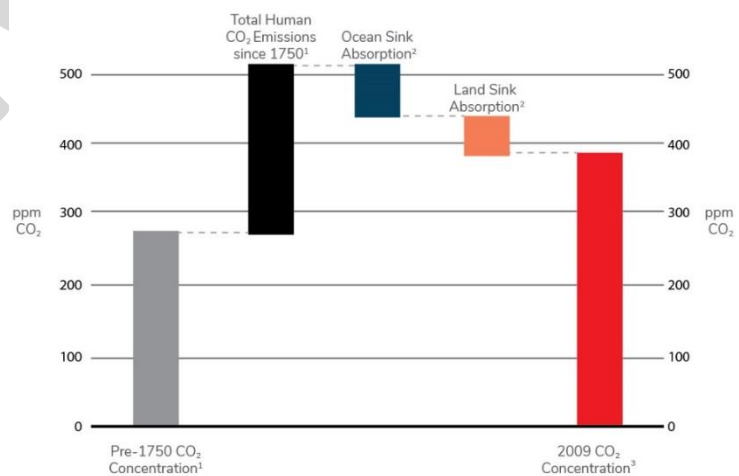
> - A **carbon sink** is a natural or artificial reservoir that accumulates and stores some carbon-containing chemical compound for an indefinite period. The process by which carbon sinks remove carbon dioxide (CO2) from the atmosphere is known as carbon sequestration.
> - **Carbon Sequestration** is the process by which CO2 is captured from the atmosphere for long-term storage to slow down the accumulation of greehouse gases. E.g.: Afforestation, Carbon Capture and Storage (CCS) techniques.

further into the soil. Planned management of catchment areas will prevent soil erosion, help recharge groundwater and d eter forest fires by retaining moisture in the soil.

- It will minimise human-animal conflict since such a plan will increase availability of water and fodder inside forests and recharge groundwater.

Step taken to increase Carbon Sink by GOI
- **Green India mission under NAPCC** is implementing the plan to plant 10 million hectares by 2030. This will create carbon sinks to the tune of 2.5 billion tons.
- **CAMPA Fund:** It will be used for afforestation to compensate for loss of forest cover, regeneration of forest ecosystem, wildlife protection and infrastructure development.
- **National Afforestation Program:** It is being implemented for afforestation of degraded forest lands
- **Nagar Vana Udyan Yojana:** A minimum of 25 hectares of forests will be created in the city.
- **A National Adaptation Fund for Climate Change:** To assist State and Union Territories vulnerable to the adverse effects of climate change in meeting the cost of adaptation.
- **"Desertification and Land Degradation Atlas of India"** by Department of Space. This provides detailed information on the present land use, and the severity of land degradation in different states from 2005 to 2013 which will provide the basis for future land use in the country.

2.5.2. GEO-ENGINEERING

Geoengineering/Climate Engineering schemes are projects designed to tackle the effects of climate change directly, usually by removing CO_2 from the air or limiting the amount of sunlight reaching the planet's surface.

It is an attempt to rebalance Earth's climate through direct, large-scale, human change to the planet's land, oceans, or atmosphere. Various method of Geo-engineering are:

Carbon Capture Technology

- **Carbon Capture and Storage (CCS):** It is the process of capturing waste carbon dioxide (CO_2) from large point sources, such as fossil fuel power plants, transporting it to a storage site, and depositing it where it will not enter the atmosphere, normally an underground geological formation.
  - As per global carbon capture and storage (CCS) institute, India is one among 24 developing countries that are currently engaged in CCS activities such as capacity development, planning and pre-investment and project development.
- **Carbon Capture Utilization Storage (CCUS):** is a process that captures carbon dioxide emissions from sources like coal-fired power plants and either reuses or stores it so it will not enter the atmosphere.
- In **CCS, emissions** are forced into underground rocks at great cost and no economic benefit while **CCUS aims** at using CO_2 emissions by exploiting the resource itself and creating new markets around it.

Significance
- **Commercial value of CO_2:** It has commercial and industrial uses, particularly for Enhanced Oil Recovery (EOR) in depleting oil fields. It has the ability to change the properties of oil and make it easier to extract.
- CCUS will make great contribution to the development of **low carbon economy for the world**.
- CCUS could **improve the contradiction** between economic development and environment protection.
- **CCUS is Imperative:** Despite the adoption of alternative energy sources and energy efficient systems to reduce the rate of CO_2 emissions, the cumulative amount of CO_2 in the atmosphere needs to be reduced to limit the detrimental impacts of climate change [IPCC, 2013]. Therefore, regardless of the deployment of clean and efficient energy solutions, CCUS technologies need to be implemented.

Solar Geo-Engineering/Solar Radiation Management (SRM)

- It is a process through which the reflectivity (albedo) of the Earth's atmosphere or surface is increased, in an attempt to offset some of the effects of GHG-induced climate change.
- The technique mimics big volcanic eruptions that can cool the Earth by masking the sun with a veil of ash or similar other things.
- The methods include:
  - **Space-Based Options/Space Sunshades**

Possible Impacts of SRM
- It may stop the rise in global temperatures but would not directly reduce concentrations of greenhouse gases.
- Stratospheric aerosols might delay the regeneration of the ozone layer. It can also lead to decrease in rainfall in the Asian and African monsoons, thereby affecting food supplies, the flow of rivers like Ganges and Amazon etc.
- Local imbalances in radiative forcing could still lead to regional climate shifts.
- There is no regulatory framework or international governing body to test the methods.

e.g. using mirrors in space, placing vast satellites at Lagrange Point 1, space parasol, etc.

- o **Stratosphere-Based Options** such as injection of sulfate aerosols into the stratosphere.
- o **Cloud-Based Options/Cloud Seeding** e.g. Marine Cloud Brightening (by spraying a fine seawater spray in the air), seeding of high cirrus clouds with heterogeneous ice nuclei.
- o **Surface-Based Options** e.g. whitening roofs, growing more reflective crops, etc.

2.5.3. NEGATIVE EMISSION TECHNOLOGIES

A **UN emission gap report** encourages negative emission technologies as it explores removing carbon dioxide from the atmosphere as an additional way to mitigate climate change, over and above conventional abatement strategies. Some highlights of report include:

- **Emphasis on certain Sectors:** Cost-effective measures in six sectors viz. agriculture, forestry, buildings, energy, industry, and transport, could reduce emissions by up to 36 $GtCO_2e$ a year by 2030,
- **Committed action from G20 countries** as they collectively generate around 75% of GHG emissions. Their success in implementing (or exceeding) their NDC pledges will have a major impact on the achievement of the global temperature goals.
  - o It has pointed that three of the G20 parties — China, the EU, and India — are on track to meet their Cancun climate pledges (In Cancun, Mexico, in 2011, nations had agreed to GHG emission cuts ahead of 2020).


- According to it, to meet climate targets 80 % of the world's coal reserves along with approximately 35% of oil reserves and 50% of gas reserves need to remain in the ground.
- **It recognizes the role of non-state actor** like action by cities, states, provinces, and non-state actors like corporations in reducing emission intensity.

Physical potential and technical feasibility of the technological intervention must be understood properly along with their environmental and political consequences. It must be an integrated research effort that considers the physical, ecological, technical, social, and ethical issues related to Geoengineering.

2.5.4. ENVIRONMENTAL REFUGEE

Why in news?

Recently, World Refugee day was observed on 20th June, 2018, which indicates toward the glaring discrimination being faced by the Environmental Refugee/ Climate Refugee.
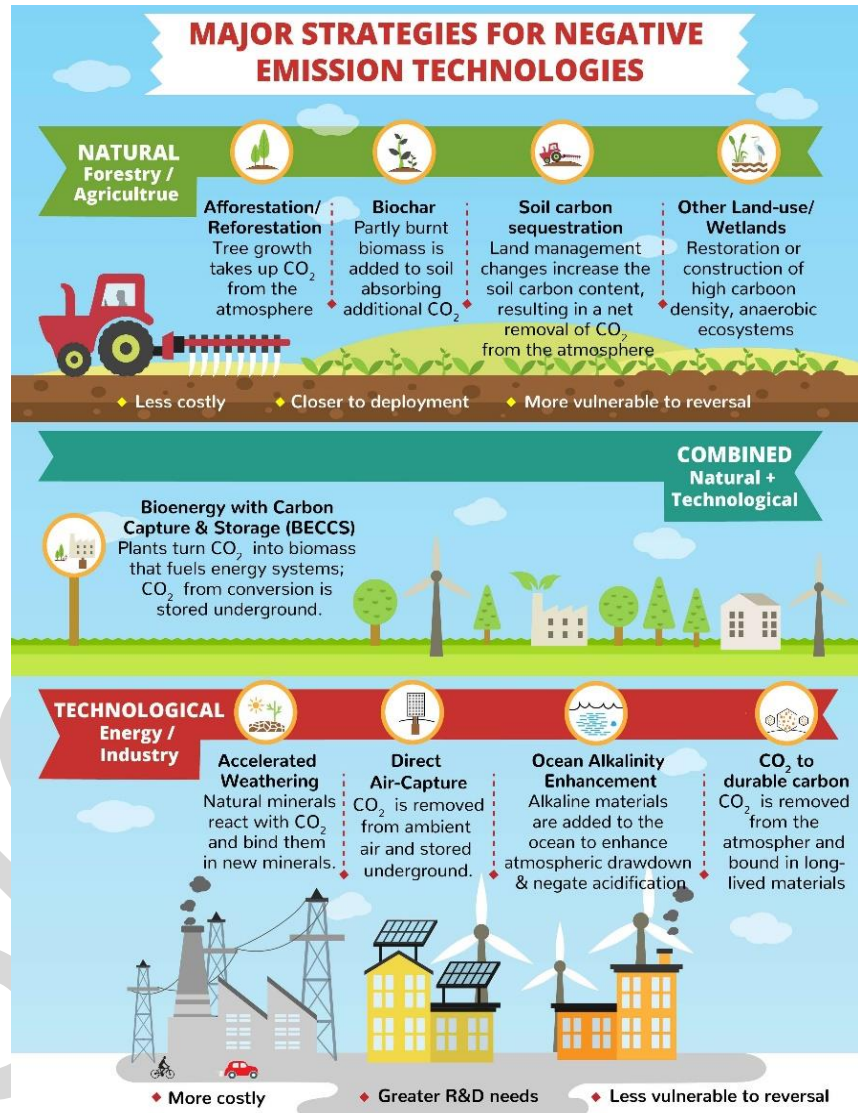
Background

- **Definition:** According to **International Organization for Migration, Environmental migrants** are persons or groups of persons who, predominantly for reasons of sudden or progressive change in the environment that adversely affects their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad.

- According to **Internal Displacement Monitoring Centre**, every year since 2008, an average of 26.4 million persons around the world have been forcibly displaced by floods, windstorms, earthquakes or droughts.

- **Vulnerable Countries**: Disaster displacement occurs mostly in low and lower-middle income countries, and is expected to increase in the future with the impacts of climate change and more extreme weather.

- According to an **UN Office for Disaster Risk Reduction (UNISDR) report**, India has been ranked as the **world's most disaster-prone country** for displacement of residents.

> **UN Refugee Convention (1951)**
> - It grants certain rights to people fleeing persecution because of race, religion, nationality, affiliation to a particular social group, or political opinion.
> - The rights they are entitled to follow the principles of non-discrimination, non-penalisation, and nonrefoulement.
> - **Cross-border displaced** who have migrated due to climate change are not recognised as refugees under the 1951 Refugee Convention or its 1967 protocol, and thus do not qualify for protection under national or international legal frameworks for refugee protection.

Issues Faced by Environment Refugee

- **Slow onset events and implications for human rights:** It includes sea level rise, increasing temperatures, ocean acidification, glacial retreat, salinization, land and forest degradation, loss of biodiversity, and desertification.
  - It can negatively impact an array of internationally guaranteed human rights by denying the rights to adequate food, nutrition, livelihood, water, health, and housing.
  - People especially in vulnerable situations are at the greatest risk of suffering human rights harms as a result of their adverse effects.
  - It has affected millions of people, more than double than those affected by storms and extreme events over the same period of time.

- **Impact on Cultural Heritage**: The loss of traditional territories land threatens the existence of traditional and cultural heritage of minority and indigenous groups

- **Impact on Right to work**: Migrant are **often abused and discriminated** in migrated country during work, which is against International Labour Organization's (ILO) Declaration on the Fundamental Principles and Rights to Work.

> **Other Challenges faced by migrants**
> - **Trafficking and forced labour**: Women and children are often an easy target for inhuman treatment.
> - **Harassment by police and officials** of states where they have migrated to
> - **Exploitation** by local contractors who force them to accept lower wages.
> - No access to schools for their children and no health services for the family.
> - **Disruption** of cultural and community ties.
>
> **ILO right of Migrant**
> - Freedom of association and the effective recognition of the right to collective bargaining,
> - Elimination of forced or compulsory labour,
> - Abolition of child labour and
> - Elimination of discrimination in respect of employment and occupation.

- **Cases of Migration Emergencies**: It refer to construction of barriers to entry and practices such as the use of violence, pushbacks, dangerous interceptions, the erection of fences, and administrative sentences that put migrants at risk.

- **Breeding ground for extremism**: Displaced people are often more susceptible to recruitment by terrorist organisation.

- **Vulnerability of South Asia**: Region has experienced slow onset changes like desertification, glacial melting, drought, riverbank erosion, sea water intrusion etc.
  - It's home to 64% of the world's total population that is exposed to floods annually
  - **India's Vulnerabilities**: India's 6% population, lives 10 metres or less above sea level. Any change in sea level can trigger mass displacement, and other issues like food shortage, salt water intrusion, decline in livelihood, health risk like epidemic, etc.

Mains 365 – Environment

Way Forward

- **Accepting Principle of non-refoulement**: State must provide human rights protections for all people under its jurisdiction, including migrants in irregular situations.
- **Human rights-based approach:** States must be obligated to respect and protect their commitment through robust implementation of human rights obligations to address the needs and vulnerabilities of those adversely affected by slow onset events.
- **Adopting principle of common but differentiated responsibility (CBDR)** alongwith **polluter pays principle**, and **climate justice approach** , so that most responsible for climate change should bear the primary responsibility for addressing its impacts.
- **Implementing International convention in soul and spirit** to avoid 2 billion climate refugees by the end of the 21st century.

- **Comprehensive Policy Formulation:** State must frame policy by adopting participatory decision making process in context of climate change to put people at the centre of solutions.
- **Proactive adaptation measures** that incorporate indigenous knowledge which offer agricultural intervention, secure livelihoods and enhance adaptive capacity.
- **According Refugee status to environmental refugees:** People migrating due to environmental disasters should be accorded 'refugee' status in international law for addressing

> **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
> - **Platform on Disaster Displacement (PDD)**: It was launched in 2016, to implement the recommendations of the **Nansen Initiative Protection Agenda**.

challenges of climate-change induced migration comprehensively.

3. CONSERVATION MEASURES

3.1. SAVING NATURAL CAPITAL

What is Natural Capital?

- Natural capital can be defined as the world's stocks of natural assets which include geology, soil, air, water and all living things.
- **Critical natural capital (CNC)** is defined as that part of the natural environment, which performs important and irreplaceable functions.

India's Natural Capital

- India boasts 11% of the world's floral and faunal species, India is one of the 17 most ecologically diverse countries. The financial value of India's forests is estimated to be $1.7 trillion.

