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TARGET 2021

ENVIRONMENT & GEOGRAPHY II

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ENVIRONMENT & GEOGRAPHY - II

(JANUARY 2021 TO JULY 2021)

ENVIRONMENT

1. POLLUTION

1.1 Deferring Fuel Efficiency Regulations

- Auto industry wants the government to defer the implementation of Corporate Average Fuel efficiency (CAFE-2) regulations and BS-VI stage II norms to April 2024.
- As of now, the CAFE-2 norms that aim to make cars more fuel efficient are set to come into effect in 2022 and BS-VI stage II norms are set to come into force beginning April 2023.
- The growth rate of passenger vehicle (PV) sales has slowed down over the last decade and more so over the last five years.
- Almost 50% of the car buyers in India are first-time buyers and since price elasticity for car purchase is high in India, it is a major factor for slowdown in growth.
- If rising cost of raw materials is a factor, high tax rates, rising service tax and insurance cost, and shift from BS-IV to BS-VI in a quick time has lifted the acquisition cost.
- The industry has made the above representations to defer the implementation due to the sales suffered due to pandemic.

1.2 La Soufriere Volcano Eruption

- Sulphur dioxide (SO_2) emissions from La Soufriere volcanic eruption in the Caribbean have reached India, sparking the fear of increased pollution levels in the northern parts of India and acid rain.
- Volcanic plumes reached a height of 20 kms above the Earth's surface, seen by the Multi-Angle Imaging Spectro Radiometer instrument on NASA's Terra satellite. It will cause aviation and air quality hazards.
- La Soufrière has delivered 0.4-0.6 teragram of SO_2 into the upper atmosphere which is the highest-ever recorded after satellites started observing the Earth's atmosphere in the mid 20th century.

La Soufrière

- It is a volcano on St Vincent Island in the West Indies. It is one of the 45 currently erupting volcanoes on Earth. Last eruption was in 1979.
- It is a stratovolcano with a crater lake and is the St Vincent Island's youngest and northernmost volcano.

Effects of Sulphur Emissions

- Emission particles in the relatively dry stratosphere last much longer and travel much farther than if they remain in the troposphere.
- This might be the reason that the particles have reached as far as India and will likely travel beyond to reach South East Asia.
- The impacts from volcanic injections into the stratosphere come from the conversion of sulphur dioxide to sulphuric acid, which condenses rapidly in the stratosphere to form fine sulphate aerosols.
- These aerosols increase the reflection of radiation from the Sun back into space, cooling the Earth's lower atmosphere or troposphere.

1.3 New Emission Norms for Thermal Power Plants

- India has pushed back deadlines for coal-fired power plants to adopt new emission norms by up to 3 years and allowed utilities that miss the new target to continue operating after paying a penalty.
- Previously, the Environment Ministry has ordered that the deadline for these plants to install Flue Gas Desulphurization (FGD) units, it includes
    a) Plants near populous regions and New Delhi will have to comply by 2022,
    b) Utilities in less polluting area shave up to 2025 to comply or retire units.
- A task force will be constituted by the Central Pollution Control Board to categorise plants in three categories on the basis of their location to comply with the emission norms.
- In case of non-compliance, a penalty of up to Rs. 0.20 will be levied for every unit of electricity produced.
- Thermal power companies produce 3/4th of the country's electricity.
- They account for 80% of industrial emissions of particulate matter, sulphur- and nitrous-oxides - Causes lung diseases, acid rain and smog.

1.4 Sensitive Birds

- A new study noted that juvenile zebra finches raised in an environment that simulated city traffic noise had weaker immune responses and delayed vocal development than chicks raised in quiet nests.
- These findings indicate that young songbirds, just like human children, are particularly vulnerable to the effects of noise because of its potential to interfere with learning at a critical developmental stage.
- The traffic noise pollution also has the potential to affect the cultural evolution of birdsong.
- A previous study proposed that traffic noise reduced breeding success in Willow Warblers (Phylloscopus trochilus).
- Another paper found that hearing the noises of cars driving by was enough to inhibit cognitive performance in songbirds.
- The loud noise has been known to disrupt the ability of birds to communicate and even attract mates.

1.5 Effects of Meat Industry on Environment

- India measure nutrition per acre, health per care, and our work with real farmers and true cost accounting is showing that small farms with biodiversity, without chemicals, can feed two times Indian population.
- Livestock provides just 18% of calories but takes up more than 80% of farmland. Now, 81% of the world's agricultural land is used to provide meat, eggs, and dairy products.
- But, plant foods require far less land and far fewer resources, and could feed the entire world's population.
- A global switch to plant-based diets could save up to 8 million lives by 2050 and reduce greenhouse gas emissions by two thirds.
- **Carnism** is the invisible belief system that conditions us to eat certain animals when we would never dream of eating others. Three Ns of justification for consuming meat is normal, natural, and necessary.
- The meat industry has been promoting meat consumption by,
    - **Objectification**, viewing animals as things rather than living, breathing, feeling beings.
    - **Deindividualization**, looking at animals as a group rather than individuals with their own personalities and preferences.
    - **Dichotomization**, categorizing animals into edible or inedible.
- Animals around the world are largely being held in captivity, in extremely toxic and inhumane conditions.
- If viruses are coming out of that, that's the microbiome's check on the reality that we live in.

Glyphosate

- It is a water soluble toxic broad-spectrum systemic herbicide.

- This molecule found in our food and water system that causes huge endocrine disruption in our bodies and poisons our environment.
- It poisons our genome and blocks the ability to make glutathione, which is our main antioxidant.

1.6 Aerosol Nucleation

- Scientists from the University of Hyderabad have found frequent formation of sub-3 nanometres aerosol particles in the atmosphere.
- They measured particle size distribution of neutral sub-3nm (1 to 3 nm) particles using AIRMODUS nano Condensation Nucleus Counter (nCNC) at an urban location in India.
- **Terminologies** - The formation of small molecular clusters of sub-3nm size is technically called aerosol nucleation.
- The subsequent growth of these newly formed clusters to the large sizes is called atmospheric new particle formation (NPF).
- NPF occurs everywhere in the terrestrial troposphere, and therefore it is a large source of aerosol numbers to the atmosphere.
- This has critical importance as a major fraction of these newly formed particles can reach to sizes of cloud condensation nuclei where they have climatic impacts.
- **Findings of the Study** - The speed with which this pool of sub-3nm particles form clusters grow depends on various factors.
- Only half of these events newly formed molecular clusters grow past 10 nm sizes. Thus particle size distributions display a conventional banana-shaped aerosol growth, which is indicative of regional NPF event.
- The team found a strong positive correlation between sub-3nm particle concentrations and sulphuric acid concentrations.
- NPF often starts with sulphuric acid in the atmosphere. Other vapours such as ammonia, amines and organics also play a crucial role in the growth of newly formed particles.

1.7 Sea Snot Outbreak

- Turkey's President has said considerable steps will be taken to solve the problem of accumulation of 'sea snot' and protect the country's seas.
- Turkey's Sea of Marmara, that connects the Black Sea to the Aegean Sea, has witnessed the largest outbreak of 'sea snot'. The sludge has also been spotted in the adjoining Black and Aegean seas.
- A 'sea snot' outbreak was first recorded in the country in 2007. It was also spotted in the Aegean Sea near Greece. But the current outbreak in the Sea of Marmara is by far the biggest in the country's history.
- **Sea snot** is a slimy layer of grey or green sludge that the floats up on the surface of the seas, which can cause damage to the marine ecosystem.
- It is marine mucilage formed when algae are overloaded with nutrients due to water pollution combined with the effects of climate change.
- **Causes** - The nutrient overload occurs when algae feast on warm weather caused by global warming.
- Overproduction of phytoplankton caused by climate change and the uncontrolled dumping of waste into the seas has led to the present crisis.
- **Impact on Marine Ecosystem** - The growth of the mucilage is posing a severe threat to the marine ecosystem of the country.
- Over a period of time, it could end up poisoning all aquatic life, including fishes, crabs, oysters, mussels, corals, sponges and sea stars.
- If unchecked, this mucilage spread can collapse to the bottom and cover the sea floor, causing major damage to the marine ecosystem.
- Besides aquatic life, the 'sea snot' outbreak has also affected the livelihoods of fishermen.

- The 'sea snot' can also cause an outbreak of water-borne diseases such as cholera in cities like Istanbul.

1.8 Pesticides Poisoning

- A research titled "Toxicoepidemiology of poisoning exhibited in Indian population from 2010 to 2020: A systematic review and meta-analysis" was done on the prevalence of various types of poisoning in India.
- It has found that pesticides are the leading cause of poisoning in India, with two in every three cases of poisoning happening because of pesticide consumption either intentionally or unintentionally.
- Overall prevalence of pesticide poisoning was at 63% due to widespread use of pesticides for agricultural and household activities.
- The second most common cause of poisoning was miscellaneous agents, followed by drugs, venoms and corrosives.
- The prevalence of poisoning was the highest in north India at 79%, followed by south India (65.9%), central India (59.2%), west India (53.1%), north east India (46.9%) and east India (38.5%).
- **Reasons for pesticide poisoning** - Co-existence of poverty and agricultural farming and thus, the easy availability of pesticides.
- The WHO and its member countries initiated a programme of safe access of pesticides, which has resulted in a decrease in the prevalence of fatal poisoning by 10% across the world.
- However, pesticides remain the leading cause of poisoning in south Asian countries including India and in South East Asia and China.

1.9 Detergent Footprint

- Water pollution caused by detergents is a big global concern.
- The per capita detergent consumption in India is around 2.7 kg per year. It is around 10 kg in the United States of America.
- **Nonylphenol**, a hazardous chemical present in detergents, is known to enter water bodies and the food chains.
- It bio-accumulates and can pose serious environmental and health risks.
- It has been detected in human breast milk, blood and urine, and is associated with reproductive and developmental effects in rodents.
- Bureau of Indian Statistics (BIS) has set the standard of phenolic compounds in drinking water (0.001 mg/L) and surface water (5.0 mg/L).
- **Carcinogens and Non-biodegradables** - The detergents contain suspected carcinogens, and ingredients that do not fully biodegrade.
- Many laundry detergents contain approximately 35 to 75% phosphate salts. Phosphates can cause a variety of water pollution problems. Non-biodegradables can't be eliminated by wastewater treatment.
- **Eutrophication** - Some phosphate-based detergents can cause eutrophication. Phosphate-enrichment can cause the water body to become choked with algae and other plants.
- Eutrophication deprives the water of available oxygen, causing the death of other organisms.
- **Oxygen-Reducing Substances** - Detergents also contain oxygen-reducing substances that may cause severe damage to the fishes and other marine animals.
- [Oxygen-Reducing Substances are chemical compound that readily transfer oxygen atoms.]
- They are capable of destroying the external mucus layers that protect the fish from bacteria and parasites, causing severe damage to the gills.
    - Fish die when detergent concentrations are near 15 parts per million (ppm);
    - Fish eggs die when detergent concentrations as low as 5 ppm.

- **Anthropogenic components** like herbicides, pesticides and heavy metals present in the detergents can cause the water to grow murky.
    - This block out light and disrupting the growth of plants.
    - Turbidity clogs the respiratory system of some species of fishes.
- Pathogens from these toxic water bodies cause diseases, some fatal, in human or animal hosts diseases.
- Drinking water contaminated with detergents can be hazardous to human health.

1.10 Fly Ash

- NTPC Ltd (formerly known as National Thermal Power Corporation Limited) has invited Expression of Interest for sale of fly ash from the designated ports of the Middle East and other regions.
- Fly ash is a finely divided byproduct obtained from the burning of coal in electric power generating plants and steam generating plants.
- It results from the combustion of pulverized coal. It is called fly ash because it is transported from the combustion chamber by exhaust gases.
- It is collected from the exhaust gases by electrostatic precipitators or filter fabric bag filters.
- Fly ash has substantial amounts of silicon dioxide (SiO_2), aluminium oxide (Al_2O_3), ferric oxide (Fe_2O_3) and calcium oxide (CaO).
- **Uses of fly ash** - Typical highway engineering applications include: Portland Cement Concrete (PCC), soil and road base stabilization, flowable fills, grouts, structural fill and asphalt filler.
- Fly ash is most commonly used as a pozzolan in PCC applications.
- [Pozzolans are siliceous or siliceous and aluminous materials, which in a finely divided form and in the presence of water, react with calcium hydroxide to produce cementitious compounds.]
- It is used as good mineral filler in hot mix asphalt (HMA) applications and improves the fluidity of flowable fill and grout.

1.11 Study on Air Pollutants

- A new study says that Black Carbon (BC) has adverse effect on human health and leads to premature mortality.
- The Scientists from the Centre of Excellence in Climate Change Research who conducted the study were supported by the Climate Change programme of Department of Science and Technology (DST).

Black Carbon

- Black carbon, commonly known as soot, is a solid particle or aerosol that is produced from incomplete combustion.
- It is a form of particulate air pollutant that contributes to warming of the atmosphere.

- The study explored the individual and cumulative impact of BC aerosol, fine (PM 2.5), and coarse (PM 10) particulates, and trace gases (SO_2, NO_2, O_3) on premature mortality in Varanasi of Indo-Gangetic plain.
- The Scientists utilized daily all-cause mortality and ambient air quality from 2009 to 2016 to clearly establish a significant impact of BC aerosols, NO_2 and, PM2.5 exposure on mortality.
- **Findings** - The inclusion of co-pollutants (NO_2 & PM 2.5) in the multi-pollutant model increased the individual mortality risks for BC aerosols.
- The effect of pollutants was more prominent for males, age group 5-44 and, in winter. The adverse effect of pollutants wasn't limited to current day of exposure but can extend as high as up to 5 days (Lag effect).
- The mortality rises linearly with an increase in air pollutants level and shows adverse impact at higher levels.

1.12 Dumping Inert Waste in Bhatti Mines

- Members of Ridge Management Board (RMB) decided to form an expert committee to study a proposal for dumping "inert material" in Bhatti mines at Asola Bhatti Wildlife Sanctuary.
- SDMC is seeking permission to dump this material in 3 former mining pits in the sanctuary and one outside it.
- It has been claimed that this inert material is waste in the form of soil and is not chemically active.
- The committee will study the impact this inert material can have if it is dumped in the mines.

Asola Bhatti Wildlife Sanctuary

- It is located on the Southern Ridge, the northern terminal of Aravalli Hills.
- It is the part of the Northern Aravalli leopard wildlife corridor.
- It is the green lung & carbon sink for country's capital, New Delhi.
- It provides a potential shelterbelt for arresting the shifting of sandunes & protection of desert storms.
- As it is located on the Delhi-Haryana border, both the governments had defined certain areas around the forests as Eco-Sensitive Zone (ESZ).

1.13 Microplastic Pollution in Ganga

- A study has found that the river Ganga is heavily polluted with microplastics as well as other kinds of plastics such as single-use plastic and secondary plastic products.
    - Ganga has India's largest river basin in terms of catchment area and constitutes about 26% of India's landmass spread across 11 states, which supports 43% of the population.
- For the study, samples of Ganga's water were collected from Haridwar, Kanpur and Varanasi and microplastics were found in all of them.
    - Of the samples, those taken at Varanasi had the highest concentration of plastic pollution.
- Untreated sewage from densely populated cities across the river's course, along with industrial waste and religious offerings wrapped in non-degradable plastic add a significant amount of pollutants into the river.
- As the river flows, these waste and plastic materials break down further and are carried into the Bay of Bengal and then into the ocean.
- Microplastics flowing all along Ganga suggest a direct linkage between the poor state of both solid and liquid waste management; hence it is critically important to initiate steps to remediate it.
- **Efforts -** Most of the efforts to clean Ganga have focussed on creating sewage treatment capacities in the major urban centres along the river.
- In 2015, the government approved the Namami Gange (100% funding from the central government) programme to clean and protect the river.
- Programmes launched before this include the Ganga Action Plan (1985), the IIT Consortium (2011) for water diversion and effective treatment, and the National Mission for Clean Ganga (2011).

Microplastics

- Among the range of plastic debris that is found in water bodies, microplastics are the most notorious because of their small size.
- On average, microplastics are less than 5 mm in length or roughly equal to 5 pinheads.
- 11% of the 663 marine species that are affected by marine debris are said to be related to microplastic ingestion.
- Microplastics are ingested by marine habitants including fish, corals, planktons etc and are then carried further into the food chain.
- In the case of humans, most of the microplastics can be found in food, water and food containers and their ingestion can cause health problems.

1.14 Microplastics in the Atmosphere

- According to the National Oceanic and Atmospheric Administration (NOAA), Microplastics measure less than 0.2 inches (5 mm) long.
- A new study has revealed that millions of microplastics are swirling around in Earth's atmosphere, with roads as the biggest contributor.
- Computer modeling showed how particles get transported vast distances across the globe and showed that nowhere is safe from the pollution.
- Likely hotspots for the highest levels of microplastics are Europe, Eastern Asia, the Middle East, India, and the United States.
- This environmental problem is likely to get much worse

and could have serious effects on human health.

- **Source** - Roads provide the mechanical energy to move particles into the atmosphere.
- Other sources included the oceans (11%) and agricultural soil dust (5%), both of which involved strong winds pushing particles into the air.
- The atmosphere has the potential to transport plastics to disparate locations, across continents and to really remote locations that would otherwise be untouched by human pollution.
- **Upper limit** - The plastic particles could remain in the air for between one hour and 6.5 days.
- That upper limit is enough time for cross-continental transportation, which means even places like Antarctica are at risk of pollution.

1.15 Harit Dhara

- It is an anti-methanogenic feed supplement developed by an Indian Council of Agricultural Research (ICAR) institute - National Institute of Animal Nutrition and Physiology (NIANP), Bengaluru.
- When given to bovines and sheep, it cuts down their methane emissions by 17-20%, and also results in higher milk production and body weight gain.
- **Emission** - An average lactating cow or buffalo in India emits around 200 litres of methane per day, while it is 85-95 litres for young growing heifers and 20-25 litres for adult sheep.
- **Methane Production by Cattle** - Methane is produced by animals having rumen, the first of their four stomachs.
- In Rumen, the plant material they eat - cellulose, fibre, starch and sugars - gets fermented or broken down by microorganisms prior to further digestion and nutrient absorption.
- Carbohydrate fermentation leads to production of CO_2 and hydrogen.
- These are used as substrate by archaea - microbes in the rumen - to produce methane, which the animals then expel through burping.
- **Working** - Harit Dhara acts by decreasing the population of protozoa microbes in the rumen, responsible for hydrogen production and making it available to the archaea for reduction of CO_2 to methane.
- It has been prepared using condensed and hydrolysable tannin-rich plant-based sources abundantly available in the country.
- Tropical plants containing tannins (bitter and astringent chemical compounds) are known to suppress or remove protozoa from the rumen.
- Rumen Fermentation continues as before, but due to Harit Dhara, there is more production of propionic acid now in proportion to acetic and butyric acid in this fermentation.
- Since propionic acid provides much of the energy for lactose (milk sugar) production and body weight gain, there is economic benefit for farmers.

2. RENEWABLE ENERGY

2.1 Electric Mobility

A shift to electric vehicles will help in the growth of lithium and cobalt industry.

- India is the 3rd largest oil importer in the world in terms of value importing 228.6 MT of crude oil worth $120 billion in 2018–19.
- Shifting to electric vehicles will reduce our dependence on crude oil, reduce carbon emissions, save forex resources & build domestic energy independence.
- In long term this shift is important because these vehicles are sustainable & profitable.
- Also this transition will fine-tune our infrastructure since they are economically and environmentally viable option.

Lithium reserves

- Latin America has the famous lithium triangle region.
- These regions comprise of lithium deposits under the salt flats of northwest Argentina, northern Chile, and southwest Bolivia.
- They hold about 80% of the explored lithium of the world & most of the production comes from these countries.
- At present, India's lithium-ion battery demand is fulfilled by imports from China, Vietnam, and Hong Kong.
- But India has a growing thirst for lithium-ion batteries in the last 2 years & its lithium imports have tripled from $384 mn to $1.2 bn.
- In 2019, India's National Aluminium Company (NALCO), Hindustan Copper Limited (HCL) and Mineral Exploration Corporation Ltd (MECL) signed a joint venture agreement.
- They formed KhanijBidesh India Limited (KABIL) to search strategic mineral -lithium and cobalt- abroad for commercial use & to meet domestic requirement.
- India plans to buy lithium from the resource-rich Latin American countries.

Lithium

- It is a key element for new technologies and finds its use in ceramics, glass, telecom and aerospace industries.
- It is used in Lithium ion batteries, lubricating grease, high energy additive to rocket propellants, and optical modulators for mobile phones.
- It is also used as a convertor to tritium, which isa raw material for thermonuclear reactions i.e. fusion.
- The thermonuclear application makes Lithium as "Prescribed substance" under the Atomic Energy Act, 1962.

2.2 Solar Energy Corporation of India

- Set up in 2011, Solar Energy Corporation of India ltd is the only Central Public Sector Undertaking (CPSU) dedicated to solar energy sector.
- Its vision is to build 'Green India' through harnessing abundant solar radiation and to achieve energy security for the country.
- It is a Section-3 company under the Companies Act, 2013 that comes under the Ministry of New and Renewable Energy (MNRE).
- It is responsible for implementation of a number of schemes of MNRE,
    1. Viability Gap Fund (VGF) schemes for large-scale grid-connected projects under Jawaharlal Nehru National Solar Mission (JNNSM),
    2. Solar park scheme and grid-connected solar rooftop scheme,
    3. A host of other specialised schemes such as defence scheme, canal-top scheme, Indo-Pak border scheme etc.
- The mandate of the company has also been broadened to cover the entire renewable energy domain.
- The company also has a power trading license and trades the solar power from projects set up under the schemes being implemented by it.

2.3 Indian Renewable Energy Development Agency

- Indian Renewable Energy Development Agency Limited (IREDA) is a Mini Ratna (Category - I) Government of India Enterprise.
- IREDA comes under the administrative control of Ministry of New and Renewable Energy (MNRE).
- It is a Public Limited Government Company established as a Non-Banking Financial Institution in 1987.
- It is engaged in promoting, developing and extending financial assistance for setting up projects relating to new and renewable sources of energy and energy efficiency/conservation.
- The motto of the organisation is "ENERGY FOR EVER"

2.4 India's First CNG Tractor

- India's first ever Compressed Natural Gas (CNG) Tractor was launched.
- The CNG tractor's most important benefit for the farmer will be to save up to 50% on the fuel cost, as CNG is only Rs. 42 / kilogram.
- The conversion from diesel to CNG will be beneficial as it is a clean fuel with lowest carbon and pollutant content.
- It is also economical as it has zero lead and is non-corrosive, non-dilutive and non-contaminating which helps in increasing the life of the engine.
- Stubble can be used as a raw material for producing bio-CNG which will help the farmers to earn money by selling it to the bio-CNG production units in their locality.

2.5 Biofuel - Lessons from Brazil

- Brazil is one country that has successfully integrated biofuels into its fuel economy.
- It has efficiently leveraged its traditions and dominance in sugarcane production into a biofuel economy without compromising food security.
- Biofuels are also central to Brazil's low carbon emission strategy.
- To mitigate high dependence on oil imports, Brazil turned to its traditional sugarcane to revolutionise its fuel economy.
- Brazil aimed for a higher productivity and sugar-ethanol balance.
- This led Brazil to revolutionise its biomass production for ethanol and develop a new variety of sugarcane.
- This is popularly known as '**energy cane'**, which is low on sucrose but high on biomass.
- With productivity up to 350 tonnes of biomass per ha, against 80 tonnes per ha of traditional sugarcane, it offered a perfect balance.
- Brazil thus took up ethanol production without compromising sugar production.
- This enabled it to gradually augment its production and blend.
- With a mandatory blending of 27% ethanol with gasoline, in 2019 alone Brazil saved about 0.5 million barrels per day of gasoline with a savings of $13 billion in imports.
- 78% of Brazilian automobiles today run on 27% of ethanol blend.
- High biomass productivity of energy-cane is the biological factor that contributes to the high positive lifecycle energy balance of ethanol produced from it.
- It thus comes with a resultant positive balance of greenhouse gases emission.
- The residual cane-waste (Bagasse) also become commercially valuable for power generation and other commercial uses.
- So, it has been possible to transform energy-cane production into a multiproduct enterprise in Brazil.
- **Significance -** Energy cane is promising on drier and lower fertility soils, not suitable for conventional cultivation.
- Initially, economic, and strategic security reasons drove Brazil's ethanol production from sugarcane.
- But later it was realised that Brazil's was the most successful renewable energy programme from biomass.
- This especially came with the opening of the debate on the planet's environmental sustainability.
- Use of fossil fuels is one of the major sources of Co2 and other GHG emission globally.
- Brazilian sugarcane ethanol is designated as an 'advanced biofuel' due to its 61% reduction of total life cycle GHG emissions.

2.6 Floating Solar Power Plant

- India's biggest floating solar power plant (by generation capacity) is being developed by National Thermal Power Corporation (NTPC) Ltd.
- The 100 megawatt plant, known as Telangana Super Thermal Power Project (TSTPP), is being built in the reservoir of NTPC's thermal plant at Ramagundam, Telangana.
- This plant is part of the renewable (solar) energy plants being developed by NTPC with a capacity of 447MW in the Southern Region, and the entire capacity would be commissioned by March 2023. It comprises,
    1. A 217 MW ground-mounted solar power plant at Ettayapuram, Tamil Nadu
    2. A 25 MW floating solar plant at Simhadri thermal power plant near Visakhapatnam
    3. A 92 MW floating solar plant at Kayamkulam in Kerala.
- As all the thermal plants would have reservoirs, establishing floating solar plants in them was the immediate available opportunity without going for any land acquisition.
- The infrastructure needed for flue gas de-sulpherisation (FGD) work is in progress in these plants would be completed by December 2022.

2.7 Ethanol Blending

Recently steps are being initiated to accelerate India's ethanol blended petrol programme.

- In 2017, ethanol blending was less than 2% and has never exceeded 5% blending thus far.
- In the first four months of the current supply year (December 2020 to November 2021), about 80 crore litres of ethanol was supplied to the fuel pumps.
- This can translate to a blending ratio of 7% and if supplies continue at this pace, the blending ratio could reach 8.5% for the full year.
- This programme can reduce India's fossil fuel dependence and trim the large crude oil import bill.
- This can help in achieving the targets set in the National Bio fuels Policy - 10% ethanol blending by 2022 and 20% by 2025.
- But India's EBP programme has often come under some issues.
- But the sugar industries and oil marketing companies (OMCs) are taking an opportunistic approach to the EBP which has proved to be undoing.
- Though sugar mills make strident demands for higher blending to get rid of excess cane, they are reluctant to stick to the fixed annual supplies.
- In deficit years, they prefer to divert more cane to sugar and alcohol to industrial or potable uses in the hunt for better margins.
- On the other hand OMCs have failed to take their contracted quantities of ethanol when imported crude oil becomes cheaper.

