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Classroom Study Material

ENVIRONMENT

July 2017 – September 20th 2017

Student Notes:

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1. CONSERVATION MEASURES

1.1. COMBATING DESERTIFICATION

Context

Kubuqi Desert in Ordos, Inner Mongolia, became the **first desert** in the world to achieve large-scale desertification control.

United Nations Convention to Combat Desertification (UNCCD)

- Adopted in 1994 and entered into force in 1996, it is the only internationally **legally binding** framework set up to address the problem of desertification
- The Convention addresses specifically the arid, semi-arid and dry sub-humid areas, known as the drylands.
- **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.

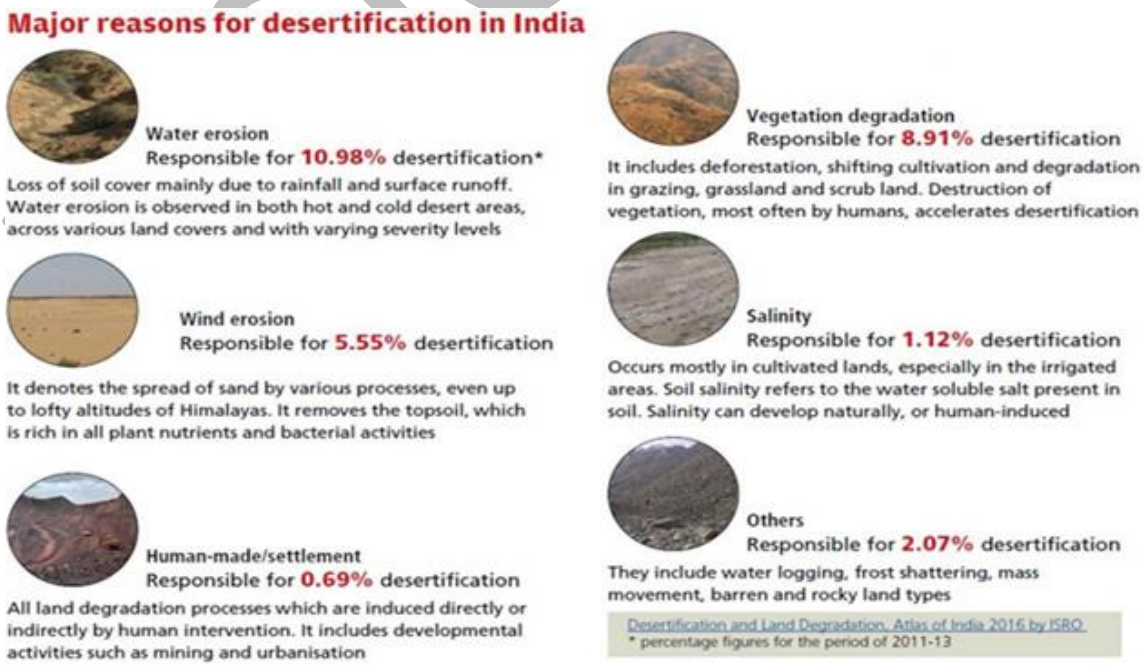
UNGA **declared 2010 to 2020 the United Nations Decade for Deserts and the Fight Against Desertification.**

Desertification Status in India

- Desertification refers to the land degradation in arid, semi-arid and sub-humid areas resulting from various factors, including climatic variations and human activities.
- According to the State of India's Environment 2017 by the Centre for Science and Environment report, nearly 30 per cent of India is degraded or facing desertification.
- In eight states—Rajasthan, Delhi, Goa, Maharashtra, Jharkhand, Nagaland, Tripura and Himachal Pradesh—around 40 to 70 per cent of land has undergone desertification.

Highlight Of Kubuqi Model

- Its **core pillars** are government policy support, industrial investment, market-oriented participation of farmers and herdsmen and sustainable ecological improvement.
- Kubuqi model can be **implemented in India** to improve the land status, as an estimated 32 percent of India's total land area is affected by land degradation (of which desertification is a major component).



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1.2. GAPS IN FORESTRY DATA

Why in news

- Recently, **Food and Agriculture Organization (FAO)** has released a set of guidelines to monitor forest resources to fill a serious gap in forest information and facilitate informed policy decisions.
- Aim of these Guidelines is to assist with the creation and operation of National Forest Monitoring System (NFMS).

National forest monitoring (NFM)

- It is a comprehensive process that includes the assessment, evaluation, interpretation and reporting of data and the derivation of information that allows for the monitoring of forest change and trends over time.
- NFM systems will be a part of global schemes (**including UN's REDD)** that pay for environmental services. Countries will receive **financial compensation** for implementing sustainable pro-forest policies

Goals and scope of national forest monitoring

- To generate a reliable data and information base for national and subnational level policies formulation related to forests and forested landscapes.
- To inform interested citizens and stakeholders about the status characteristics, services and development of national forest.
- To facilitate discussions and the development of agreements at the international level and to submit regular reports in accordance with international conventions and processes.
- To provide baseline data to enable the measurement of progress towards sustainable forest management.

Green Facts about India

- It ranks as the **10th most forested nation** in the world with 23.4% (76.87 Mha) of its geographical area under forest and tree cover.
- Out of **34 global biodiversity "hot spots**," four are located in India (Eastern Himalayas, North-east, Sundarbans, and Western Ghats)
- India is one of the **17 megadiverse countries.**
- With only 2.4% of the land area, India accounts for 7 to 8 percent of the recorded species of the world.
- Approximately 275 million people in India (27% of the total population) are known to live in the forest fringes and earn bulk of their livelihood from forests.

Background

- In 2010, only 45 countries worldwide were able to assess changes in forest area and characteristics through consecutive systematic national forest inventories.

Recommendation

- **National Ownership of Forest Monitoring:** It should be a government duty to collect data. This will pave the way for more comprehensive usage of the generated information.
- **Institutionalising forest monitoring**: A properly equipped national level institute, within the national administration, can promote long-term availability of data, adequate data management and availability of expertise. Like: Forest Survey Of India.
- **Defining a policy**: It may help to establish a formal link between the national forest monitoring system and a national forest programme, if such exists.

Significance of Guidelines

- **To Address Information Gaps** about the location of forests, their extent and composition, their ownership, biomass, carbon diversity and site fertility.
- **To Understand Human Dependence Of Forests**: who benefits or depends on them, how much of the forest produce is being used.