Significance of natural capital

- **Ecosystem service**: Humans derive a wide range of services, often called ecosystem services, from natural capital to make human life possible like fresh air, water, food, etc.
- **Immaterial And Intangible Nature**: They provide many, socio–economic benefits, which might be assessed through both qualitative and quantitative valuation methodologies.
- **Balancing nature**: They capture and store great amount of carbon through carbon sequestration to maintain the composition of atmosphere.
- **Economic contribution**: They provide employment and are used as a raw material in many economic activities around.
- **Asset to countries**: Natural capital is a critical asset, especially for developing countries where it makes up a significant share (36%) of total wealth.

Natural capital at risk

- **Affecting humanity**: With increasing economic activity, natural capital assets are on the decline, directly affecting the quality of life and potentially giving rise to future inefficiencies in the economy.
- **Ignoring or Undervaluing Natural Capital**: This is leading to execution of projects with far higher **negative externalities** compared to the benefits.
- **Financial impact**: Unsustainable use of Natural capital leading to phenomena such as water scarcity etc. is **directly linked** to lower profitability of an economy. **Indirect effects** can include social pressure that prompts changes in demand and regulation and generates socio-economic unrest due to resource crunch.
- **Depleting planetary boundaries:** This means that human activity has altered the balance of a few delicate equilibriums, the effects of which are reflected by changing weather patterns, accelerated extinction events for both flora and fauna, and global warming.

Planetary Boundaries
- The planetary boundaries concept presents a set of nine planetary boundaries within which humanity can continue to develop and thrive for generations to come. Crossing these boundaries increases the risk of generating large-scale abrupt or irreversible environmental changes.
- These include **Climate Change, Biosphere Integrity, Land System Change, Freshwater Use, Biogeochemical Flow, Ocean Acidification, Novel Entities, Atmospheric Aerosol Loading** and **Stratospheric Ozone Depletion.**
- Out of these, four boundaries (**Climate Change, Biosphere Integrity, Land System Change and Biogeochemical Flow**) have now been crossed as result of human activity.

- **Wealth Accounting and the Valuation of Ecosystem Services (WAVES) partnership** aims to promote sustainable development by ensuring that natural resources are mainstreamed into development planning and national economic accounts.
- World Bank Group leads a partnership to advance natural capital accounting internationally.

Way Forward

- **Accounting intangible nature of natural assets:** Making natural capital thinking a norm through policy push and the adoption of valuation frameworks such as the **Natural Capital Protocol** (Protocol provides a standardised framework for organisations to identify, measure and value their direct and indirect impacts and dependencies on natural capital).
- **Factoring natural capital** in the economic, social, cultural and spiritual value of ecosystem services in the calculation of true economic growth and development.
- **Risk Management to Include Natural Capital:** For a comprehensive evaluation system that takes undesirable side-effects of economic activities into account.
- **Maximizing Profit:** Proper valuation of natural capital has the potential to optimise resources and thus maximise the net benefits of economic growth and development
- Integrating natural capital assessment and valuation into our economic system is critical to usher in a truly sustainable future for India.

3.2. FOREST CONSERVATION

What is Forest Conservation?

- Forest conservation is the practice of **planting and maintaining forested areas** for the benefit and sustainability of future generations. Forest conservation involves the upkeep of the natural resources within a forest that are beneficial to both humans and the environment.
- Forests are vital for human life because they provide a diverse range of resources:
    - they store carbon &act as carbon sink
    - produce oxygen which is vital for existence of life on the earth, so they are rightly called as earth lung
    - help in regulating hydrological cycle, planetary climate, purify water, provide wild life habitat(50% of the earth's biodiversity occurs in forests)
    - reduce global warming, absorb toxic gases & noise, reduce pollution, conserve soil, mitigate natural hazards such as floods& landslides etc.
    - World Bank states that forest resources contribute directly to the livelihoods of 90% of the 1.2 billion people living in abject poverty

CAUSES OF FOREST DECLINE

DIRECT

→ **Natural Causes**
- Hurricanes
- Floods
- Natural fires
- Pests

→ **Resulting From Human Activity**
- Agricultural expansion
- Cattle ranching
- Construction of dams
- Mining and oil extraction
- Logging
- Roads

→ **Agents**
- Agribusiness
- Cattle ranchers
- Oil corporations
- Non timber commercial corporations
- Miners
- Slash & burn farmers
- Loggers

UNDERLYING

→ **Market Failures**
- Unpriced forest goods and services
- Monopolies and monopsonistic forces

→ **Mistaken Policy Interventions**
- Wrong incentives
- Regulatory mechanisms
- Government investment

→ **Governance weaknesses**
- Concentration of land ownership
- Weak or non-existent ownership and land tenure arrangements
- Illegal activities and corruption

→ **Broader socioeconomic and political causes**
- Population growth and density
- Economic growth
- Distribution of economic and political power
- "Excessive" consumption
- Toxification
- Global warming
- War

- The loss of trees and other vegetation can cause climate change, desertification, soil erosion, fewer crops, flooding, increased greenhouse gases in the atmosphere and loss of animal and plant species due to their loss of habitat.
    - Degradation and deforestation of the world's tropical forests are cumulatively responsible for about 10% of net global carbon emissions.
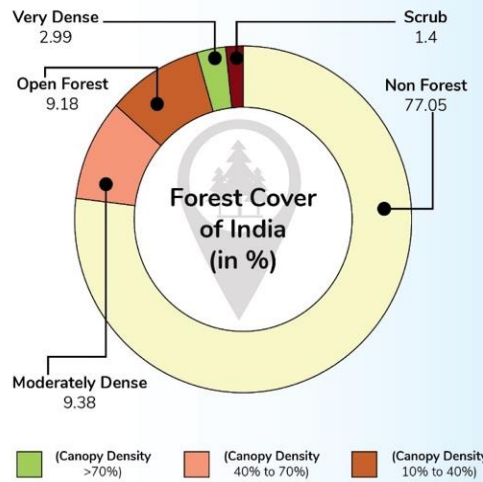
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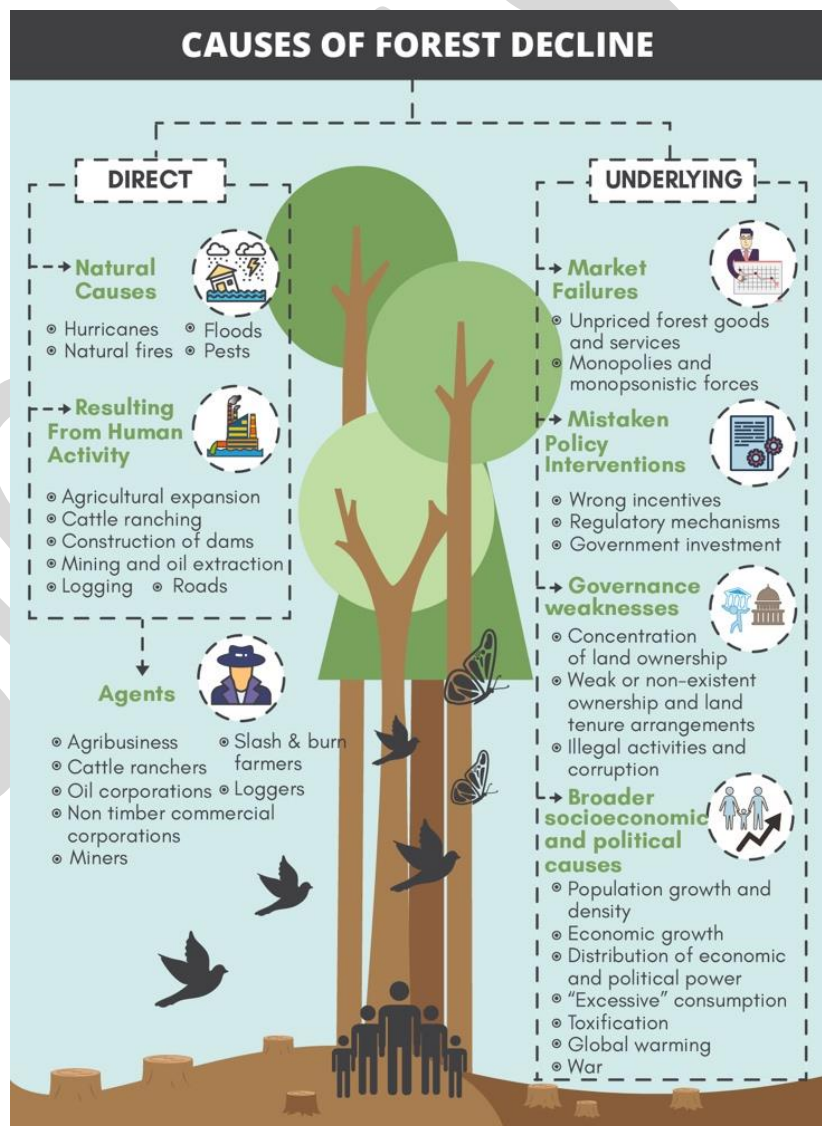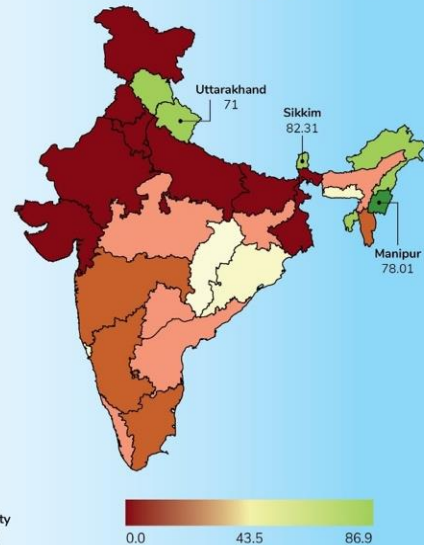
Forest Cover in India

- India is **ranked 10th in the world**, with 24.4% of land area under forest (21.53%) and tree cover. The **target is to achieve 33% of area under forest cover**.

- There is an increase of 1% (8,021 sq km) in the total forest and tree cover of the country, compared to the previous assessment in 2015.

- The maximum increase in forest cover has been observed in Very Dense Forest (VDF) followed by increase in forest cover in open forest (OF).

- The agro-forestry and private forestry has also shown expansion.

- **Forest cover in states:**
  - 15 states/UTs have above 33% of geographical area under forest cover. About 40% of country's forest cover is present in 9 large contiguous patches of the size of 10, 000 sq.km, or more.
  - 7 States/UTs have more than 75% forest cover: Mizoram, Lakshadweep, Andaman & Nicobar Islands, Arunachal Pradesh, Nagaland, Meghalaya and Manipur.
  - The three leading States with maximum Forest cover (in terms of area): Madhya Pradesh, Arunachal Pradesh and Chhattisgarh.
  - States with highest Forest cover in terms of percentage geographical area: Lakshadweep (90.33%), Mizoram (86.27%) and Andaman & Nicobar Islands (81.73%)

- **Global trend:**
  - India has shown an increasing trend in the forest and tree cover, in comparison to the global trend of decreasing forest cover during the last decade.
  - As per the latest FAO report, India is placed 8th in the list of top ten nations reporting the greatest annual net gain in forest area.
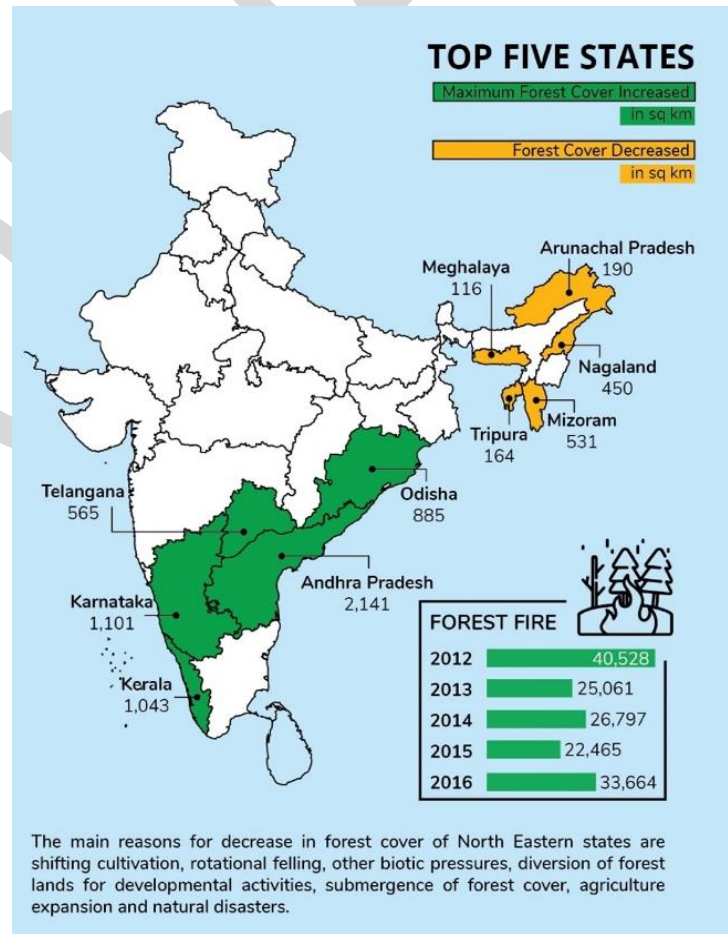
- **Carbon stock:** There is an increase of 38 million tonnes in the carbon stock of India bringing it to total 7083 million tonnes. India's NDC goal is to create additional carbon sink of 2.5 to 3.0 billion tonnes of CO equivalent through additional forest and tree cover by 2030.

- **Forest fires:** In most of the years, maximum number of forest fires occurs in OF followed by Moderately Dense Forests (MDF). However, in 2012 and 2016 (severe fire years), the proportion of forest fires in MDF and VDF were higher compared to OF.

GREEN COVER

This time information of forest cover is covered for 633 districts in place of 589 districts.

Very Dense 2.99
Scrub 1.4
Open Forest 9.18
Non Forest 77.05
Forest Cover of India (in %)
Moderately Dense 9.38

(Canopy Density >70%)
(Canopy Density 40% to 70%)
(Canopy Density 10% to 40%)

Forests as % of Geographical area

Uttarakhand 71
Sikkim 82.31
Manipur 78.01

0.0   43.5   86.9

TOP FIVE STATES

Maximum Forest Cover Increased in sq km
Forest Cover Decreased in sq km

Arunachal Pradesh 190
Meghalaya 116
Nagaland 450
Tripura 164
Mizoram 531
Telangana 565
Odisha 885
Karnataka 1,101
Andhra Pradesh 2,141
Kerala 1,043

FOREST FIRE

Year	
2012	40,528
2013	25,061
2014	26,797
2015	22,465
2016	33,664

The main reasons for decrease in forest cover of North Eastern states are shifting cultivation, rotational felling, other biotic pressures, diversion of forest lands for developmental activities, submergence of forest cover, agriculture expansion and natural disasters.

- **Mangrove**: Total mangrove forests have increased by 181sq kms. 7 out of the 12 mangrove states have shown an increase in mangrove cover and none of them show any negative change.
- **Bamboo Cover**: The extent of bamboo-bearing area in country is estimated at 15.69 million ha. There has been an increase of 1.73 million ha in bamboo area.
- **Water bodies inside forests -** Forests play a vital role in water conservation and improving water regime in area. The report observes that water bodies inside forest cover have increased by 2,647 sq kms during the last decade. Almost all the states have shown a positive change in water bodies.