2.8 National Offshore Wind Energy Policy

- This Policy was notified by the Government in 2015 providing the basic framework for developing the offshore wind sector.
- [Offshore wind power or energy is the deployment of wind farms sited in bodies of water. It is the clean and renewable energy obtained by taking advantage of the force of the wind that is produced on high seas.
- In the high seas, offshore wind energy reaches a higher and more constant speed than on land due to the absence of barriers.]
- **Objective** of this Policy is to develop the offshore wind energy in the Indian Exclusive Economic Zone (EEZ) along the Indian coastline.
- [EEZ of the country includes area up to the seaward distance of 200 Nautical Miles from the base line.]

- **Nodal Ministry** - Ministry of New and Renewable Energy will act as the nodal Ministry for overall monitoring of Offshore Wind Energy development in India.
- It will work in close coordination with other government entities for Development and Use of Maritime Space within the EEZ of the country.
- **Nodal Agency** - National Institute of Wind Energy (NIWE), Chennai will be the nodal agency,
    1. To carryout resource assessment, surveys and studies in EEZ,
    2. Demarcate blocks and facilitate developers for setting up offshore wind energy farms.
- The Ministry set a target of 5.0 GW of offshore wind installations by 2022 and 30 GW by 2030.

Other Initiatives

- Through NIWE, the Government has issued 'Guidelines for Offshore Wind Power Assessment Studies and Surveys' in 2018 to enable private investors to carryout offshore wind resource assessment.
- Further, Government is carrying out offshore wind resource assessments through NIWE to validate the offshore wind resource potential in identified locations off the coast of Gujarat and Tamil Nadu.
- The Ministry of New and Renewable Energy has formulated a committee to finalize a roadmap for offshore wind development in the country.
- The Government has permitted Foreign Direct Investment (FDI) up to 100% under the automatic route for renewable energy projects, including offshore wind energy projects.

3. CLIMATE CHANGE

3.1 Emissions from Grasslands

- A new study shows that emissions of methane (CH_4) and nitrous oxide (N_2O) from grasslands increased by a factor of 2.5 since 1750 mainly due to increased emissions from livestock.
- This has more than compensated for reduced emissions from the shrinking number of wild grazers.
- Net carbon sink effect of grasslands was estimated to have intensified over the last century but mainly in sparsely-grazed, natural grasslands.
- [Carbon Sink Effect is the ability of grasslands to absorb carbon and pack it in the soil.]
- Conversely, over the last decade, grasslands intensively managed by humans have become a net source of greenhouse gas emissions.
- It has greenhouse gas emission levels similar to those of global croplands, which represent a large source of greenhouse gases.

3.2 Extinction Rebellion

- Extinction Rebellion (XR) was launched in the **United Kingdom** in 2018, as a response to the UN Intergovernmental Panel on Climate Change (IPCC) report that declared,
    1. We only have 12 years to stop catastrophic climate change and
    2. We have entered the 6th mass extinction event.
- It is a global movement to **persuade the governments** to act justly on the Climate and Ecological Emergency.
- It is a decentralised and politically non-partisan movement that uses non-violent Direct Action and Civil Disobedience.
- It asks the groups to **rebel and self-organise**, without the need for anyone's permission, to come up with collective action plans that adhere to the group's core principles and values.
- The group has "three core demands" to the governments around the world, in order to confront the climate and ecological emergency that the world is faced with.

- It wants governments to "Tell the Truth", "Act Now", and "Go Beyond Politics".

3.3 Miyawaki Technique

- In a year, a patch of land in Mumbai's eastern suburbs has become a testament to create the "urban forests" through the Miyawaki technique.
- Miyawaki is an **afforestation technique** to create urban forests based on the work of Japanese botanist Akira Miyawaki in the 1980s.
- Miyawaki forests are tiny forests grown on small plots of land in 2 to 3 years and are self-sustaining, like how a forest is.
- Three layers of greens - shrubs and undergrowth, medium-height trees and taller canopies - are integral components of the Miyawaki forests.
- Before plantation, local agro-climatic conditions are studied. Around 3 to 4 saplings per sq. m of 30 or more native varieties of plants are planted.
- Mulching, natural water retention and perforation material like rice husk and use of organic compost, cow dung support their growth.

3.4 Antarctic Ozone Hole

- One of the deepest, largest gap in the ozone layer-Antarctic ozone hole - has closed,according to World Meteorological Organization (WMO).
- The annually occurring ozone hole over the Antarctic had rapidly grown from mid-August and peaked in early October 2020.
- The expansion of the hole was driven by a strong, stable and cold polar vortex and very cold temperatures in the stratosphere.
- The same meteorological factors also contributed to the record 2020 Arctic ozone hole, which has also closed.
- [A polar vortex is a wide expanse of swirling cold air, a low pressure area, in Polar Regions.
- During winters, the polar vortex at the North Pole expands, sending cold air southward.
- An ozone hole is the thinning of the ozone layer boosted in size by colder temperatures.]
- As the temperatures high up in the stratosphere start to rise, ozone depletion slows, the polar vortex weakens and breaks down.
- By the end of December 2020, ozone levels return to normal. This time around, however, the process took longer.
- Human-made chemicals migrate into the stratosphere and accumulate inside the polar vortex.
- It begins to shrink in size as warmer temperatures dominate.
- The 2020 Antarctic hole was unprecedented as the polar vortex kept the temperature of the ozone layer cold, preventing the mixing of ozone depleted air above Antarctica with ozone rich air from higher latitudes.

3.5 Doomsday Glacier

- The melting of Antarctica's Thwaites Glacier or the "Doomsday Glacier" has long been a cause of concern because of its high potential of speeding up the global sea level rise happening due to climate change.
- Researchers at University of Gothenburg are saying that fears related to its melting are worse than previously thought, owing to the supply of warm water flowing underneath at a rate underestimated in the past.
- Called the Thwaites Glacier, it is 120 km wide at its broadest, fast-moving, and melting fast over the years.
- Because of its size (1.9 lakh square km), it contains enough water to raise the world sea level by more than half a metre.
- Studies have found the amount of ice flowing out of it has nearly doubled over the past 30 years.

- Thwaites's melting already contributes 4% to global sea level rise each year. It is estimated that it would collapse into the sea in 200-900 years.
- Thwaites is important for Antarctica as it slows the ice behind it from freely flowing into the ocean.

University of Gothenburg's Study

- This study used an uncrewed submarine to go under the Thwaites glacier front for the first time to make observations.
- The submersible "Ran" measured among other things the strength, temperature, salinity and oxygen content of the ocean currents that go under the glacier.
- The researchers identified three inflows of warm water, among whom the damaging effects of one had been underestimated in the past.
- There is a deep connection to the east through which deep water flows from Pine Island Bay, a connection that was previously thought to be blocked by an underwater ridge.
- There were distinct paths that water takes in and out of the ice shelf cavity, influenced by the geometry of the ocean floor.

3.6 Shrinking Marine Life Richness

- A study by the National Academy of Sciences has found a strong correlation between marine species decline and rising temperature - Fish species diversity tended to either plateau or decline at or above 20°C.
- **Threats to marine life** - Overfishing and pollution, the warming of waters due to climate change have impacted tropical species.
- Globally, the total number of open-water species declined by about half in the 40 years up to 2010 in tropical marine zones. During that time, sea surface temperatures in the tropics rose 0.2°C.
- The total number of species attached to the seafloor remained somewhat stable in the tropics between the 1970s and 2010.
- Climate change is already impacting marine species diversity distribution, with changes being more dramatic in the Northern Hemisphere where waters have warmed faster.
- Some were also found beyond the tropics, suggesting they had expanded their ranges. Species that can move are moving. But, for fixed species like corals, moving is not an option.

3.7 Hydrogen - Fuel of the Future

- Hydrogen, the most abundant element in the universe, was used as a fuel in Apollo I that landed on the moon in 1969.
- Hydrogen provides three times more energy than fossil fuels. It is the ultimate green fuel that releases pure water as the only by-product.
- It is one of the leading options for storing energy from renewable as it may be the lowest-cost option for storing electricity over days or even months.
- **Shift** - Countries want to replace fossil fuels with renewable sources to isolate green hydrogen. This shift is happening as,
    1. Fossil fuels can no longer be used to meet the world's energy needs.
    2. Natural abundance of hydrogen means it has the potential to level competition in the automotive sector, whereas the supply of raw materials for EV batteries is controlled by a few large players.
- **Challenges** - Availability of cheap fossil fuel meant hydrogen energy never really picked up.
- Hydrogen does not occur naturally as a gas on the Earth (Always occurs combined with other elements such as water).
- This is because an external energy source is required to isolate hydrogen.
- Currently, fossil fuels are used to isolate hydrogen almost. This is called grey hydrogen and it is as polluting as fossil fuel.

- TERI says that the current cost of green hydrogen production is $5-6/kg, which is almost thrice the cost of grey hydrogen.

Findings

- **International Renewable Energy Agency (IRENA)** suggests that the share of hydrogen in the 2050s energy mix should reach to 12% from almost zero right now.
- It says 66% of the hydrogen to be used in 2050 needs to be green - produced from water as compared to natural gas.
- **IRENA's World Energy Transitions Outlook Report** - Around 120 tonnes of hydrogen are produced annually and less than 1% is green hydrogen.

Green Hydrogen Catapult Initiative

- In 2020, a consortium of seven biggest global green hydrogen project developers launched the Green Hydrogen Catapult Initiative to increase the production of green hydrogen 50-fold in the next six years.
- The initiative aims to cut the cost of green hydrogen to less than $2/kg, which is a potential tipping point that will make it competitive in multiple sectors including steel, power generation, shipping, etc.
- It will ramp up the annual green hydrogen production to 25GW by 2026.

3.8 Green Hydrogen Energy Mission

- The Union Budget proposed to launch a Hydrogen Energy Mission in 2021-22 for generating hydrogen from **green power sources**.
- Even though Hydrogen can be generated from many sources, India stresses on the renewable sources.
- This mission would decarbonise heavy industries, and also holds the key to clean electric mobility that doesn't depend on rare minerals.
- Hydrogen can act as an energy storage option, which would be essential to meet intermittencies (of renewable energy) in the future.
- Green hydrogen energy is vital for India to meet its Nationally Determined Contributions and ensure regional and national energy security, access and availability.

Green Hydrogen

- NTPC Ltd, India's largest energy integrated company under Ministry of Power anchored a 2-day online event BRICS Green Hydrogen Summit.
- **Green hydrogen** is produced using renewable energy and electrolysis.
- Electrolysis method uses an electrical current to separate the hydrogen from the oxygen in water. By Products are water and water vapour.
- If this electricity is obtained from renewable sources we will, therefore, produce energy without emitting carbon dioxide into the atmosphere.
- NTPC is pioneering Green Hydrogen Initiatives in India.
- India's National Hydrogen Energy Mission focuses on generation of hydrogen from green power resources.

Grey Hydrogen

- Grey hydrogen is produced from hydrocarbons (methane, fossil fuels, natural gas) and releases greenhouse gases into the atmosphere.
- It constitutes India's bulk Production.

Blue Hydrogen

- Blue hydrogen captures the above greenhouse gas emissions and stores them underground to prevent them causing climate change.
- By products are CO, CO2. They are Captured and Stored, so better than grey hydrogen.

3.9 Artificial Islands

- A report by the National Aeronautics and Space Administration (NASA) showed that the Maldives government is developing at least three artificial islands to tide over the rising sea-levels due to climate change.
- Maldives is one of the world's most low-lying terrains. About 80% of the archipelago's coral islands are at less than 1 metre above sea level.
- **Hulhumale** is an artificial island located to the northeast of Male.
- The government had started constructing Hulhumale in 1997 Hulhumale on a lagoon off Male to accommodate the capital's population swell.
- It was created by pumping out sand from the seafloor onto a submerged coral platform and is now Maldives's fourth-largest island.
- Since the 1990s, the government has expanded at least two other coral atolls - **Thilafushi and Gulhifalhuea** - through land reclamation.
- They are currently being used as industrial areas or landfills.
- The coral atolls have natural properties to resist sea-level rise. Most of the reefs have remained stable or even grown larger in recent decades.

Other Findings

- US Geological Survey study 2018 - The low-lying islands will become uninhabitable by 2050 due to flooding and scarcity of freshwater.
- Intergovernmental Panel on Climate Change - Sea-level will rise half a metre by 2100 if greenhouse gas emissions are drastically reduced, or by 1 m if they continue to rise.

3.10 National Climate Vulnerability Assessment Report

- The report, titled 'Climate Vulnerability Assessment for Adaptation Planning in India Using a Common Framework' was released by the Department of Science and Technology (DST).
- It identifies the most vulnerable states, districts and panchayatsin India with respect to current climate risk and key drivers of vulnerability.
- It was coordinated by the Climate Change Program of SPLICE Division of the DST in partnership with the Swiss Agency for Development and Cooperation, Embassy of Switzerland.
- [SPLICE - Strategic Programs, Large Initiatives and Coordinated Action Enabler]
- It was part of a capacity building programme under the National Mission on Sustaining the Himalayan Ecosystem and National Mission on Strategic Knowledge for Climate Change.

Findings

- The report revealed that eight Indian states - Chhattisgarh, Jharkhand, Mizoram, Odisha, Assam, Bihar, Arunachal Pradesh and West Bengal - are highly vulnerable to climate change.
- Key vulnerability drivers arelack of forest area per 100 rural population, low road density, poor health infrastructure, lack of implementation of MGNREGA, lack of women's participation in workforce, among others.
- Among all states, Assam, Bihar and Jharkhand have over 60% districts in the category of highly vulnerable districts.
- **States with lower-middle vulnerability** - Himachal Pradesh, Telangana, Sikkim and Punjab.
- **States with low vulnerability** - Uttarakhand, Haryana, Tamil Nadu, Kerala, Nagaland, Goa and Maharashtra.
- **Uses** - The report will aid in prioritising adaptation investment, developing and implementing adaptation programmes by the states.
- The assessments can further be used for India's reporting on the Nationally Determined Contributions under the Paris Agreement. They will support India's National Action Plan on Climate Change.

3.11 Climate Change & Shift in Earth's Axis

- A new study has added shifting of Earth's axis to the list of consequences of climate change, which already includes rising sea levels, heat waves, melting glaciers and storms.
- While this change is not expected to affect daily life, it can change the length of the day by a few milliseconds.
- As per the study, since the 1990s, **climate change** has caused significant glacial ice to melt into oceans, which in turn has caused the Earth's poles to move in new directions.
- Other causes may include **terrestrial water storage** change in non-glacial regions due to climate change and **unsustainable consumption of groundwater** and other anthropogenic activities.
- The North Pole has shifted in a new eastward direction since the 1990s, because of changes in the hydrosphere.
- The calculations were based on satellite data from NASA's Gravity Recovery and Climate Experiment (GRACE) mission and estimates of glacier loss and groundwater pumping going back to 1980s.

Earth's Axis

- The Earth's axis of rotation is the line along which it spins around itself as it revolves around the Sun.
- The points on which the axis intersects the planet's surface are the geographical north and south poles.
- The location of the poles is not fixed, however, as the axis moves due to changes in how the Earth's mass is distributed around the planet.
- Thus, the poles move when the axis moves, and the movement is called "polar motion".
- Generally, polar motion is caused by changes in the hydrosphere, atmosphere, oceans, or solid Earth.
- According to NASA, data from the 20th century shows that the spin axis drifted about 10 centimetres per year.

3.12 Climate Change & Oldest Cave Art

- A new study has found that one of the oldest pieces of the world's human heritage in Sulawesi island of Indonesia is weathering at an alarming rate due to climate change.
- **Significance** -The Sulawesi cave art is much older than the prehistoric cave art of Europe.
- These Pleistocene-era rock paintings found in caves of the Maros-Pangkep region in southern Sulawesi date back to 45,000-20,000 years.
- The area is known to be home to over 300 cave paintings, and more are being discovered with further explorations.
- **Artwork** in the area includes the world's oldest hand stencil(almost 40,000 years ago), created by pressing the hand on a cave wall, and spraying wet red-mulberry pigments over it.
- A nearby cave features the world's oldest depiction of an animal, a warty pig painted on the wall 45,500 years ago.
- **Findings of the Study** - The flakes of rock that have begun to detach from cave surfaces had calcium sulphate and sodium chloride salts. These salts form crystals on rock surfaces, causing them to break.
- The artwork made with pigments was decaying due to haloclasty process.
- This is a process triggered by the growth of salt crystals due to repeated changes in temperature and humidity, caused by alternating wet and dry weather in the region.
- Indonesia has also experienced several natural disasters in recent years, which have quickened the process of deterioration.
- **Recommendations** - Regular physical and chemical monitoring of the cave art sites would help.

3.13 Global Methane Assessment Report

- The "Global Methane Assessment: Benefits and Costs of Mitigating Methane Emissions" report was released by the Climate and Clean Air Coalition and the United Nations Environment Programme (UNEP).
- The report has said that human-caused methane emissions must be cut by 45% to avoid the worst effects of climate change. Such a cut would,
    1. Prevent a rise in global warming by up to 0.3 degrees Celsius by 2045.

2. Prevent 260,000 premature deaths, 775,000 asthma-related hospital visits annually, as well as 25 million tonnes of crop losses.

- Human-caused methane emissions are increasing faster currently than at any other time since record keeping began in the 1980s. Methane in the atmosphere reached record levels in 2020.
- The report noted that the most human-caused methane emissions came from three sectors - Fossil fuels, waste and agriculture.

Actions to be Taken

- **Fossil fuels Sector** - Oil and gas extraction, processing and distribution accounted for 23% of methane emissions in the fossil fuel sector. Coal mining accounted for 12% of emissions.
- Up to 80% of measures in the oil and gas industry could be implemented at negative or low cost. About 60% of methane cuts in this sector could make money as reducing leaks would make more gas available for sale.
- **Waste Sector** - Landfills and wastewater made up about 20% of emissions in the waste sector.
- This sector could cut its methane emissions by improving the disposal of sewage around the world.
- **Agricultural Sector** - Livestock emissions from manure and enteric fermentation constituted for 32% and rice cultivation 8% of emissions.
- The mitigation potential varied between countries and regions.
    1. Europe had the greatest potential to curb methane emissions from farming, fossil fuel operations and waste management.
    2. India had the greatest potential to reduce methane emissions in the waste sector.
    3. China's mitigation potential was best in coal production and livestock, while Africa's was in livestock, followed by oil and gas.
- The report said that three behavioural changes could reduce methane emissions by 65-80 million tonnes per year over the next few decades,
    1. Reducing food waste and loss,
    2. Improving livestock management and
    3. Adopting healthy diets (vegetarian or with a lower meat and dairy content).

3.14 Impact of Climate Change

- People around the world have been doubly hit by the pandemic and extreme weather events which have been fuelled by climate change.
- **2021 is a Year of Extreme Weather Events** - Among the extreme weather events across the world this year are,
    1. Unprecedented heat wave that drove temperatures across Canada and parts of the US to a record high,
    2. Extreme floods in Germany that killed over 180 people;
    3. Cyclones Tauktae and Yaas that hit India's west and east coasts;
    4. New South Wales (Australia) floods were the worst flooding on the mid-north coast since 1929.
- Extreme weather events like more powerful heat waves, extreme rainfall, droughts, etc., are likely to become more frequent or more intense with rising anthropogenic climate change.
- Rising temperatures will have far-reaching consequences, like impact on food security, health, the environment and sustainable development.

Reports

- Carbon dioxide in the atmosphere at 419 parts per million (ppm) in May 2021 was the highest level in 63 years. This was recorder in the NOAA's Mauna Loa Atmospheric Baseline Observatory using Keeling Curve.
- According to the NOAA's Climate Extremes Index, the area in the Southwest are experiencing extremely high temperatures in summer over the last 20 years, with very little relief in the last six years.

- According to the Climate Science Special Report, global temperatures are likely to continue to increase due to the release of greenhouse gases.
- According to a report, temperatures at the Earth's poles are rising at two to three times the temperature at the equator. This weakens the jet stream of the mid-latitudes, situated over Europe.
- During summer and autumn, the weakening of the jet stream has a causal effect resulting in slower-moving storms. This can result in more severe and longer-lasting storms with increased intensity.
- A 2016 study stated that human-induced global warming has contributed to the increased frequency and intensity of cyclonic storms over the Arabian Sea.
    - Indian Ocean is heating up at a faster pace in comparison to the Pacific or the Atlantic.
    - Western parts of the Indian Ocean are warming up even more.
- Many studies have found that a rise in the temperature of the sea surface is related to the changes in the intensity and frequency of cyclones.

3.15 Keeling Curve

- The amount of carbon in Earth's atmosphere in May 2021 reached its highest level in modern history, a global indicator showed.
- The Keeling Curve, named after its creator Dr. Charles David Keeling, is a global benchmark for carbon levels in the atmosphere.
- It is a graph that represents the concentration of carbon dioxide (CO_2) in Earth's atmosphere since 1958 at the Mauna Loa Observatory in Hawaii.
- It is the longest uninterrupted instrumental record of atmospheric CO_2 in the world, and it is commonly regarded as one of the best and most recognizable products of a long-term scientific study.
- It is considered by many scientists to be a trustworthy measure of CO_2 in the middle layers of the troposphere.
- At Mauna Loa Observatory, Keeling discovered global atmospheric CO_2 levels were rising nearly every year. By analyzing the CO_2 in his samples, he was able to attribute this rise to the use of fossil fuels.

Keeling's Discoveries

- Keeling found that the air samples taken at night contained a higher concentration of CO_2 compared to samples taken during the day.
- He drew on his understanding of photosynthesis and plant respiration to explain this observation:
    1. During the day, plants take in CO_2 to photosynthesize, and
    2. At night, the plants release CO
- By studying his measurements over the course of a few years, Keeling also noticed a larger seasonal pattern.
    1. CO_2 levels are highest in the spring, when decomposing plant matter releases CO_2 into the air, and
    2. CO_2 levels are lowest in autumn when plants stop taking in CO_2 for photosynthesis.

3.16 Carbon Watch

- It is India's first app to assess the carbon footprint of an individual.
- [Carbon footprint is the amount of greenhouse gases-especially carbon dioxide-released into the atmosphere by a particular human activity.]
- Chandigarh became the first state or Union Territory in India to launch the Android-based app Carbon Watch.
- As a person downloads the app, they will need to fill details in four categories - Water, Energy, Waste andTransport (Vehicular movement) category.

4. ENVIRONMENTAL ORGANISATIONS, CONVENTIONS & TREATIES

4.1 UN High-Level Dialogue on Desertification, Land degradation and Drought

- The United Nations High-Level Dialogue on Desertification, Land Degradation and Drought (DLDD) was convened with the support of the United Nations Convention to Combat Desertification (UNCCD).
- It assessed the progress made in fighting land degradation, and map the way forward on global efforts to revive and restore healthy land.
- It encourages all the member states to adopt and implement UNCCD's Land Degradation Neutrality (LDN) targets and National Drought Plans.
- [LDN is a state whereby the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remains stable or increases within specified temporal and spatial scales and ecosystems.]
- **Challenges** - Globally, one fifth of land area (more than 2 billion hectares) is degraded, including more than half of agricultural land.
- Each year, more than 12 million hectares of land are lost to DLDD. Annually, 24 billion tons of fertile soil is lost due to dryland degradation.
- Land degradation currently undermines well-being of 3.2 billion people, more than 40% of the entire world population. Unless we change how we manage soil, 90% could become degraded by 2050.

Steps Taken by India

- India is on track to achieve its national commitment on Land Degradation Neutrality (LDN) (SDG target 15.3).
- It is working to restore 26 million hectares of degraded land by 2030.
- India is assisting fellow developing countries to develop land restoration strategies.
- Over the last 10 years, around 3 million hectares of forest cover has been added.
- A Centre of Excellence is being set up at Indian Council of Forestry Research and Education (ICFRE) to promote a scientific approach towards land degradation issues.
- Based in Dehradun, ICFRE is an autonomous body of the Ministry of Environment, Forest and Climate Change.

Terminologies

- **Land degradation** can be considered in terms of the loss of actual or potential productivity or utility as a result of natural or anthropic factors; it is the decline in land quality or reduction in its productivity.
- The UN says that desertification is a process, which is a consequence of severe land degradation in typically dry areas resulting from various factors, including climatic variations and human activities.
- **Desertification** creates arid, semi-arid and dry sub-humid areas.
- The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) estimates that over 70% of all natural, ice-free land has been transformed by human activity, devastating global biodiversity.

4.2 International Nitrogen Initiative

- The United Nations (UN) Sustainable Development Goals (SDGs) are the main focus of the eighth triennial conference of the International Nitrogen Initiative (INI).
- The International Nitrogen Initiative (INI) was set up in 2003 under the sponsorship of Scientific Committee on Problems of the Environment (SCOPE) and the International Geosphere-Biosphere Program (IGBP).
- The key aims of the INI are to:
    1. Optimize nitrogen's beneficial role in sustainable food production,
    2. Minimize nitrogen's negative effects on human health and the environment resulting from food and energy production.
- The program is currently a sustained partner of Future Earth.
- INI is coordinated by a **Steering Committee**, led by a chair and six regional centre directors representing, Africa, Europe, Latin America, North America, South Asia and East Asia.

- Steering Committee members serve a ~four year term.