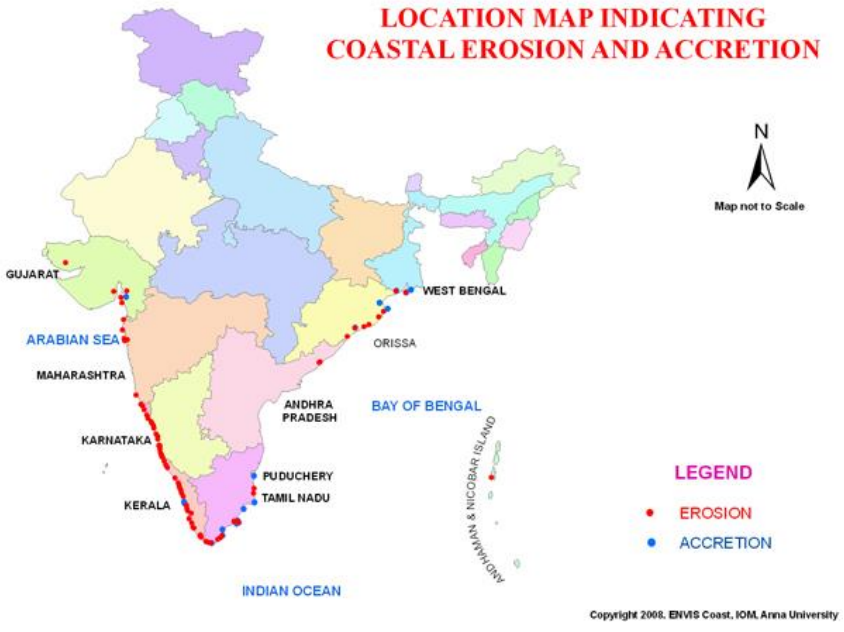
- **Sustainable National Planning**: As it will provide more accurate information on changes in carbon stocks, socio-economic aspects including the contribution to livelihoods and poverty reduction, governance and broader land use issues.
- **Strengthnening Institutional Mechanism**: It will enable member countries to set up and strengthen NFMSs, by addressing principles and key guidance elements required for a transparent, reliable and long-term process.
- **Tackling Climate change**: Information is necessary for policy-makers and other stakeholders to effectively enhance the role of forests in reducing the impact of climate change and providing other key ecosystem services.
- **Achieving FAO goals**: Evidence-based policies and practices that support highly productive and sustainably managed agricultural sectors are key to achieving FAO's goals of eradicating hunger and eliminating poverty for the benefit of present and future generations.

Reducing Emissions from Deforestation and forest Degradation plus (REDD+)

- It is a set of steps designed to use **market/financial incentives** in order to reduce the emissions of greenhouse gases from deforestation and forest degradation. It also includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks.
- It is an effort to create a financial value for the carbon stored in forests, offering incentives to reduce emissions from developing countries
- FAO supports developing countries in their REDD+ processes and in turning their political commitments, as represented in their Nationally Determined Contributions, into action on the ground.
- The REDD+ mechanism contributes directly to achieving Sustainable Development Goals (SDGs) 13 and 15. These address climate change, reducing deforestation and sustainable use of ecosystems.

1.3. 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.
- 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.

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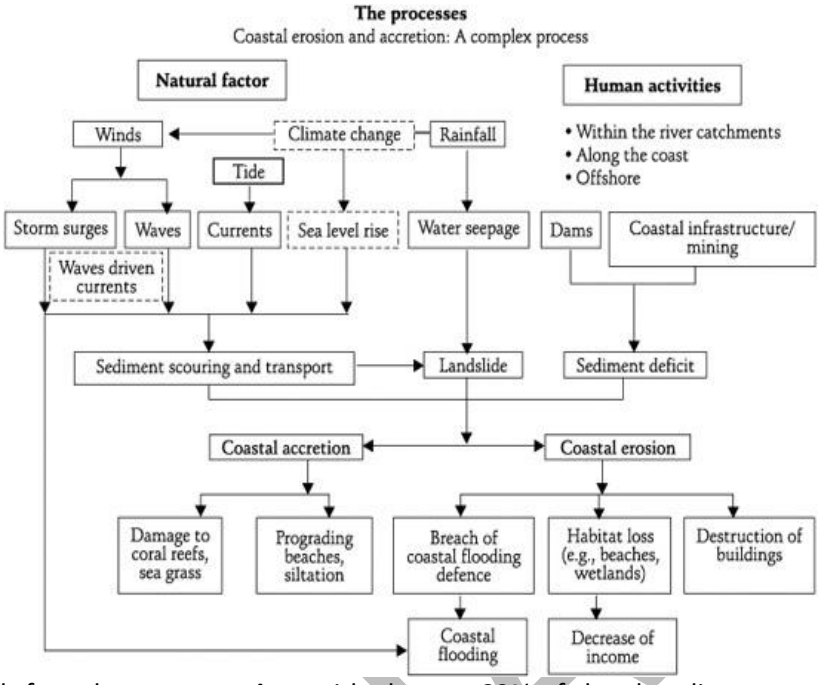
Coastal Erosion in India



- **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:
  - ✓ The Andaman and Nicobar Islands face the **most erosion,** with close to 89% of the shoreline eaten away by the Bay of Bengal.
  - ✓ 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.
  - ✓ 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:** Several options are identified including both hard or soft solutions for arresting acute or chronic coastal erosion like
  - ✓ Interventions such as **saline stone-packaging and breakwaters**, structures which are constructed on coasts are traditionally made as part of coastal defence.
  - ✓ To prevent erosion of the coast**, low walls called groynes** are built out into the sea.
  - ✓ **Geo-Synthetic Tubes**, a soft engineering technique, which has been used along Odisha coast.
  - ✓ **Vegetation:** Important for improving slope stability, consolidating sediments and providing some shoreline protection.

- **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.

2. CLIMATE CHANGE

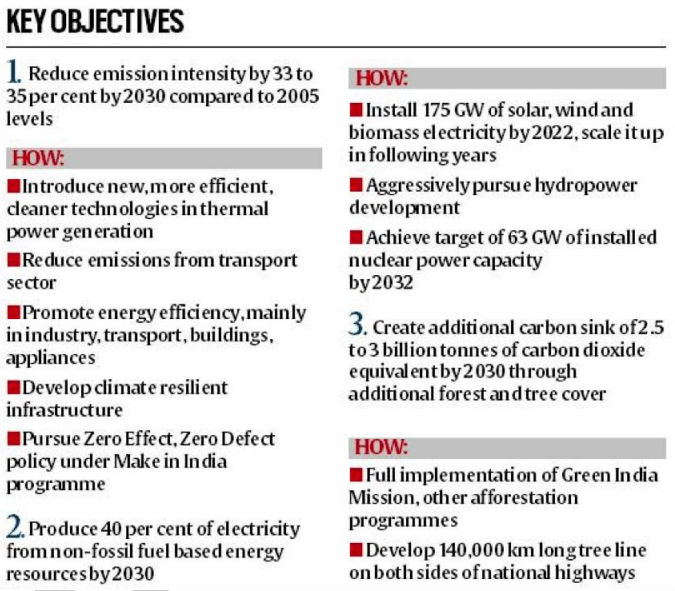
2.1. GREEN CLIMATE FUNDING

Why in news?

- Recently, National Bank for Agriculture and Rural Development (NABARD) signed an **Accreditation Master Agreement (AMA)** with the Green Climate Fund which will help India in accessing resources under **the Green Climate Fund** for financing its climate action plans.

Background

- The **World Bank** estimates that some $158 trillion worth assets — double the total output of global economy — could be in jeopardy without preventable action.
- **Finance needed by India** to achieve the **India's Intended Nationally Determined Contribution** (see infographic)
  - ✓ Preliminary estimates suggest India would require at least USD 2.5 trillion at current prices to implement all these plans till 2030.
  - ✓ NITI Aayog has said that the mitigation activities for moderate low carbon development would cost around 834 billion dollars till 2030.
  - ✓ $200 billion needed to attain a target of 100 GW of solar power and 60 GW of wind power installation by 2022.