National Forest Policy, 1988

Aim: To ensure environmental stability and maintenance of ecological balance including atmospheric equilibrium which are vital for sustenance of all life forms, human, animal and plant.

Objectives

- To have a minimum of one-third of the total land area of the country under forest cover. In the hills and mountainous regions, the aim should be to maintain two-third of the area under such cover.
- **Conservation of the country's natural heritage and biological diversity**, increasing the productivity of degraded forests, and meeting the local needs of the people.
- **Checking soil erosion and denudation** in the catchments areas of rivers, lakes, reservoirs.
- **Checking the extension of sand-dunes** in the desert areas of Rajasthan and along the coastal tracts.
- Meeting the requirements of fuel-wood, fodder, minor forest produce and small timber of the rural and tribal populations.
- **Creating a massive people's movement** with the involvement of women.

> Recently, The Indian Forest (Amendment) Bill was passed by Parliament amending the Indian Forest Act (IFA) 1972, to exempt bamboo grown in non-forest areas from the definition of trees.
>
> **Benefits of amendment**
>
> - It will promote cultivation of bamboo in non-forest areas to achieve twin objectives **of increasing the income of farmers**, especially in North-East and Central India and also **increasing the green cover of the country**.
> - It will create a viable option for **cultivation in** 12.6 million hectares of **cultivable waste land** by **removing the legal and regulatory hardships** being faced by farmers and private individuals.
> - The amendment will unleash the potential of bamboo in terms of **rural and national economy** apart from **ecological benefits** such as soil-moisture conservation, landslide prevention and rehabilitation, conserving wildlife habitat, enhancing source of bio-mass, besides serving as a substitute for timber.
> - It will **encourage farmers** and other individuals to take up plantation/ block plantation of suitable bamboo species on degraded land, in addition to plantation on agricultural land and other private lands **under agroforestry mission**.
> - It will **enhance supply of raw material** to the traditional craftsmen of rural India, bamboo based/ paper & pulp industries, cottage industries, etc.
> - Besides **promoting major bamboo applications** such as wood substitutes and composites like panels, flooring, furniture and bamboo blind, it will also help industries such as those dealing with food products (bamboo shoots), constructions and housing, bamboo charcoal etc.
> - It will help to **fulfill domestic demand and reduce the imports**. Though India has 19% share of world's area under bamboo cultivation (India is the world's second largest bamboo producer), its market share in the sector is only 6%. In 2015, India imported about 18.01 million cubic meters of timber and allied products worth Rs 43000 crores.

Achievements of National Forest Policy, 1988.

- **Increase in the forest and tree cover**: According to State Forest Report 2017, total forest cover in the country increased from 19.47% in 1989 to 21.54 per cent of the country's geographical area.
- **Involvement of local communities** in the protection, conservation and management of forests through Joint Forest Management Programme.
- Significant contribution in maintenance of environment and ecological stability in the country.
- It debarred the private sector from raising plantation on forestland and encouraged them to source raw materials directly from farmers.

Analysis

- **Colonial Hangover:** Forest Policies in India have changed significantly since the enunciation of the first Forest Policy in 1894, however it suffered from a major weakness of being been developed solely within the forestry sector, without being closely linked to related sectors.

- **Lack of deadline**: India's forest policy indicated the nature and intensity of action needed without providing a clear time frame for the various activities required for achieving the specified objectives.
- **Protectionist stand**: World Bank criticised it for promoting forest conservation at some expense to commercial forest use. However, according to National Forestry Action Programme of the Ministry of Environment and Forests (1999), the failure to achieve some of the policy objectives has also been mainly due to the ineffective implementation rather than inadequacies of the policy
- The policy of substituting wood with plastic and metals has been successful. But the **goal of preserving natural forests has failed miserably** and so has the goal of vesting forest rights in forest-dependent communities, which is being resisted by the forest department.

Recently government has released **Draft National forest Policy, 2018.** The salient features of this are:

- **Objective:** To safeguard the **ecological and livelihood security** of present and future generations.
- **Eco-security**: The country should aim to have a **minimum of one-third** of the total land area under forest and tree cover and in hilly and mountainous regions, the aim will be to maintain two-third of the area under forest and tree cover.
- **Institutions:** Setting up **National Board of Forestry (NBF)** at central level (headed by the Environment Minister) and **State Boards of Forestry** at state level (headed by state ministers in charge of forests) for ensuring inter-sectoral convergence, simplification of procedures, conflict resolution, etc. They will also **periodically review** implementation of this policy.
- **Strengthening community participation in forestry**: To ensure synergy between gram sabhas and joint forest management committees for successful community participation in forestry, **National Community Forest Management Mission** will be launched under Forest Rights Act (FRA).
- **Promote agro-forestry, farm forestry and Urban Green** to increase the tree cover outside forests.
- **Stabilizing ecologically sensitive catchment areas** with suitable soil and water conservation measures.
- **Biodiversity Conservation** through surveying of forest areas and promoting modern techniques of ex-situ conservation for Relic, Endangered and Threatened (RET) species.
- **Identifying and maintaining wildlife rich areas and corridors** outside protected areas for ensuring ecological and genetic continuity.
- Develop a **national forest ecosystems management in formation system** for scientific planning and management.
- **Research and Education in Forest management** for increasing forest productivity, enhancing the capacity of the forest ecosystems for carbon sequestration, reclamation of degraded and mined areas for ecological security, addressing the contemporary priorities and for increasing livelihood support and economic growth.
- **Enhance Quality and Productivity of natural forests** by promoting natural regeneration through locally suitable indigenous species.

Initiatives for Forest Conservation

- **United Nations strategic plan for forests 2017-2030:** It aims to promote sustainable forest management and the contribution of forests and trees outside forests to the 2030 Agenda for Sustainable Development, including by strengthening cooperation, coordination, coherence, synergies and political commitment and actions at all levels.
- **Reducing Emission from Deforestation and Forest Degradation (REDD):** is a framework through which developing countries are rewarded financially for any emissions reductions achieved associated with a decrease in the conversion of forests to alternate land uses. **REDD+** now includes:
  - Reducing emissions from deforestation;
  - Reducing emissions from forest degradation;
  - Conservation of forest carbon stocks;
  - Sustainable management of forests;
  - Enhancement of forest carbon stocks.
- **National Afforestation Program:** It is a flagship scheme of Ministry of Environment and Climate Change which aims to support and accelerate the ongoing process of devolving forest protection, management and development functions to decentralized institutions of Joint **Forest Management Committee (JFMC)** at the village level, and **Forest Development Agency (FDA)** at the forest division level.
- **National Mission For Green India Mission:** It is one of the eight missions outlined under India's National Action Plan on Climate Change
  - The mission has a broad objective of both increasing the forest and tree cover by 5 million ha, as well as increasing the quality of the existing forest and tree cover in another 5 million ha of forest/mom forest land in 10 years.
- **National Agro-Forestry & Bamboo Mission (NABM):** It envisages promoting holistic growth of bamboo sector by adopting area-based, regionally differentiated strategy and to increase the area under bamboo cultivation and marketing.

- **Increase the productivity of forest plantations** by intensive scientific management of commercially important species like teak, sal, sisham, poplar, eucalyptus, bamboo etc.
- **Public private participation models:** will be developed for undertaking afforestation and reforestation activities in degraded forest areas and forest areas available with Forest Development Corporations and outside forests.
- **Forest Based Industry will be incentivized** as it being labour intensive can help in increasing green jobs and meeting the demand of raw materials as well.
- **Management of Non-Timber Forest Produce** through Value Chain approach would be made compulsory and part of the business plans related to NTFP.
- **Management of North-Eastern Forests** which have a vital impact on climate, agriculture production, and mitigation of floods in the plain areas of North-East.
- **Forest Certification** to enhance value of forest product harvested sustainably.
- **Forest Skill Development Centres,** for skilling forest dependent population in forestry sector jobs, will be instituted for training of frontline staff who are at the cutting edge of the forest department.
- **Addressing forest fires** by mapping vulnerable areas and develop early warning systems and methods to control fire through remote-sensing technology and community participation.
- **Human-wildlife conflicts:** It proposes dedicated and well-equipped quick response teams with health and veterinary services for speedy assessment of damage and quick payment of relief to the human victims, to minimise conflicts with the wildlife.

Concern

Although, it recognizes the role of forests in climate change mitigation unlike previous policies, there are various concerns as well:

- Environmentalists object in involving PPP model for afforestation and reforestation activities, pointing out that this would mean **privatisation of India's natural resources** and creating **private forests**.
- **National Community Forest Management** mission is based on the joint forest management model (involving both the state **forest** departments & local communities) that has no legal standing after enactment of Forest Rights Act, which vests management authority with gram sabhas.
- Policy orients itself more on the conservation and preservation of forest wealth rather than regenerating them through people's participation.
- Concern over the achievement of policy, as most of the objectives mentioned in **earlier National Forest Policy 1988** have not been met so far.
- It fails to mention or address the degradation of growing stock in the natural forests
- It persists with the methodological weakness of the Indian Forest Survey Reports of the past 30 years that conflate plantations with forest cover.

3.2.1. COMPENSATORY AFFORESTATION

Why in news?

Recently, Environment Ministry has notified the draft rules of the Compensatory Afforestation Act to expand India's forest cover.

Background

- It refers to the afforestation and regeneration activities carried out as a way of compensating for forest land which is diverted to non-forest purposes.
- **The Forest (Conservation) Act, 1980** provides that whenever a forest land is to be diverted for non-forestry purposes, the equivalent non forest land has to be identified for compensatory afforestation and funds for raising compensatory afforestation are to be imposed.
- The act further requires that:
  o the non-forest land for CA are to be identified contiguous to or in the proximity of Reserved Forest or Protected Forest, as far as possible.
  o in case, non-forest land for CA is not available in the same district, non-forest land for CA is to be identified anywhere else in the State/Union Territory.
  o If non forest land is unavailable in the entire State/ UT, funds for raising CA in double the area in extent of the forest land diverted need to be provided by the user agency on the basis of the rates fixed by the State Forest Department.

- Compensatory Afforestation Fund (CAF) Act came into force in 2016.
- Over Rs. 50,000 crore has been collected under CAMPA fund in lieu of forest land diverted to non-forest purposes such as industrial projects like mining.
- Currently State receives only 10% of funds to use for afforestation and forest conservation, as against the Act's promise of 90%.

Highlight of the rules

- **Allowed Activities**:
  - **80% of the accumulated funds** can be utilized by states for 12 listed activities which include protection of plantations and forests, pest and disease control in forest, forest fire prevention and control operations, improvement of wildlife habitat, relocation of villages from protected areas etc.
  - While remaining **20% will be used** to strengthen forest and wildlife related infrastructure, capacity building of the personnel of state forest departments and other associated agencies and organisations.

Compensatory Afforestation Fund Act 2016

- It established National Compensatory Afforestation Fund (NCAF) under the **Public account of India** and State Compensatory Afforestation Funds under public accounts of states.
- These funds will receive payments for:
  - compensatory afforestation,
  - net present value of forest (NPV),
  - Other project specific payments.
- The National Fund will receive 10% of these funds, and the State Funds will receive the remaining 90%.
- The funds will be non-lapsable and interest bearing by the rate decided by central government on a yearly basis.
- 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 institution, namely;
  - **National** Compensatory Afforestation Fund Management and Planning Authority **(CAMPA)** 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 multi-disciplinary 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.

Recently Forest Survey of India has taken an initiative namely, **e-green watch**, for online monitoring of various afforestation works being carried out by state forest departments under CAMPA.

- **Prohibited activities**: Funds cannot be used for certain activities like payment of salary and travelling allowances to regular state forest department employees, undertaking foreign visits etc.
- **Accountability Framework**: Forest bureaucracy would be accountable for any lapse on the part of state in carrying out compensatory afforestation exercise in a time-bound manner.
- **Consultation with gram sabha or Van Sanrakshan Samiti (VSS) or village forest committee:** while taking up afforestation or plantation projects in forest land under the control of forest department and being managed under a working plan with participation of local people.
  - However, concerns have been raised over the Draft rules as they tend to bypass Gram Sabha through VSS, which is not a legal body, over lack of clarity over consultation mechanism. It also enables the forest bureaucracy to entrench its control over forests and subvert democratic forest governance established by the **FRA Act**, 2006 and **PESA Act**, 1996

Issues with compensatory afforestation in India

- **Forest as commodity:** The principle of CA reduces a "forest" to a "commodity which acquires certain area on the ground". Its loss are deemed to be compensated financially. Its ecology, biodiversity and ecosystem services were completely ignored.
- **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.
- **Capacity building of state forest departments**: as utilisation of 90% of funds depend on it and they lack the planning and implementation capacity to carry out compensatory afforestation
- **Difficulty in procuring 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.

- **Low quality forest cover**: compensatory afforestation cannot make up for the ecological value lost by cutting the existing forests. Also, computing the appropriate NPV of a forest is a challenge.
- **Increase atrocities against tribals and forest dwellers**: as it create scope for illegal plantations by forest departments and the joint forest management committees.

> **Guidelines for suitability and identification of land bank for compensatory afforestation.**
> - It mandates that states and UTs shall create land bank for CA for speedy disposal of the forest clearance proposals under FC Act 1980.
> - The states shall also set up committee with principal chief conservator of forests, chief wildlife warden and representatives of revenue department for expediting creation of land banks in a systematic manner.
> - The state governments shall formulate CA scheme including activities like soil and moisture conservation, regeneration cleaning, silvicultural activities and shall ensure maintenance of these plantations for a period of seven to 10 years as per requirement.
> - It stipulates that for CA the number of plants to be planted over CA land shall be at least 1,000 plants per hectare of forest land diverted. However, if 1,000 plants cannot be planted on the non-forest land identified for CA, then the balance will be planted in degraded forest land.

Way forward

Along with the forest bureaucracy the CAMPA funds can also be entrusted to local communities to further strengthen local rights and empower communities to restore forests and degraded lands.

- India has a large number of such examples of communities taking up ecological restoration at low costs. The decision over where, what and how to plant and regenerate degraded lands, instead of being in the hands of a distant, inefficient bureaucracy, needs to be in the hands of local communities, who have the capacity to undertake adaptive management and maintain close oversight.
- Innovative systems of incentives and direct payments can be designed using remote sensing.
- Using CAMPA funds to support community-based afforestation will also lead to major positive social and ecological outcomes. It will ensure a flow of Rs 4,000-5,000 crore to some of the poorest communities, as wage labour every year, with positive spin-offs in terms of improved incomes, poverty alleviation, food security and nutrition as well as better ecological outcomes in terms of eco-restoration, biodiversity conservation and carbon sequestration.

3.2.2. COMMUNITY FOREST RESOURCE

Why in news?

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

What is Community Forest Resources?

- **National Forest Policy, 1988**, had paved the way for semi-decentralization of forest governance in the country, leading to the emergence of **joint forest management (JFM).** It led to increased availability of non-timber forest produce (NTFPs) and fuel wood and improved forest protection.
- However, barring a few exceptions, JFM largely failed in recognizing communities as equal stakeholders in the management of forests, with forest departments retaining the decision-making power and final authority.
- In 2006, The **Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act** or the **Forest Rights Act (FRA)** was passed which provides for recognition of forest lands as **community forest resources (CFR).**
- The **Forest Rights Act** defines **Community Forest Resources (CFR)** as "customary common forest land within the traditional or customary boundaries of the village or seasonal use of landscape in case of pastoral communities, including reserved forests, protected forests and protected areas such as Sanctuaries and National Parks to which the community had traditional access."
- **CFR rights** is the most empowering provision of the Act because it restores gram sabha's 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.