4.3 Post-2020 Global Biodiversity Framework

- The UN Convention on Biological Diversity (CBD) has demanded an additional $200 billion fund flow to developing countries from various sources to manage nature through 2030.
- It is one of many demands and targets that have been set through 2030 in the official draft of a new Global Biodiversity Framework.
- The post-2020 global biodiversity framework builds on the Strategic Plan for Biodiversity 2011-2020.
- This new framework will be the global guiding force to protect nature and to retain its essential services for humans from 2020 to 2030.
- **Goals** - The new frameworks have four goals to achieve by 2050.
    - To halt the extinction and decline of biodiversity,
        - The rate of extinctions has been reduced at least tenfold and
        - The risk of species extinctions across all taxonomic and functional groups is halved and
        - Genetic diversity of wild and domesticated species is safeguarded, with at least 90% of genetic diversity within all species maintained.
    - To enhance and retain nature's services to humans by conserving.
    - To ensure fair and equitable benefits to all from use of genetic resources.
    - To close the gap between available financial and other means of implementation and those necessary to achieve the 2050 Vision.
- The framework document says that the adequate financial resources to implement the framework are available and deployed, progressively closing the financing gap up to at least $700 billion per year by 2030.
- **Targets** - The new framework has the same 21 lofty targets agreed earlier to meet by 2030.
    - To bring at least 30% of land and sea under the world's protected areas,
    - To redirect, repurpose, reform or eliminate incentives harmful for biodiversity, in a just and equitable way, reducing them by at least $500 billion per year.
- This framework ensures the right capacity building of the communities /governments to take up conservation measures to meet the goals.
- These include the contentious technology transfer to countries that don't have it currently and also a wide scientific cooperation among countries.

5. GOVERNMENT INTERVENTIONS

5.1 M-Sand Policy

- Rajasthan government has brought the policy on M-sand (manufactured sand), which would be a "game changer" for the construction industry.
- [M-sand is produced after crushing hard granite stones and rocks extracted from quarries.]
- This policy would give industry status to the units producing it for construction work.
- It would reduce the dependence on natural bajri (riverbed sand).
- The policy will enable the investors to set up M-sand units by utilising the incentives and facilities offered by the State government.

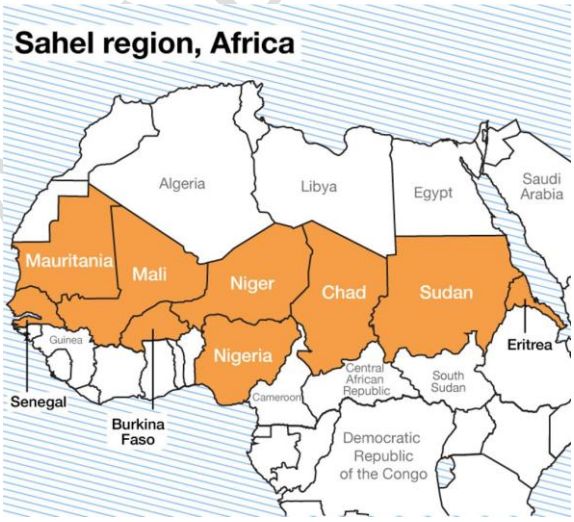
5.2 Centre for Wetland Conservation and Management

- Indian government will establish the first Centre for Wetland Conservation and Management (CWCM) in the National Centre for Sustainable Coastal Management (NCSCM), Chennai.

- [NCSCM - An institution under the Ministry of Environment, Forest and Climate Change.]
- It would aid in the application of integrated approaches for conservation, restoration, management and wise use of the wetlands.
- It would address specific research needs and knowledge gaps, and help in building partnership and networks with relevant national and international agencies.
- It would serve as a knowledge hub and enable exchange between State/ UT Wetland Authorities, wetland users, researchers, etc.
- It would assist the national and State/ UT Governments in the design and implementation of policy and regulatory frameworks, management planning, monitoring and targeted research for its conservation.

5.3 Great Green Wall

- Great Green Wall (GGW) initiative, launched by the African Union in 2007 had hit a wall due to funds crunch.
- It was conceived by 11 countries located along the southern border of the Sahara and their international partners.
- It was launched to address desertification, land degradation and climate change in the Sahel region.
- [Sahel region stretches from Senegal on the Atlantic coast, through parts of Mauritania, Mali, Burkina Faso, Niger, Nigeria, Gambia, Cameroon, Chad and Sudan to Eritrea on the Red Sea coast.]



- It aims to restore 100 million hectares of degraded land by 2030.
- At the fourth One Planet Summit for Biodiversity co-organised by France, the United Nations and World Bank, France has announced $14 billion to scale up work of GGW.
- The GGW goals will also contribute to the UN-mandated Sustainable Development Goal 15 (SDG 15) - Life on land.
- [SDG 15 - Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and biodiversity loss]
- **PROGREEN** is a World Bank fund dedicated to boosting countries' efforts to address landscape degradation.
- It will also invest $14.5 million in five countries in the Sahel region: Burkina Faso, Chad, Niger, Mali and Mauritania.

5.4 Tree City Status to Hyderabad

- Hyderabad city has the 'Tree Cities of the World' status by the Arbor Day Foundation jointly with the UN Food and Agriculture Organisation.
- It is the only city in India to have been selected for this recognition for its commitment to growing and maintaining urban and community forestry.
- Hyderabad applied for this recognition, citing the State government's Haritha Haram programme and its initiative for the Urban Forest Parks.
- It was evaluated based on five standards –
    1. **Establish Responsibility** - For taking care of trees within municipal boundary to a staff member, a city department, or a group of citizens (Tree Board).
    2. **Set the Rules** - A law or an official policy to govern the management of forests and trees.

3. **Know What You Have** - An updated inventory or assessment of the local tree resource.
4. **Allocate the Resources** - Dedicated annual budget for the routine implementation of the tree management plan
5. **Celebrate the Achievements**

Determining a Tree's Age

- The most common method of determining the age of the tree is Dendrochronology – or tree-ring dating also called growth rings.
- Each year, roughly a tree adds to its girth, the new growth is called a tree ring. By counting the rings of a tree, the age can be determined.
- To analyse the rings, core samples are extracted using a borer that's screwed into the tree and pulled out, bringing with it a straw-size sample of wood. The hole in the tree is then sealed to prevent disease.

5.5 Heritage Trees

- The Maharashtra government will make amendments to the Maharashtra (Urban Areas) Protection and Preservation of Trees Act of 1975, to introduce provisions for the protection of 'heritage trees'.
- **Heritage trees** - Under the proposed amendment, a tree with an estimated age of 50 years or more shall be defined as a heritage tree. It may belong to specific species, which will be notified from time to time.
- The environment department, in consultation with the forest department, will issue guidelines to determine the age of the tree.
- **Protection** - According to the current Compensatory Plantation in the state, one sapling has to be planted for each tree that is cut.
- Under the proposed amendment, anyone cutting a heritage tree must plant compensatory trees in the same numbers as the cut tree's age.
- **Maintenance** - The organization planting these trees will have to ensure the survival of the plantation for 7 years and geo-tag the trees.
- Such plantations can be carried out either in the same plot or a common amenity plot.
- The amendment also has the fine for illegal felling of trees from a maximum of Rs 5,000 to Rs 1 lakh per tree.

5.6 Seaweed Mission

- It is an initiative for commercial farming of seaweeds and its processing for value addition towards boosting national economy.
- It is initiated by Technology Information, Forecasting and Assessment Council (TIFAC).
- If sea weed cultivation is done in 5% of the Exclusive Economic Zone (EEZ) area of India, it can
    1. Set up new seaweed industry;
    2. Provide employment to people and Contribute to national GDP;
    3. Improve ocean productivity and create a healthier ocean;
    4. Abate algal blooms, sequester millions of tons CO_2;
    5. Produce bio-ethanol approx. 6.6 billion litres.

5.7 Fish Pass

- Fish passes for hilsa fish constructed by the government in 2019, to redesign the navigation lock at the Farakka Barrage, has proved fruitful now.
- Hilsa is an anadromous fish i.e., it lives most of its life in the ocean, but during the rainy season (spawning time), it moves towards the estuary, where the rivers of India and Bangladesh meet the Bay of Bengal.
- This fish pass project has facilitated the movement of hilsa upstream along the Ganga to its spawning grounds.
- [Farakka Barrage, operational on the Ganga since 1975, disrupted the westward movement of the hilsa.]
- Fish passes or fish ladders or fish ways aim to assist fish in crossing obstacles presented by dams and barrages.

- They usually consist of small steps that allow the fish to climb over the obstacles and enable them to reach the open waters on the other side.
- For the intervention to work, the water running over these ladders must be controlled - it must be adequate to catch the attention of the fish, but not too strong to deter them from swimming against it.

5.8 Bio-Restoration

- A new technology for ecological restoration (Bio-restoration) was developed to revive the mangroves degraded due to rising sea levels, climate change and human intrusion in the Sunderbans, West Bengal.
- [The Sundarbans is a protected wetland under the Ramsar Convention and is also a UNESCO World Heritage site.]
- Ecological restoration means reviving native ecosystem in degraded areas while maintaining diversity of original flora and fauna through regeneration but bringing down the regeneration period to 4 to 5 years.
- Restoration process begins with stabilising entire site by planting native salt tolerant grasses. It involves the use of growth-promoting bacteria.
- The restoration project was initiated with help from the Department of Biotechnology in 2013 and is now likely to be extended to 100 acres.
- The transplantation of propagated mangroves started in 2014, initially at a moderately degraded patch and then at severely degraded zones.

5.9 Failure of First Inter-State Tiger Relocation Project

Sundari, a tigress shifted as part of India's first inter-state translocation project in 2018 from Madhya Pradesh (MP) to Odisha, was relocated back to MP.

- The tiger relocation project was initiated in 2018.
- As part of this, two big cats were relocated to Satkosia Tiger Reserve in Odisha, to shore up the tiger population in the state.
    - a male (Mahavir) from Kanha Tiger Reserve and a female (Sundari) from Bandhavgarh from Madhya Pradesh
- Both were selected for the translocation project as per the NTCA (National Tiger Conservation Authority) guidelines and in collaboration with the Wildlife Institute of India and the Government of India.
- The relocation was meant to serve two purposes:
    i. reducing tiger population in areas with excess tigers to majorly reduce territorial disputes
    ii. reintroduce tigers in areas where the population has considerably reduced due to various reasons
- The project was estimated with a budget of Rs 19 crore.
- It was started under the project of "augmentation and recovery of tiger population in Satkosia tiger reserve".
- Six tigers (three pairs) from different reserves of Madhya Pradesh were to be sent to Odisha under the project.
- The project ran into trouble within weeks of initiation.
- The arrival of the tigers was followed by severe protests by villagers living on the fringes of the reserve.
- Forest department officials were attacked and their offices burnt down by the villagers.
- This reaction was the outcome of displacing tribals from Raigoda in the core area to Saruali on the outskirts of the reserve.
- The villagers feared the big cats would endanger their livelihoods, lives and livestocks.
- They also alleged that they were not consulted or informed prior to the translocation.
- Within months of the translocation, Mahavir was found dead.
- Earlier, a woman was allegedly mauled to death by Sundari and another person was also killed.

- A major reason for the failure was the lack of confidence and trust building between the forest department and the villagers.
- Notably, the translocation was done in haste.
- The field staff and tiger reserve management were not prepared.
- Capacity for tiger monitoring was poor.
- The local communities were not taken into confidence nor conveyed the benefits from tourism that tigers could bring them.
- While Mahavir had settled down after initial exploration of the forest area, Sundari was venturing into human habitation.
- Protection was not up to the mark and the only undisturbed, prey rich habitat was already occupied by the old resident tigress.
- The already existing female tigress in the core area did not allow the presence of another tigress and chased her away.
- This caused Sundari to occupy human dominated, disturbed areas.
- Sundari's proximity to human habitations which are in abundance even close to the core area in Satkosia could have led to the human-animal conflict.
- Addressing these issues and relocating villages should be prioritised before tiger reintroduction is continued.

5.10 Ken-Betwa Link Project

- A memorandum of agreement was signed between Union Minister of Jal Shakti and the Chief Ministers of Madhya Pradesh and Uttar Pradesh to implement the Ken-Betwa Link Project (KBLP).
- Ken-Betwa Link Project is the first project under the **National Perspective Plan** for interlinking of rivers (Peninsular component).
- Under this project, water from the River Ken will be transferred to the River Betwa. Both these rivers are tributaries of river Yamuna. The project has two phases,
    a) **Phase-I** - Daudhan dam complex and its appurtenances like Low and High Level Tunnel, Ken-Betwa link canal and Power houses
    b) **Phase-II** - Lower Orr dam, Bina complex project, Kotha barrage
- Daudhan dam comes within the core habitat of Panna Tiger Reserve.
- **Benefit** - The project is expected to provide annual irrigation, drinking water supply and also generate 103 MW of hydropower.
- It will be of immense benefit to the drought-prone Bundelkhand region, which spreads across 13 districts of Uttar Pradesh and Madhya Pradesh.

National Perspective Plan (NNP)

- In 1980, the Ministry of Irrigation prepared a National Perspective Plan (NNP) for water resources development.
- This was introduced for inter basin water transfer in the country.
- Based on the NPP, the National Water Development Agency (NWDA) identified 30 river links.
- The NPP comprised two components:
    a) 14 river links under Himalayan Rivers Development Component;
    b) 16 river links under Peninsular Rivers Development Component.
- The clearances required for a river-linking project are,
    a) Techno-economic (given by the Central Water Commission);
    b) Forest and Environmental clearance (Environment Ministry);
    c) Resettlement and Rehabilitation (R&R) Plan of Tribal Population (Ministry of Tribal Affairs) and Wildlife clearance

5.11 Amendments to Forest Conservation Act

- Ministry of Environment, Forest and Climate Change (MoEFCC) has proposed amendments to Section 1 and 2 of the Forest (Conservation) Act, 1980 (FCA).
- It proposes two changes to strengthen the applicability of the FCA,

1. To complete the process of forest identification in a time-bound manner,
2. To enable the creation of 'no-go' areas, where specific projects would not be allowed.

- The amendments propose to grant exemptions to infrastructure projects like railways, roads, tree plantations, oil exploration, wildlife tourism and 'strategic' projects in the forests areas.
- Exemption is subject to terms and conditions of the central government.
- A new explanation is added to the Section 2 that states 'survey, reconnaissance, prospecting, exploration or investigation' for a future activity in the forest will not be classified as a **Non-forestry Activity**.
- This means such survey works would not require any prior permission from the government. Only exception is if the activity falls within a wildlife sanctuary, national park or tiger reserve.
- The amendments aim to empower state governments to lease forest land to private individuals and corporations.
- If the proposed amendments come into force, they would dilute the provisions of the Supreme Court's decision in Godavarman case (1996).

Forest (Conservation) Act, 1980

- Forest (Conservation) Act, 1980 is the principal legislation that regulates deforestation in the country. The FCA has only five sections.
  a) Section 1 defines the extent of coverage of the law,
  b) Section 2 restrictions of activities in forest areas, and
  c) The rest deals with the creation of advisory committees, powers of rule-making and penalties.
- It prohibits the felling of forests for any "non-forestry" use without prior clearance by the central government.
- The clearance process includes seeking consent from local forest rights-holders and from wildlife authorities. The Centre may reject such requests or allow them with legally binding conditions.

5.12 Compressed Biogas Plants

- Under the Sustainable Alternative Towards Affordable Transportation (SATAT) scheme, Oil and Gas Marketing Companies (OGMCs) invited entrepreneurs to procure Compressed Bio Gas (CBG).
- Under this scheme, few of the enablers have been provided. They are,
  1. Assured price for offtake of CBG with long term agreements by OGMCs;
  2. Inclusion of bio manures produced from CBG plants as Fermented Organic Manure (FOM) under Fertilizer Control Order 1985;
  3. Inclusion of CBG projects under Priority Sector Lending by RBI.
- So far, 9 CBG plants have been commissioned and started supply of CBG in Andhra Pradesh, Gujarat, Haryana, Maharashtra and Tamil Nadu.
- These plants are set up by entrepreneurs and private companies who have raised financial resources to develop these plants on the basis of LoIs issued by OGMCs.
- Technology for a plant is chosen by the entrepreneurs depending upon various factors including feedstock techno-commercial feasibility, etc.

Sustainable Alternative Towards Affordable Transportation Scheme

- It was launched by Ministry of Petroleum and Natural Gas in 2018.
- It will promote the use of Compressed Bio-Gas (CBG) production plants and make available CBG in the market for use in automotive fuels.
- It will be launched in association with PSU oil marketing companies, which invites potential entrepreneurs to set up CBG plants.

5.13 Vehicle Scrappage Policy

- This policy, proposed in the Union Budget for 2021-22, will deregister commercial vehicles in 15 years and private vehicles in 20 years if they fail to get fitness certificates.
- Every vehicle beyond the age-limit will have to undergo the mandatory automated fitness test, failing which it will be taken off the road and the owner will be fined.

- A vehicle that fails the fitness test or fails to get its registration renewed will be termed 'end of life vehicle'.
- To discourage people from driving around in their 'unfit', polluting vehicles, the cost of registration renewal for old vehicles have been hiked.
- Automated Fitness Centres will be set up on a PPP model by the state government, private sector and automobile companies to provide fitness certificates.

Aroma Mission

- In 2016, the Centre launched Aroma Mission to boost cultivation of plants for essential oils which have aromatic medicinal properties.
- The mission supports domestic aromatic crop based agro economy to move from imported aromatic oils to homegrown varieties.
- Nodal laboratory - CSIR-Central Institute of Medicinal and Aromatic Plants (CSIR-CIMAP), Lucknow.
- Participating laboratories - CSIR-Institute of Himalayan Bioresource Technology (CSIR-IHBT), Palampur; CSIR-Indian Institute of Integrative Medicine (CSIR-IIIM), Jammu etc.

5.14 Purple Revolution

- Council of Scientific and Industrial Research-Indian Institute of Integrative Medicine, Jammu announced phase 2 of purple revolution under Aroma Mission, after the success of the phase 1 in Doda, Jammu.
- Under the purple revolution, the farmers in Doda district had their incomes quadrupled after shifting from maize to lavender cultivation.
- First-time farmers were given free lavender saplings and those who have cultivated lavender before were charged Rs. 5-6 per sapling.
- The farmers will get help from IIIM-Jammu to sell their produce.
- Farmers could reach the four distillation units set up by CSIR-IIIM Jammu in Doda for extraction of lavender oil.
- At present, large-scale lavender cultivation is limited to J&K but governments in Himachal Pradesh, Arunahal Pradesh and Uttarakhand are also encouraging their farmers to take up lavender.
- **Purple Economy** - Lavender oil sells for at least Rs 10,000 per litre
- Lavender water can be separated from lavender oil. It is used to make incense sticks.
- Hydrosol is formed after distillation from the flowers. It is used to make soaps and room fresheners.

5.15 Green Bonds

- India has announced its intention to achieve all the United Nations Sustainable Development Goals (SDG) by 2030.
- The evolution of green finance came into being when the first green bond was issued in 2015 (This is an alternative to Kuznets hypothesis that is used by the developed countries to achieve SDG goals).
- **Green bond** is a fixed-income instrument designed specifically to support specific climate-related or environmental projects.
- It encourages sustainability and more specifically, green bonds finance projects aimed at energy efficiency, pollution prevention, etc.
- Such bonds also finance the cultivation of environmentally friendly technologies and the mitigation of climate change.
- The key features involving the green bond market in India include:
    1. The market commenced with banks issuing green bonds. The share of corporates is now increasing, similar to the situation abroad
    2. Use of green label and certification is increasing, with many issuers opting for post-issuance certification
    3. Corporates issue green bonds for a period of 3-5 years. Banks opt for a longer tenure, i.e., 5-10 years
    4. The US dollar and Indian Rupee are two preferred currencies. The National Thermal Power Corporation and the International Finance Corporation started the overseas 'Masala Bond' market.

5.16 Task Force on National Mission on Sustaining Himalayan Ecosystem

- A team of Indian Council for Agricultural Research (ICAR) scientists has been awarded for Excellence in Dissemination of agricultural practices and technologies from a National Agriculture Magazine.
- Their work has been recognised for improving livelihood and subsistence production systems in remote areas like Leh.
- The group was supported by Task Force on Himalayan Agriculture under National Mission on Sustaining Himalayan Ecosystem (NMSHE).
- The Task Force, as part of Climate Change program of Department of Science and Technology (DST), worked on the six components.
- [Six components - Database development, monitoring, vulnerability assessment, adaptive research, pilot studies, and organized capacity building/ training programmes.]

National Mission on Sustaining Himalayan Ecosystem

- National Mission on Sustaining Himalayan Ecosystem (NMSHE) is one of the eight missions under the National Action Plan on Climate Change (NAPCC).
- Launched in 2010, NMSHE delivers better understanding of the coupling between the Himalayan ecosystem and the climate factors.
- It aims to develop in a time bound manner a sustainable National capacity to assess the health status of the Himalayan Ecosystem.
- It enables the policy bodies in their policy-formulation functions and assists States in the Indian Himalayan Region with their implementation of actions selected for sustainable development.
- NMSHE adopts different approaches for building various capacities for sustainable development.
- The mission covers 11 states (Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, Assam and West Bengal) and UTs of Jammu and Kashmir and Ladakh.

5.17 First-ever GM Rubber

- Kerala-based Rubber Research Institute of India (RRII), under the Rubber Board, had developed the world's first genetically modified (GM) rubber plant tailored for the climatic conditions in the Northeast.
- This is the first time any GM crop has been developed exclusively for this region after years of research in RRII's biotechnology laboratory.
- The GM rubber has additional copies of the gene MnSOD, or manganese-containing superoxide dismutase, inserted in the plant.
- MnSOD may tide over the severe cold conditions during winter - a major factor affecting the growth of young rubber plants in the region.
- Natural rubber is a native of warm humid Amazon forests and is not naturally suited for the colder conditions in the Northeast.
- Growth of young rubber plants remains suspended during the winter months, which are also characterised by progressive drying of the soil.
- This is the reason for the long immaturity period of this crop in the region. With the MnSOD gene in the GM crop, the plants will be protected from adverse effects of severe environmental stresses.

5.18 LiDAR Survey

- Environment Minister released the Detailed Project Reports (DPRs) of LiDAR based survey of forest areas in ten states.
- [Ten states - Assam, Bihar, Chhatisgarh, Goa, Jharkhand, Madhya Pradesh, Maharashtra, Manipur, Nagaland, and Tripura.]

- The project, which was awarded to WAPCOS in 2020 for implementation in 26 states, is a first of its kind experiment using LiDAR technology.
- WAPCOS has prepared these DPR's using LiDAR technology in which the 3-D (three dimensional) DEM (Digital Elevation Model), imagery and layers of the project areas are used.
- This LiDAR Survey will,
    - Help augment water and fodder in jungles areas thereby reducing human-animal conflict,
    - Help in groundwater recharge,
    - Recommend different types of Soil & Water conservation structures such as Anicut, Gabion, etc.,
- State forest departments must use CAMPA funds towards implementation of these projects in accordance with the 'Ridge to Valley' approach of watershed management.
- WAPCOS with the participation of State Forest Departments identified one major ridge inside a forest block in these states with average area of 10,000 ha selected in each State for preparation of DPRs.
- States/UTs identified one major ridge inside a forest block with the criteria that
    1. Area selected should have average rainfall of the state, and
    2. Area requires assisted natural generation which means the density of forests should be less than 0.4 or below, but should have reasonable potential to regenerate with the ANR interventions.

LiDAR

- Light Detection and Ranging (LiDAR) is a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth.
- A LiDAR instrument has a laser, scanner and a specialized GPS receiver.
- It determines the ranges by targeting an object with a laser and measuring the time for the reflected light to return to the receiver.
- Airplanes and helicopters are the most commonly used platforms for acquiring LiDAR data over broad areas.
- **Types** - Two types of lidar are topographic and bathymetric.
    1. Topographic lidar uses a near-infrared laser to map the land,
    2. Bathymetric lidar uses water-penetrating green light to also measure seafloor and riverbed elevations.
- **Uses** - It is used for agriculture, hydrology and water management systems and geology-related applications.
- It is also used in archaeology.

5.19 Forest Rights & Forest Conservation

Recently, at the UN High-Level Dialogue on Desertification, Land Degradation and Drought, Indian PM reiterated India's target of land degradation neutrality by 2030, citing the Banni grassland in Gujarat.

- One of Asia's largest tropical grasslands, Banni is home to great biological diversity.
- It is the lifeline of its pastoralist communities.
- However, climate change and the invasion by Prosopis juliflora have severely impacted its unique ecology.
- It was found that unless action was taken, Banni grassland was headed for severe fodder scarcity.
- The region's highly degraded lands were being restored.
- The livelihoods of pastoralists were supported using a "novel approach."
- The Banni's pastoralist communities (Maldharis) uproot Prosopis in the pre-monsoon period.
- When it rains, the native grass species regenerate from their rootstock.
- This is precisely what the pastoralist communities have been doing for the past few years.
- Their endeavour needs to be supported.

5.20 Flex Fuel Vehicles

- The Government may issue guidelines for Flex Fuel Vehicles (FFV) soon.

- FFV or "dual-fuel vehicle" is a modified version of vehicles that which comprises of the internal combustion engine which could run both on gasoline and blended petrol with either ethanol or methanol fuel.
- [Ethanol blends - E12 fuel is a blend of 12% ethanol in gasoline, while E 15 fuel is a blend of 15% ethanol in gasoline.]
- Both of the fuels are stored in same common tank. The fuel injection and spark timing are automatically adjusted in accordance with the actual blend detected by the fuel composition sensor.
- **FFV is different from the bi-fuel vehicles** - In the bi-fuel vehicle, two fuels are stored in the separate tanks and engine runs on one fuel at a time.

5.21 Project BOLD

- The project "Bamboo Oasis on Lands in Drought" (BOLD) is an initiative of the Khadi and Village Industries Commission (KVIC) that seeks to create bamboo-based green patches in arid and semi-arid land zones.
- It has been launched as part of KVIC's "Khadi Bamboo Festival" to celebrate 75 years of independence "Azadi ka Amrit Mahotsav".
- It is the first of its kind exercise in India which was launched from the tribal village NichlaMandwa in Udaipur, Rajasthan.
- The saplings of special bamboo species – Bambusa Tulda and Bambusa Polymorpha specially brought from Assam – have been planted over 16 acres of vacant arid Gram Panchayat land.
- KVIC is set to replicate the Project at Village Dholera in Ahmedabad district in Gujarat and Leh-Ladakh region by August 2021.
- **Significance** - It is a scientific exercise that will reduce desertification and provide livelihood and multi-disciplinary rural industry support. It will be havens of sustainable development and food security.
- **Reasons for selecting Bamboos** - Bamboos grow very fast and in about three years' time, they could be harvested.
- They conserve water and reduce evaporation of water from the land surface - An important feature in arid and drought-prone regions.

