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MAINSTORMING 2019

ENVIRONMENT & GEOGRAPHY I

Shankar IAS Academy™

Door No 18, Old Plot No 109, New Plot No
259, AL Block, 4th Avenue, Shanthi Colony,
Anna Nagar, Chennai 600040.

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MAINSTORMING 2019

GEOGRAPHY AND ENVIRONMENT I (JUNE 2018 TO FEBRUARY 2019)

ENVIRONMENT

1. POLLUTION

1.1 Uranium Contamination in Ground Water

What is the issue?

- Reports of widespread uranium contamination in groundwater across India demand an urgent response.
- Groundwater contamination across India must be probed and mapped, and safe sources need to be identified.

What is the scenario of uranium contamination?

- Evidence** - A recent study, has found over 30 micrograms per litre (mcg/l) of the heavy metal in parts of north-western, southern and south-eastern India.
- Reports of uranium contamination has cropped up across India in recent years, with south Bangalore recording 2000 mcg/l of uranium in groundwater.
- Previously, regions of Andhra Pradesh and Telangana were found to have over 500 mcg/l of uranium in their aquifers.
- More recently, parts of Gujarat and Rajasthan recorded undesirable uranium levels in their waters.
- Regulations** - Drinking such water can damage one's kidneys, and the World Health Organization (WHO) prescribes '30 mcg/l' as an upper limit.
- But unfortunately, the residents of the regions surveyed were using wells recording far greater uranium levels as their main source of drinking water.
- Significantly, as the "Bureau of Indian Standards" does not specify a norm for uranium level, water is not tested regularly for it.

Tainted groundwater

Sixteen States show a high prevalence of uranium concentrations above the WHO provisional guideline value (30 μ g/L)

- India has no standards for uranium levels in groundwater
- There have been reports of high levels of uranium in Andhra Pradesh
- Over-pumping of groundwater causes a decline in water levels
- This induces oxidation conditions that enhance uranium enrichment in shallow groundwater



Source:
"Large-Scale Uranium Contamination..." Rachel M. Coyte et al.

What are the health effects?

- Preliminary studies on the health effects of drinking uranium-tainted water among animals and humans have revealed that it causes kidney damage.
- Notably, this is said to be caused by the chemical effect of uranium, rather than a radiological, even though uranium is radioactive.
- Nonetheless, we need more comprehensive systematic studies to establish the chronic health effects of uranium exposure.

How does uranium enter ground water?

- The mechanism by which uranium enters groundwater is still under research.
- Two types of terrains have been identified with heavy contamination, namely:
 - Alluvial aquifers in Rajasthan and other north-western regions
 - Crystalline rocks such as granite in southern regions like Telangana.

- Some researchers have hypothesized that over-extraction of ground water exposes uranium to air, which triggers its release from the rocks.
- Further research is needed in this regard as it would help in identifying regions where safer water can be found.
- Notably, even information of how uranium accumulated with the rocks (during sedimentation), would help in estimating the regions of prevalence.

1.2 Dealing with Petcoke

What is the issue?

- With restrictions on sulfur consumptions, petcoke is getting to be a favourable alternative.
- India has to react appropriately to this in the context of the environmental implications involved.

What is the recent challenge?

- Sulfur is a common impurity in crude that can cause respiratory problems and acid rain when it's burned.
- The global shipping industry has started implementing regulations to limit its sulfur consumption.
- This will make the bunker fuel used in ships cleaner than the crude oil produced worldwide.
- Traditionally, it has been the cheapest, dirtiest fraction from refining.
- The rules on sulfur content will come into force at the start of 2020.
- The oil market and refiners would thus have to find another way to dispose of their by-products.
- One popular way of disposing this of late has been to sell it to India as a cheap petcoke.

How is petcoke an alternative?

- Petroleum coke or petcoke is a spongy, solid residue from oil distillation.
- It is a coal substitute and can be burned for fuel in the same manner as coal.
- It notably has a higher energy content.
- Petcoke has become an attractive raw material for power stations and cement plants in India.
- The loophole in India's environmental taxes has facilitated this.
- Plain old coal attracts a clean-energy levy that has risen to Rs.400 a metric ton since it was introduced in 2010.
- On the other hand, petcoke has been exempt from this levy.
- Indian price for coal of comparable heating values in the region is Rs. 4,000 a ton.
- Given this and the high tax, petcoke has been a favourable alternative.
- Similar levy issues have favoured petcoke over natural gas as well.

How has petcoke use been?

- Petcoke was the fastest-growing fraction of oil demand in India.
- Its consumption is the second-biggest share of India's petroleum consumption after diesel.
- It has outstripped even LPG and gasoline.
- While petcoke is richer in energy than coal, it can have 20 times as much sulfur too.
- The choking smogs have made India's cities the world's most polluted in recent years.

What are the measures?

- The Supreme Court last year banned the use of petcoke in New Delhi and adjacent states.
- It however allowed a reprieve for the cement companies that consume about half of it.
- Cement plants currently escape the court ban on the grounds that all their sulfur is removed in the production process.

- Government is planning a nationwide ban on using petcoke as fuel.
- Also, there are, reportedly, measures to halt imports.
- This is because petcoke produced overseas now accounts for about 40% of supply.
- Much of it is from U.S. refineries processing heavy Canadian and Latin American crude.

1.3 Construction and Demolition(C&D) Waste

What is the issue?

- The Supreme Court has stayed construction activity in States that do not have a solid waste management policy.
- In this context, understanding the Construction and Demolition (C&D) Wastes' potential becomes essential.

What is Construction and Demolition Waste?

- Construction and demolition waste (C&D) is generated during the construction, renovation, and demolition of buildings or structures.
- These wastes include materials such as concrete, bricks, wood and lumber, roofing, drywall, landscape and other wastes.
- Construction and Demolition Waste Management Rules 2016 was released by Ministry of Environment.
- It clearly defines the duties of Waste Generator, Service providers and Contractors, State Government and Local Authorities and Pollution Control boards.
- C&D wastes can revolutionize the construction industry, especially the Housing Industry, if they are properly reused.

What are the guidelines in place?

- Earlier in 2012 the Ministry of Urban Development urged States to set up C&D waste management facilities.
- The Central Pollution Control Board (CPCB), in 2017, brought out the guidelines on Environmental Management of C&D Wastes in India.
- It observed that Construction accounted for nearly 65% of the total investment in infrastructure.
- Therefore it becomes more important to know how to effectively manage construction and demolition waste.
- Further the CPCB's Waste Management Rules of 2016 and the guidelines 2017 mentions clear timelines on
 - formulating policies
 - identifying sites for processing
 - commissioning the wastes

What are the concerns?

- Despite the above, the performance of industry and the State pollution control boards is poor.
- Around 25-30 million tons of C&D waste is generated annually in India of which only 5% is processed.
- It is significant that 36% of C&D waste comprises soil, sand and gravel.
- This waste impacts soil fertility and is a health hazard in urban areas.
- The virtual absence of recycling also goes against India's commitments with respect to carbon emission reduction.
- There is an urgent need to recycle C&D waste.
- This is because the rampant sand mining is already destroying river beds and eventually worsening the impact of floods.

What could be done?

- Promoting Green buildings, which entail that C&D waste is utilized, can be made mandatory all over the country.

- At present they are only incentivized in certain States.
- As the 2016 rules have pointed out, the Bureau of Indian Standards and Indian Roads Congress should initiate processes for the use of recycled material.
- For example, pavements and drainage structures can be made this way.
- Recycling will reduce housing costs, given the materials shortage, and can be an integral aspect of 'affordable housing'.
- The construction sector should be more environmentally responsible, by shifting to the use of recycled water and recycling its own waste.
- All stakeholders, especially States and industry, need to create an environmentally sustainable ecosystem.

1.4 Emission Standards for Thermal Plants

What is the issue?

- Thermal power plants failed to comply with new emissions standards notified in 2015, by December 2017 deadline.
- Implementation remains unclear, even with the new opportunity to comply over a five-year period that ends in 2022.

Why is it significant?

- Air quality is no longer a seasonal irritant as a public health crisis is looming.
- It may adversely impact public and private spending on health care.
- The health cost borne by society, if the standards are not implemented, far exceeds the implementation cost.
- It could make India's cities less attractive for investment.
- It may also weaken long-term productivity, due to an unhealthy population.
- So it is crucial that the emission standards are implemented by the power plants.

What are the directions?

- The Central Pollution Control Board issued an order in December 2017.
- It lays out a clear implementation plan for
 - i. electrostatic precipitator (ESP) retrofits (components) aimed at particulate matter
 - ii. flue-gas desulfurisation (FGD) units for reducing sulphur oxides (SOx) emissions from power plants
- A successful reduction in emissions from power plants will depend on:
 - i. plant operators investing in retrofits
 - ii. regulators permitting a full price revision for additional costs
 - iii. decline of bulk procurement costs for utilities

What are the concerns and challenges?

- Power Utilities currently incur losses to the tune of Rs 700 billion a year from their operations.
- This is because consumers are either subsidised or given free electricity, due to political pressures.
- Utilities are thus unable to recover even the cost of supplying power.
- So they are unlikely to recover higher costs resulting from plant retrofits.
- The installation and operation of these retrofits could increase the cost of procuring from coal-fired power stations.
- It could result in an increase of 20% on the average costs of procurement today.
- In turn, plant operators are concerned about their capital investment if utilities do not pay up.
- The pace of implementation of the standards is thus well off the mark and there could be further delays.

- Another challenge is that India has followed a command and control approach.
- It does this by setting almost a uniform standard for all plants.
- The United States had addressed an earlier acid rain issue through a comprehensive cap-and-trade mechanism for SOx emissions.
- But India has many challenges in rolling out a cap-and-trade regime including:
 - i. low levels of monitoring of emissions
 - ii. low capacity within state pollution control boards
 - iii. lack of a cadre of administrators to monitor

1.5 Supreme Court Ruling on Firecrackers

Why in news?

The Supreme Court recently gave some guidelines in line with the sale, manufacture and use of firecrackers.

What are the guidelines?

- The ban came on the basis of a petition filed by two infants through their fathers in 2015.
- They said the air pollution caused by various factors, especially firecrackers, made Delhi a gas chamber and pleaded for their right to life.
- **Time** - The Supreme Court restricted the use of fireworks during Deepavali and other festivals to an 8-10 pm window.
- For Christmas and New Year, the time slot allowed is half-an-hour, between 11.55 p.m. and half-past midnight.
- **Manufacture** - The court banned crackers that are loud and toxic to man, animal and the environment.
- It banned the manufacture, sale and use of joined firecrackers (series crackers or 'laris').
- It held that they caused "huge air, noise and solid waste problems."
- It allowed the manufacture and sale of only "green" and reduced-emission or "improved" crackers.
- **Sale** - The sale of green and improved crackers would be only through licensed traders.
- The court banned the online sale through e-commerce websites, including Flipkart and Amazon.
- Any e-commerce company selling crackers online would amount to contempt of court.
- It may also invite orders of monetary penalties from the court.
- **Community** - The court urged the Central and State governments to permit "community" bursting of crackers during festivities in pre-designated areas.
- In the case of Delhi and the National Capital Region (NCR), the court made it mandatory.
- It gave the Centre, the Delhi and other State governments, whose areas fall within the NCR, a week's time to identify these pre-designated areas.
- It directed that the public should be informed about the designated places a week before Diwali.
- **Violation** - Local Station House Officers would be held personally liable and hauled up for contempt by the court if there was any violation of the judgement.
- This applies both to the time slots for bursting crackers and the sale of banned crackers.
- **PESO** - The court banned the use of barium salts in fireworks.

Green crackers

- They do not contain harmful chemicals that would cause air pollution.
- Components are replaced with others that are less dangerous and less harmful to the atmosphere.
- The idea was carried forward by a network of CSIR labs.
- The team came up with 3-4 formulations and looked at 30-40% of active materials which reduce particulate matter.
- Potential sound-emitting functional prototypes that do not emit sulphur dioxide were also developed.
- These crackers are named as Safe Water Releaser (SWAS), Safe Thermite Cracker (STAR) and Safe Minimal Aluminium (SAFAL).
- These have the unique property of releasing water vapour and/or air as dust suppressant and diluent for gaseous emissions.

- It entrusted the Petroleum and Explosives Safety Organisation (PESO) in this regard.
- PESO will have to ensure that only fireworks with permitted chemicals are sold or purchased during festivities or celebrations.
- It should also test and check for the presence of banned chemicals like lithium/arsenic/antimony/lead/mercury.
- It has to ensure that only those crackers whose decibel (sound) levels were within the limits are allowed in the market.
- PESO has been empowered to suspend the licences and appropriately dispose of stocks of manufacturers who violated the court's directions.

What is the court's rationale?

- The court rejected arguments that bursting crackers was a fundamental right.
- It also ruled it out as being an essential practice during religious festivals like Diwali.
- It held that Article 25 (right to religion) is subject to Article 21 (right to life).
- So a religious practice that threatens the health and lives of people is not entitled to protection under Article 25.
- The ruling has thus struck a balance between two rights -
 - i. right of the petitioners under Article 21 (right to public health)
 - ii. right of the manufacturers and traders under Article 19(1)(g) (right to practice any profession or to carry on any occupation, trade or business)

1.6 Enforcement of BS-VI standards in India

Why in news?

Supreme Court ordered a complete ban on the sale and registration of Bharat Stage IV (BS-IV) vehicles in the country from April 1, 2020.

What was the ruling?

- The manufacturers were allowed to manufacture BS-IV vehicles till March 31, 2020
- So the government proposed to give reasonable time till June 30, 2020, to sell those BS-IV vehicles.
- However, the court ordered that only BS-VI vehicles will be allowed after the April 1, 2020, at the same time BS-VI grade petrol and diesel would also come into force across the country.
- The court also said that the right to life (Article 21) includes the right of a citizen to live in a clean environment
- The court said the need of the hour was to move towards usage of cleaner fuel along with developing an engine accommodative to the fuels.

| Standard | Reference | Year | Region |
|------------|-----------|---------------|--|
| India 2000 | Euro 1 | 2000 | Nationwide |
| BS-II | Euro 2 | 2001 | NCR, Mumbai, Kolkata, Chennai |
| | | 2003 | NCR, 13 Cities |
| | | 2005 | Nationwide |
| BS-III | Euro 3 | 2005 | NCR, 13 Cities |
| | | 2010 | Nationwide |
| BS-IV | Euro 4 | 2010 | NCR, 13 Cities |
| | | April, 2017 | Nationwide |
| BS-V | Euro 5 | (Skipped) | - |
| BS-VI | Euro 6 | April, 2018 | Delhi NCR (BS VI Fuel only) |
| | | January, 2019 | 13 Cities (BS VI Fuel only) |
| | | April, 2020 | Nationwide (Both BS Fuel & Compliant vehicles) |

What are Bharat Stage emissions standards?

- The Bharat Stage emission standards are standards instituted by the government to regulate the output of air pollutants from the internal combustion engines.
- It includes both emission standards for new vehicles as well as specifications for commercial petrol and diesel fuels.

- In April 1999 the Supreme Court of India ruled that all vehicles in India have to meet Euro I or India 2000 norms by 1 June.
- The Central Pollution Control Board sets timelines and standards which have to be followed by automakers.
- BS norms are based on European emission norms which are referred to in a similar manner of ‘Euro 4’ and ‘Euro 6’.
- Implementation of the intermediate BS-V standard was originally scheduled for 2019.
- But the Centre had announced that the country would skip the BS-V norms altogether and adopt BS-VI norms by 2020.