Challenges that impact climate specific financing from financial sector include-

- **Difficulty in the sustenance of clean energy enterprises due to**
  - ✓ **Restrictive regulatory framework**: A slew of regulations ranging from the flow of international finance into the domestic economy to those related to debt and equity markets, disincentivise capital investment in climate action

Green Climate Fund

- **It** was **set up in 2010 under the UNFCCC's financial mechanism** to channel funding from developed countries to developing countries to allow them to mitigate climate change and also adapt to disruptions arising from a changing climate.
- The GCF support projects, programmes, policies and other activities regarding climate change adaptation and mitigation projects in developing countries.
- The operationalization of GCF is **noteworthy from India's point of view** because it was India and other developing countries who insisted on setting up a multilateral financial mechanism under UNFCCC with resources provided by developed countries.
- NABARD has been accredited by GCF as the first Entity for sourcing financial resources from GCF for India.
- Currently, In India only one project Installation of Groundwater Recharge System in Odisha is underway using funds from GCF.

in developing countries and LDC's.

- ✓ **Risk for investors**: Lack of a proper business model keeps the investors at high risk. Also there is a longer gestation period and capacity constraints involved in such projects.
- ✓ **Financial unviability of projects**: Technological constraints due to which many of the projects in solar and wind have high capital investments making them financial unviable.
- ✓ **Low Return on Investment**: Sustainable projects don't attract investments due to lower ROI and returns more in form of social benefits.

- **Market and financial sector hindrance**
  - ✓ **Lack of developed Green Energy- Cap and Trade market** in developing countries for climate financing
  - ✓ **Costly Insurance:** Insurance covers in these projects are costly, making them unattractive for investors.
  - ✓ **Unused Pool in Pensions**: Insurance stuck due to lack of political will.
  - ✓ **Compliance to Basel III** accords disincentivizes investment in climate change
- **Other factors**
  - ✓ **Non transfer of technology**: Some pressure groups e.g. those in USA are lobbying for not transferring clean technology.
  - ✓ **Reluctance in Investment**: Financial institutions in developed countries choose not to invest across borders as more emphasis is given on regional and national targets, which hinders flow of investment across borders to other countries. In 2016, only about 16% of all flows moved from developed to developing countries.
  - ✓ **Non binding nature of Paris Climate agreement** decreases the incentive for compliance.
  - ✓ **Faulty classification of projects:** Flows of conventional development finance and infrastructure finance are on occasion are either reclassified as climate finance, or are removed to generate climate finance.
  - ✓ **Poor government policies**: Many governments are subsidising fossil fuels instead of taxing it.

Green Finance in India

Green Bonds: Green bond issuance in the country witnessed a 30 per cent year-on-year increase in 2016 and making India the seventh largest green bond market globally.

Priority Sector Lending (PSL): RBI puts renewable energy project financing as a part of category in July 2015.

The Companies Act, 2013 mandates that larger companies should contribute at least 2 per cent of their average net profits annually towards **Corporate Social Responsibility (CSR) activities**, which again contributes to green financing.

Carbon Tax: It is a form of pollution tax. It levies a fee on the production, distribution or use of fossil fuels based on how much carbon their combustion emits.

Clean Energy Cess: It is imposed on coal mines in India or imported into India is collected into the **'National Clean Energy Fund'** set up for funding research and innovative projects in clean energy technologies.

Securities and Exchange Board (SEBI) published its **official green bond guidelines and requirements** for Indian issuers, placing India amongst a select set of pioneering countries who have developed national level guidelines.

Steps To Improve Climate Financing -

- **Lowering Insurance Cost:** Policies like insurance for the investments made on clean energy projects will help reduce the risk and attract more finance.
- **Sound regulatory framework**: Government should intervene in facilitating market- enabling policies. Eg: for easy flow of international finance in the domestic economy.

- **Encouraging Green finance:** By Developing Green Bond Market, Incentivizing Clean Energy Projects with Low Taxes, imposing carbon tax, renewal purchase reobligation etc
- **Integrating Green Accounting Principle in corporate books:** To mainstream green finance as it incorporate the environmental impact into commercial lending decisions while simultaneously balancing the needs of economic growth and social development.
- **Encouraging public-private partnership**: To tackle the underlying drivers of inadequate insurance, especially lack of risk awareness or experience with risk management products and practices; unaffordability, especially among lower-income households or small enterprises; and fundamental limits to insurability.
- **Utilize global platforms** for ensuring funding obligations and sharing of advanced technology, promised by developed nations are fulfilled as per Paris Agreement.
- **Finance by multinational financial institutions:** They should be encouraged to fund projects where private players/ countries do not find ROI.
- **Capacity building**: Attention should be given for improving capacity for bankable project development, implementation and monitoring, and evolving commonly acceptable technical standards.
- **Updating Basel III or similar international financial norms** to comply with sustainability norms.
- **Credit Rating and Benchmarking of green initiative projects:** Initiatives like green rating for the industries and GRIHA for human habitat.

2.2. CARBON CAPTURE TECHNOLOGY

- As part of its climate change commitments in the aftermath of signing the historic Paris agreement India is now exploring the possibility of **carbon capture utilization storage (CCUS)**
- **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 CO2 emissions, the cumulative amount of CO2 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.

- **Carbon Capture And Storage (CCS):** It is the process of capturing waste carbon dioxide (CO2) 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.
- **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 CO2 emissions by exploiting the resource itself and creating new markets around it.

3. AGRICULTURE AND ENVIRONMENT

3.1. GENETICALLY MODIFIED CROPS

Background

The department-related parliamentary standing committee recently made its recommendations in its 301st report on 'GM crop and its impact on environment'.

GEAC established under MoEFCC is the apex body for approval of activities involving large scale use of hazardous microorganisms and recombinants in research and industrial production from the environmental angle.

The GEAC is also responsible for approval of proposals relating to release of genetically engineered organisms and products into the environment including experimental field trials.

Problems observed by committee in approval process of GM crops

- **Possibility of data manipulation:** The Genetic Engineering Appraisal Committee (GEAC) does not conduct the closed field trials on their own but are solely dependent on the data provided to them by the technology developer making it susceptible to manipulations. Thus, the Committee recommends to ensure that the whole process of field trials is done in closed environment keeping bio-safety and health safety in mind and in collaboration with the agricultural universities so as to minimise the scope of fudging the primary data.
- **Concerns regarding GEAC:** such as *ad hocism* in its constitution, criteria adopted for selection of its members, dominance of bureaucrats, no representation from civil society or states where Bt Cotton has been introduced, head is not from field of Biotechnology etc.
- **Functioning of DLCs:** The Committee also feels that the presence of District Level Committee (DLC), which is one of the most important committees to regulate GM crop at the ground level, is hardly felt in any of the States/Union Territories. The Committee is of the view that MPs should be nominated as members in the District Level Committees so that the activities of these Committees are also shared with the public.

GM Crops- Impact on Environment

- **Contamination and cross pollination with non-GM and creation of super weed:** as a herbicide tolerant gene may escape through pollen into nearby farms and fields, to another GM or non-GM cultivars or to a wild and weedy relative.
- **Development of insect resistance to Bt crop:** The amount of Bt toxins produced by GM Bt crops can be much greater than the reduction in chemicals sprayed. such heavy and continuous exposure induces the target pest to develop resistance far more rapidly
- Likelihood of one or a few **GM genotypes becoming the dominant cultivars** thus leading to reduction of crop diversity in farmers' fields.
- **Soil/water contamination:** Bt toxin produced in GM Bt Crops is present in every part of the plant, so when the parts that have not been harvested decompose, a considerable amount of the toxin may reach the soil.
- GM crops do **impact unintended organisms** including beneficial organisms like bees and butterflies along with predators which are also impacted.
- Studies conducted by ICAR on animals have found no deleterious effect of GM plants approved for animal feed. But these trials are of short duration. Hence, long term feeding trials in all the species of livestocks must be undertaken.