6. PROTECTED AREAS

6.1 Biodiversity Heritage Site

- Maharashtra government declared an area at Amboli in Western ghats in Sindhudurg district as a Biodiversity Heritage Site (BHS).
- BHS are areas that are unique, ecologically fragile ecosystems - terrestrial, coastal, and inland and marine waters - having rich biodiversity.
- The biodiversity comprises of any one or more of the components like,
  a) Species richness - Wild and domesticated species or intra-specific categories,
  b) High endemism,
  c) Presence of rare, endemic and threatened species, keystone species, species of evolutionary significance,
  d) Presence of wild ancestors of domestic/cultivated species or land races or their varieties,
  e) Past pre-eminence of biological components represented by fossil beds and having cultural or aesthetic values.

Schistura hiranyakeshi

- It is a new small freshwater fish species discovered near Amboli in Sawantwadi tehsil of Sindhudurg district.
- It is a rare sub-species of Schistura, a freshwater loach.
- Named after the Hiranyakeshi River near Amboli village, this fish is a colourful fish that lives in water and streams in an abundance of oxygen.
- It was important to conserve this species as it might face extinction due to fishing activities.

f) Area with significant cultural, ethical or aesthetic values; important for the maintenance of cultural diversity

- As per the Section 37 of the Biological Diversity Act, 2002,
  a) State Governments can notify in the official gazette, in consultation with 'local bodies', areas of biodiversity importance as BHS.
  b) State Government in consultation with the Central Government may frame rules for the management and conservation of BHS.
  c) State Governments can frame schemes for compensating or rehabilitating anyone economically affected by such notification.
- State Biodiversity Boards (SBB) may invite suggestions for declaration of BHSs, through the Biodiversity Management Committees (BMCs) and other relevant community institutions.

6.2 Indian Sunderbans

- Zoological Survey of India's (ZSI's) publication 'Birds of the Sundarban Biosphere Reserve' states that the Indian Sunderbans is home to 428 species of birds.
- Indian Sunderbans is part of the world's largest mangrove forest.
- It comprises of the Sunderban Tiger Reserve - home to Royal Bengal Tigers is a World Heritage Site and Ramsar Site.
- Birds, like Masked Finfoot and Buffy fish owl, are recorded only here.
- The area is home to nine out of 12 species of kingfishers of the country as well rare species such as the Goliath heron and Spoon-billed Sandpiper.
- The mudflats and wetlands of Sunderbans act as a stopover site for migratory flight south (south wards) and back.
- [The mudflats exposed in the low tides, rich in microorganism, deposited during tidal activity are ideal feeding for migratory birds.]

6.3 Virunga National Park

- Six rangers have been killed in the Virunga National Park in the Democratic Republic of the Congo (DRC).
- Virunga National Park stretches from the Virunga mountains in the south, to the Rwenzori mountains in the north.
- It borders Volcanoes National Park in Rwanda and Rwenzori Mountains National Park and Queen Elizabeth National Park in Uganda.
- Established in 1925, it is Africa's first national park, which is famous for its **mountain gorillas**.
- It is a United Nations Educational, Scientific and Cultural Organization. (UNESCO)-designated World Heritage Site since 1979.

6.4 Manas National Park

- It is located at the foot hills of the Bhutan-Himalayas, Assam and is one of the first tiger reserves under Project tiger in 1973.
- It extends from Sankosh River in the west to Dhansiri River in the east.
- 1985 - Manas Wildlife Sanctuary became UNESCO World Heritage Site.
- 1989 - Manas acquired the status of a Biosphere reserve.
- River Manas flows into the National Park from the gorges of Bhutan and split into two major streams of which the main course comes out of the Park about 30 km downstream is known as '**Beki**'.
- Manas is the only landscape in the world where Terai Grasslands merge with the Bhabar grasslands interspersed with habitats ascending to Semi-Evergreen forests and then to Bhutan Himalayas.

- The last population of the Pygmy Hog survive in the wilds of Manas and nowhere else in the world.

6.5 Great Himalayan National Park

- Established in 1984, it was formally declared as a National Park in 1999.
- It is located in the Kullu region of Himachal Pradesh at an altitude between 1500 and 6000 m.
- The flora and fauna species here are protected under the Wildlife Protection Act of 1972; hence any sort of hunting is not permitted.
- In 2010, both the Sainj and Tirthan Wildlife Sanctuaries were added to GHNP.
- In 2014, GHNP was added to the United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Sites under the criteria of 'outstanding significance for biodiversity conservation'.

6.6 Raimona National Park

- Recently, the Assam government created the Raimona National Park in western Assam.
- Raimona National Park will be administered by the Kachugaon Forest Division of Bodoland Territorial Council.
- Raimona is bounded on the west by the Sonkosh river, on the east by the Saralbhanga river and on the south by the Pekua river.
- It adjoins the Buxa Tiger Reserve in West Bengal to its west, Phipsoo Wildlife Sanctuary in Bhutan to its north and the first addition to Manas National Park to the east.
- Raimona, which has 11 different forest types and subtypes, is home to the golden langur, elephant, tiger, clouded leopard and Indian gaur.
- Conservation of this area shall provide water security to the people downstream in Kokrajhar and Dhubri district.

6.7 Dihing Patkai National Park

- Recently, the Assam government notified Dihing Patkai as the seventh National Park of the state.
- [The six other National Parks in Assam are Kaziranga, Manas, Nameri, Orang, Dibru-Saikhowa and Raimona.
- Assam now has the third most National Parks after the 12 in Madhya Pradesh and nine in the Andaman and Nicobar Islands.]
- Dihing Patkai national park will be administered by Soraipung Range of Digboi Forest Division and Jeypore Range of Dibrugarh Forest Division.
- Dehing is the name of the river that flows through this forest and Patkai is the hill at the foot of which the sanctuary lies.
- The Dihing Patkai straddling eastern Assam's Dibrugarh and Tinsukia districts is a major elephant habitat.
- It encompasses the erstwhile Dehing Patkai Wildlife Sanctuary, Jeypore Reserve Forest and the western block of Upper Dihing Reserve Forest.
- The forest village area diverted under Forest Conservation Act has been excluded.
- Stretches of Dirak and Buri Dihing rivers have been included in the park.

Dehing Patkai Wildlife Sanctuary

- Dehing Patkai Wildlife Sanctuary is known as the Jeypore Rainforest.
- It is the only sanctuary in India which is home to seven different species of wild cats - tiger, leopard, clouded leopard, leopard cat, golden cat, jungle cat and marbled cat.
- It is home to Chinese pangolin, flying fox, barking deer, serow, Malayan giant squirrels, Assamese macaque and White Winged Wood Duck.

6.8 Mahendragiri Biosphere Reserve

- Odisha government has proposed a second biosphere reserve in the southern part of the state at Mahendragiri.
- [Similipal Biosphere Reserve is Odisha's first such reserve, which was notified in 1996.]
- The area of the proposed Mahendragiri Biosphere Reserve is spread over Gajapati and Ganjam districts in the Eastern Ghats.
- Mahendragiri hill ecosystem acts as a transitional zone between the flora and fauna of southern India and the Himalayas, making the region an ecological estuary of genetic diversities.
- Mahendragiri is inhabited by the Soura people, a particularly vulnerable tribal group as well as the Kandha tribe.

6.9 Navegaon-Nagzira Tiger Reserve

- A manmade forest fire was started at Navegaon-Nagzira Tiger Reserve (NNTR), which is situated in Gondia and Bhandara districts of Maharashtra.
- [Gondia District shares common boundaries with the state of Madhya Pradesh and Chhattisgarh in the north and eastern side respectively.]
- Almost all forest fires in central India are manmade, caused by those collecting mahua flowers and tendu leaves.
- Notified as the 46th tiger reserve of India in 2013, NNTR comprised of the notified area of Navegaon National Park, Navegaon Wildlife Sanctuary, New Nagzira Wildlife Sanctuary and Koka Wildlife Sanctuary.
- Strategically, the Tiger Reserve is located in the heart of central Indian Tiger landscape which contributes almost one sixth of the total tiger population of the country.
- NNTR has connectivity with the major tiger reserves in Central India,
    1. Kanha and Pench tiger reserve (Madhya Pradesh),
    2. Tadoba-Andhari Tiger reserve (Maharashtra),
    3. Indravati Tiger Reserve (Chhattisgarh),
- It is indirectly connected to the Kawal and Nagarjuna Sagar in Telangana and Andhra Pradesh and, Achanakmar Tiger reserve in Chhattisgarh. It is also connected to important tiger bearing areas like Umred-Karhandla sanctuary and Brahampuri Division (Maharashtra).

6.10 Srivilliputhur-Megamalai Tiger Reserve

- In February 2021, the Srivilliputhur-Megamalai Tiger Reserve (SMTR) was jointly declared by the Centre and Tamil Nadu governments by clubbing together the Megamalai WLS and the Srivilliputhur WLS.
- The declaration of SMTR could reduce the problems faced by the River Vaigai, as the formation of a tiger reserve has many advantages.
- The staffs who work here are given pay benefits to motivate them to carry out their work with zeal. They are provided with special training and equipped with latest gadgets and weapons to tackle illegal activities.
- Whatever funds are provided by the National Tiger Conservation Authority, are directly allotted to the concerned tiger reserve.
- Due provisions are made for giving compensation for damage caused by wildlife to agricultural and horticultural crops as well as injuries caused and deaths of humans and livestock.
- By protecting wild animals, the natural forests, their habitats which act as watersheds, are given protection. If forests are revived through proper protection, we can be ensured of perennial water supply.

Vaigai River

- The Vaigai is a 'heritage river' as it has seen the rise and fall of human civilisation for centuries. The river is mentioned in Sangam literature.

- The 258-kilometres long river originates in the Western Ghats. It travels through the Pandya Nadu region of Tamil Nadu and finally empties into the Palk Strait near the Pamban Bridge in Ramanathapuram district.
- Its main tributaries are Suruliyaru, Mullaiyaru, Varaganadhi, Manjalaru, Kottagudi, Kridhumaal and Upparu.
- The river fulfils the drinking water requirement of five districts of Tamil Nadu - Theni, Madurai, Ramnathapuram, Sivagangai and Dindigul.
- **Deterioration** - Vaigai started to deteriorate at the end of the 18th century when the British started deforesting the Megamalai region (major catchment for Vaigai) for commercial plantations.
- Consequently, the water flow in the river reduced gradually. Following the Great Famine of 1876-77, Major John Pennycuik built a dam at the confluence of Mullaiyar and Periyar rivers that was completed in 1895.
- After completion of the dam, the water from the Periyar was successfully brought to the Vaigai, which revived again.
- The Vaigai presently gets about 80% of its water from the Periyar dam. The balance 20% is obtained from the major watershed of the Megamalai region during the northeast monsoon season.
- Due to indiscriminate removal of sand from the river, water flowing into the Vaigai gets drained within a few days.

6.11 Ramgarh Vishdhari Tiger Reserve

- National Tiger Conservation Authority (NTCA)'s technical committee has given a nod for the Ramgarh Vishdhari wildlife sanctuary to become Rajasthan's fourth tiger reserve.
- The area that has been identified as the reserve area comprises of two forest blocks of Bhilwara, territorial forest block of Bundi and Indargarh, which falls under buffer zone of Ranthambore Tiger Reserve (RTR).
- Prior to the formation of the state of Rajasthan, these forests were a part of the erstwhile Bundi princely states and were hunting reserves.
- In 1982, a part of the forest was declared as Ramgarh Vishdhari Wildlife Sanctuary under the Rajasthan Wild Animals and Birds Protection Act, 1951. The core area of the Ramgarh Vishdhari has eight villages.
- The sanctuary has leopards, sambhars, chitals, wildboars, smaller cats, caracals, chinkaras and nilgai.
- Other Tiger Reserves in Rajasthan,
    - Ranthambore Tiger Reserve (RTR) in Sawai Madhopur,
    - Sariska Tiger Reserve (STR) in Alwar, and
    - Mukundra Hills Tiger Reserve (MHTR) in Kota.

6.12 No Great Indian Bustards in Kutch Bustard Sanctuary

- The Central government informed that there was no Great Indian Bustards (GIB) in Kutch Bustard Sanctuary (KBS) in Gujarat.
- KBS near Naliya in Kutch district's Abdasa block is a tiny sanctuary notified in 1992 and spread over just 2 sqkm. But its eco-sensitive zone spread over 220 sqkm covers most of present-day core GIB habitat.
- Besides the KBS, Prajau, Bhanada and Kunathia-Bhachunda are important grasslands that are declared unclassified forests.
- Due to the barrier created by the power infrastructure on all its sides, sightings of GIB inside the KBS' notified area is becoming rare.
- **SC's intervention** - In April 2021, the Supreme Court ordered that all overhead power transmission lines in core and potential GIB habitats in Rajasthan and Gujarat should be undergrounded.
- The SC also formed a three-member committee to help power companies comply with the order.

Great Indian Bustards

- They are the largest among the four bustard species in India. Other three being MacQueen's bustard, lesser florican and the Bengal florican.

- GIBs' historic range included much of the Indian sub-continent but it has now shrunken to just 10% of it.
- Among the heaviest birds with flight, GIBs are the flagship bird species of grassland and hence barometers of the health of grassland ecosystems.
- Being **terrestrial birds**, they spend most of their time on the ground with occasional flights to go from one part of their habitat to the other.
- **Threats** - Overhead power transmission lines is the biggest threat. Others are agriculture; energy production & mining; transportation; human intrusions, and invasive and other problematic species.
- Change in landscape by way of farmers cultivating their land, which otherwise used to remain fallow due to frequent droughts in Kutch.
- Cultivation of cotton and wheat instead of pulses and fodder.
- **Conservation measures** - In 2015, the Central government launched the GIB species recovery programme.
- Under this, the Wildlife Institute of India (WII) and Rajasthan forest department have jointly set up conservation breeding centres.
- In these centres, GIB eggs harvested from the wild are incubated artificially and hatchlings raised in controlled environment.

6.13 Lemru Elephant Reserve

- The Chhattisgarh Government has proposed to decrease the area of the proposed Lemru Elephant Reserve, in Korba district, to 450 sq km.
- The proposal for the Lemru Reserve was passed by the Assembly in 2005 and got central approval in 2007.
- This reserve is a **natural elephant habitat**. The reserve will be a part of an elephant corridor that connects Lemru (Korba), Badalkhol (Jashpur), Tamorpingla (Surguja).
- Lemru is one of two elephant reserves planned to prevent human-animal conflict in the region, with elephants moving into Chhattisgarh from Odisha and Jharkhand.
- [**Badalkhol Tamorpingla** is another elephant reserve that was notified in 2011.]
- The area proposed under the reserve is part of the Hasdeo Aranya forests, a very diverse biozone that is also rich in coal deposits.
- The reserve is in a coal-bearing area with an estimated value of Rs 100,000 crore.

6.14 Shivalik Elephant Reserve

- Uttarakhand government issued a stay on its earlier order to denotify the Shivalik Elephant Reserve.
- Shivalik Elephant Reserve is the premier and only elephant reserve of Uttarakhand.
- Covering both Kumaon and Garhwal regions,Shivalik ER has around a dozen elephant corridors.
- Shivalik Elephant Reserve was first identified by the central government in 1991-92 under 'Project Elephant'.
- Its objective was to arrest man-animal conflict in the region and rehabilitate elephants that were held captive.
- In 2002, Shivalik was notified through a government order by the Uttarakhand government.
- In 2003, Uttarakhand was included in the 10 MIKE (Monitoring of Illegal Killing of Elephants) sites of India.

6.15 Bankapur Wolf Sanctuary

- Karnataka State Wildlife Board approved the formation of the first-ever 'Wolf Sanctuary' in the drylands of Bankapur of Koppal district.
- The region around Bankapur is interspersed with rocky hillocks and thorny vegetation.
- Besides Indian Grey wolves, the area can also help in the conservation of striped hyena, golden jackal, Indian fox and other fauna.
- **Indian Grey Wolf** is a subspecies of grey wolf that inhabits semi-arid and arid areas.

- It inhabits the dry grassland regions of Deccan Plateau in pockets and prey on blackbucks and other herbivores.
- It lacks the luxuriant winter coat as it lives in warmer conditions.
- It has a wide distribution range that extends from Southwest Asia to the Indian Subcontinent.
- International Union for Conservation of Nature Status - Least Concern
- Wildlife (Protection) Act of 1972 - Schedule I Part I.

6.16 Shoolpaneshwar Wild Life Sanctuary

- It was created in 1982 as 'Dumkhal Sanctuary' - home for sloth bears.
- It is found at the congregation of Vindhyan-Satpura hill ranges.
- The sanctuary derives its name "Shoolpaneshwar" from a temple of Lord Shiva, which once existed in this region on the banks of river Narmada.
- The area is predominantly tribal with 'Vasavas' as the main tribe.

6.17 Pobitora Wildlife Sanctuary

- Two One-Horned rhinos from Pobitora Wildlife Sanctuary were released in the central part of Bansbari range of Manas National Park (MNP).
- This is 8th round of rhino translocation under the Indian Rhino Vision 2020.
- Pobitora Wildlife Sanctuary is situated in the flood plains of River Brahmaputra in the Morigaon district of Assam.
- It has the highest concentration of endangered one-horned rhinos (Rhinoceros unicornis) in the world.
- It is called 'Mini Kaziranga' due to similar landscape and vegetation.
- **Boundary** - Garanga Beel on the south and River Brahmaputra on the North, rest of the boundary are artificial and surrounded by 27 villages.
- **Fauna** - One-horned rhinoceros, Chinese pangolins, Leopard cat, Fishing cat, Jungle cat, etc.

6.18 Elephant Corridor Case

- The Supreme Court appointed a conservationist as a Member of Technical Committee of the National Elephant Action Plan.
- This three-member Committee was constituted for looking into the Elephant Corridor Case.
- It hears complaints by land owners against the action taken by the Nilgris Collector, which included allegations about arbitrary variance in acreage of the elephant corridor.
- The Supreme Court upheld Tamil Nadu government's authority to notify an 'elephant corridor' and protect the migratory path of the animals through the Nilgiri biosphere reserve.
- The corridor is situated in the Sigur plateau and sustains elephant (Keystone species) populations and their genetic diversity.
- The elephants cross the plateau in search of food and water.
- Sigur plateau connects the Western and the Eastern Ghats.
- It has the Nilgiri Hills on its south western side and the Moyar River Valley on its north-eastern side.
- Keystone species is a plant or animal that plays a unique role in the way an ecosystem functions.
- Without them, the ecosystem would be dramatically different or cease to exist altogether.
- Its disappearance could affect other species that rely on it for survival.

6.19 Jammu and Kashmir Lakes

- Srinagar's Dal Lake along with five other ones in Jammu and Kashmir are to be declared protected wetlands.
- Other lakes - Wular Lake, Nigeen Lake in the Kashmir region; Sanasar Lake, Manasbal Lake and Purmandal lake or Chotta Kashi (in Samba district) in the Jammu region.
- The decision was taken in the meeting of the Jammu and Kashmir Wetland Authority, chaired by Chief Secretary.
- Chief Secretary asked the Forest Department to profile various wetlands of Jammu and Kashmir and recommend their notification under, Environment Protection Act, 1986 and Wetland (Conversation & Management) Rules.
- [Forest Department is the nodal department for the preparation of digital inventory, documentation and development of a geo-spatial database on wetlands.]

6.20 Deepor Beel

- Kamrup district administration has prohibited community fishing at Deepor Beel - Assam's only Ramsar site.
- Deepor Beel is a permanent freshwater lake located to the south-west of Guwahati city.
- Lying in a former channel of the Brahmaputra river, it lies to the south of the main river channel.
- It was designated as a Ramsar site in 2002 for sustaining a range of aquatic life forms besides 219 species of birds.

6.21 Illegal Farming in Wenlock Downs

- Over 100 hectares of the total expanse of 1,500 hectares of the last remaining grasslands in the Wenlock Downs of the upper Nilgiris is being slowly eroded by encroachments of the Todas and Kotas.
- This is because many of the Todas and Kotas have leased the "forest lands" to non-tribals in exchange for a small fee.
- A majority of these encroached lands were formerly lands to which the Todas had grazing rights to, or Toda patta lands, where the Todas were allowed to cultivate with the permission of district administration.
- However, since the early 2000s, the adivasis have stopped applying for permissions and are cultivating without proper approvals.

Wenlock Downs

- Wenlock Downs Reserve Forest is a crucial wildlife corridor, as it allows wildlife from Sigur plateau to make their way up to the upper Nilgiris.
- The landscape is also one of the last remaining patches of Shola and grasslands in the entire Nilgiris other than Mukurthi National Park.

- The problem is that the adivasis encroach on a portion of grassland one year, and the next they lease it to outsiders and move to another portion.
- There is also the question of the Forest Rights Act in this area, as to whether it would supersede the rights acknowledged under the Toda patta lands, or whether it offers additional protection.

6.22 Chilika Lake

- A study by the marine archaeology department of the National Institute of Oceanography (NIO) has found that the Chilika lake in Odisha was once part of the Bay of Bengal.
- **Formation** - The process of the formation of the Chilika, Asia's largest brackish water lake, might have begun in the later part of the Pleistocene epoch (20,000 years ago.)
- The sea is connected with the Chilika Lake near Satapada through a shallow and narrow connecting channel, which was obstructed by shoals, sand spits and sandbars.
- The lake became shallower due to the deposition of sediments brought by the Mahanadi as outflow from the lake was restricted.

- **History** - The Chilika once acted as a safe harbour for cargo ships bound for Southeast Asia and other parts of the world.
- Greek geographer Claudius Ptolemy (150 CE) described Palur or Paloura as an important port of Kalinga that is situated close to the 'point of departure' outside the southern tip of the Chilika lake at Kantiagarh.
- Stone anchors and hero stones from Manikapatna, Palur and the adjoining onshore regions of the Chilika suggest that the Chilika lake was in fact a part of the Bay of Bengal.
- Chinese pilgrim Xuanzang (7th century CE) recorded 'Che-li-ta-lo-Ching' as a flourishing port located at Chhatargarh on the banks of the Chilika.
- Brahmanda Purana says the Chilika was an important centre of trade and commerce, with ships sailing to Java, Malaya and Ceylon.
- Sanskrit poet Kalidas called the king of Kalinga 'Madhodhipati' or 'Lord of the Ocean'.

6.23 Hospet-Vasco Da Gama Project

- This was cleared by the Standing Committee of the National Board for Wildlife (NBWL), despite warnings by a committee appointed by the Ministry of Environment, Forest and Climate Change (MoEF&CC).
- This project aims to double a railway track of the the Hospet-Hubballi-Londa-Vasco Da Gama railway line by the Rail Vikas Nigam Ltd (RVNL) in Karnataka and Goa passing through the Western Ghats.
- [The Western Ghats is one of the world's eight 'hottest hotspots' of biological diversity.]
- The project is divided into two phases,
    1. Phase I covering the Hospet-Tinaighat stretch that is being funded by the Asian Development Bank (ADB) and
    2. Phase II covering the Tinaighat-Vasco stretch. It diverts forest land in the Dandeli Wildlife Sanctuary (Karnataka) and the Bhagwan Mahaveer Wildlife Sanctuary and Mollem National Park (in Goa).

Dandeli Wildlife Sanctuary

- The Dandeli Wildlife Sanctuary s located in Uttara Kannada, Karnataka and is located on the banks of River Kali. It is part of the Kali Tiger Reserve, which was earlier called the Dandeli Anshi Tiger Reserve.
- [The Kali Tiger Reserve has two protected areas - Dandeli Wildlife Sanctuary and Anshi National Park]
- **Species found** - Crocodiles, barking deer, bison, Indian Mongolian, black panther, sambhar, tiger, leopard, elephant, flying squirrel and the Malabar giant squirrel, king cobra, or giant iguana.

Bhagwan Mahaveer Wildlife Sanctuary and Mollem National Park

- It is a protected area located in the Western Ghats in Goa, along the eastern border with Karnataka. It is situated near the town of Molem.
- It was first known as Mollem Game Sanctuary. It was declared a wildlife sanctuary in 1969 and renamed as Bhagwan Mahaveer Sanctuary.
- National Highway 4A divides it into two parts and the Mormugao - Londa railway line passes through the area.
- It contains several important temples dating to the Kadambas of Goa, and home to waterfalls, such as Dudhsagar Falls and Tambdi Falls.
- It is home to a community of nomadic buffalo herders called Dhangar.

6.24 India's 14 Tiger Reserves Recognized by Global CA/TS

- The 14 Tiger Reserves in India received the accreditation of the Global Conservation Assured | Tiger Standards (CA|TS).
- **14 tiger reserves** - Manas, Kaziranga, Orang (Assam), Satpura, Kanha, Panna (MP), Pench (Maharashtra), Valmiki (Bihar), Dudhwa (UP), Sunderbans (West Bengal), Parambikulam (Kerala), Bandipur (Karnataka) and Mudumalai and Anamalai (Tamil Nadu).

- CA|TS has been agreed upon as accreditation tool by the global coalition of Tiger Range Countries (TRCs). Officially launched in 2013, it has been developed by tiger and protected area experts.
- It is a set of criteria which allows tiger sites to check if their management will lead to successful tiger conservation. It sets minimum standards for effective management of target species and encourages assessment of these standards in relevant conservation areas.

7. -ANIMAL CONFLICTS

7.1 Project RE-HAB

- As a part of Project RE-HAB (Reducing Elephant-Human Attacks using Bees), bee boxes were installed by the Khadi and Village Industries Commission (KVIC) across the elephant paths in southern Karnataka.
- These spots located on the periphery of Nagarahole National Park and Tiger Reserve, known conflict zones.
- Project RE-HAB is a sub-mission of KVIC's National Honey Mission.
- It intends to create "**bee fences**" by installing bee boxes along the periphery of the forest and the villages to block the entrance of elephants to human habitations.
- The bee boxes are connected with a string so that when elephants attempt to pass through, a tug causes the bees to swarm the elephant herds and dissuade them without causing any harm to them.
- Bee boxes have been placed on the ground as well as hung from the trees.

Nagarahole National Park

- Nagarhole National Park or Rajiv Gandhi National Park is located in Kodagu and Mysore district in Karnataka.
- It is an integral part of the Nilgiri biosphere, which holds world's single largest tiger population.
- It was established as a wildlife sanctuary in 1955 and became a national park in 1988. It was declared as a Tiger Reserve under Project Tiger in 1999.
- Nagarahole River flows through the park, which joins the Kabini River. Kabini reservoir separates the Nagarahole and Bandipur National Park.

7.2 Advisory on Human-Wildlife Conflict

- The Standing Committee of National Board of Wildlife (NBWL) has approved the advisory for management of Human-Wildlife Conflict (HWC) in the country.
- The advisory makes prescriptions for the States/Union Territories for dealing with HWC situations.
- It seeks expedited inter-departmental coordinated and effective actions.
- It envisages empowering gram panchayats in dealing with the problematic wild animals as per the WildLife (Protection) Act, 1972.
- It suggested that utilizing add-on coverage under the Pradhan Mantri Fasal Bima Yojna for crop compensation against crop damage due to HWC would, in turn, reduce HWC.