- As of 2016, a little over 1.1 million hectares (ha) of forestland had been brought under CFR management. However, as per an estimate by **Community Forest Resource-Learning and Advocacy**, 45 % of India's total forest area, should be recognised as CFR.

Present Status of CFR

In modern times, community forests have gained importance due to indiscriminate deforestation of Tropical forests. Today about One tenth of the total carbon contained above ground in tropical forests is in collectively managed forests which lack formal and legal recognition.

Without secure rights, these communities and their forests are at risk of illegal, forced, or otherwise unjust expropriation and capture by more powerful interests, thus displacing the residents, destroying the forests and releasing the carbon they contain into the atmosphere.

- **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.

Challenges

- **Operational Challenges**: Communities have often faced **stiff resistance** from forest departments in attempts to assert CFR rights despite approval from gram sabhas.
- **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.
- **Administrative reluctances**: The state and district administration have taken little initiatives to scale up the recognition of CFR rights or support

IMPORTANT DIFFERENCES BETWEEN JFM AND CFR

Joint Forest Management	Community Forest Resource Management
Lacking legal sanctity, JFM is an approach to involve local people as partners in the protection and management of forests, implemented through resolutions adopted by states.	CFR rights are provided under a Central legislation, thus, they have legal backing. Guidelines issued by the Ministry of Tribal Affairs in April 2015 require CFR areas to be recorded as a new category of forest area under the record of rights (ROR) maintained by the forest department.
The allocation of forestland under JFM is done in an ad hoc manner by the forest department.	Under the CFR provisions of FRA, customary forest boundaries of a village are identified and demarcated by the gram sabha. Often the CFR area of one gram cuts across the areas of more than one JFM group.
The executive committee of the joint forest management committee (JFMC) is supposed to have a number of official members from the forest department and sometimes, also the panchayat.	The committees constituted for CFR management comprise members exclusively from the gram sabha with no representation of forest or other officials.
JFM provided for a state-specific benefit-sharing mechanism from the harvest of forest produce. In Odisha, JFMCs are entitled to 100% of intermediate NTFP produce and 50% share from timber at the time of final harvest. In West Bengal, the share from timber is 25% of the net profit.	CRs and CFR rights provide 100% authority over collection and sale of all NTFPs to the gram sabhas. Timber rights are contentious under FRA.
Under JFM, communities had usufruct but no tenurial rights over forestlands assigned to them. JFMCs were subject to dissolution if an inspecting forest officer recorded irregularity or illegality in their work.	CFR provisions of FRA provide tenurial rights to gram sabhas over forestlands. FRA does not provide for revocation of forest rights once recognized.

CFR management in the country.

- **Fencing of CFR** areas to avoid case of 'encroachment', when a group of outsiders from a nomadic community camped inside the village's CFR with their livestock.
- **Unscientific Plans:** Concerns among the department officials about ecological integrity and scientific rigour in the CFR plans of gram sabhas, as sometimes their plans are for short term gains rather than long-term sustenance.
- **Conflicting legislations and orders:**
  o **Conflicts between Ministry of Tribal Affairs and MoEF&CC:** National Tiger Conservation Authority order in March 2017, denied forest rights to communities in critical tiger habitats.
  o **Indian Forest Act (IFA), 1927,** prohibits (and prescribes punishment) for activities such as grazing and removal of forest produce, FRA, on the other hand, legitimizes the use of forests for grazing and collection and sale of NTFPs
  o Different legislations in states for collection and trade of NTFP's.
- **Poor Financial health of concerned departments in States:** A total of Rs 26.54 crore have been approved to five states which is insufficient for proper implementation of ACT.
- **Lack of Awareness:** Most gram sabhas eligible for CFR rights are not aware of the full potential of CFR rights
- **Infrastructure and Marketing constraints:** Connectivity to market is a major challenges as it constraint future prospect of minor produce sale and production.

Way Forward

- **Convergence of Plans and procedure:** CFR management should be integrated into existing government's programmes like MGNREGA, National Bamboo Mission, National Horticulture Mission, Aspirational District program etc. so that the flow of funds to gram sabhas becomes an institutionalized practice.
- **Use of technology:** GPS devices can be used by the villages in identifying and mapping locations in their CFR areas that need intervention.
- **Adopting best practices:** Many states can learn from other in effective implementation of FRA, as CFR rights can revitalise rural economy, create employment and develop sustainable business models from forestry.
- **CAMPA fund** can be utilized strengthening CFR activities like fund for fire protection work in the CFR areas.
- **Develop guidelines for the role of government departments in CFR areas** to explicitly clarify the role of government as facilator and support CFR governance processes without undermining the autonomy and authority of gram sabhas
- **Develop a new framework for CFR governance:** Ministry of Tribal Affairs should develop a framework to ensure ecological sustainability, financial transparency and social equity in CFR governance.
- **Build capacity and leadership of CFRMCs:** To provide them information on the best methods to tap the potential of these areas to improve their livelihoods as well as health of the forests.
- **Resolve the timber debate in CFR areas:** Gram sabhas should be allowed to sustainably harvest and sell timber in their CFR areas with proper checks and balances mechanism in place to ensure that illegal timber exploitation does not happen inside CFR areas.
- **Develop a multi-tier FRA monitoring and information system:** rigorous well-designed web-based information system is needed to ensure successful implementation, disseminating cross learning and monitoring the impact of FRA initiatives on local livelihoods and forest health.

3.3. WETLAND CONSERVATION IN INDIA

What are 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.

- It may be **manmade or artificial** such as **Lakes, ponds, ox-bow lakes, estuary, lagoon, creek, backwater, mangroves, peatlands etc.**
- They support rich biodiversity and provide wide range of ecosystem services such as water storage, water purification, flood mitigation, erosion control, aquifer recharge, act as carbon sinks and others.
- There are at least 115 wetlands that are officially identified by the central government and of those 26 are identified as wetlands of international importance under **Ramsar Convention.**
- Wetlands in India account for 4.7% of the total geographical area.

Importance of Wetlands

- Wetlands are highly productive and support exceptionally large biological diversity.
- Provides services such as waste assimilation, water purification, flood mitigation, erosion control, ground water recharge, micro climate regulation.
- Supporting 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.
- 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.

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 provide 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:**
  o Designate wetlands for inclusion in the List of Wetlands of International Importance.
  o Promote, as far as possible, the wise use of wetlands in their territory.
  o Promote international cooperation especially with regard to transboundary wetlands, shared water systems, and shared species.
  o Create wetland reserves.

Urban Wetlands: The theme for World Wetlands Day, 2018 was 'Wetlands for a sustainable urban future':

- Urban wetlands are found in and around cities or their suburbs. They include rivers and their floodplains, lakes and swamps as well as coastal variants such as salt marshes, mangroves and coral reefs.
- These wetlands control flooding, filter waste from water, improve air quality and a source of drinking water and provide livelihoods.
- As demand for land increases, the tendency is to encroach on wetlands. About half of world population lives in urban areas today. By 2020 this proportion will reach 66%.
- To make cities sustainable following steps can be taken:
  o Wetlands should be included as elements of urban infrastructure within City Development Plans.
- Stakeholder participation in management of urban wetlands should be promoted. Urban Local Bodies, Resident Welfare Associations, civil society and other local organizations should be proactively associated with management of wetlands within their localities through sensitization workshops, engagement in monitoring, and design and implementation of management plans.
- Development of urban infrastructure should not lead to alternation of natural water inflow and outflow regimes. Wetlands should also not be used to discharge untreated sewage and solid waste.
- Urban wetlands should be appropriately delineated and boundaries notified to ensure that these ecosystems are not encroached and converted for alternate use.
- Urban wetlands should be comprehensively monitored to assess changes in ecological, hydrological, and socioeconomic features, and appropriate management responses put in place for addressing adverse changes.

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- **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 management- they 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.

> **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.

3.3.1. NEW WETLAND CONSERVATION RULES

Why in News?

- Recently, Central government notified **Wetlands (Conservation and Management) Rules, 2017.**

Provision under the new rules

- **Definition of wetlands**: They are defined as "an area of marsh, fen, peatland 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 six meters, but does not include river channels, paddy fields, human-made water bodies/tanks specifically constructed for drinking water purposes and structures specifically constructed for aquaculture, salt production, recreation and irrigation purposes".

> **Function of State Wetland Authority**
> - These authorities will develop a comprehensive list of activities to be regulated and permitted within the notified wetlands and their zone of influence, recommend additional prohibited activities for specific wetlands, define strategies for conservation and wise use of wetlands, and undertake measures for enhancing awareness within stakeholders and local communities on values and functions of wetlands.
> - The State authorities will prepare a list of all wetlands of the State or union territory within three months, a list of wetlands to be notified within six months and a comprehensive digital inventory of all wetlands to be uploaded on a dedicated website developed by the Union government within a year which will be updated every ten years.

- **Decentralisation of Power**: Under the new rules, the central government has empowered the states and union territories to identify and manage their wetlands.
- **Constitute State Wetlands Authority** in each State and union territories that will be headed by the State's environment minister and include a range of government officials. They will determine, the 'wide use principle,' that shall govern the management of wetlands.
- **Setting Up National Wetlands Committee:** it will replace Central Wetlands Regulatory Authority (CWRA), to monitor implementation of these rules and advise the Central Government on appropriate policies and action programmes for conservation and wise use of wetlands
- **The rules prohibit** solid waste dumping, discharge of untreated waste and effluents from industries, cities, towns, villages, and other human settlements into wetlands.

- **Banned activities**: Certain activities are banned in notified wetland like setting up of industries, dumping of solid, electronic, hazardous and construction wastes, poaching of animals, conversion of wetland area into non-wetland purposes, encroachment and even construction of any permanent structure will also be banned at the notified wetlands.
- **Applicability of rules**: These rules shall apply to the following wetlands or wetlands complexes, namely:
  - Wetlands categorised as 'wetlands of international importance' under the Ramsar Convention
  - Wetlands as notified by the Central Government, State Government and Union Territory Administration

Issues involved

- **Diluted definition:** The 2010 rules and even the 2016 draft rules covered all wetlands, including man-made wetlands other than river channels and paddy fields. The new rules, however, exclude human-made water bodies and tanks specifically built for drinking water purposes and structures constructed for aquaculture, salt production, recreation and irrigation. Thus, the rules fail to cover 9.7 million hectares or 65% of the total area identified as wetlands.
- **Abuse of rule**: Provisions like "central government may consider proposals from the state government or union territory administration for omitting any of the (prohibited) activities on the recommendation of the authority" in the new rules can be misused.
- **Process of appeal against the decisions of wetland authorities**: According to the 2010 rules, anyone aggrieved with the CWRA's decisions could have filed an appeal with the National Green Tribunal, but the new 2017 rules are silent on the appeal process.
- Subjective definition of "wise use" (Wise use is defined as the principle of sustainable uses that is compatible with conservation) which is to be determined by the state wetland authority.
- **Poor record of States**: The onus of identification and notification of wetlands has been passed on to states, which have virtually never acted on wetlands protection in the past and have been lax in implementing the old rules.

3.3.2. PEATLANDS

Why in news?

Recently, Brazzaville Declaration was signed to promote better management and conservation of Cuvette Centrale Region in Congo Basin.

About the Brazzaville Declaration

- The declaration has been signed by Democratic Republic of Congo, the Republic of Congo and Indonesia in the backdrop of the 3rd **Conference of Partners of the Global Peatlands Initiatives (GPI),** taking place in Brazzaville, Republic of Congo.
- GPI is an initiative by leading experts and institutions to save peatlands as world's largest terrestrial organic carbon stock and to prevent it being emitted.

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 form where climate, bedrock and relief create an area with permanent water saturation i.e. either in shallow water over layers of lake sediments (called terrestrialisation) or directly on mineral soil (called palaudification).
- 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.

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 unique and critically threatened biodiversity** – They are home to some of the most unique and even endangered species which are adapted to live there. e.g. 37% of all the vascular plants in the peatlands of Yamal Peninsula and 10% fish species within Malay Peninsula are only found in peatland ecosystem.
- **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 salt water.
- **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.
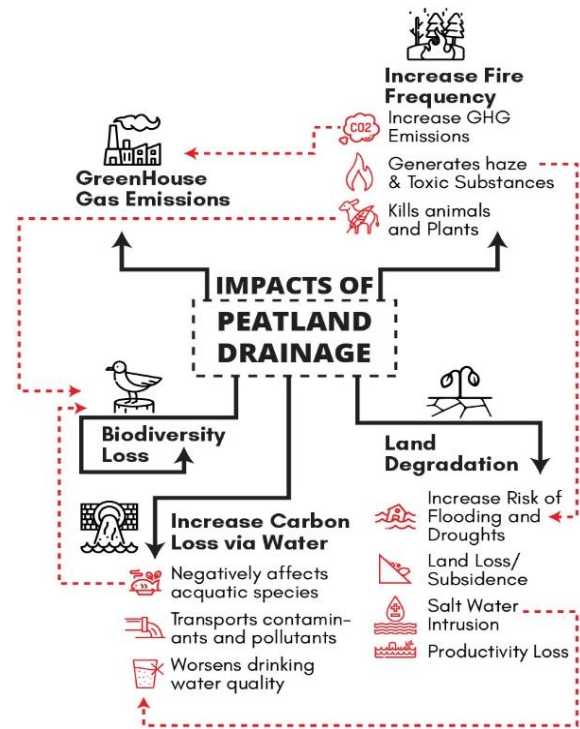
Threats to Peatlands

- **Drainage for agriculture** – Agriculture expansion has been main driver of changes in peatlands. Peat soil needs to be regularly saturated otherwise they lose nutrients very fast.
- **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.

Solutions

- **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 eco-tourism.
- **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.
- **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.

3.4. WILDLIFE CONSERVATION

What is wildlife conservation?

- Wildlife conservation is the **practice of protecting animal species and their habitats**. It is achieved through legislation such as Wildlife Protection Act 1972, the establishment and protection of public lands, and responsible public practices that conserve wild animal populations.

- **Wildlife Protection Act, 1972** was enacted for the protection of plants and animal species. The Act provided for establishment of schedules of protected plants and animal species and hunting or harvesting of protected species was outlawed.
- It provides for six schedules which give varying degrees of protection, such as Schedule 1 and 2 which provide absolute protection i.e. offences under these are prescribed highest degree of penalties.
- The Act also provides for establishment of **protected areas** as mentioned below –
  o **Sanctuary** is an area which is of adequate ecological, faunal, floral, geomorphological, natural or zoological significance. It is declared for the purpose of protecting, propagating or developing wildlife or its environment. Certain rights to people living inside the Sanctuary could be permitted.
  o **The National Park** is like that of a Sanctuary. However in a National Park, no rights are allowed.
  o **Conservation Reserves** can be declared by the State Governments in any area owned by the Government, particularly the areas adjacent to National Parks and Sanctuaries and those areas which link one Protected Area with another. The rights of people living inside a Conservation Reserve are not affected.
  o **Community Reserves** can be declared by the State Government in any private or community land, not comprised within a **National Park, Sanctuary or a Conservation Reserve**, where an individual or a community has volunteered to conserve wildlife and its habitat. The rights of people living inside a Community Reserve are not affected.