What is the difference between BS-IV and BS-VI standards?

- The main difference between the existing BS-IV and the upcoming BS-VI auto fuel norms is the **presence of sulphur**.
- The BS-VI fuel is estimated to bring around an 80% reduction of sulphur, from 50 parts per million to 10 ppm.
- The emission of NOx (**nitrogen oxides**) from diesel cars is also expected to come down by nearly 70% and 25% from cars with petrol engines.
- Also, BS VI will bring the cancer causing **particulate matter** in diesel cars by a phenomenal 80%.

What are the concerns raised?

- The Supreme Court verdict may hit the automobile industry as it takes years for automakers to develop a new kind of an engine or to tweak around with the current ones used in their vehicles.
- Then comes the task of setting up full scale production comes up.
- All of this comes at a cost which eventually makes the vehicle more expensive.
- This is a cause of concern for automakers given how price sensitive the Indian market is.
- In the previous transition, automakers were supposed to make their models BS IV compliant by April 1, 2017.
- While some automakers have met the targets and updated their products, there is a huge stock of vehicles left to be sold into the market that are BS-III compliant and as per the latest SC decision, they won’t be able to do so.
- Recently, Society of Indian Automobile Manufacturers (SIAM) had told the court that the companies were holding stock of around 8.24 lakh such vehicles.
- Also, there is also the requirement of cleaner fuel to run these vehicles that comply with a stricter emission regulation as it is not feasible to make internal combustion engines pollute less while using poor quality of fuel.
- Using the introduction of higher grade fuel will be beneficial only if it is done in tandem with the rollout of BS-IV compliant vehicles.
- Using BS-VI fuel in the current BS-IV engines or, conversely, running BS-VI engines on the current-grade fuel, may be ineffective in curbing vehicular pollution.
- The Centre argues that automakers have been given enough time for the transition and they have done their part to provide cleaner fuel.
- However, automakers have a huge stock that does not comply with the soon-to-be-implemented BS VI emission norm and they risk facing huge losses.

1.7 Air pollution report – WHO

Why in news?

The report on air pollution and child health was recently released by the WHO on the sidelines of its first ever global conference on Air Pollution and Health.

What does the report contain?

- About 93% of the world’s children under the age of 15 (1.8 billion children) breathe polluted air every day that puts their health and development at serious risk.

- This includes 630 million children under 5 years, and 1.8 billion children under 15.
- Many of these children die, with as many as six lakh estimated to have died in 2016 alone due to complications from acute lower respiratory infections caused by dirty air.
- In low- and middle-income countries, 98% of all children under 5 are exposed to PM2.5 levels above WHO air quality guidelines and in high-income countries, the figure is 52%.
- Air pollution also impacts neurodevelopment and cognitive ability and can trigger asthma, and childhood cancer.
- Children exposed to high levels of air pollution may be at greater risk for chronic diseases such as cardiovascular disease later in life.
- It can damage children's lung function, even at low levels of exposure.
- Also, when pregnant women are exposed to polluted air, they are more likely to give birth prematurely, and have small, low birth-weight children.
- One reason why children are particularly vulnerable to the effects of air pollution is that they **breathe more rapidly** than adults and so absorb more pollutants.
- They also live closer to the ground, where some pollutants reach peak concentrations at a time when their brains and bodies are still developing.
- In addition, new borns and small children are often at home.
- If the family is burning fuels like wood and kerosene for cooking, heating and lighting, they would be exposed to higher levels of pollution.

Why the air pollution is high in northern India?

- Air pollution is choking several cities in the northern States, as changes in temperature and slowing winds trap soot, dust and fine particulate matter.
- Delhi's air quality was on the brink of turning "**severe**" recently, which falls in the 'very poor' category at that time.
- The System of Air Quality and Weather Forecasting and Research (SAFAR) also said the upcoming days are expected to see a sharp deterioration of air quality in Delhi-NCR.
- This is due to a western disturbance system in the north of India which is bringing moisture and a cyclonic system on the eastern side which is suppressing winds.
- There is also the increased burning of paddy straw in Punjab and Haryana, evident from images released by NASA, which brings the wind from the northwest.
- Its footprint may be growing because of wider use of mechanical harvesters that is producing more waste.
- Burning of agricultural residue also releases large volumes of smoke containing, among other pollutants, highly damaging fine particulates, or PM2.5.
- All this, combined with Delhi-NCR's own pollution sources, could lead to a spike in pollution.
- The problem is aggravated by the burning of urban waste, diesel soot, vehicular exhaust, road and construction dust, and power generation.

What should be done?

- The UNEP's recent report pointed out that only 8% of the population in the countries of the Asia and the Pacific get to breathe air of acceptable quality.
- A study of degradation of Delhi's air over a 10-year period beginning 2000 estimated premature mortality to have risen by as much as 60%.
- With the steady growth in the population of the capital and other cities, the trauma is set to worsen.
- Although India has nine of the 10 most polluted cities in the world, it has not taken consistent action on pollution.
- Tens of millions live with ambient air quality that is well short of even the relaxed parameters the country has set for fine particulates, compared with those of the WHO.

- Hence, India should now give high importance to the WHO warning about air pollution.
- The ‘severe’ air quality rating for Delhi and poor conditions prevailing in other cities in the Indo-Gangetic Plain should compel a decisive shift in policy.
- The Centre and the State governments need to get into crisis mode to dramatically reduce emissions.
- They must address the burning of carbon, which is a direct source, and emissions with oxides of nitrogen and sulphur from vehicles that turn into fine particulates through atmospheric reactions.
- Failure to take sustainable and urgent measures will inflict long-term harm on public health, affecting children even more by putting them at higher risk for diseases.
- An innovative approach could be to use climate change funds to turn farm residues into a resource, using technological options such as converting them into biofuels and fertilizers.
- From an urban development perspective, large cities should reorient their investments to prioritise public transport, favouring electric mobility.
- Governments should make the use of personal vehicles in cities less attractive through strict road pricing mechanisms.
- Also, sharply escalated, deterrent parking fees can be implemented in crowded areas of the sprawling cities.
- Finally, public pressure must force governments to act, if they delay action on the critical issue of pollution control.

1.8 National Clean Air Programme

Why in news?

The Centre recently launched the National Clean Air Programme (NCAP).

What are the features of the programme?

- **Objective** - The overall objective of the programme includes comprehensive mitigation actions for prevention, control and abatement of air pollution.
- It also aims to augment the air quality monitoring network across the country and strengthen the awareness and capacity building activities.
- Also, city-specific action plans are being formulated for 102 non-attainment cities that are considered to have air quality worse than the National Ambient Air Quality Standards.
- The Smart Cities programme will be used to launch the NCAP in the 43 smart cities falling in the list of the 102 non-attainment cities.
- **Target** - It proposes a tentative national target of 20%-30% reduction in PM_{2.5} and PM₁₀ concentrations by 2024, with 2017 as the base year for comparison.
- However, the government has stressed that NCAP is a scheme, not a legally binding document with any specified penal action against erring cities.
- **Implementation** - NCAP talks of a collaborative, multi-scale and cross-sectoral coordination between central ministries, state governments and local bodies.
- The CPCB will execute the nation-wide programme for the prevention, control, and abatement of air pollution within the framework of the NCAP.
- NCAP will be “institutionalised” by respective ministries and will be organised through inter-sectoral groups that will also include the Ministry of Finance, Ministry of Health, NITI Aayog, and experts from various fields.
- Other features of NCAP include –
 1. Increasing the number of monitoring stations in the country including rural monitoring stations
 2. Technology support
 3. Emphasis on awareness and capacity building initiatives
 4. Setting up of certification agencies for monitoring equipment
 5. Source apportionment studies

6. Emphasis on enforcement
7. Specific sectoral interventions.

What are the proposed mitigation measures?

- **Enforcement** - It calls for stringent enforcement through a web-based, three-tier mechanism that will review, monitor, assess and inspect to avoid any form of non-compliance.
- The experience indicates lack of regular monitoring and inspection as the major reason for non-compliance.
- Trained manpower and regular inspection drive will be ensured for stringent implementation purpose.
- It also calls for an “extensive plantation drive” at pollution hotspots and execution.
- However, it is not made clear how much air pollution this will seek to reduce.
- **Elaborating existing schemes** – While some of the strategies are not new to India, NCAP appears to be targeting effective implementation.
- For example, it talks of “congestion management” at traffic junctions by the traffic police, solid waste management by municipal corporations, and stringent industrial standards put in place by concerned ministries.
- For power sector emissions, it refers to emission standards set by the Ministry of Environment and Forests for Thermal Power Plants in December 2015 to be implemented within a two-year period.
- It notes that this has since been extended to December 2022.
- For agricultural stubble burning, it highlights the initiatives already in place by way of the central assistance of Rs 1,151 crore for in situ management of crop residue and provides for general action points to be explored.
- **Focus** - NCAP calls for a city action plan that needs to be guided by a comprehensive science-based approach involving source apportionment studies.
- It also advises that state capitals and cities with a million-plus population be taken up on priority.

What are the concerns?

- NCAP takes into account available international experiences and national studies.
- It notes that internationally, actions have been “city-specific” rather than country-oriented, and cites examples such as Beijing and Seoul that saw 35%-40% PM2.5 reductions in five years.
- However effective this might have been abroad, reductions by similar levels might leave Indian cities still heavily polluted.
- Delhi’s very severe pollution levels are four times the permissible limits now, and a 30% reduction by 2024 would still leave it very dangerous for health.

1.9 UP Sludge Management Systems - CSE Study

What is the issue?

The Centre for Science and Environment recently released a report on its analysis of sludge management systems in 30 cities in Uttar Pradesh.

What are the highlights?

- **Waterbodies** - Urban Uttar Pradesh has an 80% coverage of toilets, but inefficient sanitation systems.
- So almost 87% of faecal sludge expelled from toilets in urban areas is untreated.
- This, in turn, is being dumped in waterbodies or agricultural lands.
- It is eventually leading to polluting the Ganga and other rivers.
- **Systems** - The number of toilets and onsite sanitation systems being built in the state are all set to increase exponentially.
- But the effluent from the septic tank, along with greywater from other uses flows out into stormwater drains and open drains.

- If not managed scientifically and sustainably, the amount of faecal sludge that new toilets will generate will swamp the State.
- It will only worsen the environmental, sanitation and manual scavenging situation.
- Manual scavengers** - The faecal sludge has to be periodically emptied from the septic tank, either manually or mechanically.
- But half of all emptying work in the studied cities is done manually.
- This is despite the legal prohibition of the employment of manual scavengers.

What are the other drawbacks?

- State support for improved housing and planned development has never been strong.
- The National Urban Sanitation Policy of 2008 has not changed this condition significantly.
- At the national scale, a UN report of 2015 estimates that 65,000 tonnes of untreated faeces is introduced into the environment in India annually.
- The Swachh Bharat Abhiyan promised a major shift, but the focus is more on the basic requirement of household and community toilets in rural and urban areas.
- So the problem of waste not being contained, collected without manual labour, transported and treated safely remains.

1.10 Effects of Drugs Discharged into the Yamuna

Why in news?

A recent study reveals the effects of the discharge of drug-containing effluents into the Yamuna.

What is the study on?

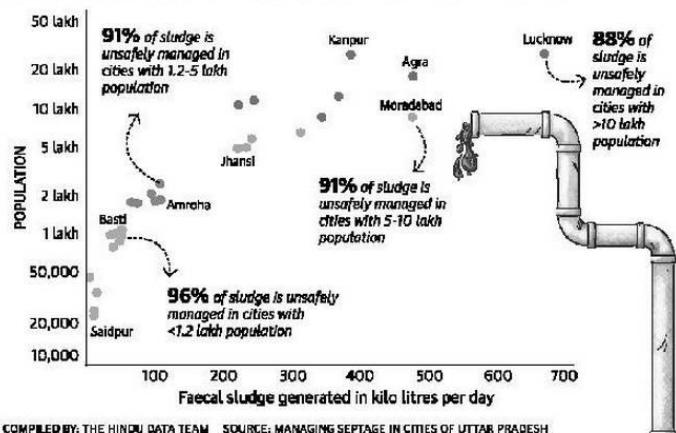
- Human body does not use the entire quantity of the drug when it is taken.
- Resultantly, most of it is excreted and thus end up in aquatic systems via domestic sewage.
- The study thus looks at the occurrence, fate and ecological risks of these compounds.
- It observed nine different pharmaceutical active compounds in the Yamuna river.
- These are six over-the-counter drugs (aspirin, paracetamol, ibuprofen, ranitidine, caffeine, diclofenac) and three prescription drugs (carbamazepine, codeine, diazepam).

What were the findings?

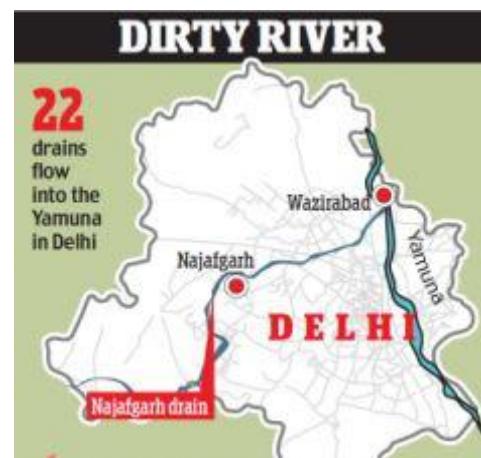
- The highest concentration of pharmaceutical compounds was located downstream Wazirabad at the point where Najafgarh drain joins the Yamuna.
- This is one of the largest drains of Delhi and has an average discharge of about 25 cubic metres per second.
- This drain is the largest polluter of the river contributing more than 50% of the total discharge into the Yamuna.

Untreated sludge

A very high percentage of faecal sludge is disposed off without treatment in various cities in Uttar Pradesh, an analysis by Centre for Science and Environment shows. Graphs plot the amount of faecal sludge generated and the percentage treated in 30 U.P. cities



COMPILED BY: THE HINDU DATA TEAM SOURCE: MANAGING SEPTAGE IN CITIES OF UTTAR PRADESH



Delhi has made no efforts to check pollution in the Najafgarh drain basin

SOURCES OF POLLUTION

WATER POLLUTION: Pickling, dyeing and electroplating units located in industrial areas are the main sources of water pollution

DOMESTIC POLLUTION: 675 MGD* of waste water generated by Delhi but only 513 MGD is treated in sewage treatment plants. The untreated waste aside, even treated waste is fed into the Yamuna

AIR POLLUTION: Industrial units and growing number of vehicles

* Million gallons per day

- At this site, ibuprofen and paracetamol were found at a high concentration of 1.49 and 1.08 microgram per litre respectively.
- Previous studies have shown that even small concentration of ibuprofen could cause an antagonistic effect on aquatic organisms.
- Studies have also shown that ibuprofen exposure could increase cyanobacterial growth in the water.
- Caffeine was found in high concentration in most of the sites.
- Caffeine is used as a stimulant in medicine. Residue from beverages and other food products may also be a contributor.

What could the impact be?