7.3 Elephant Casualties on Train Tracks

- According to the Project Elephant Division of the Environment Ministry, a total of 186 elephants were killed after being hit by trains across India between 2009-10 and 2020-21.
- Assam (62) accounted for the highest number of elephant casualties, followed by West Bengal (57), and Odisha (27).
- Trains claimed the highest number of pachyderms in **2012-13**, when 27 elephants were killed in 10 States.
- **Measures taken** - A Permanent Coordination Committee was constituted between the Railways Ministry (Railway Board) and the Environment Ministry for preventing elephant deaths in train accidents.
- The Ministry cleared vegetation along railway tracks to enable clear view for loco pilots, signage boards at suitable points to alert loco pilots about elephant presence on the track.

- Moderating slopes of elevated sections of railway tracks, setting up underpass/overpass for safe passage of elephants, regulation of train speed from sunset to sunrise in vulnerable stretches.
- Regular patrolling of vulnerable stretches of railway tracks by frontline staff of the Forest Department and wildlife watchers.
- Environment Ministry released funds to protect elephants for the elephant range States under Centrally Sponsored Schemes of Project Elephant.

8. BIO-DIVERSITY

8.1 Re-wilding of Wild Animals

- Periyar Tiger Reserve (PTR) attempted to reintroduce into the wild an abandoned tiger cub after rearing it in 'captivity' for two years.
- **Re-wilding** is systematic, scientifically planned re-introduction of viable populations of lost animals to natural environments.
- It is a form of environmental conservation and ecological restoration that has significant potential to increase biodiversity, create self-sustainable environments and mitigate climate change.
- **SOP** - National Tiger Conservation Authority (NTCA) laid down the Standard Operating Procedures (SOPs)/Guidelines under Section 38(O) of The Wildlife Protection Act, 1972.
- As per these SOPs, there are three ways to deal with orphaned or abandoned tiger cubs.
    1. First way is to make an effort to reunite the abandoned cubs with their mother.
    2. If a reunion of the cub with its mother is not possible, then shift the cub to a suitable zoo.
    3. Reintroduction of the cub into the wild after a certain time when it appears that the cub is capable of surviving in the wild independently. This is what is known as 're-wilding'.
- NTCA stresses that the tiger cub should be reared in an in situ enclosure for a minimum of two years, and during this time, each cub should have a successful record of at least 50 'kills'.
- Tiger cubs should be in prime health, and of dispersing age (three/four years). There should be no abnormality/incapacitation.
- **Challenges** - Failures of re-wilding led to deaths of many tigers due to illness, injuries and territorial fight. as well as serious livestock depredations, and even man-eating problems.
- Besides, the re-wilding process is very costly.
- **Choosing the location** - There is a need to protect more habitats strictly, so that the prey densities rise and more tigers can thrive.
- Reintroduction of captive animals in protected areas, which already have the presence of the same species, results is territorial fights. If these animals are released in a protected area, which requires a particular species, then there are chances of survival.

8.2 WWF Report on Sturgeon

- According to a World Wildlife Fund (WWF) report, illegal sale of sturgeon is rampant in the lower Danube region (mainly in Bulgaria, Romania, Serbia and Ukraine) - first survey to quantify illegal trade.
- [Danube is Europe's second-longest river after the Volga, flowing through much of Central and Southeastern Europe, from the Black Forest into the Black Sea.]
- Sturgeon is poached for its meat and caviar - Caviar is a food consisting of salt-cured egg of a fish. It is considered a delicacy.
- The researchers did an isotope analysis for each sample and found that almost 20% were wild-caught sturgeon and did not come from farms.
- The report recommended controlling domestic trade; increasing border controls; improved inter-agency cooperation and coordination; controlling the CITES caviar labelling requirements.

Sturgeons

- The nearly 7-foot-long Detroit River fish is one of the largest ever caught in the U.S., which could be more than 100 years old.
- This large fish is a lake sturgeon (Acipenser fulvescens), but the planet's largest freshwater fish species is the beluga sturgeon (Huso huso).
- **Beluga sturgeon** is the biggest of the 27 sturgeon and paddlefish species alive today. It can reach a maximum length of more than 8 m.
- They are living between Europe and Asia in the Black, Azov and Caspian seas, and the rivers feeding them.
- Beluga sturgeons can live more than 100 years, like lake sturgeon, which gives them plenty of time to grow. So, there's a lot of time to eat.
- They are listed as **critically endangered** on the IUCN Red List of Threatened Species, the category for species most at risk of extinction.
- This species is under great pressure due to poaching. Adult females are prized for their fish eggs (caviar) and valued at more than $8,000/kg.
- **White Sturgeon** - The title for biggest growing sturgeon today may actually belong to the white sturgeon (A. transmontanus).
- People are probably more likely to see larger white sturgeon than beluga sturgeon, as white sturgeons are probably better protected.
- For now, white sturgeons are not threatened with extinction and their population is stable, according to the IUCN. However, they are threatened by the construction of dams.

8.3 Improvement of Quality of Aquatic Life in Chambal

- The aquatic animal population, including dolphins and gharial, in the Chambal River increased significantly in the past year due to a decrease in demand for fish and sand amid the pandemic-induced lockdown.
- [The Chambal River passes through Rajasthan, Uttar Pradesh and Madhya Pradesh.]
- **Threats for the dolphins** - Illegal sand mining and illegal net fishing were the threats for the dolphins. There were the major reasons behind the death of calves.
- The dolphin pools were identified in 2019. The dolphin population was falling every year between 2016 and 2020 but for the first time in six years the population has increased.
- **Reasons** - The Ghat (bank) in-charges were deployed near the pools to check illegal net fishing.
- But with the slowdown of the business of hotels and restaurants during the lockdown and other restrictions imposed due to Covid-19, illegal net fishing has almost stopped.
- Decrease of demand of both sand and fish due to lockdown also helped us in saving calves.
- **Impact** - The improvement of quality of aquatic life in the Chambal River caused an increase in the population of gharial crocodile by 17% and crocodiles by 24%.

8.4 Mice Plague

- A mouse plague that started around mid-March in Australia's eastern states is being called one of the worst plagues in decades.
- As a result of the rampaging mice, some farmers lost entire grain harvests, hotels have had to close and residents of affected areas reported mice falling out from roof tops causing "mice rain".
- The government of New South Wales (NSW) in Australia has extended a support package of $50 million to the farmers affected by the plague.
- **Causes** - Abundant grain harvest, short breeding cycle of mice (a pair of breeding mice can give birth to a new litter every 21 days or so) and mice are not very choosy about food rodents.
- Rats and mice can stay in walls, ceilings, under cupboards or bathtubs, in rubbish heaps, wood piles, thick vegetation and in holes under buildings.

- **Impacts** - Rodents are capable of destroying food grains and can cause widespread damage to domestic households, commercial businesses, farms, manufacturers and livestock.
- Rodents can chew through materials, ruin supplies by excreting on them, cause diseases such as leptospirosis and typhus fever, and also carry fleas or ticks that can harm pets and humans.
- **Control** - Increasing zinc phosphide in mouse baits will help farmers to battle the higher than average mouse numbers in eastern Australia.
- To control the plague, the NSW government has now authorised the use of an otherwise outlawed poison called bromadiolone.

8.5 Whiteflies Invasion

- The results of a study by a team from ICAR- National Bureau of Agricultural Insect Resources that set out to investigate a coconut field in Tamil Nadu in 2016 are released.
- **Patterns of occurrence** - The study found that there are about eight invasive species found in India.
- Most of these species are native to the Caribbean islands or Central America [or both]. It is difficult to pinpoint how they entered India.
- May be a nymph or baby insect may have come along with imported plants.
- Out of curiosity, people randomly pluck and bring tiny plants which lead to the accidental introduction of invasive species.
- **Invasion** - The first invasive spiralling whitefly Aleurodicus dispersus reported from Kerala in 1995 is now spread across India except Jammu & Kashmir.
- Similarly, the rugose spiralling whitefly which was reported in Pollachi, Tamil Nadu in 2016 has now spread throughout the country including the islands of Andaman Nicobar and Lakshadweep.
- **Reasons** - The host range of all of the invasive whiteflies was increasing due to their polyphagous nature (ability to feed on various kinds of food) and prolific breeding.
- Aleurodicus dispersus and Aleurodicus rugioperculatus have been reported on over 320 and 40 plant species, respectively.
- Other invasive whiteflies were found to expand their host range on plants species, especially coconut, banana, mango, sapota, guava, cashew, and ornamental plants and important medicinal plants.
- **Control** - Entomopathogenic fungi (fungi that can kill insects) specific to whiteflies are isolated, purified, grown in the lab or mass-produced.
- They are applied into the whitefly infested field in combination with the release of lab-reared potential predators and parasitoids.
- Continuous monitoring of the occurrence of invasive species, their host plants and geographical expansion is needed.

8.6 Study on Invasive Species

- A study says that the "exotic" intruders have a vast and growing cost to humanity and the environment.
- It estimated that the invasive species have cost nearly $1.3 trillion dollars to the global economy since 1970, an average of $26.8 billion per year.
- There is also sign of a steady upward trend since 1970.
- Most of the price tag is associated with the damage to ecosystems, crops or fisheries, though pest-control measures were included in the research.
- A preliminary roundup of the top ten invasive pests includes

Invasive Species in History

- Australia - Feral European rabbits (early 1800s). In 1950, the government killed the rabbits by releasing the disease myxomatosis.
- Guam - The brown tree snake has eaten nearly all of the native birds and lizards of since it was accidentally introduced in the mid-20th century from its South Pacific habitat.
- North America's Great Lakes - Zebra Mussel (1980s and 90s) originating in the waterways of the former Soviet Union.
- American and European forests - Devastated by Asian long-horned beetle
- Hawaii - Puerto Rican coqui frog with no natural predators

1. Crop-eating rats,
2. Asian gypsy moth attacking trees throughout the northern hemisphere,
3. Tiger mosquito, native to Southeast Asia, carrying diseases like chikungunya, dengue and zika.

- The UN's Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) has said invasive species are among the top five human-driven culprits of environmental destruction worldwide.
- [Other 4 culprits - Land use, resource exploitation, pollution and climate change.]
- In 2019, IPBES estimated there had been a 70% increase in invasive species since 1970, in the 21 countries studied.

8.7 Eriophyid Mite Infestation in Amaranthus

- Researchers in Kasaragod have found Eriophyid mite infestation in amaranthus, a common leafy vegetable cultivated all over the country.
- Even though Eriophyid mites were reported in Tanzania in 1992, it is the first report of the mite infestation in amaranth in India.
- The mite causes severe malformation of the amaranthus shoot, making it fibrous and reducing the yield.
- The affected plants showed crinkling deformity and malformation of tender leaves, a severe reduction in the leaf size and stunting.
- An observation trial to contain the pest immediately after a harvest reduced the mite damage symptoms almost completely for at least 15 days when the new shoots would be ready for the next harvest.

8.8 Ambergris

- Ambergris (French for grey amber) is generally referred to as whale vomit. This preternaturally hardened whale dung is produced only by 1% of sperm whales.
- **Formation** - A sperm whale eats several thousand squid beaks a day.
- Occasionally, a beak makes it way to the whale's stomach and into its looping convoluted intestines where it becomes ambergris through a complex process, and may ultimately be excreted by the whale.
- Ambergris is a solid waxy substance that floats around the surface of the water body and at times settles on the coast.
- **Floating Gold** - This excretion is so valuable it is referred to as floating gold. 1 kg of ambergris is worth Rs 1 crore in the international market.
- The reason for its high cost is its use in the perfume markets (like Dubai), especially to create fragrances like musk.
- Ancient Egyptians used it as incense. It is used in traditional medicines.
- Since the sperm whale is a protected species, hunting is not allowed. But, due to Ambergris' high value, the fish has been a target to the smugglers.

Sperm Whale

- The Sperm Whale (Physeter macrocephalus), or cachalot, is the largest of the toothed cetacean. They are often spotted in groups (called pods).
- Spermaceti oil extracted from it is used in oil lamps, lubricants and candles.
- **Protection** - The species is protected by a whaling moratorium.
- IUCN Status - 'Vulnerable'

8.9 Indus and Ganges River Dolphins

- A new study has shown that the detailed analysis of South Asian river dolphins has revealed that the Indus and Ganges River dolphins are two separate species.

- Currently, they are classified as two subspecies under Platanista gangetica.
- The study estimates that Indus and Ganges river dolphins may have diverged around 550,000 years ago.
- The Indus and Ganges River dolphins are both classified as 'Endangered' species by the International Union for Conservation of Nature (IUCN).
- **Threats** - Physical barriers such as dams and barrages across the river reduced the gene flow; declining river flow; accidental catches; accidental injury due to the use of mechanised boats; pollution.

8.10 Vaquita Porpoises

- Mexico's decision to loosen its policy of keeping a fishing free zone around a protected area in the Gulf of California region was a "setback" to keeping alive a near-extinct vaquita porpoise species.
- Vaquita porpoise, the world's rarest and the smallest marine mammal, is on the edge of extinction.
- It is also known as "the panda of the sea" for the distinctive black circles around its eyes. This porpoise was discovered in 1958.
- It is unique among the porpoises as it is the only species of that family found in warm waters, and the size of the dorsal fin is believed to be an adaptation to that, allowing for extra body heat to dissipate.
- **Habitats** - Found only in the northern Gulf of California (Sea of Cortez) in Mexico. Most commonly seen in shallow waters up to 50 metres deep.
- **Threats** - They are caught and drowned in gillnets set up by poachers to catch totoaba, an endangered species of marine fish sought by Chinese buyers on the black market for its prized swim bladders.
- This species die more each year in fishing nets than are being born.

8.11 Platypus

- To promote breeding and rehabilitation of platypus that faces extinction due to climate change, the world's first platypus refuge would be built in Australia.
- Platypus is one of the five species of monotremes, the only mammals that lay eggs instead of giving birth to young ones.
- This duck-billed mammal is the only animal in the world to have a beak, fur and webbed feet.
- It is endemic to eastern Australia, including Tasmania, where it is classified as an endangered species.
- International Union for Conservation of Nature (IUCN) Red list Status - **Near Threatened**.

8.12 Snake Eel

- A new species of snake eel has been discovered from the ports of Paradip in Odisha and Petuaghat harbour in West Bengal.
- The name proposed for the new species is 'Indian fringe-lip eel' or Cirrhimuraena indica.
- The new species belonged to the same clade as Cirrhimuraena chinensis and was separated from it morphologically and genetically.
- Cirrhimuraena chinensis is a tropical, marine eel that is known from China and Papua New Guinea, in the western Pacific Ocean.
- Cirrhimureaena genus in Indian waters is Cirrhimuraena playfairii or the fringe-lip snake eel in the Godavari estuarine system.

8.13 Blue-finned Mahseer

- On the International Union for Conservation of Nature's (IUCN) red list, the Blue-finned Mahseer (Tor Khudree) has been moved from the 'endangered' status to the 'least concern' status.
- However, the golden mahseer is still in danger of going extinct.

- The IUCN group is involved in conservation of the blue-finned and golden Mahseer for 50 years in Lonavala, Maharashtra.
- **Characteristics** - They inhabit both rivers and lakes. Most of species ascend into rapid streams with rocky bottoms for breeding.
- They are omnivorous. They eat algae, crustaceans, frogs, insects and other fish. They also eat fruits that fall from trees overhead.
- **Habitat** - This species is found in River Mota Mola east of Pune and other rivers of the Deccan Plateau.
- The species is migratory; moving upstream during rains. It prefers clean, fast flowing and well oxygenated waters.
- **Threats** - Over harvesting, habitat manipulation and competition from other fish species.

8.14 American Red-eared Slider

- The invasive red-eared slider (Trachemys scripta elegans), released in natural water bodies by people who keep them as pets, could threaten to invade the natural water bodies across the Northeast.
    - Northeast is home to 21 of the 29 vulnerable native Indian species of freshwater turtles and tortoises.
    - Northeast is home to 72% of the turtle and tortoise species in India.
- Red-eared slider derives its name from red stripes around the part where its ears would be and from its ability to slide quickly off any surface into the water.
- They are native to the **U.S. and northern Mexico.**
- This turtle is a popular pet due to its small size, easy maintenance, and relatively low cost.
- But, they grow fast and leave nothing for the native species to eat. Hence, they are **invasive species**.
- **Catch-22 situation** - People who keep red-eared slider as pets become sensitive about turtle conservation but endanger the local ecosystem by releasing them in natural water bodies after they grow big.
- Also, these turtles can impact human health as they may accumulate toxins in their tissues which pass on with the food chain upto humans.

8.15 Freshwater Black Softshell Turtle

- Hayagriva Madhava Temple Committee (Assam) signed a MoU with two NGOs, Assam State Zoo cum Botanical Garden and the Kamrup district administration for conserving the rare freshwater black softshell turtle.
- Also, a Vision Document 2030 was launched to raise at least 1000 black softshell turtle (Nilssonia nigricans) by 2030.
- These turtles are found along the Brahmaputra River's drainage in Assam, and in ponds of temples in north-eastern India and Bangladesh.
- **Conservation** - The International Union for Conservation of Nature had in 2021 listed the turtle as 'critically endangered'.
- But it does not enjoy legal protection under the Indian Wildlife (Protection) Act, 1972.
- **Threats** - It has traditionally been hunted for its meat and cartilage, traded in regional and international markets.
- Since the turtles are conserved in these ponds only based on religious grounds, many biological requirements for building a sustainable wild population have since long been overlooked.

8.16 New Red Algae Species

- Two new species of red seaweed have been discovered by marine biologists from Central University of Punjab (The genus Hypnea includes red seaweeds.)
    1. Hypnea indica - Discovered from Kanyakumari in Tamil Nadu, and Somnath Pathan and Sivrajpur in Gujarat.
    2. Hypnea bullata - Discovered from Kanyakumari and Diu island of Daman and Diu.
- Another species, Hypnea nidifica, has been found for the first time in Indian coasts.
- Including the two new species, there are 63 species in the genus Hypnea globally.
- The genus Hypnea consists of calcareous, erect, branched red seaweeds.
- They grow in the intertidal regions of the coast, namely the area that is submerged during the high tide and exposed during low tides.
- **Uses** - Species of Hypnea contain the biomolecule carrageenan, which is widely used in the food industry.
- **Threat** - Algae with calcareous mineral deposits are prone for the damage from ocean acidification, an aftermath of climate change.

8.17 Butea monosperma

- Butea monosperma tree is now in bloom across the Nilgiris. Generally, they bloom from January to March.
- Native to India, this small to medium sized deciduous tree wear more flowers than leaves. Flowers are bright orange with a unique petal shape, hence called **'flame of the forest**.'
- Each flower consists of five petals with a very curved beak-shaped keel. This keel gives it the name, **Parrot Tree**.
- In Manipur, when a member of the Meitei community dies, and his body cannot be found, the wood of this tree is cremated in place of the body.
- A postal stamp was issued by the Indian Postal Department to commemorate this flower.
- Also known as **Bastard teak,** this treeis widely grown in South Asia, and has multiple purposes, with a range of medicinal and other uses.

8.18 Pyrostria laljii

- Recently, Pyrostria laljii has been discovered from the Andaman Islands. It is a 15-meter-tall tree that belongs to the genus of the coffee family.
- The new species is also the first record of the genus Pyrostria in India. Plants belonging to genus Pyrostria are usually found in Madagascar.
- The tree is distinguished by a long stem with a whitish coating on the trunk, and oblong-obovate leaves with a cuneate base.
- It was first reported from South Andaman's Wandoor forest.
- The other places in the Andaman and Nicobar Islands where the tree is found are,
    - Tirur forest near the Jarawa Rerserve Forest and
    - Chidia Tapu (Munda Pahar) Forest.
- Pyrostria laljii has been listed as 'Critically Endangered' on the International Union for Conservation of Nature's (IUCN) Red List.
- While the genus Pyrostria is not found in India, there are several genera from the family Rubiaceae that are common in India - Cinchona, coffee, adina, hamelia, ixora, etc. They have high potential for economic value.

Rivina andamanensis

- It is a new species of pokeweed.
- It was found growing under large trees, shaded and rocky areas, along with herbs and shrubby plants.
- It represents the first record of the pokeweed family Petiveriaceae in Andaman and Nicobar Islands.

8.19 Seabuckthorn Plantations

- Himachal Pradesh government has decided to start planting seabuckthorn in the cold desert areas of the state.
- Seabuckthorn (or chharma) is a shrub that produces an orange-yellow coloured edible berry.
- In India, around 15,000 hectares in Himachal, Ladakh, Uttarakhand, Sikkim and Arunachal Pradesh are covered by this plant.
- It is found above the tree line in Himalayas, generally in dry areas such as the cold deserts of Ladakh, Lahaul and Spiti, and Kinnaur.
- **Benefits** - As a folk medicine, seabuckthorn has been widely used for treating stomach, heart and skin problems.
- Its fruit and leaves rich in vitamins, carotenoids and omega fatty acids, among other substances help people acclimatise to high-altitude.
- Besides being a source of fuel wood and fodder, seabuckthorn is a soil-binding plant which prevents soil-erosion, checks siltation in rivers and preserves floral biodiversity.

8.20 Dahanu Gholvad Sapota

- In a major boost to exports of Geographical Indication (GI) certified products, a consignment of Dahanu Gholvad Sapota (Chikoo) from Palghar district of Maharashtra was shipped to the United Kingdom.
- Ghovad Sapota has a unique taste that is believed to be derived from calcium rich soil of Gholvad village.
- **Promoter** - The Agricultural and Processed Food Products Export Development Authority (APEDA) has been thrust on promotion of exports of GI products.
- GI products with its uniqueness, intrinsic value and practically no competition from outsiders, offers good potential for export.
- **Sapota** is grown in many states- Karnataka, Gujarat, Maharashtra, Tamil Nadu, West Bengal and Andhra Pradesh.
- Karnataka is known to be the highest grower, followed by Maharashtra.

Asiatic Lion

- Asiatic lions are found in protected areas and agro-pastoral landscape of Saurashtra, covering nine districts in Gujarat.
- Its current estimated population is 674.
- India has recorded a 29% increase in its population in the past five years — from 523 in 2015 to 674 in 2020.
- Asiatic Lions are listed as 'Endangered' under the IUCN Red List.
- Asiatic Lions are protected under Schedule I of Wildlife Protection Act (1972).
- Eight Asiatic Lions housed in the Nehru Zoological Park (NZP), Hyderabad were infected with SARS-COV2.
- The samples from the lions were shared with the Centre for Cellular and Molecular Biology - Laboratory for Conservation of Endangered Species (CCMB-LaCONES) Hyderabad.

8.21 Flowering of Bamboo - A Threat

- Bamboo groves of Wayanad Wildlife sanctuary, and Mudumalai Tiger Reserve and Gudalur forest division in Tamil Nadu have fully bloomed.
- [The flowering of bamboo is a phenomenon said to occur once in the life cycle of bamboo plants.]
- With the advent of the season, migration of wild animals starts from the adjacent sanctuaries in Karnataka and

Bamboo Regeneration

- Thorny bamboo (Bamboosa bambos) is a monocarpic (flowering only once) plant belonging to the grass family.Its flowering cycle varies from 40 to 60 years.
- Profuse natural regeneration occurs from seeds after flowering.
- Seeds have no dormancy, and it helps germination under favourable conditions soon after seed fall.

Tamil Nadu to Wayanad due to shortage of fodder and water.

- Bamboo groves in the Wayanad forest are the mainstay of herbivores in the Nilgiri biosphere during summer.
- The recent flowering may adversely affect migration of wild animals owing to the mass destruction of bamboo groves after the flowering.
- Moreover, 25% of bamboo groves in Wayanad and nearby sanctuaries have bloomed since 2010, and the phenomenon is continuing.

8.22 Beema Bamboo

- The Tamil Nadu Agricultural University (TNAU) has designed an 'oxygen park' within its premises at Coimbatore with Beema or Bheema Bamboo.
- **Superior Clone** - Beema Bamboo is a superior clone, selected from Bambusa balcooa, a higher biomass yielding bamboo species.
- This thorn-less species is considered to be one of the fastest-growing plants. It grows one-and-a-half feet per day under tropical conditions.
- This clone is developed by the conventional breeding method (Tissue Culture). So, it is free from pest and disease.
- It is not a product of genetically modified organisms. In this case, new culms (hollow stem of a grass or cereal plant especially that bears flower) only grow around the mother shoot and hence it is non-invasive.
- **Sterile** - As it is sterile, this bamboo does not produce any seed and does not die also for several hundred years and keeps growing without death.
- As a result, this species can be able to establish permanent green cover.
- Since the plants are produced through tissue culture, the culms grow almost solid and adapt to different soil and climatic conditions.
- After every harvest cycle, it re-grows and doesn't require replanting for decades.
- **Carbon Sink** - This species is the best 'carbon sink' to mitigate carbon dioxide (CO_2) emissions.
- A four-year-old bamboo may absorb over 400 kg of CO_2 per annum.
- A fully-grown bamboo tree generates over 300 kg of oxygen annually.
- As its rhizome and root formation provide a strong foundation, the plant becomes robust against natural forces and plays a major role in mitigating global warming and climate change.

8.23 Arka Shubha

- Arka Shubha variety of marigold was developed by the Indian Institute of Horticultural Research (IIHR).
- It has the **highest carotene content** of 2.8% from plant source. All marigolds have carotene content that ranges up to a maximum of 1.4%.
- Arka Shubha is of value even if it gets spoilt after full bloom as it can be used for **extraction of crude carotene** - to be used in pharmaceutical sector.
- Apart from ornamental use and carotene content extraction, its petals could be used as **poultry feed** to get quality yolk.

8.24 Red Rice

- In a major boost to India's rice exports potential, the first consignment of 'red rice' was flagged off to the USA.
- This rice variety is called '**Bao-dhaan**' - Integral part of Assamese food.
- 'Red rice' is grown in **Brahmaputra valley** of Assam, without the use of any chemical fertilizer. It is rich in **iron**.
- Agricultural and Processed Food Products Export Development Authority (APEDA) has promoting rice exports through the Rice Export Promotion Forum (REPF).