Impact of Genetically Modified Crops on Human Health

- No in house scientific study has been carried out till date to study the impact of GM crops on human health. Without having been scientifically proven that GM crops would have no adverse impact on human health and solely relying on the studies which have not been done here in India and on our own population as well as in the context of our climate and environment negating any adverse impact on human health, the Government should reconsider its decision to commercialize GM crops in the country.
- GM products being sold in the country have no labeling. The Committee strongly recommends that labeling on GM foods must be done with immediate effect.

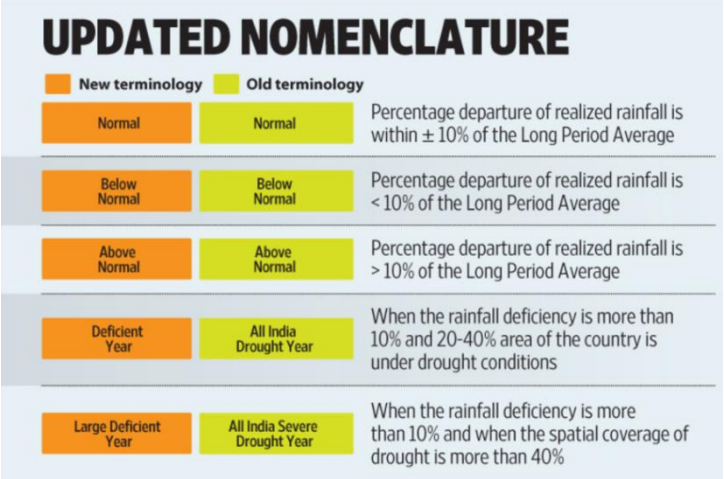
Overall recommendations

- No genetically modified (GM) crop should be introduced in India unless the biosafety and socio-economic desirability is evaluated in a "transparent" process and an accountability regime is put in place.
- The ministry should examine the impact of GM crops on environment thoroughly, in consultation with all stakeholders so that the nation is very clear about all its probable effects before taking a call on the matter.

4. DISASTER MANAGEMENT

4.1. CHANGE IN DEFINITION OF DROUGHT

Why in News?



- In the 'Manual for Drought Management' released by the government in December 2016, the 'moderate' drought category has been deleted.
- IMD replaced the word "drought" to describe poor rainfall with "deficient year" and "large deficient year", while incorporating standard practices from across the world.
- The new norms, which are mandatory in nature, were formulated based on the direction of the Supreme Court.
- Karnataka government has opposed this move to change parameters for drought assessment.

Why is it a Problem?

- The change means drought-hit areas will now be categorised as 'normal' and 'severe'. Only in case of 'severe' drought, a state would be eligible for central assistance from the **National Disaster Relief Fund (NDRF).**
- The states will have to pay for the relief from their own pocket.
- The criteria to prove that the drought is 'severe' has been made stringent.
- Assessment is done based on area under sowing and soil moisture-based indices. To get the drought situation considered as 'severe', the sowing must be below 50 per cent of the normal which is hard to achieve. Even during the hardest droughts the sowing has been above 80%.
- It is a matter of concern for the states because already most of the states lack drought early warning systems.
- It is alleged that the Centre has changed the norms unilaterally without consulting the states.

NDRF is defined in **Section 46 of the Disaster Management Act, 2005,** as a fund managed by the Central Government for meeting the expenses for emergency response, relief and rehabilitation due to any threatening disaster situation or disaster.

NDRF is constituted to supplement the funds of the **State Disaster Response Funds.**

Drought Fact File

- **Drought is a temporary aberration**, unlike aridity or even seasonal aridity, which is a permanent feature of climate. It is a recurrent, yet sporadic feature of climate, known to occur under all climatic regimes and is usually characterized by variability in terms of its spatial expanse, intensity and duration.

Institutional Structures for monitoring

Central Government- Central Drought Relief Commissioner (CDRC) & Crop Weather Watch Group.

State Government- State Drought Monitoring Centres.

- Drought stems from a deficiency or erratic distribution in rainfall but the spread and intensity of the calamity is contingent on several factors, including the status of surface and ground water resources, agro-climatic features, cropping choices and patterns, socio-economic vulnerabilities of the local population etc.
- According to the National Commission on Agriculture the 3 types of droughts are:
  - **Meteorological drought:** This happens when the actual rainfall in an area is significantly less than the climatological mean of that area.
    - **Excess:** 20 per cent or more above normal
    - **Normal:** 19 per cent above normal - 19 per cent below normal
    - **Deficient:** 20 per cent below normal - 59 per cent below normal
    - **Scanty**: 60 per cent or more below normal
  - **Hydrological drought**: A marked depletion of surface water causing very low stream flow and drying of lakes, rivers and reservoirs.
  - **Agricultural drought**: Inadequate soil moisture resulting in acute crop stress and fall in agricultural productivity.

IMD can define a meteorological drought, but agricultural and hydrological droughts are different and states are better equipped to declare them.

Changes adopted in the new Manual

- The new manual, which adopted standard practices from across the world, gives certain parameters for declaration of drought. These categories of indices are:
  - Rainfall-related Indices
  - Remote Sensing-based Vegetation Indices
  - Crop situation-related indices
  - Hydrological Indices
  - Ground verification
- These indices are further elaborated into more than 13 sub-points, making it technically extensive.
- Except rainfall and ground verification, all other indices are considered impact indicators. To come under 'severe' drought category, a state has to prove severity in three out of these four impact indicators.
- The current manual said that more than three weeks of dry spell is possibly detrimental to crop health as against less than three weeks window before.

The manual sets out four important measures that a State government should take at the time of a drought, with the Union government's help.

- It should use the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) to provide immediate employment to drought-affected people.
- The public distribution mechanism should be strengthened to provide food and fodder as a measure to sustain the rural economy.
- The government should initiate actions to recharge the groundwater table by building check dams and providing pipeline water and other irrigation facilities.
- The government should either waive off or defer farmer loans and arrange for crop loss

4.2. FLOODS IN INDIA

Why in news?

- From Assam and Bihar in the east to Rajasthan and Gujarat in the west, floods are creating havoc with the lives of people.

Causes of Floods in India

- **Natural causes** – includes 80% of precipitation in just 4 months, **sharp fall in gradient** of rivers in Eastern Himalayas, soft unconsolidated rocks causing heavy siltation, heavy landslides causing obstruction to river flow, storm surges or cyclones in coastal areas etc.
- **Anthropogenic** – includes global warming; deforestation; encroachment of river basin; ill maintained embankments (80% have not been enforced in several decades); poor drainage and infrastructure;
- This year heavy rain is occurring in certain parts because of an **unusual formation of the monsoon trough**, with two separate depressions present at the Arabian Sea and Bay of Bengal at the same time.