Aichi biodiversity targets
- They are a series of goals that were set in 2010 at a Conference of Parties to the **Convention on Biological Diversity** meeting for protection and conservation of biodiversity.
- **Target 11:** By 2020, at least 17% of terrestrial & inland water, and 10% of coastal & marine areas, are conserved through systems of protected areas and other effective area-based conservation measures.

Current Status

- At present protected areas are 729 in number & cover 4.9% or 162,072 sq. km of India's geographical area and about 0.3% of EEZ (exclusive economic zone) is under Marine Protected Areas (MPA) in India.
- However, India's environment ministry is considering to **double the current number of protected areas** because –
  o India's network of protected areas is far below the **"Aichi Target".**
  o Protected areas are the last refuges of endangered wildlife. They also provide ecosystem services being river watersheds and sequestering carbon.
  o Competing use of land will put more pressure on forests in future.
  o To tackle climate change and Global warming effect. Also, increase in forest cover is declared under India's INDCs.
  o States such as Uttar Pradesh (2.4 %), Rajasthan (2.8 %), Jharkhand (2.7 %), West Bengal (3.2 %), Bihar (3.4 %), Madhya Pradesh (3.5 %), Tamil Nadu (4.1 %), which have contributed less than the national average to the network of projected area, may be requested to achieve the average national target of at least 5% of their geographical area under the four protected area categories.
  o Some of the critical marine area within territorial water of India can be considered for declaring as sanctuaries whereas a large marine area can be covered under conservation reserve.
- While India has done well in conserving some

National Wildlife Action Plan (NWAP) for 2017-2031
- The NWAP was first conceived in 1982 which came into effect from 1983 through 1996.
- The National Wildlife Action Plan 2017-2031 has been drafted by a 12 member committee headed by J. C. Kalra with special emphasis on **people participation**.
- **Important Components of NWAP 2017-2031**
  o strengthening and promoting the **integrated management of wildlife and their habitats**
  o adaptation to **climate change** and promoting integrated sustainable management of **aquatic biodiversity** in India
  o promoting **eco-tourism, nature education and participatory management**
  o strengthening **wildlife research** and monitoring of **development of human resources** in wildlife conservation
  o **enabling policies and resources** for conservation of wildlife in India.
- The plan has adopted the **Landscape approach** rather than the earlier strategies more concentrated on national parks and wildlife sanctuaries.
- **The Landscape approach** is based on the importance of conservation of uncultivated flora and undomesticated fauna that had ecological value irrespective of their place of occurrence.
- Plan also highlights role of **private sector** in the wildlife protection by ensuring adequate fund flow from the **Corporate Social Responsibility (CSR) fund**.
- It also emphasizes upon preservation of **genetic diversity** and sustainable utilization of species and ecosystem.

species like tiger, it needs to up its ante as far as Protected Area Network is concerned, where its neighbours like Bhutan and Nepal fare better than our 5% of land under PA.

Along with doubling the protected areas there is also need to increase the use of technology in biodiversity conservation.

Role of technology in wildlife conservation

- **Collection of data:** lack of adequate data - especially data on species yet unknown to science, their locations, and their rates of extinction - prevents their study. Modern technology can be used to study them.
- **Collaboration among scientists, public and government:** Online databases, smartphone apps, crowd-sourcing and new hardware devices are making it easier to collect data on species. When combined with data on land-use change and the species observations of millions of amateur citizen scientists, technology is increasingly allowing scientists and policymakers to more closely monitor the planet's biodiversity and threats to it.
- **International collaboration:** In order to develop more effective conservation policy in an age of complex and growing environmental threats, cross-country and inter-university data sharing is needed. Databases of the Red List of Threatened Species and of Protected Planet WWF report, Living Planet report are good examples.
- **Monitoring health of protected areas:** Hyperspectral imagery of landscapes can provide detailed information on a host of chemical and geological parameters and biological processes in both terrestrial and aquatic systems. Drones are increasingly being used to routinely monitor tracts of habitat and even individual animals. These types of remote sensing can help ensure that habitats remain healthy and protect the biota.
- **Restoration ecology** can play a significant role in augmenting the conservation value of marginal and degraded lands.
- Monitoring reproductive status and other physiological parameters in the wild can be facilitated by broader deployment of **biotelemetry devices and the use of mobile communication networks**. Advances in brain mapping may eventually be applied to technologies that can determine how species perceive their environment. Such information could help identify and ameliorate stressors that could be impediments to reproduction or survival and considerably improve animal welfare.
- **Assisted Reproductive techniques:** The techniques that have been developed for captive populations in zoos, aquaria, and botanic gardens can be employed in the wild.
- **Promoting peaceful cohabitation:** Real-time data on animal movements can help with policing of the wildlife-human interface. Enhanced knowledge of animal behavior through advanced monitoring technologies can further improve management techniques.
- Technological advances in animal husbandry and plant propagation for highly marketable biological products could **reduce the incentives for illegal trade** (for example, crocodile farming has reduced poaching of wild populations for skins). It is even possible that future technology may bring about synthetic substitutes for some of the most sought-after animal products, for example by 3D printing rhino horn tissue.

3.4.1. MAN-ANIMAL CONFLICT

Why in news?

Recently, officials from five states viz. Odisha, Chhattisgarh, Bihar, Jharkhand and West Bengal proposed a number of strategic measures, to tackle human-elephant conflict.

Man-Animal Conflict

- It refers to the interaction between wild animals and humans which results in negative impact on people or their resources, or wild animals or their habitat.
- It occurs when growing human populations overlap with established wildlife territory, creating reduction of resources for some people or wild animals.
- Some examples of human-wildlife conflict include:
  - Predation on livestock or domestic animals by wildlife
  - Ungulate damage crops and fences
  - Flooding caused by beavers

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- o Birds nesting in undesirable residential locations
- o Vehicle/wildlife collisions

Reasons for Increasing Man-Animal Conflicts

- **Urbanisation and increasing population** - The primary reason for the increasing interaction is urbanisation. Human settlements expanding into established wildlife territories lead to conflict over not only space, but also food.
- **Habitat Fragmentation and shrinking** - Due to deforestation and habitat fragmentation and shrinkage, the quality of the habitat has declined and prey base has reduced.
- **Land Use Transformation** - Humans encroach on clear large areas of protected forest patches for development of agricultural and horticultural lands. Developmental activities such as hydroelectric projects also result in submergence of nearby forests and fragmentation of habitat.
- **Road Kill** - India's road network is expanding at a large scale due to the expanding economy and increase in vehicular traffic. Some of this road network is being expanded through protected areas. Apart from fragmentation, roads are becoming a serious threat to wildlife as several wild animals are killed on a daily basis by speeding vehicles.
- **Livestock Grazing** - Livestock grazing in forests leads to human-wildlife conflict as carnivores are attracted towards the easy prey and become direct enemies of livestock graziers.
- Presence of a large number of animals and birds outside the notified protected areas. Wildlife experts estimate that 29 per cent of the tigers in India are outside the protected areas.

Steps to address the issue

- **The National Wildlife Action Plan (2017-2031)** calls to make people an intrinsic part of the process to check rising human-animal conflict. It recommends following measures:
  - o **Identify and document the wide range of wildlife species** that regularly come into conflict with humans, and prioritise the species that cause maximum damage to humans and are most adversely impacted due to conflict.
  - o **Wildlife corridors** should be identified, recognized, established and maintained to reduce conflict.
  - o **Develop a national level database** to document frequencies of conflicts, quantum of damage to human life and property and wildlife deaths due to conflict.
  - o Draw up comprehensive, species and region specific, **conflict-mitigation plans based on scientific management** of wildlife populations as well as land-use practices that aid and abet HWC.
  - o Establish a Land-use Practices Assessment and Planning Committee to identify the various land-use practices that promote HWC and develop more pragmatic land-use practices.
  - o **Constitute a well-trained and adequately equipped workforce in the State Forest Departments** (SFDs) to actively address HWC situations in situ, especially those involving dangerous large mammals.
  - o **Create a Centre of Excellence (CoE) on HWC mitigation**, under the aegis of the MoEFCC, to address, develop and implement long-term and shortterm measures to reduce the adverse impacts of HWC.
  - o **Formulate and implement extensive education and awareness programmes** to reduce the growing animosity among people towards wild animals involved in conflict situations, as well as to enlist their help in mitigating HWC.
  - o Constitute a network of **Primary Response Teams (PRTs) consisting of local community persons** which address conflict situations in situ and form a bridge between the larger community and the SFD.
  - o Identify, validate and **support Indigenous Traditional Knowledge** (ITK) available in various parts of the country for dealing with the HWC.
  - o Ensure that **Environmental Impact Assessment (EIA)** of developmental projects takes into consideration potential wildlife-human conflict spinoffs that large landscape level land-use practices or alterations can cause.
- **Protocol by Environment Ministry** in 2011 listing the steps to be taken if a leopard strays into human habitation.
  - o Wild carnivores generally attack in self-defense and it is, thus, advisable to avoid provoking them.
  - o The area should be cordoned off with barricades and all attempts should be made to keep the crowd and local people from approaching the animal.

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- **Translocation** is suggested. However, this does not solve the problem but only shifts it to a different place. In fact studies show that human-animal conflict tends to increase after translocation.
- **Lethal control** has been banned since 1972. Further, lethal control may not reduce the density of a carnivore in an area because, as transient individuals may immediately occupy the vacated territories.
- Government has also prepared strategic measures to address human-elephant conflict as well.
- **Learning Best Practices:** Chhattisgarh and Jharkhand have developed apps that can track the population of elephants in the region which can be adopted by other states.
- The proposed plan by the officials of fives states divides habitats into three zones:
  - **Areas with large forest cover** that are relatively intact where elephants can be conserved,
  - **Elephant-Human Co-Existence Zones** which will serve as an interface between human settlements and elephants
  - **Elephant Removal Zones** in agricultural areas from where they will be captured and relocated to other forest areas which are intact, but if that fails, they will kept under captivity.
- Some of the animals are adaptable and in some time adapt to living in close contact with humans. Therefore, there is a need to maintain the existing tolerance by steps like:
  - **Improving techniques to protect livestock** with better pens and sheds.
  - **Reducing organic filth** so that feral dog and pig populations decrease, thereby decreasing the attractiveness of the area for leopards.
- A **robust and timely compensation/insurance scheme** administered by the local community.
- Fragmentation of wild life must be prevented and migratory corridor such as eco-bridge should be notified on priority based.

3.4.2. CRITICAL WILDLIFE HABITAT

Why in news?

Recently, government notified new guidelines on Critical Wildlife Habitat.

What are Critical Wildlife Habitats (CWH)?

- As per the Forest Rights Act, Critical Wildlife Habitat refers to such areas of National Parks and Sanctuaries that are required to be **kept as inviolate for the purpose of wildlife conservation**.
- For declaring the critical wildlife habitat state government needs to establish if the presence of right-holder is causing irreversible damage to wildlife and its habitat and that co-existence between rights holders and wildlife was not a reasonable option.
- In absent of the CWH Guidelines, **National Tiger Conservation Authority (NTCA)** had earlier issued order to deny forest rights in critical tiger habitats (core areas of tiger reserves).

Key features of CWH Guidelines

- The Chief Wildlife Warden of a state will notify an **Expert Committee** for the purpose of identification of critical wildlife habitats (CWH) in a national park or sanctuary.
- The Expert Committee will identify areas within national parks and sanctuaries, based on **scientific and objective criteria** relevant to the protected area, required to be kept inviolate for the purpose of wildlife conservation.
- The Expert Committee shall issue a public notice on the intention to notify CWH stating details of areas required to be kept inviolate, criteria adopted for CWH identification, implication of the notification on existing rights etc.
- The Expert Committee shall carry out open consultations with all stakeholders, and the proceedings of the consultations, especially the objections, will be documented appropriately.
- The committee will submit the CWH proposal to the Chief Wildlife Warden. The decision on the proposal will be taken by the Standing Committee of the National Board for Wildlife. A **representative of the Ministry of Tribal Affairs** would also be invited to be a member of the expert committee.
- Following the committee's recommendation, the notification of CWH will be published in the official gazette.

Challenges of the CWH Guidelines

- The guidelines are being seen as dilution of the Forest Rights Act as the guidelines are silent on the issue of the settlement of rights before notifying CWH.

- Relocation requires completion of recognition of rights and informed consent from gram sabhas. But the guidelines have left it for a next stage. This leaves space open for manipulations.
- The guidelines are also silent on the revision based on the objections of affected communities, neither does it say that the public notice has to be published and distributed in the local language.
- There are no provisions w.r.t to raising objections during consultations and neither has it been made clear if the process would include single consultation or multiple consultations.
- The Objective of the guidelines state creation of inviolate spaces within the national parks. However, inviolate in general indicates no human settlements and usage. Therefore the definition of inviolate should be suitably modified to allow for minimal human activity which are not threat to species or ecological communities.

Conclusion

The CWH guidelines are important for the conservation of wildlife and their habitat. However, there should be a healthy balance between conservation process and rights of forest dwellers. Government should strive to develop transparent and inclusive mechanism to ensure participatory decision making.

3.4.3. HIMALAYAN BIODIVERSITY

Why in news?

Recently it was reported by Zoological Survey of India that Himalayan Biodiversity is faced with multiple threats.

About Himalayan Biodiversity

- Himalayas form about 12% of the country's landmass and is home to about 30.16% of it fauna and 31.6% of its flora.
- India, Himalayas is spread over six states – Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, West Bengal and Arunachal Pradesh.
- It is divided into two bio-geographic zones namely – Trans-Himalayas and Himalayas based on the physiographic, climatic and eco-biological attributes.
- **Himalayas** is endowed with a varied biodiversity from alluvial grasslands to subtropical broadleaf forest, mixed conifers and conifer forests in higher hills and alpine meadows above the tree line.
- Himalayas has high species diversity and endemism and is one of the hotspots located in India.
- **Himalayas** has over 131 protected areas which include 20 national parks, 71 wildlife sanctuaries, five tiger reserves, four biosphere reserves and 7 Ramsar Sites.

Threats faced by Himalayan Biodiversity

- **Climate Change and Global Warming –** It is one of the biggest threat faced by many threatened species of vertebrates and mammals and is evident from the shifting distribution of certain species such as Asiatic Black Bear, Snow Leopard etc.
- **Poaching –** Illegal trade in some of the flagship species such as snow leopard, tigers etc. Has lead to uncontrollable poaching and killing of wild animals for trade.
- **Human - Animal Conflict -** The retaliatory killing by the farmers and villagers is also a major threat.
- **Habitat loss and Receding glaciers due to climate change –** Climate change has many associated impact on an ecosystem which leads to changed precipitation pattern and change in mean temperature. This results in loss of endemic plants species and loss of glaciers in the Himalayas.
- **Unregulated harvesting of Himalayan Herbs –** Some of the Himalayan herbs have medicinal qualities such as Himalayan trillium, due to which they are extensively harvested combined with grazing of cattle leads to their vulnerability and possible extinction.
- **Alien Species –** Alien species are a threat to endemic species because they grow unchecked and do not have natural predators such as lantana camara.
- **Natural threats –** Threats such as landslides and shifting river course also impact the natural vegetation and faunal diversity.
- **Encroachment:** There is increasing population pressure seen in terms of extension of agricultural land, exploitation of forests for timber, fodder and fuel wood, intensive grazing. These are the major factors contributing to the habitat loss of various flora and fauna

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- **Infrastructure Development**: The competition to develop economy, increasing urbanisation, attaining energy security, connecting remote areas intrudes massively in the natural ecosystem of the Himalayan region.
- **Waste Disposal**: Human populations, their habitat, discharge from the industries in Himalayan regions give rise to unimaginable non-biodegradable wastes and toxics. These foreign substances enter in the local food chain and through bioaccumulation and biomagnifications completely alter the natural ecosystems.
- **Political reasons**: Insurgencies, wars, military operations and presence of war zone along India's Pakistan and China Border cause destruction of forests and the biodiversity.
- **Ceasing the conservation effort**: Downlisting the species from 'endangered' to only 'vulnerable' signals that the species does not require the same amount of attention and resources as before.