- The individual levels of the drugs were small and cannot cause acute toxicity to the marine life.
- But the mixture of compounds can “possibly cause chronic toxicity” to aquatic life and to humans who use this water for drinking purposes.
- This not only affects the biodiversity of the river but can also lead to the rise of superbugs.
- The discharge of drug-containing effluents in rivers and other water bodies can potentially make many microbes drug-resistant.
- The sewage treatment plants are not designed to take care of these pharmaceutical compounds.
- The study thus highlights the need for the government to bring in the guidelines or specific rules to arrest and address this.

1.11 Maharashtra Bans Plastics

What is the issue?

- Maharashtra may be gearing up for a stringent ban on plastic.
- But experience from across the country suggests that claims on reigning in plastic are stronger on paper than on the ground.

What does the ban encompass?

- Ban** - Environment experts have been blaming plastics for choking of nullahs in Mumbai and the flooding in parts of the city during monsoons.
- Hence, the government has notification a ban on manufacture, use, transport, distribution, wholesale and retail sale, storage and import of plastic bags.
- The ban also covers disposable plastic products such as single-use disposable dishes, cups, plates, glasses, fork, bowl, container, spoon, straw, and wraps.
- Notably, the ban is applicable to manufacturers and consumers as well as the chain in between, which includes shops, hawkers, vendors and offices.
- Exemptions** - While the ban is not applicable to PET bottles, a predefined and explicitly printed buyback price (on the bottle) has been mandated.
- The price is slated to vary between Rs. 1 to Rs. 2, depending on the size.
- Compostable plastic bags and plastic used for packaging of medicines, for plant nurseries, and for handling of solid waste, have been exempted.
- Plastic used for packaging of milk, those manufactured for export in SEZs and plastic wrap for material at the manufacturing stage are also not ban.

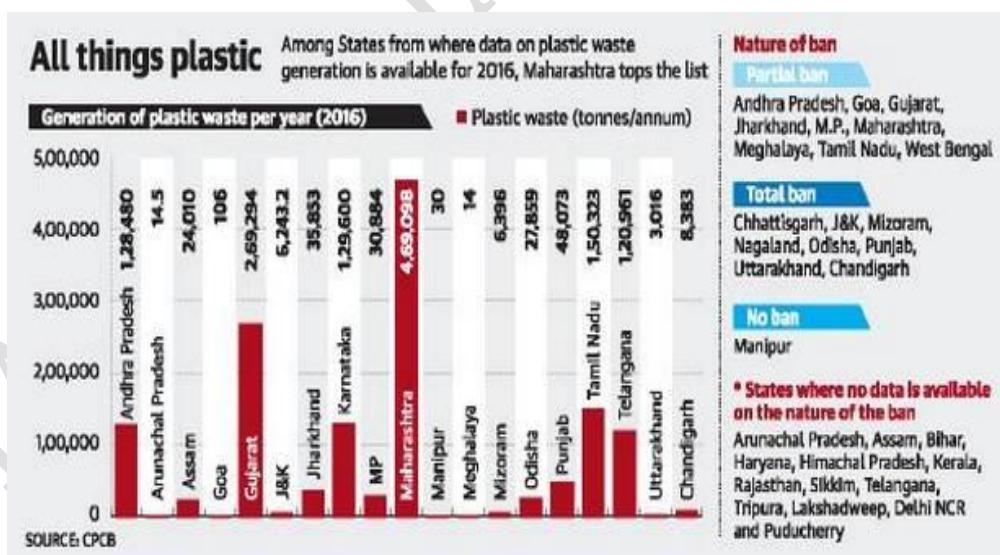
What are the challenges in implementing the ban?

- The Affected** - Maharashtra has 2,500 units making plastic bags, employing 56,000 people and they owe nearly Rs. 11,000 crore to banks.
- ‘Plastic bag manufacturers’ and ‘retail traders’ approached the Bombay High Court against the decision, but their appeal was turned down.

- ‘Clothing Manufacturers’ have spoken against the ban, stating that apparel trade employs 30 lakh people in India and depends on plastic packaging.
- **Alternatives Packaging** - The State is not directly providing alternatives to banned items and has relied on people for solutions.
- In this context, Mumbai Corporation has invited manufacturers of alternative products to showcase their wares at a three-day exhibition.

How is the ban going to be implemented?

- **Authority** - Collectors, forest officers, police and Pollution Control Board officials have been empowered to implement the ban and take legal action.
- Local bodies are training a cadre of inspectors to keep a constant vigil and a operating procedure for levying penalty has also been given out.
- Awareness for waste segregation, door-to-door campaign about the policy and establishment of multiple waste collection centres has already been done.
- **Fine** - Penalty for violating the ban starts from Rs. 5,000 (first offence), Rs. 10,000 (second time) and Rs. 25,000 (third time) with three months in jail.
- In case one fails to pay the minimum penalty, the civic body can file a prosecution complaint before the court, which will decide the fine.
- **What is the countrywide status on plastic management?**
- India generates an estimated 5 million metric tonnes of plastic packaging waste each year, of which less than half is recycled.
- Centre’s “Plastic Waste Management (PWM) Rules - 2016”, mandate all States to annually apprise the Central Pollution Control Board (CPCB) on the steps taken to reign in plastic use.
- The overall appraisal also involves a report on the strength and performance of the recycler and waste-processing network of states.
- Sadly, in CPCB’s latest report in 2016, it was noted that only 24 States/UT have complied with the centre’s directions for appraisal.



How do states fare in regulating plastics?

- **Poor implementation** - Most States, while claiming total ban, implement ban only in specific towns or cities or only on particular type of plastics.
- In fact, they don’t even set-up proper monitoring system for use of carry bags as per the specified guidelines of the union government.
- More significantly, even in areas where total ban on plastics has been imposed, plastic bags are stocked, sold and used indiscriminately.

- **Violation** - Delhi reportedly generates the largest quantity of plastic waste in India, but it hasn't even provided its plastic management plan yet.
- While law requires that all plastic recyclers register themselves, there were around 312 unregistered plastic recycling units across the country.
- **Single Use Plastic** - Around 43% of manufactured plastics are used for packaging, and most of this is "single-use" plastic.
- So far, not one of the 24 States that report their plastic waste management performance has plans in place to tackle single use plastics.

Will Maharashtra's ban work?

- Independent experts say that while Maharashtra's initiative is laudable, it still hinges on extremely efficient enforcement.
- Efforts for proper implementation are being undertaken with seriousness, but manpower for regulating the ban is bound to remain a challenge.
- Identifying suitable plastic packaging alternatives is key to sustain the ban in the long run as mere policing will not work.
- Kerala and Sikkim have the most creditable plastic waste management policies and Maharashtra would do well by adopting their best practices.

1.12 Concern's with Regulating Plastic Ban

What is the issue?

- In recent times use of plastic become the major threat to the environment.
- India lacks proper framework mechanisms to discourage plastic use.

What are the concerns with plastic usage in India?

- India is the major producer of plastic waste that ends up in the oceans.
- The Centre's somewhat liberal estimate shows over 60% of about 25,000 tonnes of plastic waste generated daily is collected.
- That essentially means a staggering 10,000 tonnes of trash is being released into the environment, a lot of it is going into the sea.
- Also, not every piece of plastic collected by the system is scientifically processed.
- Ganga-Brahmaputra-Meghna river system is on the UN map of 10 rivers worldwide that collectively carry the bulk of the plastic waste into the oceans.
- The effects are evident that they threaten marine life and the well-being of people, as micro plastics are now found even in drinking water.

What are the pitfalls with measures taken?

- In their response to the crisis, communities and environmentally minded individuals are ahead of governments and municipal authorities.
- They segregate waste, compost at home, conduct "plastic free" social events and help recover materials that would otherwise just be dumped in the suburbs and wetlands.
- But, valuable as they are, voluntary efforts cannot achieve what systemic reform can.
- India's Solid Waste Management Rules and the Plastic Waste Management Rules of 2016, which built on previous regulations, mostly remain on paper.
- State governments have simply not given them the necessary momentum, and the producers of plastic articles that are invariably used just for a few minutes have shown little concern about their negative environmental impact.
- Local bodies mandated under rules to ensure segregation, collection and transfer of waste to registered recyclers have spectacularly failed to fulfil their responsibilities.

What measures need to be taken?

- It is the Centre's responsibility to ensure that the Environment (Protection) Act, the overarching law that enables anti-pollution rules to be issued, is implemented in letter and spirit.
- Ideally, regulation should help stop the manufacture of single-use plastic articles such as carry bags and cutlery, and encourage the use of biodegradable materials.
- The provisions of the Plastic Waste Management Rules require manufacturers of compostable bags to get a certificate from the Central Pollution Control Board.

1.13 Pragmatic Steps towards Plastic Ban

Why in news?

From January 1, 2019, the government of Tamil Nadu will implement a limited ban on certain plastic consumer goods.

What is TN's plan on plastics?

- The ban is brought under the Environment Protection Act, 1986 and it would come into effect from January 1, 2019.
- This to allow people to change over to using paper bags and other products made out of paper as substitutes to the plastic items facing ban.
- The ban will be primarily on plastic carry bags, plastic plates, plastic cups, plastic flags, small plastic sachets used in packaging water, among others.
- A few plastic materials used for packing milk, curd, oil and medicines have been exempted from the ban.
- The ban would cover these plastic articles irrespective of the size of the micron.

What is the evolution of essential carbon?

- Before the 20th century, some of the carbon compounds available in nature were largely useful as food and to a smaller degree as fuel (being mostly wood and coal).
- These carbon compounds can be called "essential carbon" or EC, the consumption of EC has also increased over the last century due to increasing human population.
- In the 20th century, few of the carbon and carbon compounds acquired an additional dimension for humans.
- They were considered to be essential for enhancing the 'quality of life'.
- This pursuit led to an increase in the per capita consumption of carbon compounds (as fuel for transportation and heating, special chemicals and plastics) and the higher presence of carbon dioxide in air, despite the cushion, or carbon sinks, provided by the oceans.
- Carbon compounds used for enhancing the quality of life can be called "other carbon" or OC.

What is the role of EC and OC in the environment?

- The EC and OC, are closely associated with human and plant life. Living plants produce EC, continuously, by photosynthesis in which water and carbon dioxide are used up with the assistance of sunlight.
- Qualitatively speaking, the speed of production of EC, luckily, is greater than its consumption.
- The continued availability of EC is going to depend on the number of plant life around.
- OC, on the other hand, is produced by the decay of dead plant and animal life to coal, natural gas and oil over millions of years.
- OC is certainly not available at the present rate of consumption (in the last century major portion of available OC has already been consumed).

What measures needs to be followed in this regard?

- The tax on OC (GST or excise/VAT on plastics) should be increased many fold.
- Among the consumer plastic products those containing carbon, hydrogen, nitrogen and oxygen (such as polyester, PET and nylon) can be taxed at the lowest, as they are likely to pose much less harm in view of their potential to biodegrade.

- Then, polyethylene and isotactic polypropylene could be taxed at moderate level, as source segregation and incineration of these plastics under oxygen-rich conditions can be used to produce energy.
- These constitute about 50 per cent of the plastics produced and consumed by volume.
- Plastics containing halogens in their backbone must be taxed heavily as the damage caused by them is far more than that by hydrocarbon-based plastics.
- Plastics can also be taxed based on ingredients that are used as additives and established to be harmful.
- There are newer plastics (natural as well as synthetic) that are established to biodegrade.
- Although they are relatively expensive compared to the synthetic plastics that do not biodegrade, promoting them would offer long-term benefits.
- Given that people have gotten used to the advantages of plastics it may be more convenient to provide no-tax incentive for biodegradable polymers to begin with.

1.14 Breathe India

- Breathe India is a 15-point formula to combat air pollution proposed by Niti Aayog.
- It has cited a WHO report to state that Kanpur, Faridabad, Gaya, Varanasi and Patna are most polluted cities in the world.
- The plan seeks "concerted action from all levels of governance".
- The 15-point formula includes measures like replacing all petrol-diesel vehicles in use at government offices by electric and hybrid vehicles, streamlining power plants, encouraging solar panels on rooftops and feebat schemes.
- It says that government should increase focus on electric and hybrid vehicles. The procurement of electric vehicles (EVs) should be mandatory for vehicles for central government use and certain public facilities.
- It has favoured setting up smog-free towers in cities for providing quick relief from sudden spike in air pollution.
- It has recommended
 - i. strategic decommissioning of inefficient power plants, primarily running on coal.
 - ii. simplification of rules, regulations and leasing policy for operations and called for power distribution reforms
 - iii. the government to enforce use of ready-made concrete to reduce construction dust, which is a major contributor to pollutants in air in expanding cities
- It has called for implementing a large scale feebate programme beginning 2020.
- A feebate is a policy that entails levying a surcharge or fee on inefficient or polluting vehicles and giving a rebate on efficient ones.

2. GLOBAL WARMING AND CLIMATE CHANGE

2.1 Impacts of Anthropocene Era

What is the issue?

The Globe has entered into an Anthropocene era, due to this India which has variety of bio-diversity would be seriously affected.

What is the global status of geological change?

- In recent decades, populations of more than 40% of large mammals have declined and insect biomass has decreased by more than 75%.
- This unique bio-cultural tapestry has been resilient to change for centuries, but with the unleashing of unprecedented economic and environmental forces, it is now subject to increasing wear and tear.

- Forests are degrading and diminishing in a higher rate, but we overlook that the whole tapestry covering our body is slowly disintegrating.
- By this the globe has entered into the Anthropocene era, a new period in earth's history, when humans have begun to impact our environment at the global scale.
- India has a myriad of unusual and exquisite species occur in the countless ecosystems spread across vast lands, rivers and oceans, for bio-logical losses, India ranks higher across the globe.

What are the concerns with India's approaches?

- Current efforts to map India's biodiversity are largely restricted to forestlands, while plans for species monitoring are even more inadequate.
- In many of India's academic institutions 'Life Sciences' are still restricted largely to the study of cells and molecules, life at microscopic and sub-microscopic levels.
- Government and private philanthropy are lagging to bring multiple stakeholders together to develop a programme to document to save the bio-diversity for the future.

What measures needs to be taken?

- India must do more to safeguard biodiversity and the ecosystem services that support all human endeavours.
- India's forest policy calls for forests to cover almost a third of the country, and if we include other natural systems such as grasslands and wetlands, the area to be protected could amount to almost 40%.
- Some areas could be fully protected while others might be managed by stakeholders for sustainable use and enrichment of biodiversity.
- Thus India need a massive new effort to catalogue, map, and monitor life, using fundamentally different approaches.

2.2 UN Framework Convention on Climate Change Conference

Why in news?

The conference of the UN Framework Convention on Climate Change recently ended in Bangkok.

What were the outcomes of the meet?

- The purpose of the meet was to draft a rulebook for the Paris Agreement ahead of a crucial international conference in Poland in December.
- But it ran into difficulties over the issue of raising funds to help poorer nations.
- Some developed countries led by the U.S. are unwilling to commit to sound rules on raising climate finance.
- Earlier, U.S. under the Trump administration, has rejected the Paris agreement in which the rich countries pledged to raise \$100 billion a year by 2020 to help developing countries reduce their greenhouse gas (GHG) emissions.

Why it is unfair on the part of developed countries?