National commission on floods set up in 1976 for an integrated approach towards floods estimated that over 40 million hectare area is prone to floods in our country

River Flooding: Assam, West Bengal, Bihar and Eastern Uttar Pradesh

Cyclone Flooding: Coastal areas of Odisha, Andhra Pradesh, Tamil Nadu and Gujarat

Flash Floods: Haryana, Uttarakhand, J&K, Bangalore etc.

Losses due to floods post 2011 are most grim for north-eastern states of Arunachal Pradesh, Sikkim, Assam and Meghalaya, and Himachal Pradesh in the north. Hilly regions suffer more due to flash floods which are difficult to predict and also cause landslides

Reason for floods in Gujarat and Rajasthan is poor drainage system while cause of Uttarakhand and Kashmir flood in 2015 & 2014 respectively was encroachment of river basin.

Impact of floods

- **Loss of GDP** - Floods resulted in loss of 0.86% of India GDP in the 1970s and 1980s. In the present decade, this share has come down to 0.1% of the GDP
- **Loss of human and cattle lives** – Official data shows that in the past four years, between 1,000 and 2,100 people have died annually. Although, these losses also have come down over the decades
- **Other effects-** Public health issues due to sanitation issues, post-traumatic stress disorder etc., hampering of education because of inundation of schools or using them as make-shift relief centres; environmental impacts; increase in commutation costs; damage to public utilities, crops and houses.

Possible solutions

Although there is a declining trend of flood-related loss on GDP but according to 2015 World Resources Institute study, expanding cities and worsening climate challenges can significantly increase flood-related risks in India. Thus following measures should be taken:

- **Short term preventive measures** aiming to build capacity for **mitigation of disaster** can be adopted:
  - **Structural measures**
    - Building embankments, floodwalls, flood levees.
    - Dams and reservoirs.
    - Natural Detention basin.
    - Channel improvement through dredging and other channel deepening measures.
    - Diversion of flood water through storm drainage system.

Role of floods in maintaining key ecosystem functions & biodiversity

- linking river with land surrounding it
- recharge groundwater systems
- fill wetlands
- increase the connectivity between aquatic habitats
- move both sediment and nutrients around the landscape
- For many species, floods trigger breeding events, migration, & dispersal
- Helps the economy through increased agricultural and fish production.

- Catchment area afforestation especially in the upstream areas of river more prone to soil erosion and landslides.

- **Non-structural measures**
  - Flood forecasting and warning system - Nearly 60% telemetry stations are non-operational, according to CAG report. CWC should modernize it especially in the North-eastern Region using sensor based instruments, satellite monitoring etc.
  - Flood hazard zoning – This will help to identify the **flood hazard prone zones** and help to prioritize flood control process. Data should include experiences of NDRF & studies by CWC
  - Regulation of reservoirs
  - Strategic environment assessment of development activities in flood prone areas, as followed in several countries
  - Strengthening planning authorities like the Brahmaputra Board and flood control departments by staffing them with scientists from various disciplines.

- **Building resilience** through following measure
  - creation of crisis-proof health infrastructure and stockpiling dry rations and medicines
  - Sanitation through elevated toilets, ecosanitation units, elevated dugwells or tubewells with iron filter, in the flood-prone areas of North Bihar and Northeast.
  - Efficiently utilizing disaster relief funds with states as Center asks them to set off the unutilised portion when making fresh claims during relief
  - Increasing coordination and adequate training at the ground level to implement NDMP (national disaster management plan) which covers all aspects of disaster management.

Issues as reported by CAG on Schemes for Flood Control and Flood Forecasting:

- Huge delays in projects related to River Management Activities which is long-term solutions for the flood problems of Assam, North Bihar and Eastern Uttar Pradesh.
- Despite the increasing frequency of floods, there were inordinate delays (2-21 months) in releasing first instalment of Central assistance even after approval of Empowered Committee (EC). It is happening despite immediate release provided in Flood Management Programme guidelines
- State governments did not ensure submission of audited statements of expenditure and Utilisation Certificates within stipulated time before releasing Central assistance.
- Dam Safety Legislation initiated in 2010 is yet to be enacted. Programmes for maintenance of dams are not prepared and adequate funds are not provided to carry out repair works. Only 349 dams out of 4,862 completed dams in the country have emergency disaster management plans.
- Non-adherence to FMP guidelines when it comes to preparing Preliminary/Detailed Project Reports (PPR/ DPRs) affected the progress of these projects. Thus, data such as meteorological, soil survey, socio-economic bench mark survey, salinity, drainage and engineering surveys etc. are not available to enable planning.

- **Cooperation with neighbouring countries** such as Bhutan, Nepal, Bangladesh, China on Trans-Border Rivers could help the authorities to utilize the **hydrological information** i.e. water level, discharge and rainfall.
- **Better coordination -** In this regard a separate ministry for disaster management could be established because currently CWC responsible for floods is under Ministry of Water Resources and Ministry of Urban Development is responsible for urban flooding while NIDM and NDMA comes under the Ministry of Home Affairs.

- **Urban planning** – It involves following
  - Building the storm drains and maintaining other drainage system.
  - **Reviewing the protocol followed by State governments** in controlling flows from dams and reservoirs. For ex-much of the waters in Rajasthan this year or Chennai in 2015 flowed from a dam that was opened to relieve pressure
  - **Inter-state cooperation or dialogue** - as opening up of dams in upstream areas such as Arunachal Pradesh become a problem for Assam, since the past seven years
  - **Prevent encroachment** on the river basin & natural lakes to ensure natural flow of the water.
- Speedy relief and rehabilitation **Post-disaster** such as –
  - alleviating financial losses
  - actions on the ground: short-term housing, food, safe water
  - access to health care and counselling services to enable coping with disaster mentally
  - protection for women, children and the elderly
  - Providing adequate number of boats to enhance access to developmental activities

4.3. DAM SAFETY

Why in news?

A workshop was organised by the Tamil Nadu Water Resources Department in collaboration with Central Water Commission, with the purpose to increase awareness about dam safety measures and finalising **Emergency Action Plan**.

Background

- Dams are a **critical infrastructure** which have multipurpose uses such as irrigation, power generation, flood moderation and supply of water for drinking and industrial purposes.
- In India there are about **5254 large dams** and about **447 are under construction**. Of these dams about 4% i.e. 209 are 100 years old, 17% i.e. 876 dams are more than 50 years old. Therefore, Dam safety becomes imperative and should be made an important aspect of planning.
- However, the dams in recent past have not been seen as models of safety. E.g.
  - Threat posed by **Mullaperiyar Dam** – Kerala has been in constant fight with Tamil Nadu over the security issues.
  - **Chennai flood of 2015** which were due to heavy rainfall was also aggravated by the unprecedented release of water from **Chembarambakkam Dam** into the **Adyar River**.
  - In 1979, Machu Dam in Gujarat claimed as many as 25,000 lives.
- According to an analysis by Central and State Level authorities, it was found that almost half of country's dams are not in line with the contemporary safety standards.
- Government is therefore taking certain steps such as Dam Rehabilitation and Improvement Plan, Dam Safety Bill and the recent Emergency Action Plan.