Steps taken to conserve Himalayan Biodiversity

- **Secure Himalaya Program** –
  - The project aims to
    - ✓ **Sustain critical ecosystem services** (such as fresh water, erosion reduction, mineral resources, land for food crops, medicinal plants, etc.)
    - ✓ **conserve vulnerable snow leopards** and other endangered species by securing community livelihoods, enhancing enforcement, strengthening community institutions,
    - ✓ Improving **knowledge, advocacy and information systems** for promoting landscape-based conservation approaches.
  - Specific landscapes (Alpine pastures, sub-alpine forest and critical watersheds) under SECURE Himalayas are:
    - ✓ Changthang (Jammu and Kashmir)
    - ✓ Lahaul – Pangi and Kinnaur (Himachal Pradesh)
    - ✓ Gangotri – Govind and Darma – Byans Valley in Pithoragarh (Uttarakhand)
    - ✓ Kanchenzonga – Upper Teesta Valley (Sikkim).
- **Himalayan Research Fellowship Scheme** –
  - The scheme aims **to create a young pool of trained environmental managers, ecologists and socio-economists**. This pool will help generate information on physical, biological, managerial and human aspects of Himalayan environment and development.
  - The research may be undertaken in any of the identified broad thematic areas (BTAs) of the NMHS such as water resource management including rejuvenation of springs and catchments, hydropower development, assessment and prediction of water-induced hazards, livelihood options including ecotourism opportunities, biodiversity management including recovery of threatened species and skill development.
- **The National Mission for Sustaining the Himalayan Ecosystem (NMSHE)**- is one of the eight missions under the National Action Plan on Climate Change (NAPCC). It is a multi-pronged, cross-cutting mission across various sectors. It contributes to the sustainable development of the country by enhancing the understanding of climate change, its likely impacts and adaptation actions required for the Himalayas- a region on which a significant proportion of India's population depends for sustenance.

3.4.4. WESTERN GHATS BIODIVERSITY CONSERVATION

Why in news?

Recently, concerns were raised on the impact of Sharavati Pumped Storage Project on the biodiversity of western ghats.

About Western Ghats

- Western Ghats are a continuous range of mountain for over 1500km along the coast of Gujarat, Maharashtra, Karnataka, Goa, Kerala and Tamil Nadu.
- They are one of the four biodiversity hotspots in India. They are also considered to be one of the most important natural heritage sites in the world and figures in UNESCO World Heritage List.
- It is considered to be one of the most important bio-geographic zones of India, as it is one of the richest centres of endemism. The extent of endemism is high amongst amphibian and reptile species.

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- Due to varied topography and microclimatic regimes, some areas within the region are considered to be active zones of speciation. They host over 400 species and seven distinct vegetation types such as evergreen forests, dry deciduous and scrub forest, shola grasslands etc.
- **Western Ghats have shrunk in space** in recent times because of loss of species and degrading habitats – this **might affect rainfall patterns, river flow, water supply and climate of the country**. Therefore its conservation is a must.
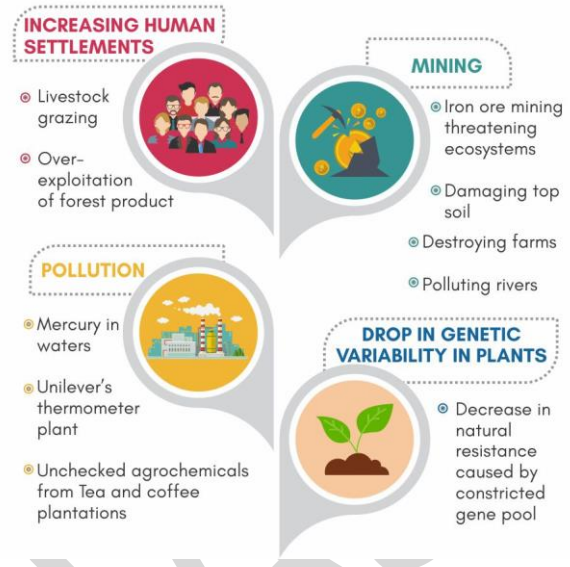
Steps taken

- A large number of protected areas comprising national parks, wildlife sanctuaries, tiger reserves and elephant reserves established to provide stringent protection to both flora and fauna in western ghats. Nearly 10 per cent of the total area of Western Ghats is currently covered under the Protected Area category.
- Government notified nearly 57,000 square km area in the Western Ghats region as ecologically sensitive area (ESA) where all kinds of mining activities, large constructions, thermal power plants and highly polluting industries would no longer be allowed. The 56,825 square km of land is spread over six states of Gujarat, Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu.
  - A committee headed by K. Kasturirangan recommended that only about 60,000 sq km or about 37% of the WG be declared as ESA. This was a significant reduction from that of the Gadgil committee which recommended making **entire Western Ghats an Ecologically Sensitive Area** because of its rich biodiversity and its ecosystem services like irrigation and drinking water to people.

However, various other steps need to taken for effective conservation of western ghats:

- **Reducing man-animal conflict:** Updated database of wildlife movement need to be maintained. Incentivising farmers to grow non-cash crops around the Protected Areas and providing of crop insurance may be taken up. Maintenance of Elephant Proof Trenches, solar fences, special structures and adequate use of Elephant Depredation Camps may be ensured to reduce Human Wildlife Conflicts.

THREATS To The WESTERN GHATS

"From 1920-1990, 40% of original natural vegetation was lost"

INCREASING HUMAN SETTLEMENTS
- Livestock grazing
- Over-exploitation of forest product

MINING
- Iron ore mining threatening ecosystems
- Damaging top soil
- Destroying farms
- Polluting rivers

POLLUTION
- Mercury in waters
- Unilever's thermometer plant
- Unchecked agrochemicals from Tea and coffee plantations

DROP IN GENETIC VARIABILITY IN PLANTS
- Decrease in natural resistance caused by constricted gene pool

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Ecologically Sensitive Area (ESA)
- MoEF defines it is as a bio-climatic unit wherein human actions have caused irreversible changes in the structure of biological communities and their natural habitats.
- As per Environment (Protection) Act, 1986, the government can prohibit industrial operations like mining, sand quarrying and thermal power plants in it.
- But Environmental Act 1986 does not mention ESA explicitly.

Madhav Gadgil committee recommendations
- It advocated zoning of ecological sensitive area of the Western Ghats in three layers –
  - Most significant area as Ecologically Sensitive Zone I (ESZ I)
  - Moderately significant area as Ecologically Sensitive Zone II (ESZ II)
  - Least significant area as Ecologically Sensitive Zone III (ESZ III) Zone 3 was given considerable flexibilities in infrastructure. By this Gadgil asked to protect about 64% of Western Ghats.
- Local self-government should have the authority to regulate and encourage activities in each zone.
- The parameters to be used to identify the Ecologically sensitive zones would be –
  - Biological forces like richness and rarity of species, ecological resilience etc.
  - Cultural and Historical significance of the area
  - Geo-climatic features such as slope, aspect, altitude, precipitation etc.
  - Hazard vulnerability
  - Stakeholders valuation
  - Origin of rivers, contiguous habitats to national parks and sanctuaries etc.
- The activities to be banned in Ecologically sensitive zones would be GM crops, SEZs, change of land use, thermal plants, sand mining etc.

- All endemic species need to be monitored so that appropriate conservation plan can be drawn for better management at landscape level. Government may consider establishing basic research laboratory in each of the Protected Areas.
- Tourist flow needs to be strictly controlled based on the carrying capacity. Forest department in coordination with Department of Tourism, needs to regulate activities of resorts / hotels / homestays, etc., in and around Protected Areas.
- Survey and demarcation along with Global Positioning System (GPS) and satellite imageries of all the Protected Areas should be done on priority basis to update database of encroached area so that appropriate action can be taken to reclaim these areas.
- Adequate amenities and training may be provided to temporary Anti Poaching Camp staff to increase the effectiveness of patrolling.

4. DISASTER MANAGEMENT

Disaster risk situation in India

- **Disaster** refers to a catastrophe, mishap, calamity or grave occurrence from natural or man-made causes, which is beyond the coping capacity of the affected community.
- According to an **UN Office for Disaster Risk Reduction (UNISDR)** report, India has been ranked as the **world's most disaster-prone country for displacement of residents.**
  o India has also been among the top **four countries** in the world with the highest number of reported disasters with **at least 167 disasters striking** India between 2005 and 2014, inflicting damages of more than $47 billion.
  o Report forecast **a continued rise in homelessness** among people in the world's most disaster prone countries unless significant progress is made in managing disaster risk.
- **Regional Vulnerability:** According to **National Disaster Risk Index, Maharashtra** is the most vulnerable state while **Delhi** is most at risk among Union territories (UTs). Other highlight of index are:
  o Some states have made significant progress in disaster risk reduction (DRR) by building resilient infrastructure and investing in early warning systems.
  o Capacity building by Gujarat, Tamil Nadu, Assam, Tripura and Himachal Pradesh has lowered their net risk to population and economic losses while States like UP, MP are considered high-risk states despite facing lower natural hazard possibilities due to high vulnerability and low capacity-building.
  o It will be used to **prepare a composite disaster scorecard (DSC)** to have a comprehensive assessment of hazards, vulnerabilities and risks of disasters at different levels, prevention of new risks and mitigation of existing risks, and mainstreaming DRR across different sectors of development.

Steps taken to improve disaster management in India

NATIONAL DISASTER MANAGEMENT PLAN (NDMP), 2016

- It aims to make India disaster-resilient, achieve substantial disaster risk reduction, and significantly decrease the losses of life, livelihoods, and assets - economic, physical, social, cultural and environmental - by maximizing the ability to cope with disasters at all levels of administration as well as among communities.
- It is made keeping in mind the **Sendai Framework (see infographic) and Sustainable Development Goals (SDGs).**
- Major highlights of the plan
  o The **plan outlines 15 disasters,** and has entrusted various ministries for its management and mitigation.
  o **Planning:** It identifies short, medium and long term measures to deal with disasters to be completed within five, 10 and 15 years, respectively.
- **Integrating approach with role clarity**
  o It provides for horizontal and vertical integration among all the agencies and departments of the Government.
  o The plan also spells out the roles and responsibilities of all levels of Government right up to Panchayat and Urban local body level in a matrix format.
  o Ministries are given role for specific disasters e.g. Ministry of Earth Sciences is responsible for Cyclones
  o The plan has a regional approach, which will be beneficial not only for disaster management but also for development planning.
  o It is designed in such a way that it can be implemented in a scalable manner in all phases of disaster management.

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- **Major activities**
  - It also identifies major activities such as early warning, information dissemination, medical care, fuel, transportation, search and rescue, evacuation, etc. to serve as a checklist for agencies responding to a disaster.
  - It also provides a generalised framework for recovery and offers flexibility to assess situation and build back better.
- **Information & media regulation**
  - To prepare communities to cope with disasters, it emphasises on a greater need for Information, Education and Communication activities.
  - It calls for ethical guidelines for the media for coverage of disasters as well as self regulation. The plan wants the media to respect the dignity and privacy of affected people.
  - To stop rumours and spread of panic, the plan directed the authorities to schedule regular media briefing (depending on the severity of the disaster) and designate a nodal officer for interacting with the media on behalf of the government

Other Steps taken

- **The National Disaster Management Act, 2005** lays down institutional, legal, financial and coordination mechanisms at the National, State, District and Local levels. The Act provides for the setting up of **National Disaster Management Authority** at national level, and, the **State Disaster Management Authority** at the state level and the **District Disaster Management Authority** at the district level alongwith the **National Institute of disaster management.**
- It provides for **National Executive Committee** which acts as the coordinating and monitoring body for disaster management. It is **chaired by the Union Home Secretary** and comprises of Secretary level

CHART OF THE SENDAI FRAMEWORK for DISASTER RISK REDUCTION 2015-2030

SCOPE AND PURPOSE

The present framework will apply to the risk of small-scale and large-scale frequent and infrequent, sudden and slow-onset disasters, caused by natural or manmade hazards as well as related environmental, technological and biological hazards and risks. It aims to guide the multi-hazard management of disaster risk in development at all levels as well as within and across all sectors

EXPECTED OUTCOME

The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social cultural and environmental assets of persons businesses communities and countries

GOAL

Prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience

TARGETS

1 Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared to 2005-2015

2 Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared to 2005-2015

3 Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030

4 Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020

5 Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this framework by 2030

6 Substantially reduce disaster damage to critical infrastructure and disruption of basis services, among them health and educational facilities, including through developing their resilience by 2030

7 Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030

PRIORITIES FOR ACTION

There is a need for focused action within and across sectors by States at local, national, regional and global levels in the following four priority areas.

PRIORITY-1
Understanding disaster risk

PRIORITY-2
Strengthening disaster risk governance to manage disaster risk

PRIORITY-3
Investing in disaster risk reduction for resilience

PRIORITY 4
Enhancing disaster preparedness for effective response, and to Build Back Better in recovery, rehabilitation and reconstruction

officers from the Ministries and departments having control of agriculture, atomic energy, defence, drinking water supply, environment and forests, finance (expenditure), health, power, rural development, science and technology, space, telecommunications, urban development and water resources. A **State Executive Committee (SEC), headed by the Chief Secretary** is also to be setup in all the states.

- o It established **National Disaster Response Fund** managed by the Central Government for meeting the **expenses for emergency response, relief and rehabilitation** due to any threatening disaster situation.
- o It also establishes **State Disaster Response Fund** used **only for meeting the expenditure for providing immediate relief** to the victims of disasters. The **state-**

The current status of implementation of provisions of DM Act, 2005:

The **implementation** of the **National Disaster Act, 2005** has been **slow, and slack.**

- The act has been criticized for **marginalizing Non-governmental organizations (NGOs), elected local representatives, local communities and civic groups.**
- It has also been accused of fostering a hierarchical, **bureaucratic, command and control, 'top down', approach** that **gives the central, state, and district authorities sweeping powers.**
- A **Comptroller and Auditor General (CAG) report in 2013** highlighted several other loopholes in the functioning of NDMA.
    - o It said **none of the major projects taken up by NDMA was complete.** The projects were either abandoned midway or were being redesigned because of **initial poor planning.**
    - o As per the CAG report, NDMA has also not been performing several functions such as recommending provision of funds for the purpose of mitigation and recommending relief in repayment of loans.
    - o It also highlighted **that several critical posts in NDMA were vacant** and consultants were used for day to day working.
- The centre, states and districts had **not constituted Mitigation Funds** which could be utilised for disaster preparedness, restoration, etc.
- Various projects undertaken for strengthening the communications network for disaster management were either at the planning stage, or were delayed.
- All States and UTs have created State Disaster Management Authorities (SDMAs) but with the exception of a few, most exist as a mere formality in the form of a committee.
- States failed to constitute advisory committees on disaster management preparedness as well as state disaster response force.
- National executive committee to monitor the implementation of disaster management guidelines meets infrequently even in the case of disasters.
- There is a lack of functional integration among concerned agencies.
- 27% posts in the National Disaster Response Force (NDRF) were vacant. The NDRF's training institute, **the National Institute of Disaster Response, had not been established,** though it had been approved in 2006.