- Historically the developed countries have contributed heavily to the accumulated CO₂ burden.
- It now measures at about 410 parts per million(ppm) of CO₂ in the atmosphere, up from 280 ppm before the industrial revolution.
- If scientific estimates are correct, the damage already done to the West Antarctic Ice Sheet is set to raise sea levels.
- A 2° Celsius rise in global temperature will also destabilise the Greenland Ice Sheet.
- This will also drive more mass migrations of people on account of failed agriculture and the associated conflicts.
- Hence the developed countries are ignoring their historical responsibility.
- Obstructing the transition to a carbon-neutral pathway is also short-sighted, simply because the losses caused by weather events are proving severely detrimental to all economies.
- Additionally, walking out of developed countries have created a financial and leadership vacuum.

- This was followed by other developed countries that are unwilling to create sustainable financial commitment to realise the objectives of Paris agreement.

What are the responsibilities of India and China in this regard?

- There is international pressure on China and India to cut GHG emissions.
- Both countries have committed themselves to a cleaner growth path.
- India reported an annual CO₂ equivalent emissions of 2.136 billion tonnes in 2010 to the UNFCCC two years ago.
- Recent estimates show that the GHG emissions intensity of its GDP has declined by 12% for the 2005-2010 period.
- China has suspended construction of 103 new coal-fired power plants last year, and announced plans to invest more than \$360 billion into renewable energy by the end of the decade.
- Both have the responsibility of climate leadership in the developing world and Innovative instruments (climate bond, social impact bond, catastrophic risk insurance, etc.,) could be leveraged to realise a “Green Economy”.
- It needs to be accompanied by a supportive framework in the form of a rulebook that:
- Binds the developed countries to their funding pledges.
- Provides support for capacity building.
- Transfer of green technologies on liberal terms.
- Thus the responsibility lies in the domain of both developed and developing countries to go beyond expediency and take the actions needed to avert long-term catastrophe.

India's Intended Nationally Determined Contributions (INDC)

- To reduce the emissions intensity of its GDP by 33 to 35 per cent by 2030 from 2005 level.
- To achieve about 40 per cent cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030.
- To create an additional carbon sink of 2.5 to 3 billion tonnes of CO₂equivalent through additional forest and tree cover by 2030.

2.3 Rulebook for the 2015 Paris Agreement

Why in news?

Negotiators from 196 countries finalised a rulebook for the 2015 Paris Agreement at the climate change conference in Katowice, Poland.

What is the rulebook for?

- The Paris Agreement seeks to keep the global average temperatures “well below” 2°C from pre-industrial times.
- It specifies the steps that countries need to take in the fight against climate change.
- The rulebook prescribes how to do those things, and how each of them would be measured and verified.
- It holds the operational details of the Paris Agreement, the processes and guidelines for its implementation.
- Notably, the rulebook is a dynamic document, as new rules can be added or existing rules amended.
- It would facilitate the implementation of Paris Agreement which is supposed to replace the existing Kyoto Protocol in 2020.
- Nevertheless, several countries and NGOs feels that the deal reached in Katowice, though welcome, was not enough.

What are the highlights?

- The Paris Agreement says every country must have a **climate action plan** to be periodically updated and submitted to the UN climate body.
- The rulebook now specifies what actions can be included in the action plan, how and when to submit them.
- Further, the Paris Agreement asks every member nation to submit information about their **greenhouse gas emissions** every two years.

- The rulebook now specifies
 - i. which gases to measure
 - ii. what methodologies and standards to apply while measuring them
 - iii. the kinds of information to be included in their submissions
- Article 4 of Paris Agreement mandates **nationally determined contributions** (NDCs) by countries.
- The rules now say that support shall be provided to developing country Parties for the implementation of Article 4.
- Parties shall provide the information necessary for clarity, transparency and understanding as applicable to their NDCs.
- The Paris Agreement demands developed countries to provide “**climate finance**” to developing countries and submit an account of this.
- The rulebook says what kinds of financial flows - loans, concessions, grants - can be classified as climate finance.
- It specifies how they should be accounted for and the kind of information about them needed to be submitted.

What were the contentious issues?

- **Carbon Credits** - An emissions trading system already exists under the Kyoto Protocol.
- But it has become ineffective over the last few years and is meant to end with the end of Kyoto Protocol in 2020.
- So Article 6 of the Paris Agreement talks about setting up a market mechanism for trading of carbon emissions.
- A carbon market allows countries, or industries, to earn carbon credits for the emission reductions they make in excess of what is required of them.
- These carbon credits can be traded to the highest bidder in exchange of money.
- The buyers of carbon credits can show the emission reductions as their own and use them to meet their own reduction targets.
- In the last few years, several countries walked out of the Kyoto Protocol, and no country was feeling compelled to meet its 2020 emission reduction targets.
- So there has been virtually no demand for carbon credits.
- As a result, developing countries like China, India and Brazil have accumulated huge amounts of unused carbon credits.
- Together, China and Brazil are estimated to account for about 70% of global unused carbon credits.
- In Katowice, these countries called for considering as valid their unused carbon credits in the new market mechanism that was being created.
- But the developed countries strongly opposed this, questioning the authenticity of the unused carbon credits.
- They pointed to the weak verification mechanisms of the Kyoto Protocol that allowed dubious projects to claim carbon credits.
- So failing to arrive at an agreement, the discussion over carbon markets was deferred to the next year.
- But the confrontation would re-emerge as countries seem to attach more importance to the new emission trading system.
- **IPCC Report** - The report highlighted the need to slash carbon pollution by nearly half before 2030 in order to hit the 1.5°C target.
- The countries were divided on the IPCC report; US, Saudi Arabia, Russia and Kuwait refused to “welcome” the report.
- So the Katowice meet welcomed “the timely conclusion” of the report and invited “parties to make use of it”.

- But it did not accede to the demand for IPCC's (Intergovernmental Panel on Climate Change) findings to form a key part of future planning.

2.4 Assessing the Progress of Paris Agreement

What is the issue?

- The 24th Conference of the Parties (COP-24) meeting to the United Nations Framework Convention on Climate Change (UNFCCC) is held in Katowice, Poland.
- With this, it is essential to assess the progress of countries in terms of Paris Agreement (PA) commitments made in 2015.

How is the global warming scenario?

- Average global temperatures have crossed a degree Celsius above preindustrial levels.
- Such concentration of carbon dioxide in the atmosphere (410 ppm) has never been seen by humans before.
- Resultantly, today's children are inheriting an earth that is out of control and heading to be 3-4° C warmer by the end of the century.
- Perpetual growth is not viable for any species.
- Business-as-usual policies with high consumption by the rich are driving the destruction of ecosystems and mass extinction of species.
- The “sixth extinction”, massive destruction of species on earth is ongoing.
- In this context, the 1.5 Degree Report, a special publication, was recently released by the Intergovernmental Panel on Climate Change (IPCC).
- It calls for far-reaching, speedy transformative changes by countries in order to stay below 1.5° C.
- It emphasises on immediate and drastic drop in GHG emissions through technology and lifestyles, and on mitigation and adaptation.

What was the outcome of the Paris conference?

- The Nationally Determined Contributions (NDCs) were planned ahead of the Paris COP-21.
- Under this, each country described the actions it would take and the levels to which GHG emissions would be reduced (mitigation).
- Countries also described what they would do to improve their capacity to live in a warmer world (adaptation).
- The extent to which these goals required support in the form of finance or technology transfer was also mentioned.
- The Paris Agreement (PA) was ratified rapidly and went into force within a year (in November 2016).
- The Katowice meeting's objective is to set guidelines, or agree on a rulebook, to implement pledges made by countries at the Paris Climate Conference in 2015.

What are the concerns with PA progress?

- **Finance** - There has been little, if any, progress on finance, technology transfer and capacity development.
- Article 9 of the PA calls for financial support from developed countries that is significantly derived from public funds.
- This was expected to result in at least \$100 billion per year to address mitigation and adaptation needs of developing countries.
- Article 9.5 requires developed countries to communicate their levels of support, including pledges of additional finance.
- Even a rough estimate of financial needs for implementing all the NDCs puts it at \$4.4 trillion.
- But the Climate Funds Update of 2018 notes that multilateral funds pledged until 2017 are less than \$30 billion.

- There have also been charges of double counting and counting of development aid levelled against developed countries.
- **Response** - While the U.S. and its current policies are much to blame for the situation, other developed countries are not doing that much better.
- Australia and France have had political turmoil due to their climate policies even while experiencing severe weather events.
- Europe is still heavily reliant on coal and European Union emissions were stable in 2014-2016.
- The U.K. has been relying on fuel from fracking.

How does the future look?

- The implementation of the activities for the PA formally begins in 2020 and concludes in 2030.
- The world is currently in the Doha Amendment period, or the second phase of the Kyoto Protocol, which has not been ratified.
- In a couple of years after the start of the PA implementation, there will be review on progress and decisions on more stringent targets for the future.
- This renewed commitment towards the future means that countries have to trust each other.
- So fulfilling obligations is a foundation of future ambition and action.

What is required?

- What is required for India is credible, accurate and verifiable numbers on the climate flows expected from developed countries.
- Such reliable flow will encourage and persuade all countries that commitments made will be fulfilled.
- There also has to be a general agreement on how to estimate adaptation.
- Countries with high emissions should alter their lifestyles considerably, for the transformational change that 1.5 Degree Report calls for.
- As extreme events are on the rise, the separate stream referred to as “loss and damage” needs attention.
- This is a provision for support to poor countries experiencing economic and non-economic losses and destruction from climate change events.
- There has not been much progress on this issue by the task force set up to advance it, which also needs to be addressed at Katowice.

2.5 Rulebook at Katowice - Concerns for Developing Countries

What is the issue?

- The recent climate conference in Katowice, Poland finalised the “rulebook” for the implementation of the Paris Agreement.
- But it brings little cheer on the climate front for developing countries, given its drawbacks.

What are the shortfalls in the rulebook?

- **Developing countries** - At Paris, the developed nations were allowed to make voluntary commitments to climate mitigation, on par with the developing nations.
- At Katowice this process went further, with uniform standards of reporting, monitoring and evaluation for all countries.
- The real targets of this uniformity are not the poorest nations, who have been provided exemptions, but the larger developing nations.
- These reporting requirements, in their uniformity, are intended as much for Maldives as the U.S.
- All developing nations are apparently allowed flexibility in these reporting requirements.
- But the concession comes with a number of conditions, with the intention of forcing them to full compliance in short order.

- **Rationale** - The reporting requirements are also marked by a pseudo-scientific concern for stringency.
- The recent Special Report of the IPCC (Intergovernmental Panel on Climate Change) highlights uncertainties in fixing global emission targets in relation with global carbon budget.
- Given such uncertainty, the requirement of reporting as little as 500 kilo tonnes or 0.05% of national emissions per country has little scientific rationality.
- Moreover, the uniformity of the stringency in reporting is being expressed in percentage terms.
- But a smaller percentage of the emissions of a large emitter will be a larger quantity in absolute terms compared to the larger percentage of emissions of a small emitter.

What are the larger concerns?

- **Mitigation** - There is lack of initiative by the developed countries in taking the lead in climate mitigation.
- All developed countries continue to invest in fossil fuels either through direct production or imports.
- Some do so because of the downgrading of nuclear energy due to domestic political pressures.
- Others are still trying to wean themselves off coal by shifting to gas.
- Overall, the use of fossil fuel-based electricity generation continues to rise for OECD (Organisation for Economic Co-operation and Development) countries.
- **Finance** - Developing countries have for long demanded that the bulk of climate finance must be from public sources.
- In contrast, the developed countries have succeeded in putting other sources of finance, including FDI and equity flows.
- But private sector flows or loans will increase the indebtedness of developing countries.
- Much of the pressure exerted by developed countries at COP24 (Conference of Parties), Katowice had the active backing and instigation of the U.S.
- The marked synergy between the U.S. and its political and strategic allies pushed through several critical elements of the “rulebook”.

What is the case with India?

- India has been articulating the need for equity in climate action and climate justice.
- But it failed to obtain the operationalisation of these notions in several aspects of the “rulebook”.
- In contrast, Brazil held its ground on matters relating to carbon trading that it was concerned about.
- It postponed finalisation of the matter to next year’s summit.
- India underestimated what was at stake at Katowice and the outcome mean a serious narrowing of India’s developmental options in the future.
- In all, the “rulebook” adoption at COP24 signals a global climate regime that benefits and protects the interests of the global rich.
- It has left the climatic fate of the world, and the developmental future of a substantial section of its population, still hanging in the balance.

2.6 World Bank Report on Climate Change

Why in news?

World Bank has released South Asia’s Hotspots - The Impact of Temperature and Precipitation Changes on Living Standards report.

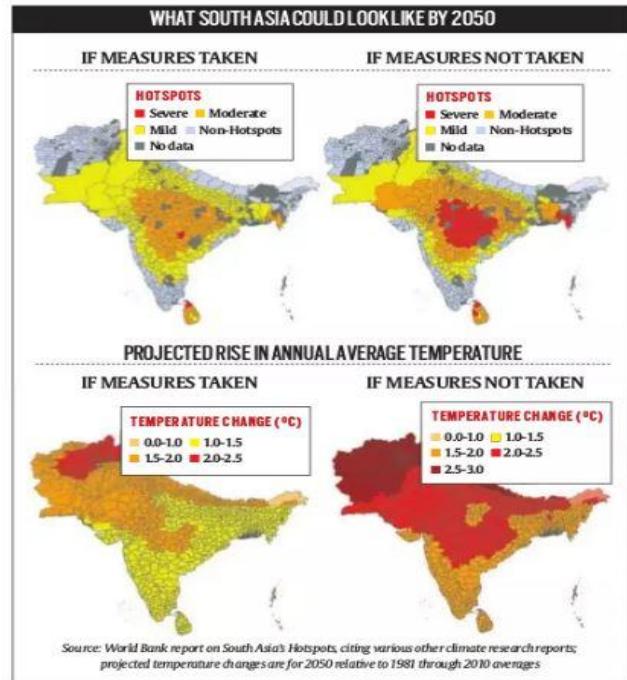
What are the findings of the World bank report?

- A World Bank report has estimated the impacts of climate change on the GDP and living standards in India and region.

- The report found that rising temperatures and changing monsoon rainfall patterns from climate change could cost India 2.8% of GDP.
- Which would also depress the living standards of nearly half the country's population by 2050.
- It looks at six countries in South Asia and how projected changes in temperature and precipitation will affect living standards in these countries.
- The report has used annual household consumption as a proxy for living standards, and identifies "hotspots" districts where these changes will have a notable effect on living standards.

What are the concerns spotlighted by the report?

- For the region, the report has found that India, Bangladesh, Pakistan and Sri Lanka will be adversely affected by these changes, while Afghanistan and Nepal will benefit as they are relatively cold.
- Based on the rise in average temperatures over the past six decades and the projected rise, the report predicts more warming inland and less warming in coastal areas beyond 2050.
- For India, it has projected that living conditions in Chhattisgarh and Madhya Pradesh will decline by more than 9%, followed by Rajasthan, Uttar Pradesh and Maharashtra.
- The report states approximately 600 million people in India today live in locations that would become moderate or severe hotspots by 2050 under the carbon-intensive scenario.



What are the scenarios taken into account by the report?

- The report looks at two scenarios namely Climate-sensitive and Carbon-intensive.
- Climate-Sensitive** - It represents a future "in which some collective action is taken to limit greenhouse gas emissions and global annual average temperatures increase 2.4°C by 2100 relative to pre-industrial levels.
- Carbon-Intensive** - It represents a future in which no actions are taken to reduce emissions and global annual average temperatures increase 4.3°C by 2100 relative to pre-industrial levels.

How will such scenarios play out in India?