Dam Rehabilitaton and Imporovement Plan (DRIP)

- It is a Government of India project which is being undertaken with the financial assistance of **World Bank**.
- This project started in April 2012, for repair and rehabilitation of initially 225 Dams across seven states namely Jharkhand (DVC), Karnataka, Kerala, Madhya Pradesh, Odisha, Tamil Nadu, and Uttarakhand (UJVNL).
- At present there are 198 Dams under this project which are scheduled for completion in June 2018.

- It is am externally aided project with 80% assistance by World Bank and 20% borne by the State/Central Government (CWC).
- Objective of DRIP –
  - to improve the safety and operational performance of selected existing dams and associated appurtenances in a sustainable manner, and
  - to strengthen the dam safety institutional setup of participating States / Implementing Agencies.

Dam Safety Bill

- In order to bring an institutional mechanism to improve Dam Safety, Central Government is contemplating to bring in a Dam Safety Bill. The proposed bill is expected to control and manage over 5000 dams in the country.
- Previous government also tried to introduce the Dam Safety Bill in 2010 which was opposed by states due to various issues such as
  - overriding powers of legislation passed by the Parliament over state opinion,
  - not recognising the long standing inter-state agreements such as Mullaperiyar, Parambikulam, Thunakkadavu etc.
  - over-riding powers of National Dam Safety Organisation
- The Bill was later referred to Parliamentary standing committee which recommended the passing of bill. However, the bill lapsed due to dissolution of 15th Lok Sabha.

Emergency Action Plan

- The Emergency Action Plan (EAP) for the Dams under DRIP has been proposed. EAP is a formal plan that identifies potential emergency conditions at a dam and prescribes the procedures to be followed to minimize loss of life and property damage.
- EAP help in **streamlining the efforts** and bring about **better coordination** among different agencies to execute rescue and relief activities.
- The need of EAP was also proposed by the Dam Safety Bill 2010.
- Under EAP, clear roles for all concerned agencies as well as Standard Operating Protocols during various stages of exigencies have been clearly mentioned.
- It also contains all technical details about the flood waves moving downstream affecting the downstream habitation.

Other Steps taken by the Government includes setting up of **Central Dam Safety Organisation** under Central Water Commission. The main goals of the CDSO were to

- To encourage and facilitate dam safety practices that will help ensure operation of dams to their full capacities and intended purposes, and
- To reduce the risk to lives and property from the consequences of both structural and operational dam incidents and failures.

4.4. EARTHQUAKE PRONE INDIAN CITIES

Why in news

- Recently, National Centre for Seismology (NCS) categorizes twenty-nine Indian cities and towns, including Delhi and capitals of nine states in high-risk seismic zones.

Background

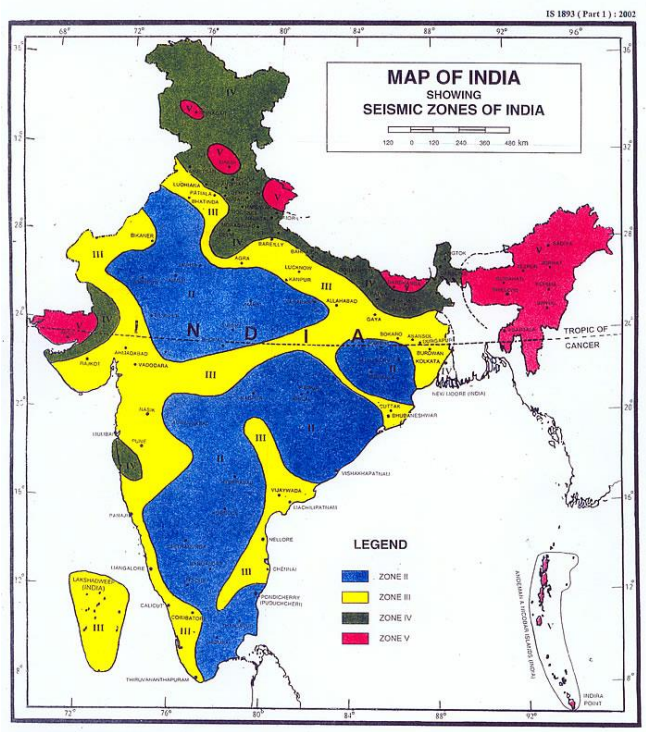
- During the last 15 years, the country has experienced 10 major earthquakes that have resulted in over **20,000 deaths**.
- **Severe economic losses** leading to the collapse of the local or regional economy after an earthquake may have long-term adverse consequences for the entire country.
- The increase in earthquake risk is due to a spurt in developmental activities driven by urbanization, economic development and the globalization of India's economy.

Critical Areas of Concern for the Management of Earthquakes in India

- lack of awareness among various stakeholders about the seismic risk
- Inadequate monitoring and enforcement of earthquake-resistant building codes and town planning bye-laws;
- lack of formal training among professionals in earthquake-resistant construction practices
- lack of adequate preparedness and response capacity among various stakeholder groups.

Bureau of Indian Standards, taking into consideration earthquake records, tectonic activities and damage caused, grouped the country into four seismic zones:

- Zone II (Low intensity zone)
- Zone III (Moderate intensity zone)
- Zone IV (Severe intensity zone)
- Zone V (Very severe intensity zone)



Seismic Microzonation

- It is defined as the process of subdividing a potential seismic or earthquake prone area into zones with respect to geological, seismological, hydrological and geotechnical site characteristics. In order to minimize the damage of natural calamities like earthquake.
- It is a measure where the emphasis on the impact of earthquake on the habitat is given.

National Disaster Management Authority (NDMA) Guidelines for the Management of Earthquakes: Guidelines have been prepared to reduce the impact of earthquakes in the short term and the earthquake risk in the medium and long term. Guideline provides **6 pillars of Earthquake management** viz.

- **Earthquake-Resistant Design and Construction of New Structures**: It emphasis on strict adherence of large number of building codes for different situations formulated by the Bureau of Indian Standards.
- **Seismic Strengthening and retrofitting of Lifeline and Priority Structures**: It recommend the **structural safety audit** and **retrofitting** of select critical lifelines structures and high priority buildings.

- **Regulation and Enforcement**: To undertake a periodic revision of the codes and standards relating to earthquake-resistant construction.
- **Awareness and Preparedness** : Comprehensive awareness campaign will be developed and implemented on the safe practices to be followed before, during and after an earthquake. Campaign will also emphasise the prevalent seismic risk and vulnerability of the states as well as highlight the roles and responsibilities of all communities and stakeholders in addressing this risk.
- **Capacity Development (Including Education, Training, R&D and Documentation) of all stakeholders.**
- **Response:** Management and Control of the adverse consequences of future earthquakes will require coordinated, prompt and effective response systems at the district and the community levels.

Recent government initiative

- India has installed an **earthquake early warning system** for the first time to detect earthquakes and disseminate warnings in Uttarakhand.
- **National Disaster Management Services (NDMS**): To provide the failsafe communication infrastructure and technical support for Emergency Operation Centre (EOC) operations across the country in the time of emergency.
- **Earthquake Disaster Risk Indexing (EDRI)** for 50 important cities and 1 District in Seismic Zone IV & V areas. It will be helpful for the administrative bodies in comparing the overall risk across large number of cities or region and also in prioritization of cities to implement appropriate disaster mitigation measures.