- REPF has representations from rice industry, exporters, officials from APEDA, Ministry of Commerce.
- It has directors of Agriculture from major rice producing states - West Bengal, Uttar Pradesh, Punjab, Haryana, Telangana, Andhra Pradesh, Assam, Chhattisgarh and Odisha.

8.25 Bhalia Wheat

- In a major boost to wheat exports, the first shipment of Geographical Indication (GI) certified Bhalia variety of wheat was exported today to Kenya and Sri Lanka from Gujarat.
- This GI certified wheat has high protein content and is sweet in taste.
- The unique characteristic of the wheat variety is that grown in the **rain-fed condition withoutirrigation**.
- The crop is grown mostly across Bhal region of Gujarat - Ahmadabad, Anand, Kheda, Bhavanagar, Surendranagar, Bharuch districts.

8.26 Man3D-printed Clay Seabed

- 3D printed tiles that work as an artificial clay seabed for corals to latch onto and thrive, is used to restore Hong Kong's fragile coral reefs.
- Around 84 species of coral are found in Hong Kong's waters, more diverse than those found in the Caribbean Sea.
- Providing suitable ground for the coral larvae to latch onto and build a new home will help in repopulating a dead or damaged reef.
- The coral fragments on the tiles definitely survive better than the traditional way of transplantation.
- Tiles used in this project are made with terracotta. Clay is basically soil, and it is found everywhere on earth. So, water chemistry is unchanged.

Corals

- Corals are colonies of living polyp invertebrates and are hugely sensitive to temperature changes.
- When they get too hot, they lose their vibrant colour and die.
- Australia's Great Barrier Reef is the world's largest coral system.
- It is now so badly damaged that it is listed by the IUCN as "critical"- Worst category.
- Some subtropical corals thrive in warmer oceans because they form harder colonies, compared with their tropical corals.

8.27 Dickinsonia

- Researchers have discovered fossils of the earliest known living animal, 550-million-year-old 'Dickinsonia' in the roof of the '**Auditorium Cave'**at theRock Shelters of Bhimbetka.
- Dickinsonia is an extinct genus of basal animal that lived during the late **Ediacaran period** in what is now Australia, Russia and Ukraine.
- These are the only Dickinsonia fossils available in India, and are similar to those seen in southern Australia.
- This is further proof of **similar paleoenvironments** and confirms the assembly of Gondwanaland by the 550 Ma (Mega Annum), but not reconstructions adjusted for true polar wander.

8.28 Woolly Rhino

- A well-preserved Ice Age woolly rhino has been recovered from permafrost in Russia's extreme north.
- The carcass has most of its soft tissues still intact, including part of the intestines, thick hair and a lump of fat. Its horn was found next to it.
- It is dated to be anywhere from 20,000- to 50,000-years-old.
- It was found on the Tirekhtyakh river bank, close to the area where another young woolly rhino (Sasha) was recovered in 2014.
- Recent years have seen major discoveries of mammoths, woolly rhinos, Ice Age foal, and cave lion cubs as the permafrost increasingly melts across vast areas of Siberia because of global warming.

8.29 Hippopotamus

- Hippopotamus amphibius is an amphibious African ungulate mammal that lives along the rivers and lakes throughout sub-Saharan Africa.
- Known as water horse (Hippopotamus is Greek for "river horse"), it is the second largest land animal after the elephant.
- Hippos favour shallow areas where they can sleep half-submerged ("rafting") as to seek refuge from the heat.
- Lactating hippo will have white milk combined with Hipposudoric acid and Norhipposudoric acid (secreted by Hippos), makes their milk pink.
- These acids protect the hippos from harmful UV rays (like a sunscreen).
- Conservation Status
    1. **CITES** - Appendix Ill
    2. **IUCN** - Vulnerable
- **Threat** - Loss of Habitat (Humans use their grazing land for farming and diverts water for farming needs) and Human-animal conflict. Poachers kill hippos for their ivory tusks and for sport.
- Extinct in northern Africa and south of Natal and the Transvaal. They are common in East Africa, but populations continue to decrease continent wide.

8.30 Black Leopard

- Sightings of the rare Black Leopard (Melanistic Leopard) were reported in the Navegaon Nagzira Tiger Reserve (NNTR), Tadoba Andhari Tiger Reserve and the Pench Tiger Reserve in Maharashtra.
- Black Leopard or Black Panther (Ghost of the Forest) is a melanistic colour variant of spotted any Panthera, particularly of the leopard (P. pardus) in Asia and Africa, and the jaguar (P. onca) in the Americas.
    - Melanism is a common occurrence in leopards. A melanistic leopard or jaguar is mistakenly thought to be a different species.
- **Habitat** - They are mainly in Southwestern China, Burma, Nepal, Southern India, Indonesia, and the southern part of Malaysia.
- In India, they are reported from densely forested areas of South India, mostly from the state of Karnataka.
- **Threats** - Habitat loss, Poaching, Diseases, Human encroachment, Collision with vehicles, etc.,
- **Conservation** - It is listed in IUCN Red List (Vulnerable), CITES (Appendix I), Wildlife Protection Act, 1972 (Schedule I).

8.31 Tracking of Tigers

- Major ways of tracking a tiger are radio collars and camera traps. GSM camera traps can also be used, though they are dependent on internet connectivity.
- **Radio collars** are put on tigers for long-term studies of their behaviour, their feeding and movement patterns, etc. For this, a tiger is tranquilised and the collar put around its neck.
- Using the highly sophisticated technology of radio telemetry, officials can get real-time information about its movement.
- **Camera traps** can be used to capture a non-collared tiger. These traps are laid at locations which the tiger is most likely to move past.
- But apart from these places, it keeps moving to scores of other areas where there are no cameras. Thus, only a few locations can be received.
- Also, the cameras are checked only after a gap of 2-12 hours.
- While camera traps do help in identifying the animal, but if more than one tiger is moving around in a given location, this can get tricky.

- **Areas** - Tiger tracking is done both in protected areas (PAs) and non-PAs (generally human-dominated landscapes).
- This is further distinguished into tracking in established and non-established territories.
- Generally, tigers have big territories and hence when they move from one end to the other, another male could even trespass into their territory.
- But there are also tigers that don't have established territories. Their movement is difficult to track.
- Tigresses have small territories, which they guard by continuously patrolling it. So they spend more energy and thus require more food.
- Females in PAs require 10-12% more food than males. The food requirement of females over males goes up by about 24% in human dominated landscapes. So, more tigresses than tigers come in conflict with humans.

8.32 Hoolock Gibbon

- The Centre for Cellular and Molecular Biology (CCMB) study has found that there is only one species of Hoolock gibbons and not two in India.
- The Western Hoolock gibbons (Hoolock Hoolock) are the only apes in India. The other species, Mishmi Hills gibbons (Hoolock leuconedys), is not present here.
- There was confusion before as these small apes present in the northeast have populations had different physical features.
- The CCMB team corroborated the data with **mitogenome** (genetic information contained in mitochondria) analysis and estimated that the split between two species occurred 1.49 million years ago.
- The new findings will help design conservation programmes by inter-breeding the two populations and maintain their genetic diversity.

8.33 Pygmy Hogs

- Under the Pygmy Hog Conservation Programme (PHCP), eight of 12 captive-bred Pygmy hogs (Porcula salvania), were released in Manas National Park (Assam).
- Pygmy hogs are the world's rarest and smallest wild pigs.
- **Habitat** - It thrives in tall and wet grasslands. It is one of the very few mammals that build its own home, or nest, complete with a 'roof'.
- Its presence reflects the health of its primary habitat, the tall, wet grasslands of the region. So, it is an indicator species of the management status of grassland habitats.
- **Presence** - Once found along a narrow strip of wet grassland plains on the Himalayan foothills - from Uttar Pradesh to Assam, through Nepal's terai areas and Bengal's duars.
- Now, they are found mainly in Assam and southern Bhutan.
- **Threats** - Loss and degradation of grasslands (Habitat loss), illegal hunting, dry-season burning, livestock grazing, afforestation of grasslands, flood control schemes.
- **Conservation** - Pygmy Hogs are protected as "Endangered" in IUCN Red List. It is kept in the "Appendix I" of CITES and the "Schedule I" under the Wildlife (Protection) Act, 1972.

8.34 Caracal

- It is a medium size wild cat found in parts of Rajasthan and Gujarat.
- It has been included into the list of critically endangered species by the Standing Committee of National Board of Wildlife (NBWL).
- Now, it will be conserved with financial support under the centrally sponsored Scheme - Development of Wildlife Habitat.
- International Union for Conservation of Nature (IUCN) status - Least Concern.

- Their survival in India is endangered due to the rapid loss of scrub and thorn habitat and unchecked human activates in the caracals habitat.

8.35 Himalayan Serow

- A Himalayan Serow has been spotted in Manas Tiger Reserve, Assam.
- It is a mammal that is somewhere between a goat and an antelope, which is a high-altitude dweller found 2,000-4,000 metres above sea level.
- International Union for Conservation of Nature (IUCN) Red List of Threatened Species Status - '**Vulnerable**'.
- It is listed under **Schedule I** of The Wildlife Protection Act, 1972, which provides absolute protection.
- A black-necked crane (Near-threatened) and white-bellied heron (Critically Endangered) were also recently sighted in Manas.

8.36 Crocidura narcondamica

- It is a new species of insectivorous mammal, a white-toothed shrew discovered by the scientists from the Zoological Survey of India (ZSI) from Narcondam Island of the Andaman and Nicobar group of islands.
- Shrews are small and mouse-like mammals, and they live in sub-leaf stratum in the forests.
- Insects are the primary diet of these animals.
- This new species has a distinct external morphology with darker grey dense fur with a thick, darker tail compared to other species of the Crocidura genus.
- Its craniodental characters also make them distinct.

Narcondam Island

- The stratovolcanic Narcondam Island is an oceanic island of volcanic origin situated in the Andaman and Nicobar Archipelago, India.
- The isolated island is one of most remote and uninhabited islands of the Andaman and Nicobar archipelago.
- This thickly vegetated island is bordered by cliffs on the southern side and crested by three peaks is part of a volcanic arc that continues northward from Sumatra to Myanmar.
- **Species found** - The endemic Narcondam Hornbill is found only here.
- The island provides habitat for the Andaman Scops Owl, Nicobar Bat, Andaman Dwarf gecko and Andaman day gecko, all of which are species endemic to the Andaman and Nicobar islands.
- **Recognitions** - Narcondam Island has been identified as an Important Bird Area by BirdLife International and Bombay Natural History Society.
- It has been notified as Sanctuary under the Wildlife (Protection) Act, 1972 granting is further protection.

8.37 Kolar Leaf-Nosed Bat

- Karnataka Forest Department, along with the Bat Conservation India Trust (BCIT), is on a war footing to save these bats from extinction.
- The natural habitats of these bats are subtropical or tropical dry forests and caves.
- It is **endemic to India** and is found in only one cave in Karnataka.
- The International Union for Conservation of Nature (IUCN) status of this species is **Critically Endangered**.

8.38 Disk-footed Bat

- Disk-footed bat (Eudiscopus denticulus) was recorded in Meghalaya's Lailad area near the Nongkhyllem Wildlife Sanctuary.
- Meghalaya has yielded India's first bamboo-dwelling bat with sticky disk-like pads in the thumb and bright orange colouration.
- The disk-footed bat was also found to be genetically very different from all other known bats bearing disk-like pads.
- Their very high frequency echolocation calls, flattened skull and sticky pads make them suitable for orientation in a cluttered and cramped environment such as inside bamboo groves.

Nongkhyllem Wildlife Sanctuary

- It falls in the Eastern Himalayan Global bio-diversity hot spot.
- It is located near Lailad village in the Ri Bhoi district of Meghalaya.
- Species - Endangered Rufous Necked Hornbill and the brown hornbill bird, the Bengal tiger, the black bear, the leopard.

8.39 Bharitalasuchus tapani

- In the mid 20th century, researchers from the Indian Statistical Institute, Kolkata, carried out extensive studies on rocks of the Yerrapalli Formation in what is now Telangana.
- By studying some of these specimens now, a team has found a 240 million year old carnivorous reptile called Bharitalasuchus tapani.
- In the Telugu language, Bhari means huge, Tala means head, and Suchus is the name of the Egyptian crocodile-headed deity.
- Bharitalasuchus tapani were robust animals with big heads and large teeth, and these probably predated other smaller reptiles.
- They might have been the largest predators in their ecosystems as they were the size of an adult male lion.
- The reptile belonged to Erythrosuchidae, a family of extinct reptiles.

8.40 Pangolins

- Pangolins in Cameroon are on the verge of extinction as the Cameroonians prefer bushmeat to domestic livestock as they are easily available and cheaper.
- Pangolin, a scaly **nocturnal anteater**, is one of the world's most trafficked mammals.
- It is being pushed towards extinction due to rampant poaching and mushrooming international wildlife trade fuelled by Chinese poachers.
- International Union for Conservation of Nature (IUCN) has classified,
    1. Indian Pangolin as **Endangered** and
    2. Chinese Pangolins as **Critically Endangered**.
- Convention on International Trade in Endangered Species (CITES) has placed all eight pangolin species to **Appendix I**.

8.41 Asian Gracile Skink

- A new species of skink was discovered at Anaikatti hills in Coimbatore - Asian Gracile Skink.
- Named Subdoluseps nilgiriensis, the reptile is closely related to Subdoluseps pruthi found in parts of the Eastern Ghats.
- It was found in a dry deciduous area, showing that even the dry zones of our country are home to unrealised skink diversity.

Skinks

- Most skinks are diurnal and usually secretive. They are non-venomous.
- They resemble snakes because of the often-inconspicuous limbs and the way they move on land.
- Such resemblance result in humans killing them.
- Skinks usually feed on insects like termites, crickets and small spiders.

- It is currently considered a **vulnerable species** under IUCN, as there are potential threats.
- **Threats** - Seasonal forest fires, housing constructions and brick kiln industries in the area, rapid urbanisation, which has increased the road networks in the area.

8.42 King Cobra

- A king cobra (Ophiophagus hannah), was sighted in the recently declared conservation reserve, Tillari, in Sindhudurg district, Maharashtra.
- It is one of the most venomous snakes on the planet. It is the longest of all venomous snakes as it can reach 18 feet in length.
- **Venom** - Their venom is not the most potent among venomous snakes, but the amount of neurotoxin they can deliver in a single bite is enough to kill 20 people, or even an elephant.
- King cobra venom affects the respiratory centers in the brain, causing respiratory arrest and cardiac failure.
- **Habitat** - King cobras live mainly in the rain forests and plains of India, southern China, and Southeast Asia.
- They are comfortable in a variety of habitats, including forests, bamboo thickets, mangrove swamps, high-altitude grasslands, and in rivers.
- They are the only snakes in the world that build nests for their eggs, which they guard ferociously until the hatchlings emerge.
- **Threats** - Heavy deforestation; Habitat destruction. They are harvested for skin, food, and medicinal purposes; international pet trade. They are persecuted by humans who fear their menacing reputation.
- **Conservation** - The International Union for Conservation of Nature has listed the king cobra as vulnerable to extinction. CITES (Appendix II) and Wildlife Protection Act, 1972 (Schedule II).

8.43 Black-Browed Babbler

- After a long time, a solitary black-browed babbler was spotted in south-eastern Kalimantan in Indonesian Borneo.
- This small brown-grey songbird was stout, with a relatively short tail and a robust bill with a black eye-stripe running all the way around its head.
- This bird is often called 'the biggest enigma in Indonesian ornithology.'
- IUCN Red List - “Data Deficient” category.

8.44 Bar Headed Goose

- The Bar Headed Goose (*Anser indicus*) are wintering at the freshwater lake Hadinaru (which takes its name after a village near Mysuru).
- Origin - Central China and Mongolia (Breeding happens here)
- They can fly at very high altitude. They make the world's highest bird migration.
- They return to their homes by crossing the Himalayan ranges.
- [April marks the return of migratory bird species visiting India, back to their breeding grounds.]
- IUCN Red List Status - Least Concern

8.45 Three-Banded Rosefinch

- Three-Banded rosefinch of Arunachal Pradesh has been added as the 1,340th species in the bird list of India.
- It was spotted by the Bombay Natural History Society (BNHS) team at Sela pass (on the border between Tawang and West Kameng districts of Arunachal Pradesh.)
- Three-banded rosefinch belongs to the family Fringillidae, which are seed-eating passerine birds with a distinctively conical bill.

- This bird is a resident of southern China and a vagrant in Bhutan.
- It may be using the high altitude temperate coniferous forest of Arunachal Pradesh as a passage while migrating from China to Bhutan.

8.46 Brood X

- The US President's first trip abroad was delayed when a swarm of cicadas bombarded the plane Air Force One. These swarms are part of Brood X group, based on their life cycles and periodic appearances.
- [Cicadas live underground for extended periods of time, typically 13 or 17 years, and feed on roots of trees both underground and above it.
- The term 'brood' refers to a population of cicadas that is isolated from other populations because of differences in their year of emergence or locality.]
- Brood X is the largest brood of 17-year cicadas and is found in Pennsylvania, northern Virginia, Indiana and eastern Tennessee.
- Brood X cicadas come out of their underground homes every 17 years. They started emerging in May and will be around until the end of June.
- The time when they decide to emerge is dependent on weather, specifically when ground temperatures reach about 17-18°C.
- **Significance of Brood X** - Because of their sheer numbers and the noise they make, cicadas in Brood X often make headlines.
- When the brood last emerged in 2004 in Washington DC, the cicadas made an impact on the cultural scene.

Cicadas

- Among periodical cicadas, there are seven species. There are also some annual cicadas, which come out every year.
- **Underground** - When underground, cicada nymphs go through five stages of development. Once they become adults, which take about 17 years for some periodical cicadas, the males emerge from underground.
- When they come out, they shed their exoskeleton (outer skin) to take their winged form.
- **Emerging Outside** - Their emergence is to ensure continuation of their species (procreation).
    1. Male cicadas emerge first and start singing to attract females. They produce the loudest sounds in the insect world.
    2. Female cicadas respond with a clicking sound with their wings.
- This process lasts for about a month, after which the cicadas die. After mating, the eggs are laid in small twigs and branches.
- Once they hatch after about six weeks, the nymphs fall to the ground, and burrow their way into the ground. After becoming adults, these nymphs will emerge again 17 years later (or 13 years in some broods).
- **Danger** - Cicadas also do not bite or sting, but when the males sing, their collective chorus can reach up to 100 decibels, a noise level that can possibly cause severe damage if you are exposed to it for several hours.
- The female may damage the small twigs when she lays her eggs in them.

8.47 Indimimus Jayanti

- Indimimus Jayanti has become the twelfth subgenus, or species, of spider cricket identified under the genus Arachnomimus Saussure, 1897.
- Found in the Kurra caves of Chhattisgarh, the new subgenus was named Jayanti after Professor Jayant Biswas, a leading cave explorer in India.
- **Difference** - Indimimus subgenu is different from the Arachnomimus and Euarachnomimus subgenera because of the male genitalia structure.
- Insects have a lock-and-key model genitalia structure which is unique to each subgenus.

- **Sounds** - Crickets are noticeable for their loud calls, especially at night.
- Male crickets produce this sound by rubbing their wings against each other. Females listen to these calls using ears located on their legs and approach the males for mating and reproduction.
- **Significance** - Interestingly, males of the Jayanti subgenus cannot produce sound and their females don't have ears.
- They may be communicating by beating their abdomen or any other body part on the cave walls (Vibrational communication).
- Further studies on their skills of vibrational communication may help in designing hearing aids for human which can capture quietest signals and amplify to an audible hearing range.
- **IUCN Status** - Critically Endangered

8.48 Caterpillar Slug

- A new study has predicted that Purcell's hunter slug or caterpillar slug (Laevicaulis haroldi), native to South Africa, could soon become an invasive species attacking western and Peninsular India.
- It is listed as an **endangered** species and was first described in 1980.
- It entered India around 2010-2012 accidentally, through international trade via Mumbai. It feeds on the leaves and bark of mulberry plants. It was also sighted on neem trees, papaya, and calotropis plants.
- **Scenarios** - Two future climate change scenarios of the Intergovernmental Panel on Climate Change (IPCC) were studied to decode which places may be vulnerable to the slug attack.
    a) RCP 2.6 scenario represents the best-case scenario where we control emissions and limit anthropogenic climate change.
    b) RCP 8.5 scenario represents the worst that could happen. We don't follow any mitigation rules and have a high-risk future in terms of temperature and other climatic conditions.
- Under both the scenarios, AP, Karnataka, southern parts of Telangana, northeast TN, Gujarat, western MH, coastal Odisha, West Bengal, and some states in North East India are highly suitable for the slug.
- **Management** - Early detection and control are the key for managing newly introduced species before they become invasive.
- Awareness needs to be created among the people to detect, manage and control this newly introduced species.
- Non-toxic methods of controlling this pest need to be developed.
- Also, a strict quarantine in the ports should be in place to avoid further introductions.

9. DISASTER MANAGEMENT

9.1 Delhi Earthquakes

- As per the National Centre for Seismology (NCS), Delhi experienced 4 small earthquakes during April - August 2020.
- All these events were located by the National Seismological Network, being operated and maintained by NCS of the Ministry of Earth Sciences.
- Seismic network in Delhi and surroundings was strengthened by deploying 11 temporary additional stations covering the known faults in the region.
- This would precisely locate the earthquakes and their aftershocks for a better understanding of the causative sources
- [**Fault** - A fracture or discontinuity in a volume of rock.]
- Data from these stations are received in near real-time and used for locating the micro and small earthquakes in the region.
- The expanded network has now improved the accuracy of the epicenter location to ~2 km.

- A geophysical survey, namely, Magneto-telluric (MT) is also being conducted over the Delhi region.
- [**Magneto-telluric** (MT) - A geophysical method that uses natural time variation of the Earth's magnetic and electric fields to understand geological (underground) structure and processes.]
- These measurements are conducted across three major seismic sources, namely Mahendragarh-Dehradun Fault (MDF), Sohna Fault (SF) and Mathura Fault (MF).

9.2 State Disaster Response Fund

- The Centre has released the first instalment of the State Disaster Response Fund (SDRF) for 2021-22 to all the States, in the wake of the second wave of COVID-19.
- Normally, the annual exercise of release of the first instalment is usually done in June, as per the recommendations of the Finance Commission.
- As a special dispensation, the Department of Expenditure, Ministry of Finance, at the recommendation of the Home Ministry, has released in advance the first instalment of the Central share of the SDRF.
- Since Delhi is a Union Territory, the fund is released by the MHA and is included in the Union Budget.
- **State Disaster Response Fund (SDRF)** has been constituted under Section 48 (1) (a) of the Disaster Management Act, 2005, based on the recommendations of the 13th Finance Commission.
- It is the primary fund available with the State governments as part of their response to the notified disasters to meet expenditure on providing immediate relief to victims.
- The Centre contributes 75% of the allocation for general category States and Union Territories and 90% for special category States (northeastern, Sikkim, Uttarakhand, Himachal Pradesh, Jammu and Kashmir).
- The annual Central contribution is released in two equal installments as per the recommendation of the Finance Commission.
- The allocation to each State depends on its population and utilisation of such funds in the previous financial year.
- The SDRF is audited by the Comptroller and Auditor General of India (CAG) every year.

9.3 Flash Droughts

- Flash droughts are those that occur very quickly, with soil moisture depleting rapidly.
- Normally, developing drought conditions take months, but these happen within a week or in two weeks' time.
- Several factors including atmospheric anomalies, anthropogenic greenhouse gas emissions play an important role.
- In 1979, India faced a severe flash drought, affecting about 40% of the country and taking a toll on agriculture.
- A new study has now pointed out that India could experience more such flash droughts by the end of this century.

9.4 Impact of Cyclones on Fishing Sector

- **Disaster management** - The State Governments concerned provide necessary relief to affected people by natural disaster from the State Disaster Response Fund (SDRF) already placed at their disposal.
- Further assistance is provided by the Ministry of Home Affairs (MHA) from the National Disaster Response Fund (NDRF) as per the procedure for management of relief necessitated by notified natural disasters.
- **Assessment** - In the case of cyclones Amphan, Taukate and Yaas, the Central Government constituted the Inter-Ministerial Central Teams (IMCT) that assessed the damages caused due to cyclones.
- IMCT visited the affected areas of Gujarat, Jharkhand, West Bengal and Odisha for on the spot assessment of damages and recommendations of Sub-Committee for National Executive Committee (SC- NEC).
- Based on the IMCT report, the High Level Committee (HLC) had approved some amount to the fisheries sector from NDRF subject to the adjustment of 50% of balance available in their SDRF account.

- IMCT report recommended help especially to the fisheries sector.
- **Fisheries sector** - The Department of Fisheries (DoF) implements the Schemes for overall development of fisheries sector.
- Fishermen are provided assistance for various components and activities like boat replacement, nets etc., under the Pradhan Mantri Matsya Sampada Yojna is implemented by DoF through the State Governments.

9.5 India cuts Cyclone Deaths

- Since the 1999 super cyclone in Odisha (claimed over 10,000 lives) to Cyclone Yaas (casualties limited to 6 lives), India seems to have made a remarkable progress in disaster risk reduction (DRR).
- **Factors** that limiting casualties to negligible numbers are,
    1. Cooperation of both the Centre and states,
    2. Large-scale rescue and relief operation by the state, National Crisis Management Committee, National Disaster Response Force and State Disaster Response Force, Army, Navy, etc.
    3. Significant increase in the funding for DRR activities - up from an average $3-4 billion over 5 years in the last decade to $4 billion a year for the last 2 consecutive years,
    4. The most modern satellites and early warning systems predicting the course of cyclones a week in advance, giving authorities' time to prepare.
- This is seen as the result of a rigorous exercise and strengthening of the DRR mechanism over the last few years.
- This remarkable demonstration of "Zero Casualty" approach of India towards every calamity has been celebrated at global forums with the UN Office for Disaster Risk Reduction (UNDRR).

9.6 US Heat Wave

- The Northwestern US and Pacific Canada are in the grips of a heat wave that the National Weather Service called "historic and dangerous". A weather anomaly called a "heat dome" is partially to blame.
- According to the US National Weather Service, in most parts of the country, temperatures must be above the historical average in an area for two or more days before the label "heat wave" is applied to a hot spell.
- **Causes of heat wave** - Heat waves begin when high pressure in the atmosphere moves in and pushes warm air toward the ground.
- That air warms up further as it is compressed, and we begin to feel a lot hotter. The high-pressure system pressing down on the ground expands vertically, forcing other weather systems to change course.
- It even minimizes wind and cloud cover, making the air more stifling. This is why a heat wave parks itself over an area for several days.