- The report states the information will be useful for designing a social welfare programme at the national level, and for determining which investments would be most needed in each community.
- If no measures are taken, average temperatures in India are predicted to increase by 1.5-3°C by 2050.
- If preventive measures are taken along the lines of the Paris Agreement, India's average annual temperatures are expected to rise by 1-2°C by 2050, the World Bank report states.

2.7 IPCC Draft Report on Global Warming

What is the issue?

- A recent Intergovernmental Panel for Climate Change (IPCC) draft report on climate change response draws global attention.

What is the report on?

- The report comes on the direction of the United Nations Framework Convention on Climate Change in 2015.
- Accordingly, IPCC was asked to prepare a special report by 2018.
- This would be on the impact if the planet grew hotter by 1.5°C over the global average surface temperatures between 1850 and 1900.

What are the highlights?

- The basic message is that the world is not doing enough to keep the planet from heating up excessively.
- If the emissions continue at the present rate, global warming will exceed by 1.5°C over the reference period by around 2040.
- The current measures such as rise of renewable energy and electric vehicles are just not enough.
- The inevitable consequences will be more
 - i. floods and droughts
 - ii. forest fires
 - iii. islands losing ground to rising sea waters
 - iv. water scarcity
 - v. vector-borne diseases
- This reiterates what the UN Environment Programme has been emphasizing in its annual Emission Gap Reports.
- In 2016 report, it said that even if countries stick to their Paris deal commitments, the target would not be met.

What are the concerns and challenges ahead?

- **Paris deal** - At Paris in 2015, all countries agreed to limit global warming to 2°C by the turn of this century.
- This aside, they also agreed on an ambitious goal to limit global warming to 1.5°C.
- But the Agreement is loosely-worded, and leaves everything to voluntary action with no penal provisions.
- **US** - The United States has recently pulled out of the Paris accord.
- It has also begun to support coal, a fuel chiefly responsible for the climate change.
- Further, the US has slashed its contribution to the Global Environment Facility (GEF).
- Resultantly, developed countries' funding to GEF has come down by \$300 million.
- Notably, GEF is a big funder of climate projects in developing countries.
- **Australia** - Australia is also following the US's example.
- It has also said that coal would have an important role in the country's energy mix.
- **Coal** - With US and Australia backing coal, poor countries like Indonesia are taking the opportunity.
- Having seen good returns in exporting coal over the last decade, it wants to do more.
- The situation is likely to worsen with the development of a new Russia-funded railway.
- The railway will open up new areas of Kalimantan (Indonesian part of Borneo island) for coal.
- Banks are also not doing enough to restrict funding for coal projects.
- **Deforestation** - According to Stockholm Environment Institute, permits for mining cover 6.3 million hectares of Conservation Forest and Protected Forest areas.
- In 2017, the tropics lost nearly 16 million hectares (size of Bangladesh) to deforestation.
- **Measures** - A recent International Energy Agency report looked at 35 areas requiring action, to be consistent with the 2°C goal.
- Out of the 35, only four were on the right track and these are solar PV, LED, e-vehicles and data centres.
- The IPCC report comes as a wake up call for nations to relook and reassess the climate strategies.

2.8 IMD Statement on Climate of India in 2018

What is the issue?

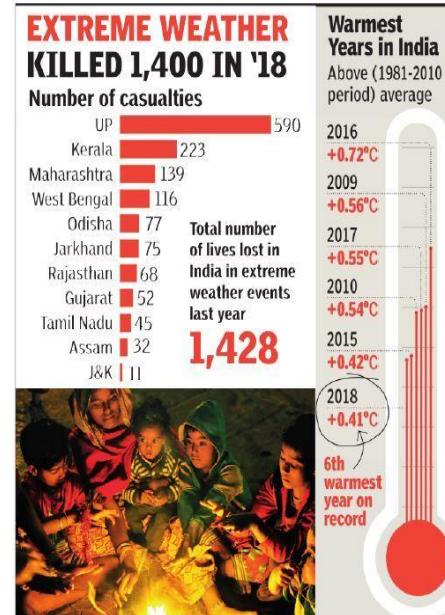
- A recently released IMD (India Meteorological Department) statement shows 2018 as the sixth warmest year on record.
- In this context, a look at the temperature and rainfall trends last year and a series of extreme weather events becomes essential.

How was 2018 overall?

- 2018 was the sixth warmest year on record, with the average temperature over India being “significantly above normal”.
- [The 5 warmest years on record (nationwide records began in 1901) are, in order, 2016, 2009, 2017, 2010, 2015.]
- Notably, 11 of the 15 warmest years were during the recent past fifteen years (2004-18).
- The 20 warmest years on record have been in the past 22 years, with the top four in the past four years.

How was the temperature trend?

- The temperature trends of recent years are part of the larger “global warming” trend.
- The rate of increase of temperatures over India is almost similar to the global average.
- The winter and pre-monsoon seasons, with an anomaly of +0.59°C and +0.55°C respectively, mainly contributed to the warming in 2018.
- Mean temperature during the monsoon and post-monsoon seasons were also above normal.
- The mean monthly temperatures were warmer than normal during all months of the year across the country, except December.
- Broadly, temperatures are increasing during both day and night time.
- Heat waves are increasing in frequency as well as in magnitude.
- Consequently, extreme rainfall and rainstorms which can cause floods are increasing.
- Dry spell duration is also increasing.



What is the case with extreme weather events?

- The increase in temperatures is predicted to lead to more extreme weather events.
- Apart from the six cyclonic storms that formed over the northern Indian Ocean, India experienced “high impact weather” events.
- These were extremely heavy rainfall, heat and cold waves, snowfall, thunderstorms, dust storms, lightning and floods.
- Uttar Pradesh was the most adversely affected state during 2018.
- It reported nearly 600 deaths due to cold waves, thunderstorm, dust storm, lightning and floods.
- Flood and heavy rain related incidents reportedly claimed over 800 lives from different parts of the country.
- North India also witnessed high-velocity dust storms and thunderstorms in April and May and then, later in June-July.
- Dust storm claimed over 150 lives from Uttar Pradesh and adjoining parts of Rajasthan.
- Thunderstorm was another major event of the year over the northeastern parts of the country.

- Notable cyclones in the year are Titli, Gaja, and Phethai which crossed the Odisha, Tamil Nadu, and Andhra Pradesh coasts respectively.

How was the monsoon rainfall trend?

- Rainfall over India as a whole during the southwest monsoon season was near normal with 90.6% of Long Period Average (1951-2000).
- But the northeast monsoon season rainfall was substantially below normal with 56% of LPA and was the sixth lowest since 1901.
- The seasonal rainfall during the northeast monsoon season over the core region of the south peninsula was also below average (66% of LPA).
- It comprises of 5 subdivisions - Coastal Andhra Pradesh, Rayalaseema, Tamil Nadu & Puducherry, South Interior Karnataka and Kerala.
- Out of these, Kerala received normal rainfall and the other four subdivisions received deficient rainfall.

2.9 Climate Change & India's Nutritional Security

What is the issue?

- Climate change and global warming are increasingly posing risks to India's food and nutritional security.
- This requires urgent prioritisation, strong political will and dedicated resources for sustainable and public health friendly measures.

What is the looming threat?

- The Intergovernmental Panel on Climate Change shared that human activities have led to a 1°C (0.8°C to 1.2°C) rise in temperatures above pre-industrial levels.
- This will reach 1.5°C between 2030 and 2052, if it continues to increase at the current rate.
- The atmospheric concentrations of carbon dioxide (the primary greenhouse gas) have risen to 410 parts per million (ppm) from about 280 ppm in pre-industrial times.
- The World Health Organisation estimated that approximately 250,000 deaths annually between 2030 and 2050 could be due to climate change.
- Several reports confirm that the poorest people, already suffering from the highest rates of under-nutrition, will be the most vulnerable to climate change.

How vulnerable is India?

- Agriculture** - Indian agriculture, and thereby India's food production, is highly vulnerable to climate change.
- This is largely because the sector continues to be highly sensitive to monsoon variability.
- About 65% of India's cropped area is rain-fed.
- Nutrition** - India already is one of the top rankers in multiple forms of malnutrition globally.
- There are multiple reasons contributing to poor nutritional status of India's population.
- They range from food scarcity to food excess (unhealthy), increased consumption of refined cereals, simple sugars and salt, etc.
- However, adverse variables like climate change, pollution, etc, added to this scenario can further worsen the public health nutrition (PHN) indices.
- With only about one in 10 children getting adequate nutrition, India at least ought to keep other potentially influential variables favourable.

How serious is nutrition and climate change link?

- India already depends a lot on imports for fulfilling nutritional needs of the population.
- With the ensuing climate change, the access to safe and nutritious food, and affordability, is bound to be impacted severely.

- Under-nutrition (increased nutrient demands and reduced nutrient absorption) can be exacerbated by the effects of climate change.
- Suboptimal diet (micronutrient deficiencies and overall poor nutritional status) during vulnerable stages (e.g. pregnancy lactation) may have adverse repercussions for several generations.
- The onset of risk factors for non-communicable diseases (hypertension, diabetes, cardiovascular problems, etc) is faster and earlier in people with nutrient deficiencies.
- The EAT-Lancet Commission's food advisory recommends consumption of fruits and vegetables rather than meat for preserving own health and nature.
- But evidently, environmental changes reduce yields of starchy staple crops and alter nutrient composition of fruits, vegetables and legumes.
- This is a serious issue in a country like India with micronutrient and protein deficiency in more than half of its population.
- Furthermore, various other factors negatively affect vegetable and legume yields, which are -
 - i. the absence of adaptation strategies.
 - ii. the increasing ambient temperature in (sub)tropical areas
 - iii. tropospheric ozone
 - iv. water salinity and decreasing water availability
- Also, the increasing level of carbon dioxide is implicated in "dilution effect" resulting in lesser vitamins and minerals per unit of yield.

What should be done?

- Funding needs to be earmarked for designing, rolling out modern climate change-resistant infrastructure and technology.
- Early warning systems are needed for farmers to produce sufficient food and traders to adequately store food in the face of extreme weather events.
- More sustainable, resilient and efficient ways of producing, trading, distributing and consuming diversified agricultural food products should be adopted.
- Involving food technologists to devise food storage and processing practices to reduce climate-related food safety concerns can help.
- These strategies can also support reducing food waste.
- Building and strengthening the capacity of public health professionals and allied forces, increasing the number of healthcare facilities/staff could help.
- Academic and research capacity needs to be augmented.
- drawing upon best practices from agriculture, public health, nutrition, transport and environment is essential to prepare Integrated curriculum qualified interdisciplinary workforce.
- Investment in social protection schemes and livelihood security mechanisms can significantly tackle malnutrition and build resilience.
- The cross-sectoral nature of nutrition, adverse impact of climate change, and the interaction between these two calls for increased policy coherence.
- India's recently launched National Nutrition Mission or the POSHAN Abhiyaan is an ideal way to start advocating for PHN in an environment-friendly manner.

2.10 Cross-border Environmentalism

What is the issue?

- Emerging environmental concerns make cross-border environmentalism crucial for South Asia.
- It is high time that India recognises this and takes the lead.

What is the emerging threat?

- Climate change is introducing massive disturbances to South Asia.
- This is most notably from the rise of sea levels.
- The entire Indian Ocean coastline will be affected.
- But the hardest hit will be the densely populated deltas.
- They include places where the Indus, Irrawaddy and Ganga-Brahmaputra meet the sea.
- The distress is paramount in the northern half of the Indian subcontinent.
- It covers areas from the Brahmaputra basin to the Indus-Ganga plain.

What are the environmental concerns?

- **Water** - The subcontinent is running out of water resource.
- This is due to the demands of industrialisation and urbanisation.
- It is also due to continuation of colonial model of irrigation based on flooding the fields.
- **Rivers** - The economic and demographic forces are arrayed against the rivers and their right-of-way.
- E.g. Ganga (Uttarakhand), Teesta (Sikkim) have been converted into dry boulder tracts by ‘cascades’ of run-of-river hydroelectric schemes.
- The tributaries of the Indus were ‘done in’ decades ago through water diversion.
- **Natural drainage** - Everywhere, natural drainage is destroyed.
- Highways and railway tracks are elevated above the flood line, and bunds encircling towns and cities.
- Reduced flows and urban/industrial effluents have converted great rivers into sewers.
- Rivers are made to carry hundreds of tonnes of plastics daily into the Bay of Bengal and the Arabian Sea.
- **Climate refugees** - The climate change discourse has not evolved enough to address this.
- Tens of millions of ‘climate refugees’ could en masse move inland.
- They may be forced to cross national boundaries in the search for survival.
- E.g. the Farakka Barrage affected the livelihoods in downstream Bangladesh, causing the flood of ‘undocumented aliens’ in India.
- **Glaciers** - The retreat of the Himalayan glaciers is jeopardising the perennial nature of our rivers.
- The '**atmospheric brown cloud**' is said to be the reason for excessive melting of snows in the central Himalaya.
- The icefalls of the Himalaya could soon transform into waterfalls.

What are the policy shortfalls?

- **Participation** - The subcontinental environmental realities demand civic participation.
- But despite being a vast democracy, the Indian state neglects this factor.
- Efforts at preserving the forests and landscapes are mostly taken up by the indigenous communities.
- The urban middle class is not visible in environmentalism, other than in ‘beautification projects’.
- **Governance** - The Environment Ministry is invariably the least empowered in the major countries of South Asia.
- It falls short of coordinating the ecological response.

Why is India's role crucial?

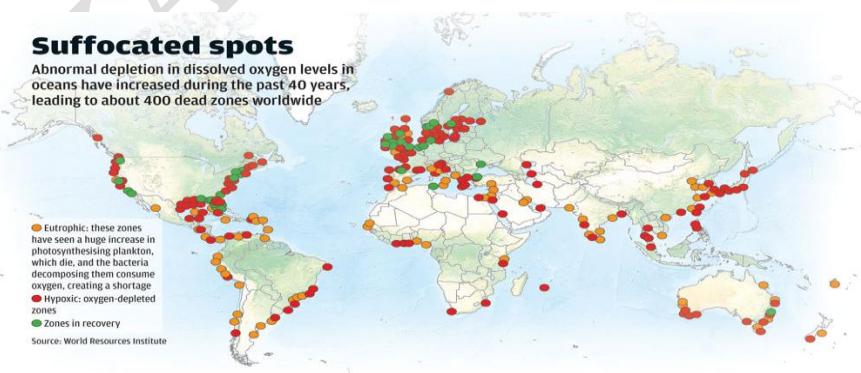
- Wildlife, disease vectors, aerosols and river flows do not respect national boundaries.
- The environmental trends must be discussed at the regional inter-country level.

- But South Asian societies are apart, when they should actually be joining hands on common ground.
- India is the largest nation-state of the region, and the biggest polluter.
- Also, its population is the most vulnerable.
- Given these, India should take the lead role in cross border environmentalism.

2.11 Dead Zones

The Gulf of Mexico's annual "dead zone" will likely persist for decades.