International initiative:

SDG goal 13:

- To Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.
- The annual average losses from earthquakes, tsunamis, tropical cyclones and flooding amount to hundreds of billions of dollars, requiring an investment of US$6 billion annually in disaster risk management alone. The goal aims to mobilize $100 billion annually by 2020 to address the needs of developing countries and help mitigate climate-related disasters.

100 RESILIENT CITIES" (100RC) NETWORK

- 100RC, pioneered by the Rockefeller Foundation, is dedicated to helping cities around the world become more resilient to the physical, social and economic challenges that are a growing part of the 21st century.

Sendai Framework for Disaster Risk Reduction

- It is a 15-year, voluntary, non-binding agreement which recognizes that the State has the primary role to reduce disaster risk.
- Aim: 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.

- **India Quake' – An App** for Earthquake Parameter Dissemination a Mobile App has been developed by the NCS for automatic dissemination of earthquake parameter (location, time and magnitude) after the occurrence of earthquakes.
- **National Retrofit Program (2014**): Retrofitting is a mechanism through which an existing building is modified, using certain strategies, to conform to the present day standards for earthquake resistance.
- **Earthquake observatories**: To detect and record earthquake parameters more accurately and identify possible precursors of tremors under admin control of National Center for Seismology

- **Supreme Court directed** the central Government to ensure that all the upcoming infrastructures in the country display their **'earthquake resistant category'** and define the implications of their category, as per the Government's definitions.

Way forward

- **Institutionalisation of initiatives and activitie**s based on scientific strategies, covering pre-earthquake components of prevention, mitigation and preparedness, as well as post-earthquake components of emergency response, rehabilitation and recovery.
- **Structural audit**: Need to be made mandatory for building older than 15 year to know the health of structure.
- Revising **National Building Code of India 2005** in present context and strictly monitoring the implementation of the guideline.
- **Increasing collaboration between different countries**: Since such calamities are transnational, strategy must be formulated by engaging all stakeholders.
- **Deployment of new technologies:** Due to its unpredictable nature, technology might come as a great help during early stage or even during post disaster stage**.**
- **Implementing best practice available:** Different countries should share their expertise in Disaster Risk Reduction eg: India can learn from Japan Earthquake prevention system.

5. GEOGRAPHY

5.1. EXPLORATION OF POLYMETALLIC NODULES

Why in news?

India's exclusive rights to explore polymetallic nodules from seabed in Central Indian Ocean Basin (CIOB) have been extended by five years by International Seabed Authority.

Details

India is the first country to have received the status of a pioneer investor in 1987 and was allocated an exclusive area in Central Indian Ocean Basin by United Nations (UN) for exploration and utilization of nodules.

- India had signed a 15 year contract for exploration of Polymetallic Nodules in Central Indian Ocean Basin with the International Seabed Authority on March 25, 2002. In 2016 the govt approved extension of this contract upto 2022.
- India is implementing a long–term programme on exploration and utilization of Polymetallic Nodules (Polymetallic Nodules programme) through Ministry of Earth Sciences.
- India is presently having an area of 75,000 square km, located about 1600 km away from her southern tip. Polymetallic nodules resource potential in this site is 380 million tonnes.

Importance

- India's exclusive rights for exploration of Polymetallic Nodules in the allotted area in the Central Indian Ocean Basin will continue and would open new opportunities for resources of commercial and strategic value.
- India is entirely dependent on imports to meet its requirements of cobalt, which is the most strategic of the three metals (cobalt, copper and nickel). As for copper and nickel, India is in a precarious position.

Economic significance

- Empowerment of coastal communities and attaining greater social and economic inclusion by providing Employment opportunities, skill-sets and capacities.
- Providing a boost to coastal and national economies and development of blue economy.
- Promoting entrepreneurship in new areas of economic activity and new development in electronics industry.

Strategic advantages

- Presently, China is controlling more than 95% of rare earth metals. This move will nullify the increasing influence of China.
- It will strengthen the bilateral relationship of India with Japan, Germany and South Korea.

Challenges: Technological and Environmental issues

- The specialized drills and extraction-technology that would be required pulling out the metals from the deep sea would develop a major technical challenge.
- Deep sea mining may cause a drastic disturbance and imbalance in the aquatic ecosystem. It is considered as the last resources to depend on. The deep sea mining may distract the keystone and the foundation species.

International Seabed Authority (ISA) is a UN body set up to regulate the exploration and exploitation of marine non-living resources of oceans in international waters. India actively contributes to the work of

International Seabed Authority. Last year, India was re-elected as a member of Council of ISA.

The Polymetallic Nodules Programme (PNP): PNP is oriented towards exploration and development of technologies for eventual extraction of nodules from the Central Indian Ocean Basin (CIOB) allocated to India. It consists of four components viz. Survey and Exploration, Environmental Impact Assessment (EIA) Study, Technology Development (Mining) and Technology Development (Extractive Metallurgy).

Present status: The extraction of metals from the polymetallic nodules lying at the deep ocean floor is not yet found to be economically viable at this stage. However, a site has been identified in the CIOB for the First Generation Mine Site on the basis of detailed surveys and analysis.

Pollymetalic nodules: A brief

What is it? Polymetallic nodules, also called manganese nodules, are rock concretions formed of concentric layers of iron and manganese hydroxides around a core.

- Besides manganese and iron, they contain nickel, copper, cobalt, lead, molybdenum, cadmium, vanadium, titanium.

Distribution: First discovered in 19th century in the Kara Sea, in the Arctic Ocean off Siberia, they were found to occur in most oceans of the world. However, nodules of economic interest are more localized. Three areas have been selected by industrial explorers: the centre of the north central Pacific Ocean, the Peru Basin in the south-east Pacific Ocean and the centre of the north Indian Ocean. They can occur at any depth, but the highest concentrations have been found between 4,000 and 6,000m.

Formation: Several theories have been proposed to explain the formation of different types of nodules. Two of the more popular are:

- A hydrogenous process in which concretions are formed by slow precipitation of the metallic components from seawater. This is thought to produce nodules with similar iron and manganese content and a relatively high grade of nickel, copper and cobalt.
- A diagenetic process in which the manganese is remobilized in the sediment column and precipitates at the sediment/water interface. Such nodules are rich in manganese but poor in iron and in nickel, copper and cobalt.

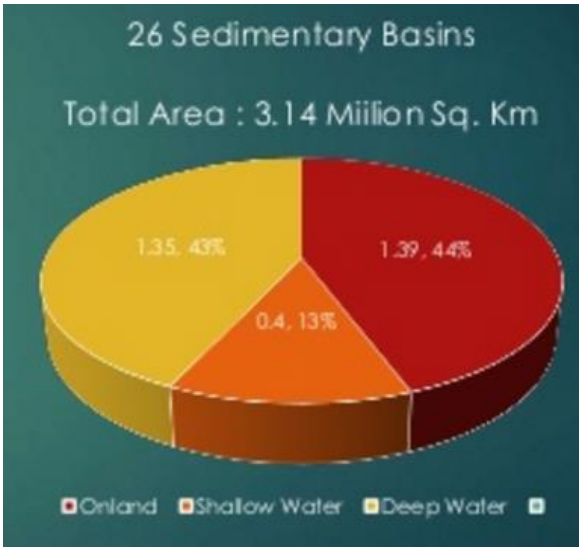
Importance

- They contain Rare Earth Elements and metals which are important to high-tech industries.
- The amount of copper contained in the CCZ nodules is estimated to be about 20% of that held in global land-based reserves.