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specific disasters within the local context in the State, which are not included in the notified list of disasters, **are also eligible** for assistance from State Disaster Response Fund.

- o **National Disaster Response force** is formed as a **specialist response force** that can be deployed in a threatening disaster situation or disaster.
- o It provides for constitution of an advisory committee consisting of experts in the field of disaster management and having practical experience of disaster management at the national, State or district level to make recommendations on different aspects of disaster management.
- **National Policy on Disaster Management (NPDM),2009** has been approved with the vision "to build a safe and disaster resilient India by developing a holistic, proactive, multi-disaster oriented and technology driven strategy through a culture of prevention, mitigation, preparedness and response".
- **ESSO-IMD (Earth System Science Organization-India Meteorological Department):** It is responsible for monitoring, detection and forecasting of weather and climate extremes including severe weather events such as cyclones, heavy rainfall, extreme temperature etc.
- **Indian Tsunami Early Warning System (ITEWS):** It is capable of sending tsunami warning in less than 10 minutes after any major earthquake of 5 magnitude and above in Indian Ocean as well as in the Global Oceans.
    - o ITEWS acts as a **Regional Tsunami Advisory Service Provider** along with Australia and Indonesia for the Indian Ocean region
- **National Cyclone Risk Mitigation Project (NCRMP):** Objective is to undertake suitable structural and non-structural measures to mitigate the effects of cyclones in the coastal states and UT's of India.

- o It is implemented by National Disaster Management Authority (NDMA) under Ministry of Home Affairs(MHA), in coordination with participating State Governments and the National Institute for Disaster Management (NIDM).
- **Ensemble Prediction Systems (EPS):** IMD recently launched the Ensemble Prediction Systems (EPS) to provide probabilistic weather forecasts upto next 10 days.
  - o It would improve deterministic forecasts that are prone to high margins of error and would lead to better management of agriculture and water resources and also helps **to promote tourism, solar and wind energy**.
- **Regional Integrated Multi-Hazard Early Warning System (RIMES):** Odisha government will collaborate with RIMES for strengthening its early warning services and enhancing preparedness for management of hazards in the State.
  - o **RIMES aims** to establish a regional early warning system within a multi-hazard framework for the generation and communication of early warning information, and capacity building for preparedness and response to trans-boundary hazards.

Prime Minister's 10-point agenda for efforts towards disaster risk reduction.

- All development sectors must imbibe the principles of disaster risk management.
- Work towards risk coverage for all - starting from poor households to SMEs to multi-national corporations to nation states.
- Encourage greater involvement and leadership of women in disaster risk management.
- Invest in risk mapping globally.
- Leverage technology to enhance the efficiency of disaster risk management efforts.
- Develop a network of universities to work on disaster issues as they have social responsibilities too.
- Utilise the opportunities provided by social media and mobile technologies and recognise the potential of social media and develop applications for all aspects of disaster risk management.
- Build on local capacity and initiative.
- Ensure that the opportunity to learn from a disaster must not be wasted.
- Bring about greater cohesion in international response to disasters

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4.1. FISCAL COSTS OF NATURAL DISASTERS

Why in news?

Recently, IMF released report on **"How To Manage The Fiscal Costs Of Natural Disasters".**

Background

- According to **International Disaster Database** annual global economic losses on account of disasters are estimated at around $306 billion.
  - o Similarly, the **cost of natural disasters in India** since 2000 is estimated at Rs 4 lakh crore with over 75,000 deaths.
- According to **World Meteorological Organisation**, for Indian Subcontinent, 2017 was the most expensive year on record for severe weather and climate events.
- **Sendai Framework for Disaster Risk Reduction** calls for reducing direct disaster economic loss in relation to global gross domestic product (GDP) by 2030.

Finding of Report

- **Disproportionate Impact of Disaster on Low-income countries:** They tend to suffer large and lasting damage relative to their economic sizes and populations. It's also exacerbated by high levels of poverty, climate change, rapid urbanisation and exposure to the entire spectrum of natural hazards including drought, floods, cyclones, earthquakes and heatwaves.
- **Fiscal Imbalance:** Natural disasters can deplete a government's fiscal position by eroding the revenue base (on average by 10%) and increasing expenditures (on average by 15%).
- **Impact on Socio-economic Development:** Disasters undermine economic growth and set back development objectives, such as poverty reduction, especially in developing and low-income countries with significant infrastructure gaps and institutional constraints.
- **Crowding out of Fund:** Disaster often increases public debt, leading to higher borrowing by government, and dampening of investment climate in country.

Suggestion in Report

Sound Public Financial Management (PFM) Strategy: This can be achieved by designing fiscal risk reduction through:

- **For small- and medium-scale natural disasters:** Budgetary support should be the main instrument for managing the fiscal impacts of probable or possible small- and medium-scale natural disasters.
  - **Creating Contingency Reserves in the Budget:** To tackle unforeseen expenditures and to cover the costs of moderate but frequent natural disasters.
- **For large-scale natural disasters:** Innovative options like **Catastrophe bonds and insurance** should be the most common instrument along with budgetary support so as to reduce government fiscal exposure on long and large term financing.
  - **Creating Natural Disaster Funds:** It aims to build **a fiscal buffer,** to cover the potential cost of a catastrophic event in a timely manner without endangering long-term fiscal sustainability. On average 3% of budget should be buffered to deal with the fiscal risks associated with natural disasters.
- **Incorporating Escape Clause in Budgets:** To provide **flexibility** with fiscal target and ensuring timely and effective disaster response.
- **Fiscal incentives:** Targeted subsidies to **strengthen resilience** by promoting strong Public Infrastructure, encouraging the retrofitting of existing properties, supporting drought-resilient crops, protecting and expanding forest coverage, and preserving scarce water resources.
- **Transparency:** It's important **to mitigate social and economic consequences** of disaster, by providing accurate and adequate information for **informed decision making** and to maintain the integrity of budget processes.

Way Forward

- **Building Back Better:** According to **World Bank**, when countries rebuild stronger, faster and more inclusively after natural disasters, they can reduce the impact on people's livelihoods and well-being by as much as 31%, potentially cutting global average losses from $555 billion to $382 billion per year.

> **Disaster Risk Insurance**
> - **Advantages**
>   - **Legal Entitlement:** Policy holders are legally entitled to compensation instead of being at the mercy of government.
>   - **Timely Intervention:** They can reach a large number of people within a short period of time
>   - **Easing of fiscal burden:** By reducing or even avoiding long-term costs to public financial stability, economic growth, optimal allocation of capital and human development.
>   - **Governance:** Its demand structured decision-making processes lead to improved and efficient disaster risk governance.
>   - **Gender impacts:** Women in the community are more receptive than men to the benefits of microinsurance
> - **Challenges**
>   - **Moral hazard** is one of the primary risks associated with indemnity insurance as policyholder increases his or her risk exposure by taking fewer preventative actions
>   - **Opportunity Cost of Premium** payments is an important factor conditioning the impact of risk transfer upon the vulnerability of policyholders.
>   - **Lack of Data:** There is scarce empirical evidence demonstrating an operational link between risk transfer and risk reduction
>   - **Low capacity from the policyholders** leading to misunderstanding of the risk context, lack of financial literacy and failure to accurately correlate risk models with losses on the ground.

- **Invest in risk reduction:** According to **Global Assessment Report (GAR)** 2015, an annual global investment of $6 billion in disaster risk management strategies would generate total benefits in terms of risk reduction of $360 billion.
- **Encouraging economic diversification:** To minimize the impact of disaster on any particular sector.
- **Increasing Insurance Penetration** for risk sharing with government in post disaster response.

4.2. DISASTER RESILIENT INFRASTRUCTURE

Why in News?

- Indian Government recently held a two-day International Workshop on **Disaster Resilient Infrastructure (DRI)** under the National Disaster Management Authority (NDMA) in collaboration with **United Nations Office for Disaster Risk Reduction** (UNISDR).

Background

- **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.
- In the **10-point agenda** announced by the Indian government during Asian Ministerial Conference on Disaster Risk Reduction (2016), the first point focused on 'working to ensure that all development projects are built to appropriate standards and contribute to the resilience of communities they seek to serve."
- 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.
- **SDG Goal 9** recognizes disaster resilient infrastructure as a crucial driver of economic growth and development.

> - **UNISDR** was established in 1999 as a dedicated secretariat to facilitate the implementation of the **International Strategy for Disaster Reduction (ISDR)**.
> - The **International Strategy for Disaster Reduction (ISDR)** is a global framework established within the United Nations for the promotion of action to reduce social vulnerability and risks of natural hazards and related technological and environmental disasters.

What is DRI?

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.

> **Why we need DRI?**
>
> The frequency and severity of disaster events, especially the large hydro-meteorological disasters, has been increasing which makes DRI inevitably the need of the hour because-
>
> - **Reduces Economic Loss**- It could bring down the economic cost of rebuilding the whole set up that the nations face due to natural disasters.
> - **Reduce loss to human life**- It will also help achieve targets pertaining to reduction in mortality and number of affected people due to disasters.
> - **Post Disaster Response**- The public infrastructure sectors - energy, transportation, tele-communication are also crucial to step up the overall disaster response, thus making their resilience critical for effective post-disaster response.

Steps to be taken

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.

4.3. CYCLONE

Why in news

- Recently, western coast of India was hit by the tropical cyclone Ockhi.

About Cyclone Ockhi

- It originated in the Bay of Bengal and intensified as it moved through the Arabian Sea, resulting into a cyclonic storm.

Mains 365 – Environment

- Ockhi name is coined by Bangladesh, which means 'eye' in Bengali.
- According to Indian Metrological Department, It was a **'very severe cyclonic storm'**.

India's vulnerability to Cyclones

- About 8% of the area in the country and 1/3rd of the population are vulnerable to cyclone-related disasters in country.
- India is exposed to nearly 10% of the world's tropical cyclone and in the last 270 years, 21 of the 23 major cyclones (with a loss of about 10,000 lives or more) worldwide occurred over the area surrounding the Indian subcontinent (India and Bangladesh).
- Majority of cyclones originate in the Bay of Bengal and mostly hit the east coast of the Indian subcontinent.

NDMA guideline on cyclone management:

- Establishing a **state-of-the-art cyclone early warning system (EWS)** involving observations, predictions, warnings and user friendly advisories.
- Commissioning of the **'National Disaster Communication Infrastructure'** (NDCI) to provide dedicated and failsafe communications to the National, State and District Disaster Management Authorities and officials concerned.
- Expanding the warning dissemination outreach by introducing 'Last Mile Connectivity', using VHF technology.
- Implementing the **National Cyclone Risk Mitigation Project (NCRMP)** in all the 13 coastal states and UTs.
- Taking up structural mitigation measures like improving structural lifeline infrastructure; construction of multi-purpose cyclone shelters and cattle mounds, ensuring cyclone resistant design standards in rural and urban housing schemes, building all-weather road links, bridges, culverts and saline embankments etc.
- Management of coastal zones to include mapping and delineation of coastal wetlands, patches of mangroves and shelterbelts and identification of potential zones for expanding bio-shield spread based on remote sensing tools.
- Setting up of an **Exclusive Eco-System Monitoring Network** to study the impact of climate change.
- Establishing a comprehensive '**Cyclone Disaster Management Information System'** (CDMIS) covering all phases of Disaster Management.
- Setting up of a '**National Cyclone Disaster Management Institute'** in one of the coastal states to address all issues related to cyclone risks.
- Commissioning of "**Aircraft Probing of Cyclone (APC) facility"** to fill the critical observational data gaps and significantly reduce the margin of error in predicting cyclone track, intensity and landfall.

INDIA METEOROLOGICAL DEPARTMENT
Tropical Cyclone Intensity Scale

CATEGORY	SUSTAINED WINDS (3-min average)
Super Cyclonic Storm	≥ 120 kt ≥ 221 km/h
Extremely Severe Cyclonic Storm	90-119 kt 166-220 km/h
Very Severe Cyclonic Storm	64-89 kt 118-165 km/h
Severe Cyclonic Storm	48-63 kt 89-117 km/h
Cyclonic Storm	34-47 kt 63-88 km/h
Deep Depression	28-33 kt 51-62 km/h
Depression	17-27 kt 31-50 km/h

Increasing cyclone frequency in Arabian Sea:
According to scientist, extremely severe cyclones are becoming more frequent in the Arabian Sea particularly post-monsoon due to:
- Arabian Sea surface becomes warmer than the other ocean basins during post monsoon season.
- Weakening of winter monsoon circulation due to the interplay of global warming, climate variability and weather change.

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.
- The next cyclone will be named by India and it will be called 'Sagar'.

4.4. DUST STORM

Why in news?

- A violent storm led to deaths of more than 100 people in Uttar Pradesh, Andhra Pradesh, West Bengal and Delhi-NCR.

What is a Dust storm?

- A dust storm, or sandstorm, is a phenomenon common in hot and dry climates.
- Dust storms are also known as **Haboob**, which is Arabic for violent wind.
- The strong storms can develop in many parts of the world and can travel for thousands of miles or even across oceans.
- A dust storm requires a large availability of dust, and enough sustained wind to lift the particles.
- Dust storms also commonly occur with thunderstorms before it is about to rain.
- The rain water does not manage to reach the ground as it is evaporated by the heat.
- This causes the air to cool down, **meaning there is an area of cold air sitting above the warm air on the ground.**
- The cold air comes down in a **down-burst** which splashes against the surface **which kicks the dust upwards.**


HOW CHAIN OF STORMS ARE FORMED

Storm cause a downward movement of air which feeds into successive convective which feeds into successive convective storm systems.

- Convective storm systems develop when intense heat at or near the surface causes air and moisture to travel upwards in the atmosphere to form storm-bearing clouds.
- As a cloud gains height, water vapour condenses and forms water droplets which fall as rain or hail when the cloud is no longer able to hold the moisture.
- The peculiar characteristic about the storms in the first week of May, especially in northern and northwestern India, was a kind of chain reaction of storms, which was apparently triggered by a single squall line—bands of high speed winds high up in the atmosphere that typically bring storms and rain. These winds entered the country through Pakistan and Afghanistan.
- The squall line not only invigorated the systems of cyclonic circulations in northern India, but also brought the moisture that perpetuated convective storms

Why was the recent storm so devastating?

- The recent storm was aided by 'ideal' conditions that magnified its intensity.
  - There was huge thunderstorm complex that swept through the area overnight, generating high winds that also carried lots of dust.
  - Temperatures in Rajasthan reached 45°C.
  - There was presence of easterly wind that brought in moisture.
  - The intensity of western disturbances increased.
- Unsustainable farming practices have deteriorated the soil profile aiding the erosion.
- There were more deaths also due to lack of disaster resilient infrastructure.