- Hypoxic zones or Oxygen minimum zones (OMZ) are areas in the ocean of such low oxygen concentration that animal life suffocates and dies, and as a result are sometimes called "dead zones."
- In dead zone area, most marine life either dies, or, if they are mobile such as fish, leave the area.
- Habitats that would normally be teeming with life become, essentially, **biological deserts**.
- The dead zones in the Arabian Sea have been growing in size.
- It is the thickest and the most intense OMZ among the world's oceans and covers an area of around two million sq km.
- The second largest dead zone in the world is in the U.S., in the northern Gulf of Mexico, which emerges during every spring.
- There are many physical, chemical, and biological factors that combine to create dead zones, but nutrient pollution is the primary cause of those zones created by humans.
- These zones are reversible if its causes are reduced or eliminated.
- Scientists have determined the area of dead zones which is 8,776 square miles. It is the largest measured since dead zones mapping began there in 1985.
- Nutrients such as nitrogen flow from North America's Corn Belt through streams and rivers before ending up in the Gulf.
- These nutrients stimulate massive algal growth that eventually decomposes, which uses up the oxygen needed to support life in the Gulf.
- This loss of oxygen can cause the loss of fish habitat or force them to move to other areas to survive, decreased reproductive capabilities in fish species and a reduction in the average size of shrimp caught.



2.12 Montreal Protocol Assessment

- The latest Scientific Assessment panel on Montreal Protocol reveals a healing ozone layer, global warming reduction potential, and options for more ambitious climate action.
- The 2018 assessment was carried under the auspices of the Montreal Protocol in coordination with the World Meteorological Organization (WMO) and the United Nations Environment Programme.

- The Montreal Protocol on Substances that Deplete the Ozone Layer has been recognized as the most successful international environment treaty in history.
- It is the only environmental treaty which enjoys universal ratification of 197 UN member countries.
- Kigali amendment to Montreal protocol was entered into force from January 1, 2019, following ratification by 65 countries.
- The protocol and its amendments have banned the use of ozone destroying chemicals and the rate of ozone depletion seems to have slowed.
- The amendment calls for slashing the future use of powerful climate-warming gases in refrigerators, air conditioners and related products.
- Under the Amendment, all countries will gradually phase down HFCs by more than 80 percent over the next 30 years and replace them with more environmentally friendly alternatives.
- Action under the Amendment will help reduce the production and consumption of hydrofluorocarbons, potent GHGs, and thus avoid global warming of up to 0.4°C this century.

3. RENEWABLE ENERGY

3.1 Moving to Methanol

Why in news?

- NITI Aayog is helping the Ministry for Petroleum and Natural Gas draft a Cabinet note on methanol.

What is the initiative?

- When a Cabinet note is circulated it covers all aspects and issues that may pose a challenge for Methanol Policy implementation.
- The policy will be a combined effort of the Ministry of Petroleum and Natural Gas, Fertiliser and Coal among others.
- The NITI Aayog will be a facilitator.
- It is also looking at possible international collaborations.
- This is to get help during the interim period till coal to methanol production in India reaches a level that it can meet the demand.
- There is a need to import certain quantity of methanol till then.

How is methanol a better option for India?

- Imports - Methanol is a cost-effective, non-polluting and versatile fuel.
- It can fully or partially replace petrol, diesel or liquefied petroleum gas (LPG).
- With methanol, India aims at trimming the crude oil import bill by 10% by 2022.
- It can thus reduce India's dependence on energy imports.
- Sources - Ethanol is made largely from plant-based sources, such as sugarcane and vegetable oil.
- A land-constrained country like India can ill-afford this.
- But unlike this, methanol can be derived from a variety of renewable, non-renewable and abundantly available feedstock.
- These include agricultural biomass, urban solid waste, coal, and natural gas.
- It, significantly, includes even carbon dioxide (CO₂) present in the air.
- Potential - India's potential to produce methanol is huge.
- As, India has over -
 - i. 125 billion tonnes of proven coal reserves

- ii. 500 million tonnes of biomass (generated annually)
- iii. substantial quantities of stranded natural gas
- Cost - The locally generated and relatively cheaper methanol can significantly contribute to saving cost.
- The Indian Railways is considering converting its entire fleet of 6,000 diesel engines to methanol-operated locomotives.
- This could cut down the railways' energy bill by half.
- Besides, if about 20% of crude oil imports are substituted by methanol, vehicular pollution can be slashed by 40%.
- In all, this is a positive move serving both the energy- and environment-related objectives.

What are the concerns?

- Methanol-powered vehicles are almost totally non-polluting.
- However, a large amount of CO₂, a potent polluter, is emitted during the process of making methanol from coal.
- This will need to be either captured and stored or used to co-generate power in methanol plants.
- Otherwise, it has to be recycled into methanol.
- However, the technology for this purpose needs further refinement and scaling up.
- Also, internal combustion engines now can accept methanol-doping of only up to 15% with minimal modification.
- Higher levels of blending will require changes in engine design.
- Despite these, the overall gains from the use of methanol outweigh the cost of surmounting the drawbacks.
- It could certainly add a new dimension to the country's energy security.

3.2 Re-vitalising Ethanol blending

What is the issue?

A consistent and flexible policy for ethanol blending is needed to derive the many advantages that it offers across sectors.

What is the need?

- To achieve the government's target of 10% blending by 2022, the ethanol required is 300 crore litres.
- Of this, 130 crore litres is consumed by the potable alcohol sector and 60 crore litres by chemical industries, leaving only about 110 crore litres for blending with petrol.
- India's fuel bill in 2018-19 is expected to rise by 42% to \$125 billion from \$88 billion in 2017-18.
- To help reduce current account deficit and to make best use of a domestically available alternate, ethanol blending with petrol for fuelling vehicles was proposed.
- It serves as an environment-friendly alternative which can help reduce India's dependence on oil imports, thus presenting itself as a compelling option.

What are the concerns?

- The ethanol blending policy was first announced in 2002 with a target of 5% blending rate.
- However, lack of a consistent policy and the will to implement the programme effectively resulted in the average blending rate still hovering around 2.07% in 2016-17.
- Along with that, pricing of ethanol, whether to be fixed by the government or identified through tendering, created so much of hassle for the oil marketing companies.
- Also, since the price offered by the potable alcohol industry more attractive, sugar mills tend to leverage more towards them rather contributing towards ethanol blending.

- State governments, on their part, have either banned inter-State movement of ethanol or dis-incentivised it by levying taxes, affecting both demand and supply.

What are the measures needed?

- For India's ethanol blending programme to deliver, three critical factors are essential — policy consistency, price stability and flexibility.
- Automotive Industry will have to study if engines need to be modified, with increasing blending requirements, and have to make necessary adjustments.
- **Price stability** - Ethanol has competing users and for OMCs to get their share for blending they should pay a remunerative price.
- Thus, for ensuring price stability, ethanol pricing should be de-linked from crude prices.
- **Policy consistency** - Blending ethanol with petrol will help the country manage its surplus farm output by using feedstock that goes into making ethanol.
- The national bio-fuel policy permits damaged/broken food grains apart from agri-waste to be converted into ethanol.
- **Flexibility**- In India, ethanol is produced after distilling molasses, a by-product of sugar.
- Sugar mills should be allowed to produce ethanol directly from cane juice or by converting molasses earlier in the process instead of producing sugar.
- This would avoid rising cane arrears due to surplus production of sugar and would also ensure better price realisation for farmers through diversification.

National Policy on Biofuels – 2018

- The Union Cabinet has approved National Policy on Biofuels – 2018 recently.
- The Policy categorises biofuels as
 1. "Basic Biofuels" as First Generation (1G) bioethanol & biodiesel
 2. "Advanced Biofuels"- Second Generation (2G) ethanol, Municipal Solid Waste (MSW) to drop-in fuels
 3. Third Generation (3G) biofuels, bio-CNG etc.
- It is to enable extension of appropriate financial and fiscal incentives under each category.
- The Policy allows use of surplus food grains for production of ethanol for blending with petrol with the approval of National Biofuel Coordination Committee.
- It is aimed at raising ethanol doping of petrol to 10% by 2022 and 20% by 2030, which will be a rise from the present national average of around 2%.
- It is likely to help farmers to get appropriate price during surplus production.
- With a thrust on Advanced Biofuels, the Policy indicates a viability gap funding scheme for 2G ethanol Bio refineries of Rs.5000 crore in 6 years in addition to additional tax incentives, higher purchase price as compared to 1G biofuels.
- The Policy encourages setting up of supply chain mechanisms for biodiesel production from non-edible oilseeds, Used Cooking Oil, short gestation crops.
- Also, biofuel blending of diesel, which is almost negligible now, is proposed to be stepped up to 5% by 2030.
- One of the expected benefits is that the Used Cooking Oil can be used as potential feedstock for biodiesel and its use for making biodiesel will prevent diversion of used cooking oil in the food industry.
- This is estimated to help save Rs 120 billion in import bill.
- The intended objective is to create Rs 1 trillion biofuel economy.

3.3 Pradhan Mantri JI-VAN yojana

- The Cabinet Committee on Economic Affairs has approved the "Pradhan Mantri JI-VAN (Jaiv Indhan-Vatavarjan Anukool fasal awashesh Nivarjan) Yojana"

- It is for providing financial support to Integrated Bio-ethanol Projects using lignocellulosic biomass and other renewable feedstock.
- It focuses to incentivize 2G Ethanol sector and support it by creating a suitable ecosystem for setting up commercial projects and increasing Research & Development in this area.
- The ethanol produced by the scheme beneficiaries will be mandatorily supplied to Oil Marketing Companies (OMCs).
- This is to further enhance the blending percentage under the ethanol blending program.
- Centre for High Technology (CHT), a technical body under the aegis of Ministry of Petroleum & Natural Gas, will be the implementation Agency for the scheme.

3.4 Off-Shore Wind Energy Project

- Ministry of New and Renewable Energy has proposed first off-shore wind energy project with a capacity of 1000 MW in Gulf of Khambat, Gujarat.
- The proposed area is located 30 km from Pipavav port.
- National Institute of Wind Energy (NIWE) is the nodal agency to carry out the necessary studies/surveys before final bidding.
- The first offshore LiDAR (Light Detection and Ranging) was installed in Gulf of Khambhat in Gujarat for measurement of wind resource.
- Areas off the coasts of **Gujarat and Tamil Nadu** are two identified areas for development of offshore wind power. The second LiDAR would be installed off Tamil Nadu coast.
- Offshore wind energy is better than onshore in terms of efficiency. It is also becoming competitive and comparable in terms of tariffs.
- Renewable Energy Ministry plans to install at least 5 GW of offshore wind capacity by 2022

Onshore and Offshore wind farms

- **Onshore wind refers to turbines located on land, while offshore turbines are located out at sea or in freshwater.**
- **Onshore windfarms** have the advantage of being one of the most affordable renewable energy sources.
- Generating electricity from onshore wind turbines typically costs half the cost of offshore wind but it is still slightly more expensive than fossil fuels (generating electricity from gas power plants).
- There will be less voltage drop between the windmill and the consumer as compared to offshore wind turbines.
- It cannot produce energy all year round due to the poor wind speed and/or physical blockage of the wind by buildings and/or hills
- It has been criticized for its visual impact, endanger birds and noise pollution.
- **Offshore windfarms** are more efficient as wind speed and direction are more consistent at its location.
- Less turbines are required to provide the same amount of electricity as onshore turbines.
- No risk of visual impact and can be built in larger area since there will be fewer physical restrictions.
- But it must endure more wear and tear from wind and waves than onshore wind farms.

4. GOVERNMENT INTERVENTIONS

4.1 Assessing National Mission for Green India

What is the issue?

- A recent study looks critically at India's National Mission for a Green India.
- It highlights that the goals under it assume arbitrary targets rooted in habits of "(neo)colonial governance" rather than "sound science".

What is the Green India mission?

- The Green India Mission is one of the 8 missions under the *National Action Plan on Climate Change*.
- It is a \$7 billion environmental intervention, laid out in 2011.
- The mission aims at protecting, restoring and enhancing India's diminishing forest cover.
- It is intended at responding to climate change by a combination of adaptation and mitigation measures.
- It seeks to put a third of the country under forest cover by increasing forest and tree cover to the extent of 5 million hectares (mha).
- Besides, there are efforts at improving quality of forest/tree cover on another 5 mha of forest/non-forest lands.
- The mission is also planned with improving forest-based livelihoods.

How is the afforestation approach in India?

- Over two centuries, afforestation has been viewed as a solution for a variety of ills.
- These include civilizational decline, diminished precipitation, warming temperatures, soil erosion, and decreasing biodiversity.
- Forest cover of Europe in the colonial period was estimated at roughly one-third.
- An afforestation rate of 30-33% became the widely accepted minimum for civilization.
- This targeted minimum, as a concept, was exported to India and continued to influence generations of forest policymakers in India.
- Despite the nature of arid and semi-arid ecosystems and the knowledge of local communities, the imported mechanism continued as a compulsion in India.

Why is it flawed?

- There is an obsession with tree-planting in India that has its roots in the colonial forestry bureaucracy.
- The approach is to plant trees to make up for deforestation and grazing habits of local people, especially pastoralists.
- The commitment to fixed rates of forest cover encourages tree plantations in ecologically inappropriate sites and conditions.
- Another problem of plantation ecologies in India is the enthusiasm for fast growing species and exotic and invasive species.
- Afforestation typically extends the "authority" of Indian state forest departments, mostly at the expense of local livelihoods rather than in support of them.
- This has historically performed a reverse role of disinheriting forest-rooted populations.
- Moreover, aggressive afforestation projects in India direct resources toward tree-planting, without addressing the drivers of widespread deforestation.
- So in all, there is much of 'planting' and essentially less of 'greening'.

What should be done?

- Greening would take a socio-ecological approach that treats the system as a whole.
- It means a 'Restoration Ecology' of grasslands, streams, mixed scrub, agro-forestry, and so on.
- The afforestation efforts should take seriously the peculiarity of local systems to preserve the diversity of the Indian ecological mosaic.

NAPCC

The eight missions under the National Action Plan on Climate Change (NAPCC) are as follows:

- i. National Water Mission
- ii. Green India Mission
- iii. National Solar Mission
- iv. National Mission on Sustainable Habitat
- v. National Mission on Enhanced Energy Efficiency
- vi. National Mission for Sustaining Himalayan Ecosystem
- vii. National Mission for Sustainable Agriculture
- viii. National Mission on Strategic Knowledge for Climate Changes

- The approach should move out from the colonial mindset and adopt a scientific view, for true 'greening'.

4.2 Concerns with Coastal Conservation Measures

Why in news?

National Centre for Coastal Research (NCCR) has found that nearly one-third of the country's coastline is severely eroded.

What are findings of NCCR?

- Over 234 square kilometres of Indian land has already been lost and more would vanish if erosion continues unrestrained.
- The problem is more formidable on the eastern coast because of frequent and relatively stronger cyclonic activity in the Bay of Bengal than on the western coast though the latter is also not fully immune to it.
- West Bengal is the most vulnerable state, with 63 per cent of its shoreline affected by erosion, followed by Puducherry (57 per cent), Kerala (45 per cent) and Tamil Nadu (41 per cent).

What are the reasons behind the erosion?

- Climate change-driven rise in sea level and increased intensity of ocean storms are among the most significant reasons for coastal erosion.
- Human activity closer to the shoreline, such as construction, dredging, quarrying and sand mining, is exacerbating the menace.
- In its natural state, this eco-system has a sobering influence on saline winds, cyclones, sea waves and incursion of seawater into underground aquifers.
- Though the coastal zone regulations, amended from time to time, are meant to preserve the seashore yet their implementation has been below par.

What are the concerns with government measures?