5.2. SEDIMENTARY BASINS OF INDIA

Why in news

- 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.



Background

- 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.

Significance

- **Increasing GDP**: Project will help in increasing the investments in domestic production of oil and gas.
- **Boost Hydrocarbon Exploration and Licensing Policy (HELP):** Data acquisition is important as it helps in giving the initial insight into the basins and helps in planning the future Exploration and Production (E&P) activities.
- **Employment opportunity**: Project is likely to generate direct as well as indirect employment for about 11,000 people in the form of skilled and unskilled workers and suppliers for support services. Blocks offered for further E&P activities will further generate employment.

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.

Importance:

- They are the **location for almost all of the world's hydrocarbon reserves**
- **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.
- **Metalliferous deposits (in less amount**) include ores of lead, zinc, iron and manganese, and there may also be some bauxite.

6. MISCELLANEOUS

6.1. DEEP SEA TRAWLING

Why in news?

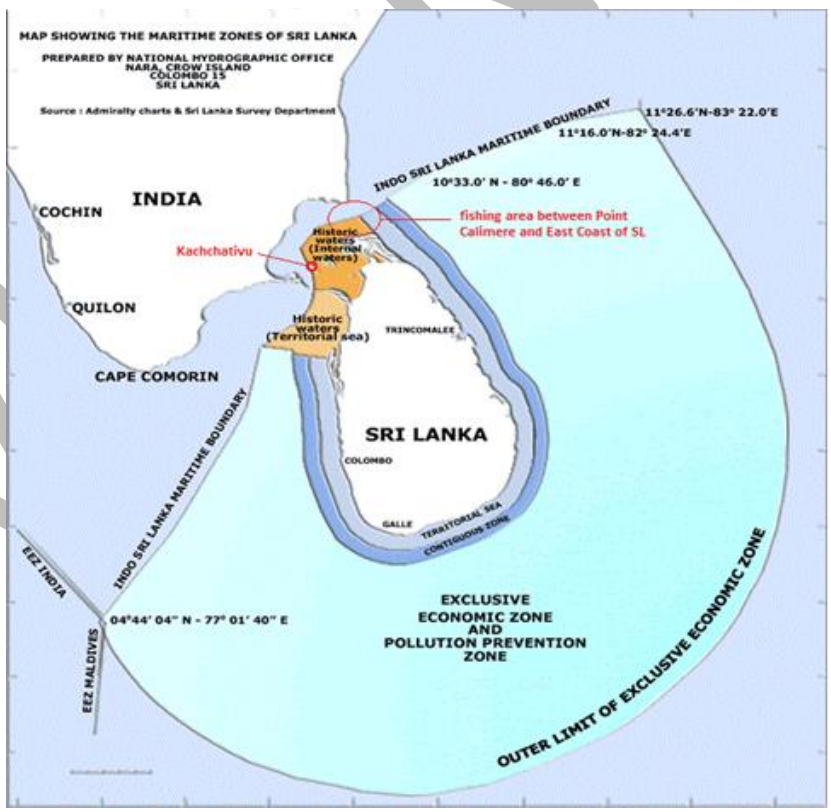
Sri Lankan Parliament passed amendment to Fisheries and Aquatic Resources Act, which will ban trawling in Palk Bay and imposes a fine of 50,000 Sri Lankan Rupees for violations.

Background

- **Deep sea trawling** refers to a practice in which fishing nets are **trawled or dragged along the sea floor** specifically to catch the seafloor animals such as shrimps, cod, sole and flounder.
- This practice is mainly used for **commercial fishing** to maximise the fish catch in temperate regions.
- India which has a coastline of about **7517 kms** has huge potential to develop its fishing industry. However, due to heavy population pressure and continuous exploitation of marine resources the marine ecosystem is under severe threat

Challenges and threats due to Deep Sea Trawling

- **Bottom Trawling** or Deep Sea Trawling is unselective and severely damages the seafloor ecosystem.
- It is harmful to **marine diversity in Tropical waters** where the species diversity is high as compared to number of each species i.e. their population.



- It also result in **conflicts and disputes** between countries. E.g. Indonesia - China; India – Sri Lanka etc.

- Deep Sea Trawling also increases the plastic debris due to wear and tear of the nets, buoys and other equipment.

Implication of Sri Lankan Fisheries Bill

- The amendment to the **Fisheries and Aquatic Resources Act** is being seen as a welcome step towards protection of marine ecosystem as this will promote the sustainable fishing methods.
- The Contested area i.e. Palk Bay is under pressure due to trawling by Indian and Sri Lankan Fishers. If preventive steps are not taken then the biodiversity in the Palk Bay would have been irredeemable.
- The amendment act may **strain the already stressed India-Sri Lankan Relations**. This is because the amendment came at the time when the **Joint Working Group** was in talks to find solution to the problem of deep sea trawling and illegal fishing in EEZ.
- An alternate to trawling is **"Deep sea Fishing**". It is an **expensive venture** for the poor fishermen.

Way Forward

- Ban on Trawling is a positive step however the decision should have been discussed with all the **stakeholders** prior to implementation.
- Alternate to deep sea trawling i.e. deep sea fishing should be promoted through government schemes and efforts such as
  - **Deep Sea Fishing Scheme** in Tamil Nadu under which financial assistance would be provided to fishermen to buy new vessels.
  - **Government** is also making efforts to convert the existing 2000 trawlers into deep sea vessels by 2019-20.
- The affected fishermen on both sides should be provided with **alternate employment opportunities** in related sectors such as food processing and packaging.

6.2. RENEWABLE ENERGY GENERATION: DISCREPANCIES BETWEEN GUIDELINES

Why in news?

Madhya Pradesh has become the latest state stonewalling Centre's bid to promote renewable energy by ranking available sources of generation based on the ascending order of prices, after Tamil Nadu and Rajasthan

Details

To promote use of energy from renewable sources, the Electricity Act, National Electricity Policy and National Tariff Policy have accorded energy from renewable sources a "must run" status. This status emanates from the Indian Electricity Grid Code notified by the Central Electricity Regulatory Commission (CERC) and adopted by the state regulators.

- Recently Madhya Pradesh has floated a proposal that would take away the "must run" status of renewable energy and subject it to "merit order dispatch" by the state grid operator.
- The "merit order dispatch" is a principle followed for conventional generation sources that essentially ranks available sources of electrical generation based on the ascending order of prices and sequences them accordingly.

Impact

- A shift to the merit order dispatch would push costly solar and wind power down the pecking order. This will put the cash flows of most of the smaller renewable firms under severe stress.
- The uncertainty in payments will lead to decline in investments in renewable sector and will hamper India's aim to ramp up the share of green power in the country's electricity supply mix from the current seven per cent to nearly 20 per cent by 2022.

Capacity addition in the renewable energy sector has shown its strongest performance in 2016-17, with a record capacity addition of 11,320 MW that eclipsed the thermal power segment's 11,551 MW during the fiscal.

- As of March 31, the total grid-connected renewable power capacity in the country stood at 57,260 MW (close to 20 per cent of India's overall installed capacity of 3,29,000 MW).
- Based on the current capacity addition targets, India is forecast to meet 19 per cent of its power demand from renewable energy sources in five years, by fiscal year 2022.