9.7 Omega Block

- A dangerous 'Omega block' is trapping scorching hot air over the US and Canada.
- **Heat Dome** - Even though the average summer temperatures are steadily increasing every year due to global warming, a weather anomaly called 'Heat dome' is partly to blame for the Pacific Northwest heat.
- As the ground warms, it loses moisture, which makes it easier to heat even more. As that trapped heat continues to warm, the system acts like a lid on a pot - earning the name "heat dome."
- Conflating high- pressure and low-pressure systems have trapped the region in a heat dome locked in place by undulations in the jet stream. [Jet Stream is a river of strong wind in the upper atmosphere.]
- In this case, the jet stream has trapped a ridge of high pressure (heat dome) over the Pacific Northwest, creating a block in the atmosphere that prevents the weather system from moving on.
- Instead, the hot air in the high-pressure system pushes down over the region, creating a suffocating blanket of heat.

- As the wind patterns swirl around the heat block in the shape of the Greek letter Omega, the systems like these got the name "Omega blocks".

Heat Dome

- The temperatures being reported from the Pacific Northwest and some parts of Canada are part of a "historic" heat wave that lasted over a week, a result of a phenomenon referred to as a "heat dome".
- Temperatures of the western Pacific Ocean have increased in the past few decades and are relatively more than the temperature in the eastern Pacific.
- This strong change in ocean temperature from the west to the east is the reason for the heat dome, which is when the atmosphere traps heat at the surface, which encourages the formation of a heat wave.
- To compare, the reason that the planet Venus is the hottest in the Solar System is because its thick, dense cloud cover traps the heat at the surface, leading to temperatures as high as 471 degree Celsius.
- A heat wave is a period of unusually hot weather that lasts for more than two days. It can occur with or without high humidity and have the potential to cover a large area, exposing many people to hazardous heat.

9.8 Forest Fires in India

Uttarakhand has witnessed over 1,000 incidents of forest fire over a six months period.

- Since the start of 2021, there has been a series of forest fires in HP, Nagaland-Manipur border, Odisha, MP, and Gujarat.
- These include the forest fires in wildlife sanctuaries.
- January 2021 saw prolonged fires in Uttarakhand, Himachal Pradesh (Kullu Valley) and Nagaland-Manipur border (Dzukou Valley).
- The recent one in Nainital began in March-end.
- The Simlipal National Park in Odisha saw a major fire between February-end and early March.
- Recent fires also include those in Bandhavgarh Forest Reserve in Madhya Pradesh, and in sanctuaries for the Asiatic lion and the great Indian bustard in Gujarat.
- April-May is the season when forest fires take place in various parts of the country.
- But forest fires have been more frequent than usual in Uttarakhand and have also taken place during winter.
- Dry soil caused by a weak monsoon is being seen as one of the causes.
- As of 2019, about 21.67% (7,12,249 sq km) of the country's geographical area is identified as forest.
- This is according to the India State of Forest Report 2019 (ISFR) released by the Forest Survey of India (FSI), Dehradun.
- Tree cover makes up another 2.89% (95, 027 sq km).
- Based on previous fire incidents and recorded events, the 2020-2021 annual report of the MoEFCC makes the following categorisations:
- Forests of the Northeast and central India regions - most vulnerable areas to forest fires
- Forests in Assam, Mizoram and Tripura - 'extremely prone' to forest fire
- States with large forest areas including Andhra Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Maharashtra, Bihar and UP - 'very highly prone' category
- Western Maharashtra, Southern Chhattisgarh and areas of Telangana and Andhra Pradesh, along with central Odisha are also turning into 'extremely prone' forest fire hotspots.
- Areas under the 'highly prone' and 'moderately prone' categories make up about 26.2% of the total forest cover.
- **Uttarakhand and Himachal Pradesh** are the two states that witness the most frequent forest fires annually.
- In Uttarakhand, over 45% of the geographical area (24,303 sq km) is under forest cover.

- The FSI has identified forests along the south, west and southwest regions of Uttarakhand as being prone to varying intensities of forest fires.
- These comprise Dehradun, Hardwar, Garhwal, Almora, Nainital, Udham Singh Nagar, and Champawat districts.

Causes of Forest Fires

- Forest fires can be caused by a number of natural causes.
- But, reportedly, many major fires in India are triggered mainly by human activities.
- Emerging studies link climate change to rising instances of fires globally.
- This is especially true in the case of the massive fires of the Amazon forests in Brazil and in Australia in the recent years.
- Fires of longer duration, increasing intensity, higher frequency and highly inflammable nature are all being linked to climate change.
- In India, forest fires are most commonly reported during March and April.
- This is when the ground has large quantities of dry wood, logs, dead leaves, stumps, dry grass and weeds.
- These can make forests easily go up in flames if there is a trigger.
- Under natural circumstances, extreme heat and dryness, friction created by rubbing of branches with each other also likely initiate fire.
- In Uttarakhand, the lack of soil moisture too is being seen as a key factor.
- In two consecutive monsoon seasons (2019 and 2020), rainfall has been deficient by 18% and 20% of the seasonal average, respectively.
- But, forest officials say most fires are man-made, sometimes even deliberately caused.
- Even a small spark from a cigarette butt, or a carelessly discarded lit matchstick can set the fire going.
- E.g. in the recent major fire in Simlipal forest in Odisha, villagers are known to set dry leaves to fire in order to collect mahua flowers, which go into preparation of a local drink

9.9 Similipal Forest Fire

The Similipal forest reserve area frequently witnesses forest fires during dry weather conditions.

Similipal Biosphere Reserve

- Similipal is a national park and a tiger reserve.
    - Similipal derives its name from ‘Simul’ (silk cotton) tree.
- It is situated in the northern part of Odisha’s Mayurbhanj district.
- Similipal and the adjoining areas was declared a biosphere reserve by the Government of India in 1994.
- It lies in the eastern end of the eastern ghat.
- **Biodiversity** - Similipal is the abode of 94 species of orchids and about 3,000 species of plants.
- The identified species of fauna include 12 species of amphibians, 29 species of reptiles, 264 species of birds and 42 species of mammals.
- All of this collectively highlights the biodiversity richness of Similipal.
- The transition zone of the reserve has 1,200 villages with a total population of about 4.5 lakh.
- Sal is a dominant tree species. Tribals constitute about 73% of the population.

Main Causes

- Natural causes such as lighting or even soaring temperatures can sometimes result in these fires.

- But forest officials and activists say most of the fires can be attributed to man-made factors.
- With dried leaves and tree trunks, even a spark can lead to a raging fire.
- Instances of poaching and hunting, wherein the poachers set a small patch of forest on fire to divert the wild animals, can lead to such fires.
- They do not douse the fire after hunting; this particular time is very vulnerable for fires to spread quickly.
- Secondly, jungle areas are also set on fire by villagers to clear the dry leaves on the ground for easy collection of mahua flowers.
    - These flowers are used to prepare a drink which is addictive in nature.
- Villagers also believe burning patches of sal trees will lead to better growth when planted again.
- This year, along with man-made factors, an advanced heat wave with the early onset of summer further deteriorated the condition.
- A total of 399 fire points have been identified in the fringe areas bordering the forest, close to the villages, during the recent fire.

Prevention

- Such fires are generally brought under control by natural rains.
- Some of the methods to prevent fires include –
    i. forecasting fire-prone days
    ii. including community members to mitigate incidents of fire, creating fire lines, clearing sites of dried biomass
    iii. crackdown on poachers
- The forest fire lines, which are strips kept clear of vegetation, help break the forest into compartments to prevent fires from spreading.
- The forest department recently intensified its mitigation measures.
- It formed a squad each for 21 ranges across the five divisions to closely monitor the situation.
    - 1,000 personnel, 250 forest guards were pressed into action.
    - 40 fire tenders and 240 blower machines were used to contain the blaze.
- Awareness programmes are also being initiated at the community level to prevent such incidents.

9.10 Dzukou Forest Fire

- A forest fire occurred in Nagaland's Dzukou range, in which the Dzukou valley (a tourist hot spot) is located.
- This valley is located at the border of states of Nagaland and Manipur.
- It is a sanctuary for the endangered Blyth's tragopan - Nagaland's State Bird.
- It is famous for its wide range of flowers in every season. Rare Dzükou Lily is found only in this valley.
- This valley is 'Valley of flowers' of the Nagaland State.

9.11 Uttarakhand Forest Fires

- The Centre has provided two MI-17 helicopters to Uttarakhand State for fire-fighting - each deployed in Kumaon and Garhwal regions.
- Uttarakhand has 38,000 sq. km. of forests (71% of its geographical area).
- 'Forest fire season' begins in mid-February continues till mid-June in the summer. Peak time is 3rd week of May when temperature is highest.
- In hilly areas, the surface gets drier faster than plains due to lower accumulation of rainwater.

- **Causes of forest fires** - Fuel load (Quantity of dry leaves), oxygen, temperature, deliberate fires by locals, friction of electricity cables with fuel load, carelessness, farming-related activities and natural reasons.
- Setting forest on fire is a punishable offence under Indian Penal Code.
- **Preventive measures** - Van Panchayats should be given rights and incentives for protecting the forests.
- The Forest Act of 1988 dissociates the local community with the forests and, in the absence of a sense of belonging, local community villagers do not initiate dousing fires on their own.
- Waterholes should be developed across the mountains to recharge groundwater and maintain moisture in the soil.
- Awareness should be given through programs to motivate locals to protect forests from fire because they act as first responder.

9.12 Cloudbursts

Recently, cloudbursts have been reported from several places in Jammu and Kashmir, UT of Ladakh, Uttarakhand and Himachal Pradesh.

- Cloudbursts are short-duration, intense rainfall events over a small area.
- According to the India Meteorological Department (IMD), it is a weather phenomenon with unexpected precipitation exceeding 100mm/h over a geographical region of approximately 20-30 square km.
- A 2017 study of cloudbursts in the Indian Himalayas noted that most of the events occurred in the months of July and August.
- A 2020 study showed that the meteorological factors behind the cloudburst over the Kedarnath region.
- It showed that during the cloudburst, the relative humidity and cloud cover was at the maximum level with low temperature and slow winds.
- Because of this situation, a high amount of clouds may get condensed at a very rapid rate and result in a cloudburst.
- **Frequency** - Studies have shown that climate change will increase the frequency and intensity of cloudbursts in many cities across the globe.
- World Meteorological Organization said that there is about a 40% chance of the annual average global temperature temporarily reaching 1.5°C above the pre-industrial level in at least one of the next five years.
- There is a 90% chance of at least one year between 2021 and 2025 becoming the warmest on record and dislodge 2016 from the top rank.
- IIT Gandhinagar states that as temperatures increase the atmosphere can hold more and more moisture.
- This moisture comes down as a short very intense rainfall for a short duration probably half an hour or one hour resulting in flash floods in the mountainous areas and urban floods in the cities.
- Also, there is evidence suggesting that globally short duration rainfall extremes are going to become more intense and frequent.
- With warming climate or climate change, we will surely witness these cloudburst events in increased frequency in the future.

9.13 Link between Cloud Bursts & Forest Fires

- A recent study has found a connection between the formation of the tiny particles, the size of a cloud droplet on which water vapor condenses leading to the formation of clouds and forest fires.
- The quantity of such particles called the Cloud Condensation Nuclei (CCN) was found to have peaks associated with forest fire events.
- Cloud condensation nuclei (CCN), which can activate and grow into fog or cloud droplets in the presence of supersaturation (SS) was measured by a droplet measurement technology's (DMT) CCN Counter.
- This observation was carried out under a Climate Change Programme Division, Department of Science & Technology funded project, where the variation of CCN was reported on diurnal, seasonal, and monthly scale.

- This study showed that the highest concentration of CCN in the high altitude was found to be associated with excessive fire forest activities of the Indian subcontinent.
- There were other peaks also associated with a variety of events, such as long-range transportation and local residential emission.

9.14 Chamoli Disaster

- A major disaster struck the Joshimath area of the Chamoli district of Uttrakhand, when a **glacier broke** after an avalanche.
- The Rishiganga Power Project had been damaged due a breach caused by the glacier in Tapovan area.
- **Reduced snowfall** in the higher elevations this winter seems to have played a major part in the disaster.
- Around 200 of the 8,800 Himalayan glacial lakes spread across countries have been classified as dangerous.
- Scientific evidence suggests that floods originating in the Himalayas are caused largely by **landslides** that temporarily block Mountain Rivers.
- The Himalayas are **warming faster** than other mountain ranges and the increased use of reinforced concrete in building construction is likely to create a heat-island effect and thus add to regional warming.

GEOGRAPHY

10. GENERAL GEOGRAPHY

10.1 Volcanic Eruption

- Basically, there are three types of volcanoes — active, dormant or extinct.
- An eruption takes place when magma (a thick flowing substance), that is formed when the earth's mantle melts, rises to the surface.
- As magma is lighter than rock, it rises through vents and fissures on the surface of the earth. Following eruption, the magma is called lava.
- Not all volcanic eruptions are explosive since explosivity depends on the composition of the magma.
    1. If the magma is runny and thin, gases can easily escape it. In such cases, the magma will flow out towards the surface.
    2. If the magma is thick and dense and gases cannot escape it, it builds up pressure inside resulting in a violent explosion.
- **Vulnerable** - The most common cause of death from a volcano is suffocation, making people with respiratory conditions such as asthma and other chronic lung diseases susceptible.
- People living close to the volcano or in low-lying downwind areas are also at higher risk in case of an explosion since the ash may be gritty and abrasive and small particles can scratch the surface of the eyes.
- Volcanic eruptions can result in additional threats to health - Floods, mudslides, power outages, drinking water contamination and wildfires.
- Lava flows, however, rarely kill people since it moves very slowly, giving enough time to escape.

10.2 Age of Plate Tectonics

- A study on the oldest minerals on the Earth **Zircon crystals** (4.3 billion years old) of Jack Hills, Australia revealed that the plate tectonics are 3.6 billion years old and they are moving continuously since they emerged.
- Previously, researchers thought that these plates formed anywhere from 3.5 to 3 billion years ago.

- **Zircon Crystals** are dense, so it was easy to separate them from the rest of the sand by using a method akin to gold panning.
- The researchers studied the uranium content (a radioactive element with a known rate of decay) of each zircon to determine their age.
- They also studied the aluminum content to know about the Earth's crust thickening on at that time.
- **Platetectonics** refers to how humongous slabs of solid rock glide over Earth's mantle, the layer just below the crust.
- These continental slabs shift, fracture and collide, causing earthquakes to occur, mountains to grow and oceans to form.
- Besides Earth, no other known planetary bodies have plate tectonics.
- **Significance** - Rocks capture carbon dioxide, a greenhouse gas that helps to warm Earth (but too much CO_2 can lead to global warming).
- Plate tectonics ensures that these rocks eventually get dragged down and melted, and their CO_2 is spewed out as gas through volcanoes. Without this process, Earth might freeze.

10.3 Study on Tropical Cyclones

- Tropical Cyclone is the combined name used for the three cyclonic storms - cyclones, hurricanes and typhoons.
- They are named differently based on which ocean they form in. They are created by warm ocean waters.
- A new joint study has said that the intensity of tropical cyclones might increase in the next century due to global warming.
- If the world warmed by 2^{o} C by 2100, cyclonic wind speeds can peak at more than 300 kms per hour, it could increase up to a maximum of 5%.
- Rising sea water levels will intensify the destructive impact of the cyclones due to increased storm surges which flood coastal areas bringing in sea-water that decreases soil fertility.
- Amount of rainfall carried by the storms might increase by an average of 14% due to the warming-fuelled increase in moisture in the atmosphere.
- Rapid intensification happens when there is an increase of maximum sustained winds of a cyclone by at least 55 kms/ hour within 24 hours.
- Stronger storms might occur in areas closer to the North and South Poles - this means that seas in these regions are becoming warmer.
- **North Atlantic Ocean** - The impact of climate change on cyclones was especially visible here, as it experienced numerous intense hurricanes.
- **North Pacific Ocean** - Intensity of tropical cyclones making landfall along the coasts of eastern and south eastern Asia from 1977-2014 had increased by 12-15%.
- **Indian Ocean region** - The chances of low pressure areas on the sea surface that may transform into cyclones have increased in Arabian Sea. This happened due to decrease in vertical wind shear in the Arabian Sea.
- [Vertical wind shears are localised winds around a cyclone in the vertical direction. When they are strong, they usually destabilise a cyclone and make it less intense.]
- In the Bay of Bengal, the number of cyclones growing to become severe cyclones had increased. This had happened because of low level cyclonic vorticity which intensified cyclones.

Tropical Cyclone Naming

- Cyclone Yaas is the name of the cyclonic storm that was formed over north Andaman Sea and adjoining east Central Bay of Bengal.
- Oman named this cyclone as 'Yaas', which refers to a tree with good fragrance, the word is similar to Jasmine.

- **Naming** - Cyclones that form in every ocean basin across the world are named by the six regional specialised meteorological centres (RSMCs) and Tropical Cyclone Warning Centres (TCWCs).
- As an RSMC, the India Meteorological Department (IMD) names the cyclones developing over the north Indian Ocean, including the Bay of Bengal and Arabian Sea.
- The IMD is also mandated to issue advisories to 12 other countries in the region on the development of cyclones and storms.
- The WMO/ESCAP (World Meteorological Organisation/United Nations Economic and Social Commission for Asia and the Pacific) started naming the cyclones in the region in 2000.
- The countries that name the cyclones are Bangladesh, India, the Maldives, Myanmar, Oman, Pakistan, Sri Lanka, Thailand, Iran, Qatar, Saudi Arabia, United Arab Emirates and Yemen.
- After each country sent in suggestions, the WMO/ESCAP Panel on Tropical Cyclones (PTC) finalised the list.
- **Guidelines to adopt names of cyclones** -
    a) The proposed name (maximum length=eight letters) of tropical cyclone over the north Indian Ocean should be new.
    b) It must be neutral to politics and political figures, religious believes, cultures and gender.
    c) It must be chosen in such a way that it doesn't hurt the sentiments of any group over the globe
    d) It should be short, easy to pronounce and should not be offensive to any member, or not be very rude and cruel in nature

10.4 South Island Subduction Initiation Experiment

- Subduction zones are very destructive plate boundaries, which are the main drivers of plate tectonics. So, they are the primary reason why the plates on Earth actually move.
- A new research reveals how a young subduction zone was formed in the Puysegur Trench, a deep cleft in the floor of the south Tasman Sea.
- [The Puysegur Trench was formed by the subduction of the Indo-Australian Plate under the Pacific Plate to the south of New Zealand.]
- This study was done by the scientists aboard the research vessel Marcus Langseth who set out to this region in 2018 as part of the South Island Subduction Initiation Experiment.

Zealandia

- The secret continent of Zealandia is found on the boundary between the Australian and Pacific plates.
- Zealandia is a submerged section of continental crust the size of Australia around New Zealand.
- It was perched over the north end of this extensional zone.

- They studied the Puysegur margin in the "Roaring Forties," the latitudes between 40 degrees south and 50 degrees south where the winds and currents are brutal.

Findings

- About 45 million years ago, a bit of the hidden continent of Zealandia got stretched and shifted, which led the denser oceanic crust to slam into it.
- A new plate boundary between the continental Australian and oceanic Pacific plates began to form because of a force called **extension** - Tectonic forces pulled the two plates apart like putty.
- As continental crust is thicker and more buoyant, the extensional forces working at the plate boundary couldn't crack Zealandia.
- Instead, the continental crust merely stretched as it spread, creating a thinned-out zone now known as the Solander basin.
- At the plate boundary, oceanic crust bumped up against oceanic crust, and continental crust against continental crust.
- **Continental crust is more buoyant than denser oceanic crust.**

- This difference in buoyancy allowed the denser Australian plate to slide under the lighter Pacific one, especially because the boundary between these plates was already weakened by the **strike-slip faulting**.

10.5 World's Fifth Ocean

- The National Geographic magazine has recognised the 'Southern Ocean' as the world's fifth ocean hoping others will soon follow suit.
- [The other four Oceans are Pacific, Atlantic, Indian and Arctic Oceans.]
- Usually, the magazine has followed the International Hydrographic Organization (IHO) on marine names.
- The change in name is in alignment with the National Geographic Society's initiative to conserve the world's oceans.
- The Southern Ocean is the **only ocean to touch three other oceans** and to **completely embrace a continent** rather than being embraced by them.
- Its northern limit is a latitude of 60 degrees south. It is also defined by its **Antarctic Circumpolar Current** that was formed 34 million years ago. The current flows from west to east around Antarctica.

International Hydrographic Organization

- The International Hydrographic Organization is an intergovernmental organization that works to ensure all the world's seas, oceans and navigable waters are surveyed and charted.
- Established in 1921, it coordinates the activities of national hydrographic offices and promotes uniformity in nautical charts and documents.
- It issues survey best practices, provides guidelines to maximize the use of hydrographic survey data and develops hydrographic capabilities in Member States.
- India is also a member of IHO.

- By officially changing the name of the waterbody, the National Geographic hoped to draw attention to the following issues,
    - Rapid warming of the Southern Ocean due to global warming,
    - Industrial fishing on species like krill and Patagonian toothfish

Recognition

- The IHO too had recognised 'Southern Ocean' as a distinct body of water surrounding Antarctica in 1937 but had repealed the same in 1953.
- However, the US Board on Geographic Names and the National Oceanic and Atmospheric Administration recognize the term 'Southern Ocean'.

10.6 Lightning Cleanser

- A team of researchers found that lightning bolts increase the ability of the atmosphere to cleanse itself or breakdown greenhouse gases (GHGs).
- The extreme amounts of hydroxyl radical (OH) and hydroperoxyl radical (HO_2) were discharged during lightning events. This OH initiates chemical reactions and breaks down molecules like the GHG methane.
- Lightning is the process of occurrence of a natural electrical discharge of very short duration and high voltage between a cloud and the ground or within a cloud.
- This would be accompanied by a bright flash and sound, and sometimes thunderstorms.
- Inter cloud or intra cloud (IC) lightning are visible and harmless.
- Cloud to ground (CG) lightning is harmful as the 'high electric voltage and electric current' leads to electrocution.
- Lightning strikes have caused 1,771 deaths between April 1, 2019 and March 31, 2020, according to a report on lightning incidents in India.
- This report has been prepared by Climate Resilient Observing Systems Promotion Council (CROPC).
- [CROPC is a non-profit organisation that works to disseminate early lightning forecasts.]
- Uttar Pradesh, Madhya Pradesh, Bihar, Odisha and Jharkhand together accounted for more than 60% of the deaths.

- A large number of deaths occur as not much awareness has been undertaken.
- As per the report, the Government of India and most states have not notified lightning as a disaster.

Lightning

- At least 30 people were killed in separate incidents of lightning in Rajasthan, Uttar Pradesh and Madhya Pradesh.
- Lightning is a **very rapid and massive discharge of electricity** in the atmosphere, some of which is directed towards the Earth's surface.
- These discharges are generated in **giant moisture-bearing clouds.**
    - Height of these clouds is 10-12 km and their base lies within 1-2 km of the Earth's surface. Temperature towards the top of these clouds are in the range of (-) 35 to (-) 45 degrees Celsius.
- As water vapour moves upward in the cloud, the falling temperature causes it to condense.
- Heat is generated in the process, which pushes the molecules of water further up. As they move to temperatures below zero degrees celsius, the water droplets change into small ice crystals.
- They continue to move up, gathering mass until they are so heavy that they start to fall to Earth. This leads to a system in which smaller ice crystals move up and bigger crystals come down simultaneously.
- Collisions follow, and trigger the release of electrons - a process similar to the generation of electricity. As the moving free electrons cause more collisions and more electrons, a chain reaction ensues.
- This process results in a situation in which the top layer of the cloud gets positively charged, while the middle layer is negatively charged.
- The electrical potential difference between the two layers is huge. So, in very little time, a massive current starts to flow between the layers.
- An enormous amount of heat is produced, and this leads to the heating of the air column between the two layers of the cloud. As the reddish heated air column expands, it produces thunder.
- **Precautions** - People are most commonly struck by "ground currents" of the lightning. They should move indoors in a storm. They shouldn't take shelter under a tree or lay flat on the ground.
- **Frequency** - Lightning is the biggest contributor to accidental deaths due to natural causes. Incidents of lightning are on an increasing trend over the last 20 years, especially near the Himalayan foothills.
- More common than is sometimes realised in the urban areas. On average, India sees 2,000-2,500 lightning deaths every year.

10.7 Last Ice Area

- A new study has found that the "Last Ice Area," may be more vulnerable to climate change than suspected.
- The Last Ice Area, an Arctic region known for its thick ice cover, spans more than 2,000 kms, reaching from Greenland's northern coast to the western part of the Canadian Arctic Archipelago.
- It earned its dramatic name because though its ice grows and shrinks seasonally, much of the sea ice was thought to be thick enough to persist through summer's warmth.
- But during the summer of 2020, the Wandel Sea in the eastern part of the Last Ice Area lost 50% of its overlying ice, bringing coverage there to its lowest since record-keeping began.
- **New study** - The study looked at the Wandel Sea north of Greenland, which is inside what's known as the "last ice area" of the Arctic Ocean.
- Researchers found that weather conditions were driving the decline, but climate change made that possible by gradually thinning the area's long-standing ice year after year.
- This hints that global warming may threaten the region more than prior climate models suggested.
- If the area is changing faster than expected, the Last Ice Area may not be the refuge for ice-dependent species in a future ice-free summer Arctic.

- **Anamoly 1 -** In recent decades, ocean currents have bolstered ice cover in the Last Ice Area with chunks of floating sea ice.
- But, northward winds transported ice away from Greenland and created stretches of open water that were warmed by the sun.
- The heated water then circulated under sea ice to drive even more melting.
- Scientists first suspected something might be amiss in the Last Ice Area in 2018, when a stretch of ice-ringed open water, known as a polynya.
- **Anamoly 2 -** In 2020, another sea ice anomaly in the Wandel Sea was gathered from an Arctic research expedition called The Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC).
- The research vessel was taking "a strange-looking route" through areas that normally were covered in thick ice.
- Satellite observations and climate models revealed that in 2020, unusual northward-moving winds broke up sea ice and pushed it away from the Wandel Sea.
- Approximately 20% of the 2020 ice loss could be directly attributed to climate change, while 80% was linked to the wind and ocean-current anomalies, the researchers wrote.