Impact of dust storms

- It leads to loss of life and property as witnessed in North India.
- They are one of the biggest contributors to **air pollution**.
- They carry harmful particles that **increase the spread of diseases** across the globe. Virus spores in the ground are blown in the air and spread through acid rain or urban smog.
- Inhaling dust affects the respiratory system. Prolonged exposure to dust can cause silicosis, which leads to lung cancer.
- They also put people in danger of keratoconjunctivitis sicca or 'dry eyes', which, if left untreated, may lead to visual impairment or blindness.
- They get deposited in the Ocean changing the salinity of the waters and affecting the marine ecology.

Related information

- IMD was able to give timely warning about the Dust storm through its "**Now Cast**" services, which is a free SMS service sent on extreme weather conditions is provided every three hours.

Way forward

- There is a need to check desertification which is affecting nearly one-fourth of the nation.
- Sustainable farming practices like Permaculture, organic farming should be encouraged in areas with degraded soil.
- There should be adoption of practices that reduce dust formation in Urban areas at construction sites, unpaved roads etc.

WESTERN DISTURBANCES
While Western Disturbances (WDs) normally peak between December and February, a greater number of active WDs have been observed in spring and summer months. Instead of the normal 2-3 active WDs seen during the months of April and May, over the past month and a half, at least 10 separate active WDs have been observed. WDs carry high velocity winds that agitate the atmosphere and aggravate storm conditions.

CYCLONIC CIRCULATIONS
In the build up of the massive storms in the beginning of May, five separate cyclonic circulations were observed across the country

UNUSUALLY HOT CONDITIONS
Temperatures over 40°C observed in northwest, central, east and north peninsular India. Interactive of hot air near the surface with colder winds from the Western Disturbances given rise to intense and widespread storms.

TROUGH
A trough is an extended area of low pressure developed alone the E-W axis. This where moisture-laden winds from the Bay of Bengal met hot and dry air from central and western India, These winds also came in contact with the cold front that develops due to active WDs. The confluence of these different winds culminated in intense and widespread storms across the Indo-Gangetic plain. Similarly a N-S trough was formed from Bihar to northen Tamil Nadu, along which stormy weather was observed in Telangana, Andhra Pradesh and some parts of Karnataka

EASTERLY WINDS
Winds from the Bay Bengal carry moisture and are associated with pre-monsoon thunder storms in the eastern coast. Moving towards the troughs, these winds provided the moisture that further intensified the convective storms

- There needs to be more investment in disaster resilient infrastructure like storm shelters.
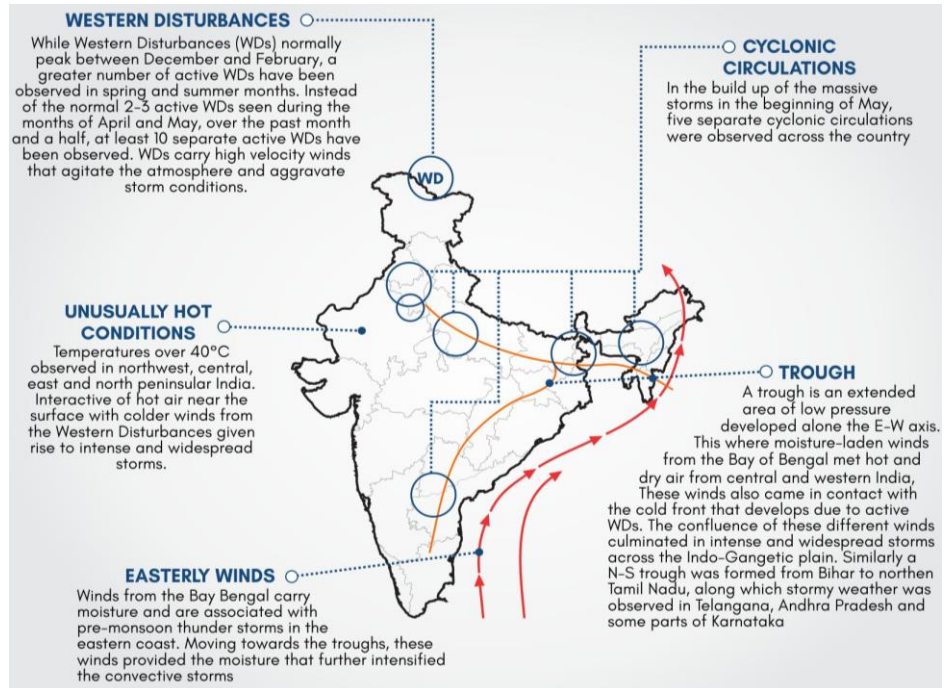
4.5. FOREST FIRES

Why in news?

National Green Tribunal has directed the Ministry of Environment, Forests and Climate Change to finalise the National Policy on Forest Fire.

Related information

- According to Global Forest Watch, India has witnessed a **125% spike in forest fires** between 2015 and 2017. In 2017, **23 out of 33 states and union territories** reported an increase in forest fires with maximum number of forest fires were reported in Madhya Pradesh (4,781) followed by Odisha (4,416) and Chhattisgarh (4,373).
- According to **India State of Forest Report (ISFR)** maximum number of forest fires occurs in Open Forest (OF) followed by Moderately Dense Forests (MDF). About 70% forest fires in India occur in the tropical dry forests encompassing scrub, savanna grassland, dry and moist-deciduous forests.
- **Fire prone region**: Himalayan regions and the dry deciduous forests of India, particularly in Andhra Pradesh, Assam, Chhattisgarh, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra and Odisha are ecologically sensitive areas and are most affected by these fires.
- According to **State of India's Environment report**, budget to fight forest fires has been reduced by 14-72% in 13 states in 2017.

Causes of forest Fire
- Traditionally Indian forests have been affected by fires. The menace has been aggravated with rising human and cattle population and the consequent increase in demand for Forest products by individuals and communities.
- **Environmental causes** are largely related to climatic conditions such as temperature, wind speed and direction, level of moisture in soil and atmosphere and duration of dry spells. Other natural causes are the lightning, friction of bamboos swaying due to high wind velocity and rolling stones that result in sparks setting off fires in highly inflammable leaf litter on the forest floor.
- **Human related causes** result from human activity as well as methods of forest management. These can be intentional or unintentional, for example:
  - graziers and gatherers of various forest products starting small fires to obtain good grazing grass as well as to facilitate gathering of minor forest produce like flowers of *Madhuca indica* and leaves of *Diospyros melanoxylon.*
  - practice of shifting cultivation (especially in the North-Eastern region of India and inparts of the States of Orissa and Andhra Pradesh).
  - the use of fires by villagers to ward off wild animals.
  - fires lit intentionally by people living around forests for recreation.
  - fires started accidentally by careless visitors to forests who discard cigarette butts.

- A report titled **Forest Fire Disaster Management**, prepared by the **National Institute of Disaster Management,** about half of India's forests were prone to fires. 43% were prone to occasional fires and 5% to frequent fires, and 1% were at high or very high risk.
- Fires are a major cause of forest degradation and have wide ranging adverse ecological, economic and social impacts, including:
  - loss of valuable timber resources.
  - degradation of catchment areas.
  - loss of biodiversity and extinction of plants and animals.
  - loss of wildlife habitat and depletion of wildlife.
  - loss of natural regeneration and reduction in forest cover.
  - loss of carbon sink resource and increase in percentage of CO_2 in atmosphere.
  - change in the microclimate of the area with unhealthy living conditions.
  - soil erosion affecting productivity of soils and production.
  - loss of livelihood for tribal people and the rural poor, as approximately 300 million people are directly dependent upon collection of non-timber forest products from forest areas for their livelihood.

Challenges of Forest fire management in India

- **Lack of appropriate policy and planning to tackle forest fire** - Existing forest policy and other documents, including plans etc. lack clear guidelines for forest fire management.
- **Lack of proper institutional mechanism** - In general forest fire management in the country is looked after by the forest department. There is no institutional mechanism available within the forest department, even in higher fire prone regions, with sole responsibility of fire management.
- **Emphasis on response only** - Very less or negligible importance is given to other issues i.e. mitigation, preparedness, human resource development, awareness creation, etc.
- **Lack of scientific approach to collect fire data and document it for forest fire management** - The Forest Survey of India has recently started compiling forest fire data, however, at State level still there is not much sincere effort to collect and document these data and use it in research and planning.
- **Other issues include** - Not many initiatives to involve local community, lack of funding and coordination with minimal information sharing etc.

Steps taken by the government for Forest Fire Management in India

- **National Plan for forest fire management**
  - **Strengthening of organizational framework-** Through appropriate modification and alteration in State Forest Departments' structural framework and providing sufficient human power.
  - **National Forest Fire Danger Rating System**- Designing uniform system of Forest Fire Danger Rating and reporting for all States/UT's

> **Forest Survey of India role in Forest Fire Monitoring**
> - **Near real time forest fire Alerts through Forest Fire Alert System 2.0**: It uses **NASA's MODIS** (Moderate Resolution Imaging Spectroradiometer) and **VIIRS** (Visible Infrared Imaging Radiometer Suite) satellites, data to pinpoint the location of forest fire boundary.
> - **Pre warning Alerts to State Nodal officer**: It uses short term weather variable like forest cover, forest type, climate variables and recent fire incidences over the area for generating warning data.
> - **Burnt Scar Assessment**: It's done to assess forest area affected measures by forest fires to assess damage to forest and bio-diversity as well as to plan restoration.

  - **Effective fire fighting tools and machinery**- Provisions of modern and effective tools and machinery e.g. Fire Beaters, Forest Fire Showel, Pulaskis Tools, etc.
  - **Financial support to States**- Provision of Aids/Loans from GOI to States/UT's according to their action plan for Systematic Forest Fire Management.
  - **Creation of a national forest fire control board**- With the task of supervising the control of devastating forest fire in exigencies in fragile areas like Himalayan zone, Western Ghats etc.
  - **Promotion of people's participation**-Through involvement of NGOs, Voluntary Organisations, Village Forest Committees (VFCs) etc.
  - **Other important provisions include** - Inclusion of Forest fire management in National Forestry Action Plan (NFAP), designing uniform formats for reporting, monitoring and evaluation, international coordination and transfer of technology, strengthening the existing and introducing new R&D institutions dealing with forest fire management, introduction of a chapter on Forest Fire Working Circle etc.

- **Forest Fire Prevention & Management Scheme (FFPMS)**
  - Intensification of Forest Management Scheme was revised and replaced as Forest Fire Prevention & Management Scheme in December 2017.
  - It's a **centrally sponsored scheme** with **an aim** to focus solely on the issue of forest fire prevention & management and related activities, to address growing concern over adverse effects of forest fire.
  - **Funding Pattern:**
    - ✓ **For Normal States**: **60:40** between center and states.
    - ✓ **NE and Himalayan states:** **90:10** between center and states
    - ✓ **For Union Territory:** 100% central funding
  - **Objective of scheme**
    - ✓ **Long Term Objectives:**
      - To minimise forest fire incidences, develop knowledge on impacts and dynamics of forest fire and assist in restoring productivity of forests in affected areas
      - To **institutionalise the partnership** with forest fringe communities for forest protection
      - To prepare **fire danger rating system** and devise **forest fire forecasting system.**
      - To encourage the states/UTs for **optimal use of modern technology** (such as Remote Sensing, GPS and GIS) in planning, developing and operationalising Fire prevention and management system.
      - To contribute to the larger goal of **maintaining environmental stability.**
    - ✓ **Short Term Objectives:**
      - To carry out **effective awareness campaign** for prevention of forest fire
      - To effectively prevent and control forest fires by i**mproving the traditional practices** and employing available modern methods
      - To **impart suitable training** to the field staff and forest fringe communities on fire fighting with help of prescribed means and methods in the forest areas
      - To encourage **community participation** in prevention and control of forest fire
      - To develop and **strengthen Forestry Infrastructure** of the States and UTs that are required for effective prevention and management of forest fire.
  - **Monitoring and Evaluation**
    - ✓ **At National level**, MoEFCC will review the scheme and will also carry out third party evaluation after every 3 years.
    - ✓ **At State Level:** State Forest Department will be responsible for regular monitoring and review of achievement under the scheme.

4.6. URBAN FIRES

Why in news?

Recently many people lost their lives in the fire in a Mumbai rooftop restaurant.

Context

- In Uphaar cinema hall fire in New Delhi in 1997 59 people were killed as the exits had been blocked by unauthorised seating.
- In 2016, fire destroyed Delhi's National Museum of Natural History thus doing the incalculable damage to anthropological heritage and specimens in it.
- Similar incidents in industrial units, hospitals, firecracker units or even in residential areas are also on the rise.

Issues

Fires are man-made disasters, which can occur as a consequence of a natural disaster like earthquake or as an individual disaster.

- **Urban Issues:** Urban issues like high population, overcrowding, unregulated commercial activities

Salient Features of National Building Code 2016

- It incorporates administrative and technical provisions which can be adopted by the local bodies to revise and revamp their building bye-laws.
- It prescribed integrated approval process from all concerned agencies through single window clearance approach and online process for time bound building approvals.
- Updated mechanism of ensuring certification of structural safety of buildings by the competent professional and peer review of design of buildings.
- Provisions for underground or multi-storeyed parking as also mechanized parking of vehicles.
- Detailed provisions relating to requirements for accessibility in buildings and built environment for persons with disabilities and the elderly.
- Latest research and development inputs and provisions on concrete, steel and masonry buildings with a view to ensuring disaster resilient buildings.
- Fire and life safety in modern complex buildings including the high rises, glazed buildings, atria, commercial kitchen and car parking facilities.

are frequently responsible for urban fires.

- **Carelessness and apathy:** According to data compiled by the Delhi Fire Service, maximum number of fire accidents occurs due to short-circuiting or faulty electrical appliances. Developers are not implementing various provisions of the Building Code like provision of fire lifts in high rise buildings, fire-scape stairs for firemen, heavy static water storage etc.
- **Shortage of fire stations** in rural areas and Indian cities as little less than 3,000 such units are operating against the requirement of over 8,500 which shows a deficiency of 65%.
- **Legislative Issues:** Maintenance of fire service is a municipal function but the Centre provides funds and training to improve the infrastructure and quality of manpower needed to tackle fire incidents.
- **Administrative Challenges:** A slow criminal justice process and rampant bureaucratic and political corruption have also contributed to the violation of building norms.
- **Challenges in Slums or illegal settlements:** In slums closely packed constructions, construction with inflammable materials, narrow lanes inhibiting access to fire engines, unauthorized electrical connections, unsafe wiring etc. increase the impact of fires.

Suggestions

- **Objective and impartial enquiry of fire incidents** to assess the cause and further the violator must be made to pay the damage if fire safety norms are not adhered to.
- **Standing Fire Advisory Council** has recommended setting up fire stations based on response time of 5-7 minutes in urban areas and 20 minutes in rural areas.
- **Shift from fire-fighting to fire prevention and mitigation –** Measures to prevent and mitigate can be divided into structural and non-structural.
- **Development of wildland-urban interface maps** i.e. mapping of areas where naturally fire-prone wilderness areas such as forests and shrublands are close to or even intermingled with, housing developments.
- **NDMA issued guidelines in 2012** to standardise the type of equipment and training of personnel to modernise and improve fire-fighting capabilities in the country. It also included enactment of fire Act and preparation of a comprehensive plan in every state.
- Further the **training** must be provided to fire officers in advanced techniques of firefighting and rescue, keeping in mind changes such as industrialisation, growth of industry and expansion of urban areas.