- Union government intends to dilute these norms by bringing a new Coastal Regulation Zone Notification, 2018.
- Under this notification, even some of the fragile coastal areas are mooted to be opened up for tourism and other purposes by simplifying the project clearance procedures and giving greater say to states to manage the seaside tracts.
- Environmentalists feel that this would impair the ecology of the coastal belts and might aggravate sea erosion.
- The changes mooted in the land use of the coastal regulation zone-I and zone-II, for instance, can be a case in point.
- The zone-I comprises ecologically the most sensitive areas, which are currently marked "off-limit" for tourism and infrastructure.
- But the draft notification allows this zone to be used for nature trails and eco-tourism, though with the state government's consent.
- Similarly, coastal zone-II, comprising relatively undisturbed areas close to the shoreline, which has a "no development" belt of 200 metres, is proposed to be redrawn to restrict the no-development strip to merely 50 metres.

What measures needs to be taken?

- Instead of relaxations government should concentrate on taking anti-erosion measures such as creating wave-breakers and raising vegetative protection belts of the kind successfully tried out in the tsunami-hit areas.
- The most endangered regions should, at least, be effectively shielded against any kind of potentially erosive activity.
- The seashore needs special care because it harbours valuable mangroves, seaweeds, coral reefs, and other kinds of marine biodiversity, which serve as a source of raw material for several industries, notably pharmaceutical and cosmetic units.

- This belt, moreover, is ecologically highly sensitive because of the constant interaction of marine and territorial ecosystems and, therefore, needs cautious handling.

4.3 Cauvery Basin - Ecological concerns

What is the issue?

Vocies have been raised against the proposal of railway lines in Cauvery river basin in recent times.

What is its importance?

- The Cauvery basin drains an area of about 81,000 sq. km across three states and a union territory.
- The river originates in Kodagu district while it irrigates agricultural fields, generates electricity, and provides drinking water to downstream communities across south India.
- The Cauvery and its tributaries contribute the bulk of water to the Krishna Raja Sagara dam which is the primary water source for Bengaluru.
- But the proposed Mega railway projects are not only economically unviable but also ecologically damaging.
- It poses a clear threat to the long-term water security of the three States that depend on the Cauvery.

What are the major implications?

- **Ecological** - All the tracks will cut through large swaths of agricultural farms and fields as well as Protected and Reserve Forests.
- These areas are spread across Kodagu and Mangaluru districts of Karnataka and Wayanad and Kannur districts of Kerala.
- In its feasibility report of the Mysuru-Thalassery line, the Delhi Metro Rail Corporation stated that the project would not be beneficial to the State.
- With the protests by the people against the project, the plan to build the line was scrapped.
- However, plans to build the tracks will re-emerge in time sooner or later.
- **Forest cover** - India State of Forests report 2017 noted that Kodagu lost 102 sq. km. of tree cover in just two years.
- The recent proposal might result in forest-depletion in the Kodagu basin that will have reduced capacity to capture and store rainwater.
- Raised railway tracks will also impede wildlife and could result in the deaths of endangered animals such as elephants.

What should be done?

- Studies by the Indian Institute of Tropical Meteorology have found evidence for increasingly variable monsoon rainfall in the Kodagu basin.
- A recent study has revealed that activities like construction, illegal mining and hill cutting are increasingly responsible for the uptick in fatal landslides, particularly in Asia.
- This makes preserving forest cover more vital in order to mitigate the collateral effects of these extreme events.
- A **UN report**, Water for a Sustainable World, pointed out that the gap between the availability of water and our need for water is only going to increase.
- The journal **Nature** has reported that diminished access to water resources increases the risk of social unrest, political instability, intensified refugee flows and armed conflicts even within borders.
- The variable nature of monsoons makes India one of the most vulnerable regions to water-related disasters associated with climate change and extreme weather events.
- Hence, preserving existing forests in the Cauvery watershed can reduce the effect of floods and droughts, while recharging groundwater.
- Economists should estimate the monetary and human cost of cities and implement policies focused on achieving and maintaining sustainable water resources.

- Good water governance of the nation's watersheds will be key to its sustainable future.
- Hence, protecting the Cauvery's source is essential for the sustained well-being of the entire basin.

4.4 Draft India Cooling Action Plan

Why in news?

The Ministry of Environment, Forests and Climate Change has released a draft India Cooling Action Plan (ICAP).

What is the Plan on?

- The many high-temperature cities in India are only set to get hotter in the coming future.
- The requirement for cooling is thus being recognised as key to health and well-being.
- The ICAP comes as an effort to assess this requirement and plan ahead.
- The draft by the MoEF Ozone Cell provides a 20-year perspective, with projections for cooling needs in 2037-38.
- It aims to provide sustainable cooling while keeping in mind, the need to protect the ozone layer from substances that can deplete it.

What are the highlights?

- **India** - The document puts India at the bottom in "access" to cooling, compared to the rest of the world.
- This is reflected in "low per-capita levels" of energy consumption for space cooling.
- It stands at 69 kWh for India as against the world average of 272 kWh.
- **Requirement** - The cooling requirement in India is projected to grow around 8 times by 2037-38.
- This is in terms of tonnes of refrigeration (TR) required.
- The building sector shows the most significant growth in required TR, nearly 11 times as compared to 2017-18.
- The cold-chain and refrigeration sectors grow around 4 times the 2017-18 levels.
- The transport air-conditioning grows around 5 times the 2017-18 levels.
- The growing transport sector and income levels will increase ownership of cars, a majority of these air-conditioned.
- It is thus expected to have a growth rate of almost 9% annually up till 2040.
- For space cooling, room air-conditioners constitute the dominant share of cooling energy consumption.
- It was around 40% in 2017-18 and projected to grow to around 50% in 2037-38.
- **Approach** - The draft looks at two scenarios:
 - i. a reference scenario that assumes current policies and level of effort
 - ii. an intervention scenario that factors in impacts of new interventions
- The intervention scenario suggests that the projected total refrigerant demand can be reduced by 25-30% by 2037-38.
- This is achievable only through improvements in cooling equipment efficiency, and operation and maintenance (O&M) practices.

What are the suggestions made?

- The MoEF states that the plan takes a holistic and balanced approach.
- It proposes combining active (air-conditioning) and passive cooling strategies.
- For instance, it considers
 - i. passively-cooled building design that deploys natural and mechanical ventilation
 - ii. promoting the use of energy-efficient refrigerant

- iii. adoption of adaptive thermal comfort standards to specify pre-setting of temperatures of air-conditioning equipment
- iv. development of energy-efficient and renewable-energy-based cold chains for perishable foods
- Even by 2038, a significant percentage of households will not be able to afford refrigerant-based cooling equipment.
- Therefore, wider proliferation of thermally efficient residential built spaces is required.
- They should have reduced heat load and enhanced ventilation.
- This should be coupled with efficient non-refrigerant-based cooling equipment, such as fans and coolers.

What are the global commitments?

- A large part of the cooling demand is met through refrigerant-based cooling.
- These refrigerants are regulated under the Montreal Protocol.
- It regulates on Substances that Deplete the Ozone Layer, and India is a signatory to it.
- In 2016, the Kigali Amendment to the Protocol was made.
- India and few other developing countries agreed to phase down hydrofluorocarbons (HFCs) by 85% of their 2024-26 levels by 2047.
- HFCs are commonly used in air-conditioners and as refrigerants.

4.5 New Coastal Regulation Zone Notification

Why in News?

Union cabinet has approved amendments to the Coastal Regulation Zone (CRZ) Notification.

What is Coastal Regulation Zone (CRZ) about?

- Ministry of Environment and Forests (MoEF) under the Environment Protection Act, 1986, issued the Coastal Regulation Zone notification for regulation of activities in the coastal area.
- As per the notification, the coastal land up to 500m from the High Tide Line (HTL) and a stage of 100m along banks of creeks, estuaries, backwater and rivers subject to tidal fluctuations, is called the Coastal Regulation Zone(CRZ).
- CRZ along the country has been placed in four categories, which are as follows
- **CRZ I - Ecologically Sensitive Areas.**
- They lie between low and high tide line.
- Exploration of natural gas and extraction of salt are permitted
- **CRZ II - Shore Line Areas**
- The areas that have been developed up to or close to the shoreline.
- Unauthorized structures are not allowed to construct in this zone.
- **CRZ III - Undisturbed Area**
- Rural and Urban localities which fall outside I and II.
- Only certain activities related to agriculture even some public facilities are allowed in this zone.
- **CRZ IV - Territorial Area**
- Area covered between Low Tide Line and 12 Nautical Miles seaward.
- Fishing and allied activities are permitted in this zone.
- Solid waste should be let off in this zone.

What are the recent changes in the CRZ notification?

- Union government made significant relaxation of development controls along the coastline through the Coastal Regulation Zone (CRZ) Notification 2018.

- **CRZ-II Urban** - The CRZ-II urban category, as per the CRZ notification of 2011, pertains to areas “that have been developed up to or close to the shoreline”, and are legally designated municipal limits already provided with roads, water supply, sewerage connections and so on.
- Under the new notification, decision has been taken to permit current Floor Space Index (FSI) or Floor Area Ratio (FAR) in urban areas coming under CRZ-II which governs the size of buildings.
- This does away with the restrictions on construction which date back to the Development Control Rules of 1991.
- **CRZ- III Rural** - For rural areas, the newly approved notification adds a sub-category to CRZ-III.
- The new provision, CRZ-III A, applies development restrictions to a much smaller area of 50 meters from the high tide line, compared to the 200 meters that was earmarked as the no development zone (NDZ) earlier for densely populated areas.
- These are defined as places with a population of 2,161 per sq km as per the 2011 Census.
- Areas with a population density below that will continue to have 200 meters as the NDZ (No-Developmental Zone)

What are the changes made to the regulatory framework?

- The system of granting clearances has also been changed. States will have the authority to approve proposals for urban (CRZ-II) and rural (CRZ-III) areas.
- The Ministry of Environment, Forests and Climate Change will grant clearances for ecologically sensitive areas (CRZ-I), and areas falling between the low tide line and 12 nautical miles seaward.
- The modifications also include demarcation of a 20-metre no development zone for all islands and guidelines to deal with sensitive areas.

What is the significance of the move?

- The notification aims to encourage construction of buildings and launch tourism activities in areas that are closer to the high tide line.
- Government has taken the view that both affordable housing availability and tourism will grow if restrictions on coastal zones are relaxed.
- However, for tourism expansion, the new scheme will allow temporary facilities such as shacks, toilet blocks and changing rooms, maintaining only a slim margin of 10 meters from the high tide line.

What are few issues with the plan?

- When the draft of the new CRZ notification was published in 2018, concerns were raised that it ignored two major issues:
 1. Maintaining a well demarcated hazard line,
 2. Factoring in the effects of climate change on sea levels.
- The disastrous impacts of periodic cyclones show that coastlines will become even more vulnerable.
- Protection of fishers poses a challenge, since the relaxation of development controls could subject them to severe commercial pressures.
- The decision to allow construction and tourist facilities closer to the coast may boost employment and grow local business, but without strong environmental safeguards, these could damage fragile ecosystems.

4.6 Hindu Kush Himalaya Assessment Report

Why in news?

The International Centre for Integrated Mountain Development (ICIMOD) recently released the Hindu Kush Himalaya Assessment report.

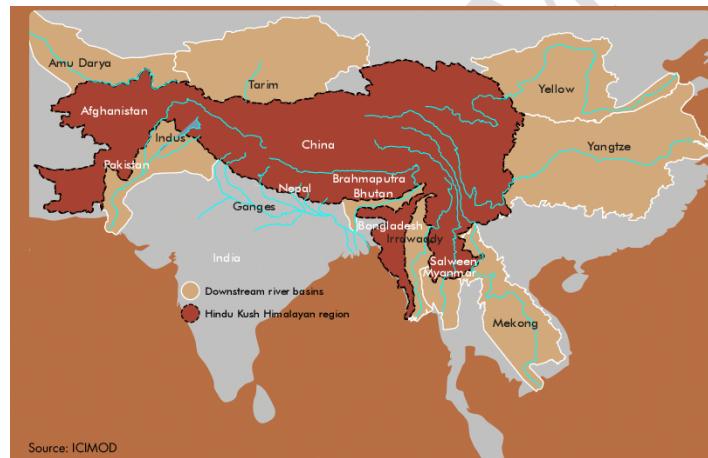
What is the background?

- The Hindu Kush Himalayan (HKH) region extends 3,500 km over all or part of **eight countries** from Afghanistan in the west to Myanmar in the east.

- It is the source of ten large Asian river systems – the Amu Darya, Indus, Ganges, Brahmaputra, Irrawaddy, Salween (Nu), Mekong, Yangtse, Yellow River, and Tarim (Dayan).
- It provides water, ecosystem services, and the basis for livelihoods to a population of around 210.53 million people in the region.
- The basins of these rivers provide water to 1.3 billion people, a fifth of the world's population.
- The Himalayan range alone has the total snow and ice cover of 35,110 sq.km containing 3,735 cu.km of eternal snow and ice.

What does the report reveal?

- It reveals that more than 35 % of the glaciers in the region could retreat by 2100, even if the global temperature rise is capped at 1.5°C.
- This could destabilise the hydrology of large parts of South Asia, China and Myanmar.
- Regions in higher altitudes tend to warm faster than low-lying lands.
- So, a global temperature increase of 1.5°C could mean at least a 1.8°C temperature rise in the Hindu Kush Himalayas.
- This will have a major bearing on the ice-fields, which are the largest repository of permafrost outside the polar regions.
- Since the region's snow is the source of 10 major river systems, large-scale warming could drastically alter the river flows in these countries.
- The receding glaciers could cause a deluge in the rivers during the monsoon while the flows are likely to reduce during the dry seasons, with serious implications for irrigation, hydropower and ecosystem services.
- Also, the receding glaciers might be the reason for the changing monsoon.
- Hindu Kush Himalayan region is a heat sink in summer and a heat source in winter, and this influences the Indian summer monsoon.
- The number of intense precipitation days and intensity of extreme precipitation have increased overall in the last five decades.
- If these trends persist, the frequency and magnitude of water-induced hazards in the Hindu Kush Himalaya region will increase.
- This is a significant conclusion given that developments in the Himalayas are known to have a spin-off on the monsoon in the Subcontinent.
- However, more studies are required to firm up the links between extreme weather events in the higher reaches of the Subcontinent and the erratic weather in the plains.
- For this, more data sharing between the countries that share the Hindu Kush Himalaya is needed.
- Political differences between these countries should not come in the way of joint efforts to build resilience of vulnerable communities and shore up the region's water security.
- Such cooperation must go alongside meeting the Paris Climate Change Pact's goals.



What should be done?

- The need is now for informed science-driven advocacy for urgent climate action and immediate conservation efforts.
- Else, the disastrous impact of glacier-melting will leave the world at large reeling.
- Success in meeting the Paris Climate Pact's target might not be enough to prevent a serious meltdown in the Hindu Kush Himalayas.

- Hence, more realistic targets specific to the region are needed, with the consensus of all the nations surrounding this part of the Himalayan region.

4.7 Felling of Trees in Delhi

What is the issue?

- Protests have erupted in Delhi over the felling of over 16,000 trees in government redevelopment yards.
- Authorities argue that the numbers are exaggerated and in any case, they would plant more trees than are being felled.

What is the government policy?