10.8 Movements of Earth

- As Earth zooms around the sun, it also turns on its own axis about once every 24 hours (precisely, every 23 hours, 56 minutes and 4 seconds).
- Earth measures 40,070 kilometers in circumference, so when you divide distance by time, that means the planet is spinning 1,670 kmph.
- Meanwhile, Earth orbits the sun at about 110,000 km/h. It is determined by taking the distance Earth travels around the sun and dividing it by the length of time Earth takes to complete one orbit (about 365 days).
- Earth is about 149.6 million km away from the sun, and it is assumed to travel in a generally circular path (it's actually more elliptical).
- The solar system is also moving; it's located within the Milky Way, which orbits around the galaxy's center. The solar system orbits the Milky Way's galactic center at about 720,000 km/h.
- Then there's the entire Milky Way, which is pulled in different directions by other massive structures, such as other galaxies and galaxy clusters.
- For humans standing on the surface of our planet, they don't feel Earth hurtling around the sun because they're also hurtling around the sun at the same speed. There's no relative motion.

11. INDIAN GEOGRAPHY

11.1 Ratle Hydro Power Project

- The Union Cabinet has approved the investment to the Ratle Hydro Electric Project.
- The investment will be made by a new Joint Venture Company (JVC).
- This JVC will be incorporated between National Hydroelectric Power Corporation and Jammu & Kashmir State Power Development Corporation Ltd. with equity contribution of 51% and 49% respectively.
- Ratle Hydro Electric Project is located on **river Chenab** in Kishtwar district of Union Territory of Jammu and Kashmir.
- The Power generated from the Project will help in providing balancing of Grid and will improve the power supply position.

11.2 Vanadium in Arunachal

- Arunachal Pradesh could be India’s prime producer of Vanadium.

- In India, Vanadium is recovered as a by-product from the slag collected from the processing of vanadiferous magnetite ores (iron ore).
- But now promising concentrations of vanadium has been found in the palaeo-proterozoic carbonaceous phyllite rocks in the Depo and Tamang areas of Arunachal Pradesh.
- This was the first report of a primary deposit of vanadium in India with an average grade of 0.76% V_2O_5 (vanadium pentoxide).
- Exploration is being carried out by Geological Survey of India (GSI).
- Vanadium mineralisation in Arunachal Pradesh is geologically similar to the "stone coal" vanadium deposits of China in carbonaceous shale.
- This high vanadium content is associated with graphite with fixed carbon content of up to 16%.

Vanadium

- In its pure form, Vanadium is a soft, grey and ductile element which is primarily derived from mined iron ore, carbonaceous shale or phyllites and steel slag.
- It is high-value metal used to strengthen steel and titanium.
- It increases the fuel-efficiency in automotive and aviation industries due to its high strength-to-weight ratio.
- It forms the integral part of vanadium redox batteries that have the least ecological impact in energy storage.
- Vanadium alloys are durable in extreme temperature and environments, and are corrosion-resistant.

10.9 National Baseline Geoscience Data Generation Programmes

- To expedite exploration activities in the country, Geological Survey of India (GSI), has embarked upon an ambitious scheme to complete some major National level surveys by 2024:
    1. National Geochemical Mapping (NGCM),
    2. National Geophysical Mapping (NGPM),
    3. National Aero Geophysical Mapping Program (NAGMP).
- GSI would adopt deep penetration geophysical techniques such as Magneto-Telluric Surveys and Deep Seismic Reflection Surveys (DSRS).
- It has also initiated the National Geoscience Data Repository (NGDR).
- **National Geochemical Mapping (NGCM)** is an all India program to cover the entire surface area of India by geochemical sampling.
- It will generate distribution pattern of 62 elements (samples collected at 1km x 1km grid) for managing and developing natural resources, etc.
- **National Geophysical Mapping (NGPM)** program has been systematically generating basic and derived maps of Bouguer (Gravity) Anomaly and IGRF corrected magnetic total field maps of the country.
- For this, it conducts ground gravity and magnetic surveys in 1: 50,000 scale with an observation density of one station in 2.5 sq. Km., to cover the entire country with preference to Obvious Geological Province areas.
- **National Aero Geophysical Mapping Program (NAGMP)** tries to delineate concealed, deep seated structure/ litho-units capable of hosting mineralization, etc.
- It is for the first time that the multi-sensor aero-geophysical surveys (magnetic gradiometry and spectrometric) are being carried out.
- It is done by adopting such large regional scale survey parameters of 300 m traverse line spacing with aircraft flown at 80 m above ground level.
- **National Geoscience Data Repository (NGDR)** was developed by GSI is in consultation with BISAG-N.
- [BISAG-N or Bhaskaracharya Institute for Space Applications and Geoinformatics is a national institute under Ministry of Information & Technology]
- NGDR is a flagship initiative for collation of all the geoscience data of the country involving GSI, other national organizations, private sector agencies working in the domain and other stakeholders.
- It will integrate the collected data by GSI and the similar organizations to build a repository on the digital medium entailing multiple user access.

- It is planned that all the stakeholders from India and across the globe who are willing to participate in the current auction regime for allocation of mineral acreages will be able to use the NGDR.
- The planned Baseline Geoscience Data Collection campaign would lead to a database, which will be the input for future exploration programs.

11.3 National Atlas & Thematic Mapping Organisation

- National Atlas and Thematic Mapping Organization (NATMO), Kolkata is a subordinate department under the Department of Science & Technology.
- It is a sole national agency with the responsibility to depict national framework data in the form of thematic maps and atlases to cater the various needs of different sectors.
- It has the largest repository of spatial and non-spatial data processed with greater accuracy.
- Main functions of this organization are :
    1. Compilation of the National Atlas of India in Hindi, English and other regional languages.
    2. Preparation of thematic maps based on socio-economic, physical, cultural, environmental, demographic and other issues.
    3. Preparation of maps/atlases for visually impaired.
    4. Digital mapping and training using remote sensing, GPS and GIS technology.
    5. Cartographic and geographical researches at national level.

Gas Hydrates

- These are ice-like crystalline minerals formed when low molecular weight gas combines with water and freezes into a solid under low temperature and moderate pressure conditions.
- [Low molecular weight gases are methane, ethane, or carbon dioxide]
- Most gas hydrates are formed from methane (CH_4).
- Gas hydrates in the ocean can be associated with unique biological communities that use hydrocarbons or hydrogen sulphide for carbon and energy via chemosynthesis.
- They could also be dangerous as their decomposition can release ample methane.

11.4 Deep Ocean Mission

- The Cabinet Committee on Economic Affairs has approved the proposal of Ministry of Earth Sciences (MoES) on "Deep Ocean Mission".
- Deep Ocean Mission aims to explore the Deep Ocean for resources and develop deep sea technologies for sustainable use of ocean resources.
- It will be a mission mode project to support the Blue Economy Initiatives of the Government of India. Ministry of Earth Sciences (MoES) will be the nodal Ministry implementing this multi-institutional mission.
- The Deep Ocean Mission consists of the following six major components:
    1. Development of Technologies for Deep Sea Mining, and Manned Submersible,
    2. Development of Ocean Climate Change Advisory Services,
    3. Technological innovations for exploration and conservation of deep-sea biodiversity,
    4. Deep Ocean Survey and Exploration to explore and identify potential sites of multi-metal Hydrothermal Sulphides mineralization along the Indian Ocean mid-oceanic ridges,
    5. Energy and freshwater from the Ocean - Studies and engineering design for offshore Ocean Thermal Energy Conversion (OTEC) powered desalination plant are envisaged in this proof-of-concept proposal.
    6. Advanced Marine Station for Ocean Biology.
- The Government of India's Vision of New India by 2030 enunciated in 2019 highlighted the Blue Economy as one of the ten core dimensions of growth.

11.5 IMD's Doppler Radars

- The India Meteorological Department (IMD) will install seven new doppler radars in Maharashtra.
- Doppler radars of varying frequencies are used by the IMD to detect and track the movement of weather systems, cloud bands and gauge rainfall over an area of 500 km, with effective range of up to 250 km.
- With the radar observations, updated every 10 minutes, forecasters can follow the development of weather systems as well as their varying intensities, and accordingly predict weather events and their impact.
- There are different types of Doppler Radars, which vary with frequencies in which they operate - S-band, C-band and X-band.
    - X-band radar - It is used to detect thunderstorms and lightning as it is more sensitive and can detect smaller particles.
    - C-band radars - The signal is more easily attenuated, so this type of radar is best used for short range weather observation. It guides at the time of cyclone tracking.
    - S band radars - Because of the wavelength and frequency, S band radars are not easily attenuated. So, they are useful for near and far range weather observation.
- The Doppler radars are operational at eight locations in India's east coast (which is frequently affected by the cyclones formed in the Bay of Bengal), four locations in the west coast as well as in other locations.

Doppler Effect

- Doppler Effect (or Doppler shift) is the difference between the observed frequency and the emitted frequency of a wave for an observer moving relative to the source of the waves.
- It was proposed by Austrian physicist Christian Doppler in 1842.
- It says, "When the source and the signal are in relative motion to each other there is a change in the frequency observed by the observer."
- If they are moving closer, frequency increases and vice versa.

RADAR

- Radio Detection and Ranging (Radar) is a detection system that uses radio waves to determine the distance (range), angle, or velocity of objects. A radar system consists of,
    - A transmitter producing electromagnetic waves in the radio or microwaves domain(pulsed or continuous),
    - A transmitting antenna and a receiving antenna and
    - A receiver and processor to determine properties of the object(s).
- Radio waves from the transmitter reflect off the object and return to the receiver, giving information about the object's location and speed.
- RADAR can be used to detect aircraft, ships, spacecraft, guided missiles, motor vehicles, weather formations, and terrain.

Doppler RADAR

- It is specialized radar that uses the Doppler Effect to produce velocity data about objects at a distance.
- It does this by bouncing a microwave signal off a desired target and analyzing how the object's motion has altered the frequency of the returned signal.
- This variation gives direct and highly accurate measurements of the radial component of a target's velocity relative to the radar.

11.6 National Monsoon Mission

- Under the National Monsoon Mission (NMM), state-of-the-art weather and climate prediction models are developed.
- These include models for short range to medium range (1-10 days), extended range (10 days to 30 days) and seasonal (up to one season).
- Launched by the Ministry of Earth Sciences (MoES) in 2012, thismission is a dynamical prediction system for monsoon rainfall on different time scales.

- It is executed and coordinated by Pune-based Indian Institute of Tropical Meteorology (IITM).
- It aims to improve the monsoon prediction over India on all time scales and hence it is implemented for the whole country which includes all the States and UTs.
- Climate Forecast System (CFS) of National Centres for Environmental Prediction (NCEP), US has been identified as the basic modelling system for the above purpose.

Models

- MoES has considered to use the following numerical models :
  1. American model Climate Forecast System (CFS) developed by NCEP, NOAA National Weather Service, USA.
  2. Unified Model (UM), developed by the United Kingdom Meteorological Office (UKMO), UK.
- **CFS model** is a coupled ocean-atmosphere modelling system.
- It combines data from ocean, atmosphere and land for providing long range forecasting (seasonal prediction of Indian Monsoon).
- Model developments on CFS will be implemented by IITM, with atmospheric initial conditions from NCMRWF and Ocean initial conditions from INCOIS.
- **UM model** will be utilized for short to

11.7 Glacial Lake Atlas

- The Department of Water Resources, River Development and Ganga Rejuvenation (DoWR, RD & GR) under the Ministry of Jal Shakti have released the updated Glacial Lake Atlas of Ganga Basin.
- For the present study, glacial lakes with water spread area greater than 0.25 ha were mapped using Resourcesat-2 (RS-2) Linear Imaging Self Scanning Sensor-IV (LISS-IV) satellite data.
- Based on its process of lake formation, location, and type of damming material, glacial lakes are identified in 9 types, grouped into 4 categories.
- The present glacial lake atlas is based on the inventoried glacial lakes in part of Ganga River basin from its origin to foothills of Himalayas. The study portion of the basin covers part of India and transboundary region.
- This Atlas is available on Bhuvan portal of National Remote Sensing Centre (NRSC), India WRIS Portal and National Hydrology Project (NHP) website.
- **Role of NRSC** - NRSC under the NHP is carrying out hydrological studies using satellite data and geospatial techniques.
- It is responsible for forming a detailed glacial lake inventory, prioritization for GLOF risk, and simulation of GLOF for selected lakes has been taken up for all the catchments of Indian Himalayan Rivers.
- Under this activity, an updated inventory of glacial lakes using high resolution satellite data was prepared for the Indus River basin in 2020.
- **Uses** - The Glacial Lake Atlas can be used for managing the glacial lakes, and to mitigate the possible impacts of Glacial Lake Outburst Floods (GLOF) and climate change.
- It provides database for regular or periodic monitoring changes in spatial extent (expansion/shrinkage), and formation of new lakes.
- Central and State Disaster Management Authorities can make use of the atlas for disaster mitigation planning and related program.

NHP-Bhuvan Portal

- The Secretary, Department of Space & Chairman of ISRO launched the National Hydrology Project or NHP–Bhuvan portal of NRSC.
- This portal is a repository of information on the initiatives undertaken by NRSC under NHP with a facility to download the reports and knowledge products being developed by NRSC.
- This initiative under NHP is a step towards facilitating acquiring reliable information and putting the same in public domain which would pave the way for an effective water resource development and management.

11.8 Shift in September Monsoon Rainfall

- A research showed that monsoon precipitation is sensitive to the choice of irrigation practices in South Asia. It investigated the impact of agricultural water use on the Indian Summer Monsoon using a climate model.

- It found that excess irrigation over northern India shifts the September monsoon rainfall towards the north-western part of the subcontinent increases widespread weather extremes over Central India.
- This is also caused by an increase in irrigation and consequent increase in evapotranspiration [Evapotranspiration is the sum of evaporation from the land surface plus transpiration from plants.]
- Meteorological hazards expose the vulnerable farmers and their crops to risks of failure.
- Increasing crop risk is predominantly driven by the decreasing number of farmers, and the wheat risk is also attributed to increasing minimum temperatures during the crop growing season.
- The findings on irrigation-monsoon feedbacks and the agri-cartographic products will directly benefit the National Initiative on Climate Resilient Agriculture by the GoI.

National Initiative on Climate Resilient Agriculture

- National Initiative on Climate Resilient Agriculture (NICRA) was launched in 2011 by Indian Council on Agricultural Research (ICAR) to enhance the resilience of agriculture to climate change.
- [ICAR is an autonomous body responsible for coordinating agricultural education and research in India that reports to the Department of Agriculture and Research (DARE) in the Ministry of Agriculture.]
- NICRA recognizes India's vulnerability to climate change with nearly half of its population dependent on agriculture. Objectives of NICRA are,
    - **Research** to improve production and risk management so as to enhance climate resilience of Indian agriculture.
    - **Technology demonstration** to enable vulnerable districts in coping with climate change through demonstration of site specific technologies on farmer s fields.
    - **Capacity building** of scientists and other stakeholders in climate resilient research.

11.9 Yerrapalli Formation

- It is a Triassic rock formation consisting primarily of mudstones that outcrops in the Pranhita-Godavari Basin in south-eastern India.
- It preserves fossils of freshwater and terrestrial vertebrates as well as trace fossils of invertebrates.
- Apart from this Bharitalasuchus tapani, the fossil assemblage of the Yerrapalli Formation includes many other extinct creatures such as ceratodontid lungfish, rhynchosaur and allokotosaurian.
- Yerrapalli Formation (fossiliferous locality) is gradually being destroyed by deforestation, mining, agricultural expansion, urbanisation, etc.,

11.10 Inland Navigation

- The National Waterways (NWs) that are operational are,
    a) NW-1 (Ganga-Bhagirathi-Hooghly river system from Allahabad to Haldia),
    b) NW-2 (River Brahmaputra from Dhubri to Sadiya),
    c) NW-3 (West Coast Canal from Kottapuram to Kollam along with Udyogmandal and Champakara Canals)
- Also, NW-10 (river Amba), NW-68 (Mandovi), NW-73 (Narmada), NW-83 (Rajpuri Creek), NW-85 (Revadanda Creek-Kundalika River System), NW-91 (Shastri river-Jaigad creek system), NW-97 (Sunderbans Waterways), NW-100 (Tapi) and NW-111 (Zuari) are operational.
- Navigability of the waterway is monitored through regular hydrographic surveys and channel inspection by Regional Directorates supported by Sub-Regional Offices located along the NWs.
- A constant vigil is kept on the river regime behaviour and accordingly appropriate river conservancy measures are taken to ensure fairways for safe movement of vessels.
- Based on the observation during channel inspection and hydrographic surveys, River Notices are issued and placed on Inland Waterways Authority of India (IWAI) website.

- River Information System (RIS) aims to streamline the exchange of information between waterway operators and users to optimize traffic and transport processes in inland navigation.
- RIS has been commissioned on NW-1 (river Ganga) which is operational between Haldia-Farakka (Ph-I) and Farakka - Patna (Ph-II) stretches of the waterway.

12. PLACES IN NEWS

12.1 Thousand Islands

- Thousand Islands (Kepulauan Seribu) are chain of islands north of Jakarta's coast, Indonesia.
- There are exactly 110 islands that together form a District, encompassing the Pulau Seribu National Marine Park.
- These islands are initially caused by the volcanoes.
- Later, the shifting of tectonic plates results in their consolidation as a grouping of small islands in a relatively small area.

12.2 Sangay Volcano

- Ecuador's Sangay volcano erupted, spewing clouds of ash. Sangay volcano has been in an eruptive stage since 2019.
- [Ecuador, part of the Pacific Rim's "Ring of Fire" region, has eight volcanoes in its territory.]
- Sangay volcano - one of the world's highest active volcanoes and one of Ecuador's most active ones - is located in the northern zone of the Andes
- It is the southernmost stratovolcano (Stratovolcano is a volcano that comprises of the alternate layers of lava and ash.)
- It had frequently erupted in historic times, mostly of strombolian type.
- [Strombolian volcanic eruption comprises of mild blasts of the lava bombs, incandescent cinders and lapilli.]
- The earliest report of a historical eruption was in 1628. More or less continuous eruptions were reported from 1934 to the present.
- The constant eruptions have caused frequent changes to the morphology of the summit crater complex. The present-day volcano is built within horseshoe-shaped calderas of two previous edifices.

12.3 Suez Canal Lakes

- Due to the blockage of the Suez Canal, the $200 billion of India's trade flows with Europe, North America and South America is at risk.
- Opened in 1869, Suez Canal is an artificial sea-level waterway in Egypt.
- It connects the Mediterranean Sea to the Red Sea through the Isthmus of Suez in Egypt, and divides Africa and Asia.
- It offers watercraft a more direct route between the North Atlantic and northern Indian oceans, avoiding the South Atlantic and Indian oceans.

- It provides the shortest maritime route between Europe and the lands lying around the Indian and western Pacific oceans.
- There are many lakes in the Suez Canal.

12.4 Mount Sinabung

- Mount Sinabung, located in the Karo regency, North Sumatra province of Indonesia erupted, belching volcanic ash and smoke 3,000 metres into the sky.
- The volcano has been active since 2010 when it erupted after nearly 400 years of inactivity.
- The eruptive phase began in September 2013 and continued uninterrupted till June 2018, according to the National Museum of Natural History's Global Volcanism Program.
- Indonesia is home to many active volcanoes owing to its location in the "Ring of Fire" or the Circum-Pacific Belt - an area along the Pacific Ocean characterised by active volcanoes and frequent earthquakes.

12.5 Mount Nyiragongo Volcano

- After a week Mount Nyiragongo volcano in the Democratic Republic of Congo (DRC) erupted, earthquakes are still being reported around it.
- **Location** - Mount Nyiragongo is an active stratovolcano in the Virunga volcanic chain inside the Virunga National Park, which has been listed in the UNESCO's List of World Heritage in Danger.
- Nyiragongo owes its existence to the activity of the African Great Rift (Albertine Rift). The rift is constantly extending and opening.
- **Particularly dangerous** - As the Mount Nyiragongo is located on a highly active segment of the African rift, the magma ascents quickly from about 100 km beneath the Earth's surface.
- Another reason for concern is the extreme fluidity of the lava that allows little time for people to escape.
- Other dangers associated with rifting, and volcano activity in the region,
    1. Dangerous earthquakes;
    2. Explosions when the hot lava reaches Lake Kivu waters causing its sudden boiling;
    3. Release of carbon-rich gases, particularly methane, during rifting and eruption, leading to explosions;
    4. Potential for carbon-rich gas accumulation at the bottom of lake Kivu, which may cause surface water to sink, releasing lethal gases threatening Goma.
- Following the last eruption in 2002, the National Institute of Geophysics and Volcanology in Italy started a programme of hazard evaluation and risk mitigation from lava flow invasion in Goma, DRC.
- Nyiragongo and nearby Nyamuragira are together responsible for 40% of Africa's historical volcanic eruptions.

12.6 Baralacha Pass

- The Border Roads Organisation (BRO) would reopen the Baralacha Pass, which is a high mountain pass in Zanskar range, connecting Lahaul district in **Himachal Pradesh** to Leh district in **Ladakh**.
- Situated along the Leh–Manali Highway, it acts as a water-divide between Bhaga river and Yunam river.
- Bhaga river, a tributary of the Chenab river, originates from Surya taal lake, which is situated a few of kms from the pass towards Manali.
- Chandra, a major tributary of the Chenab River, also originates from a glacier in this region.
- The native name of Chenab, "Chandrabhaga", represents the union of Chandra and Bhaga rivers downstream.

12.7 Nag River

- The Nag River Pollution Abatement Project has been approved under the National River Conservation Plan.

- It will be implemented by the National River Conservation Directorate.
- **Nag River**, which flows through Nagpur city, is a highly polluted channel of sewage and industrial waste.
- Origin - Western weir of **Ambazari Lake** in west Nagpur.
- Nag River is the main river along with the other, River Pili Nadi.
- The Nag River and River Pili Nadi later merge, and join the **River Kanhan** near the city outskirts.

12.8 Rule Curve of Mullaperiyar Dam

- The Supreme Court said that Tamil Nadu Chief Secretary is "personally responsible" for the failure to give information on the rule curve for Mullaperiyar dam to the Court-appointed Supervisory Committee.
- **Rule curve** in a dam decides the fluctuating storage levels in a reservoir. The gate opening schedule of a dam is based on the rule curve. It is part of the "core safety" mechanism in a dam.
- The Court directed the Committee to submit a compliance report after issue directions or take steps to address the three core safety issues and,
    1. Monitoring and performance of the instrumentation of the dam,
    2. Finalising the rule curve and
    3. Fixing the gate operating schedule.

12.9 Inner Line Permit

- **U**ttarkhand government, in a recent meeting with Union Home Minister, had sought withdrawal of "inner-line permit" (ILP) system in Niti Valley (Chamoli district) and Nelang Valley (Uttarkashi district).
- They want the withdrawal for a better border management and expansion of tourism and other economic activities in villages there.
- The ILP system restricts movement in areas close to the border for everyone other than those with a formal permission.
- In Uttarkhand, tourists have to obtain ILP for locations near China border in the three districts of Uttarkashi, Pithoragarh and Chamoli.
- Among the 13 districts of Uttarkhand, 5 districts have borders with China and Nepal.
- Pithoragarh is strategically more sensitive as it shares boundaries with both China and Nepal.

Nelong Valley

- Nelong valley - 100 km from Uttarkashi - is an inner line area (India-China border) opened to domestic tourists only during the day.
- In Nelong valley, there are two villages - Nelong and Jadong - both of which have been abandoned since the 1962 war.
- Foreign tourists are prohibited in this area while domestic tourists are allowed entry with ILP. People cannot stay there at night.

Niti Valley

- Located at an altitude of 3600 metres, Niti village in Joshimath (Chamoli district) is the last populated village before China border.
- The Niti Pass was an ancient trade route between India and Tibet, and it was sealed after the 1962 Sino-Indian War.
- Foreign tourists can travel to Niti village after obtaining ILP from Joshimath for a single-day visit, but night stay remains prohibited.
- Domestic tourists can travel to the village any time in the year by producing any identity proof.
- The village remains populated with locals for 6 months in a year as they migrate to lower altitudes during winters due to adverse weather.

12.10 Milam Glacier

- It is a major glacier of the Kumaon Himalaya. It is located in Pithoragarh district of Uttarakhand.
- Milam village is open to tourists but movement in the valley after Lilam village is not allowed without ILP.
- Tourists come here for glacier trek. ITBP allows minimum number of tourists to enter the valley due to the risk of getting trapped in snowfalls.
- Villagers in Milam migrate to lower reaches in winters due to snowfall.

12.11 Vyas Valley

- Vyas valley, also known as Kalapani, is a Himalayan valley located in Dharchula, Pithoragarh district of Uttarakhand.
- It shares border with China and Tibet. Kuti is the last habitable village.
- Permit is required for tourists to visit Naabhi and Kuti villages. Domestic tourists require ILP to move after Chhiyalekh - 40 km before Kuti village.

12.12 Umngot River

- People of Meghalaya's villages fear the death of Umngot River and their tourism-based livelihood if the 210 MW hydroelectric project comes up.
- Umngot River is considered as the cleanest river in India and in some parts is as transparent as crystal and you can actually see the river bed.
- This river, which flows in both India and Bangladesh, is in Meghalaya.
- It is the natural boundary between RiPnar (of Jaintia Hills) with HimaKhyrim (of Khasi Hills).
- Over this river hangs a single span suspension bridge called Dawki Bridge.

12.13 Mekedatu

- The National Green Tribunal (NGT), Southern Zone, has appointed a joint committee to look into allegations of unauthorised construction activity taking place in Mekedatu, Karnataka.
- Mekedatu (means 'goat's leap') is a gorge along Kaveri where Arkavati merges with Kaveri. From this point, about 3.5 kilometers downstream, the river Kaveri flows through a deep and narrow gorge.
- In 2017, the Karnataka government had proposed to construct a dam in Mekedatu across the Cauvery River.
- This project received approval from the erstwhile Ministry of Water Resources for the detailed project report. It was opposed by Tamil Nadu government.

12.14 River Devika National Project

- The River Devika Project in Jammu & Kashmir is being compared with the pioneer "NamamiGange" project of the Central Government.
- The Devika river originates from the hilly Suddha Mahadev temple in Udhampur district of Jammu and Kashmir.
- It flows down towards western Punjab (now in Pakistan) where it merges with the Ravi river.
- The Devika river holds great religious significance as it is revered by Hindus as the sister of river Ganga.
- In 2019, the Devika Bridge in Udhampur was inaugurated. This Bridge takes care of traffic congestion and also ensures smooth passage of Army convoys and vehicles.