- In India's countryside, forest lands underwent diversion for "non-forest purposes".
- These have been compensated for, through a series of laws.
- The Forest Conservation Act of 1980 was the foremost one.
- The policy culminated in the Compensatory Afforestation Fund (CAF) Act of 2016.
- It assumes that planting large number of trees would compensate for the loss.
- However, how effectively will this redress cutting down natural wilderness is uncertain.
- On the other hand, compensatory afforestation largely exists on paper.

Will planting new trees really help?

- Clearly, compensation is reduced to a matter of counting trees.
- But an old forest is a whole lot more than the sum of its trees.
- Plants, fungi, microbes, insects and animals are all part of a living jungle ecosystem.
- Recreating this community is not an easy task, as it takes decades.
- Also, soil with microorganisms and mycorrhiza inhabiting the humus takes 30,000 years to build up.

What are the governance issues?

- The sole agency for carrying out compensatory afforestation is the Indian Forest Department.
- Rewilding is possible, but it needs tools, knowledge and techniques.
- But, no Forest Department in India has any experience or track record of doing any ecological restoration work of any kind.
- It is also not taught to foresters in their training.

What is the case with Delhi?

- **Authority** - For compensatory afforestation, it is the Forest Department which implements the planting schemes.
- It is charged with compliance under the CAF Act.
- But, in a city like Delhi, the Forest Department is confused of what role to play.
- It is confused in the centre of power and with so many horticultural agencies competing for its natural turf.
- The Forest Department thus plays little role in managing the green areas of Delhi.
- This is the case even with the Central Ridge, which is nominally under its control.
- **Afforestation** - In Delhi, the land that is made available for afforestation is mostly least arable and degraded.
- Also, small plots are crammed with large number of saplings which are not even native trees.
- Clearly, they cannot be relied upon or sustained, once watering and care are withdrawn.
- Delhi is one of the cities with toxic air quality in the world.
- Given this, any development that adversely impacts Delhi's air quality needs a reassessment.

4.8 Supreme Court's Order on Eviction of Forest Dwellers - Forest Rights Act

What is the issue?

- The Supreme Court has ordered the state governments to evict over 10 lakh forest dwelling families whose claims have been rejected under the Forest Rights Act.
- The order is likely to hurt some of India's most vulnerable communities, and thus needs a relook.

What does the Forest Rights Act provide for?

- The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act or FRA was passed by the Parliament in 2006 and came into effect in 2008.
- It was intended to correct the “historical injustice” done to forest dwellers from the colonial times.
- [The traditional rights of such communities were derecognised by the British Raj in the 1850s.]
- The Act recognises and vests the forest rights and occupation in forest land in the forest dwelling Scheduled Tribes.
- It also covers other traditional forest dwellers who have been residing in such forests for generations but whose rights could not be recorded.
- The Act recognises -
 - i. individual rights to forest land and livelihood
 - ii. community rights to forest 'land' exercised by their gram sabha
 - iii. community forest 'resource' rights, giving gram sabhas the power to protect and manage their forest
- Conservation plans and developmental projects in these areas would have to be approved by gram sabhas.

What are the concerns in implementation?

- The implementation of the safeguards offered in the Act has not been that satisfactory.
- **Rejection** - There are deep procedural flaws in processing of the claims to forest land, and there is a high rejection rate.
- As of April 2016, only 40% of the claims received across the country had been settled.
- Of the 44 lakh claims filed before authorities in the different States, 20.5 lakh claims (46.5%) were rejected.
- In Chhattisgarh, Adivasi communities account for a third of the population.
- But over half of individual rights and a third of community rights claims were denied.
- **Arbitrary** - Claims are being rejected without assigning reasons, or based on wrong interpretation of the provisions, or simply for lack of evidence or ‘absence of GPS survey’.
- The rejections are not being communicated to the claimants, and their right to appeal is not being explained to them or facilitated for.
- The mere rejection of claims by the state therefore does not mean that their possession of land is a crime of “encroachment”.

What was the 2016 petition?

- The petitions challenging the Forest Right Act were filed by Wildlife First, a non-governmental organisation, and retired forest officials.
- It relates to the challenge on constitutional validity of the FRA and the issue of preservation of forests in the context of it.
- Deforestation is, in fact, largely driven by 'indiscriminate clearances' for large, potentially destructive projects.
- The petition thus blamed the law for deforestation and encroachment on forest lands.
- As, the rights over the land by the forest dwellers are being denied under the provisions of the Act which was actually meant to protect them.

What was the Supreme Court's response?

- A claim is based on an assertion that a claimant has been in possession of a certain parcel of land located in the forest areas.
- If the claim is found to be unreasonable by the competent authority, the claimant would not be entitled for the grant of any Patta or any other right under the Act.
- Also, such a claimant is either required to be evicted from that parcel of land or some other action is to be taken in accordance with law.
- The claimant cannot contest the decision of the authority.
- With respect to actions to be taken on "unauthorised possessions of forest land", the States were asked by the Court to report on concrete measures.

What is the present order?

- In the present order, the Supreme Court has specifically directed governments in 21 States by name to carry out evictions.
- The families had filed claims to forest land under the Forest Rights Act, 2006 and on rejection of their claims the court has directed that the eviction be carried out on or before July 24, 2019.
- The court cautioned the States that if the evictions are not carried out within the stipulated time, the matter would be viewed seriously.
- It ordered the States' Chief Secretaries to also file affidavits, explaining why the rejected claimants on previous court orders were not evicted.
- The court ordered the Forest Survey of India (FSI) to make a satellite survey and place on record the "encroachment positions."
- It directed the FSI to also place on record the position after the eviction as far as possible.

Why is the court's order disputable?

- The immediate result would be the forced eviction of over one million people (STs and other forest communities).
- **Governance** - It is not clarified if the Supreme Court has the authority to order evictions of Scheduled Tribes from Scheduled Areas.
- There is no reference to the implications for governance in the Scheduled Areas.
- This is because the constitutional mechanisms protect the boundaries to Adivasi homelands and restrain interference in self-governance.
- **Constitutional protection** - Around 60% of the forest area in the country is in tribal areas.
- These are protected by Article 19(5) and Schedules V and VI of the Constitution; the area marked for eviction falls under these.
- It specifically mentions that the State had to make laws for the protection of the interests of any Scheduled Tribe.
- So the Court's order is a disregard for this core fundamental right protection to Adivasis.
- In fact, it is the responsibility of the Supreme Court to uphold the constitutional claims and equal citizenship.

4.9 NGT ruling on INO Observatory

Why in news?

The National Green Tribunal (NGT) upheld the environmental clearance granted to the India-based Neutrino Observatory (INO) recently.

What does the ruling say?

- The application for environmental clearance was referred to Environmental Appraisal Committee (EAC) by the State Environment Impact Assessment Authority of Tamil Nadu as it preferred the centre to assess a project of this nature.

- Environment ministry (MoEFCC) gave the clearance on March 2018, but it was challenged in NGT by Pooulagin Nanbargal.
- The INO project was approved under **category B**, even though it is about to located near an eco-sensitive national park.
- Thus the organization objected to the category under which the project was cleared.
- However, the NGT held that the environment ministry has the legal and technical competence to assess the INO project and upheld the environmental clearance.
- The judgment states that it was correct on the part of the EAC and the ministry to appraise the project at their level.
- However, the court reiterated that the INO must also obtain approval from National Board for Wildlife.
- This is because the proposed site is about 4.9 km from Mathikettan Shola bird sanctuary bordering Kerala.
- Any major activity within 5km from any wildlife sanctuary requires a specific approval by the National Board for Wild Life.
- Also, NGT ruled that specific or general condition or recommendation made by the committees and expert groups on Western Ghats will be mandatorily made applicable in the current project of INO.

What is the INO project?

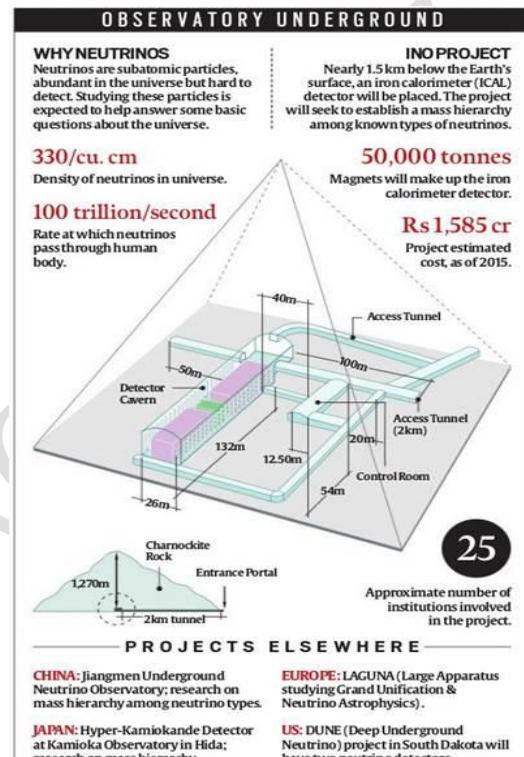
- It is a particle physics research project to primarily study the elusive sub-atomic particles called neutrinos.
- Neutrinos are extremely tiny elementary particles that are omnipresent in universe which carries no electric charge.
- It is considered to be the second most abundant particle in the universe after the photon, or light particle.
- Yet, they are very difficult to detect because they pass seamlessly through all kinds of matter, unimpeded and undetected.
- Its rest mass is almost zero (1 millionth of an electron).
- It interacts only via weak short range subatomic forces and gravity.
- Hence its detection needs high-end instruments and an environment that is effectively shielded from other radiant interference.
- Hence, a cavern is being carved out at the depth of 1,300 meters (4,300 feet) below the Western Ghats stretch in Bodi West Hills in Theni district for establishing the research site.
- An underground laboratory will be located there, nearly 1.5 km below the Earth's surface, where a giant neutrino detector is to be placed.
- The overhead rock will effectively shield it from natural cosmic radiation from outside.
- Many countries are carrying out research on neutrinos, believing that it holds important clues to some basic questions on the universe.

When will it operationalize?

- The original timeline had envisaged experimental work starting from 2017, later advanced to 2020.
- It is now unlikely to begin before 2025, even if construction starts next year.
- Construction of the underground facility would take at least 5 years and hence the project cost too is likely to escalate.

What are the challenges?

- Environment** - It has had to move from its initially proposed location, because the nearby Mudhumalai National Park had been declared a tiger reserve during the same time.



- Hence this second site was selected.
- **Litigations** - The project has been mired in all kinds of trouble such as litigation, public protests, opposition from NGOs and political parties, including the recently ended litigation with NGT.
- **Red Tapes** - Bigger uncertainties in terms of government approvals, meanwhile, are still to come.
- The project applied for clearance from the National Board of Wildlife only in January this year and that approval is still awaited.
- Last year, the INO was told it would also need building approval from relevant state government agencies.
- The building plan is being prepared and an application is likely to be moved later this month.
- It is unclear how much time it will take to get that approval.
- The Tamil Nadu government, on its part, has taken its time deciding on approvals for the project.
- **Cost** - The Union government had, in 2015, approved a budget of Rs 1,583 crore for the project.
- That budget was based on cost assessments done in 2012.
- It is estimated the project would now cost at least 25% more than that amount.

Categories under EIA

- The EIA Notification, 2006, broadly divides all projects into two categories, Category A and Category B, based on potential impacts over an area and on human health and natural and man-made resources.
- Accordingly, all Category A projects required to undertake EIA and a public hearing and its clearance are granted by the Union environment ministry.
- On the other hand, Category B projects are given a clearance by state level authorities.
- Category B projects are further classified as B1 and B2.
- While projects under Category B1 also require an EIA and public consultation, those falling under B2 are exempted from requirements of both EIA and public consultation.

4.10 Human-Tiger conflict

Why in news?

The shooting of a tigress in Maharashtra shows that big cats were victims of human-tiger interface conflict.

How has the issue evolved?

- The six-year-old tigress, named Avni, is survived by her two cubs who are 10 months old.
- Of the 13 people killed in tiger attacks in the Pandharkawda divisional forest in over two years, at least five deaths were attributed to Avni.
- The first order to shoot T1 was issued in January but was stayed by the Nagpur bench of the Bombay High Court after the tigress was found to be moving with her cubs.
- The second order came after the three successive fatal attacks in August, leading to massive public outrage.
- The operation to capture or kill T1 and capture her cubs had been going on since then, making it one of the longest such in the country to capture or kill a tiger.
- The tigress was finally shot down recently.

What are the concerns with tiger protection in India?

- India is in a leadership position on the tiger front with almost 70% of the global tiger population.
- India pioneered tiger conservation with Project Tiger by conserving 2.4% of our geographical area as tiger reserves.
- However, our tiger reserves, national parks and sanctuaries exist only as small areas in a vast sea of human, cattle and unsustainable land use.
- The stakeholders are many here, from primary (local people) to secondary (government departments) and tertiary (business groups, semi-urban scape).
- Urbanisation and growth agendas alter landscape dynamics, which has a cascading effect on the ecological dynamics of wildlife.

- This results in ecological dislocation of sorts, wherein endangered wild animals like tigers either cause distress or land themselves in trouble.
- Our per capita forest is just 0.064 ha compared to the global average of 0.64 ha, which partly explains the forest resource dependency of a large number of rural people.
- India has 668 protected areas, which add up to 14% of her forest area and 50 of these protected areas are tiger reserves.
- But the concessions in our forests have caused overuse and abuse of resources.
- Loss of forest productivity in terms of forage for wild herbivores has meant that the bulk of our forests cannot sustain medium-sized wild herbivores like deer, mega herbivores like elephants or big cats like tigers.
- In fact, successive assessments have revealed that tigers are largely confined to their source areas (core areas of tiger reserves) and their fringes (buffers).
- The bulk of other forests in most of India's tiger states have practically lost their habitat value owing to excessive biotic pressure.
- Consequently, agriculture and cash crops beyond protected areas readily lure wild pigs and other preys, which in turn lure big cats.
- The inevitable outcome is "conflict of interface" between wildlife and humans, which cause distress to people.
- This "interface" is further influenced by urbanisation, rail and road transport infrastructure and intensive operations like mining or special economic zones which are part of the growth agenda in any developing country.

What should be done?

- Human-wildlife interface is here to stay and while there can be no "co-existence" with tigers or elephants, a "co-occurrence" agenda with a proactive management control is available.
- The National Tiger Conservation Authority (NTCA) has brought out several Standard Operating Procedures (SOPs) to deal with various challenges of the human-tiger interface.
- An incapacitated tiger or leopard has to be captured on priority.
- A prime animal straying close to human settlements requires active monitoring and translocation to suitable habitat as in the case of an orphaned tigress shifted from the fringes of Bandhavgarh to Satpura.
- This requires –
 - 24x7 monitoring using technology
 - Management of corridors
 - Building up the frontline capacity
 - Creating village teams for reporting wild animal presence
 - Intersectoral portfolio at the landscape level akin to the "master plan" envisaged for an eco-sensitive zone.
- Human-tiger interface management demands proactive measures.
- One cannot allow a big cat to get habituated and then brutally eliminate it.
- The Avni story is a tragic end for our national animal, and a complete travesty of the responsibility reposed on foresters and wildlife experts.

4.11 Restriction on Highways - Bandipur Tiger Reserve

Why in news?

The Centre has asked Karnataka the consent to allow night traffic on the highway passing through Bandipur Tiger Reserve.

What and why is the current restriction?

- The National Highway (NH) 212 cuts through the Bandipur Tiger Reserve.

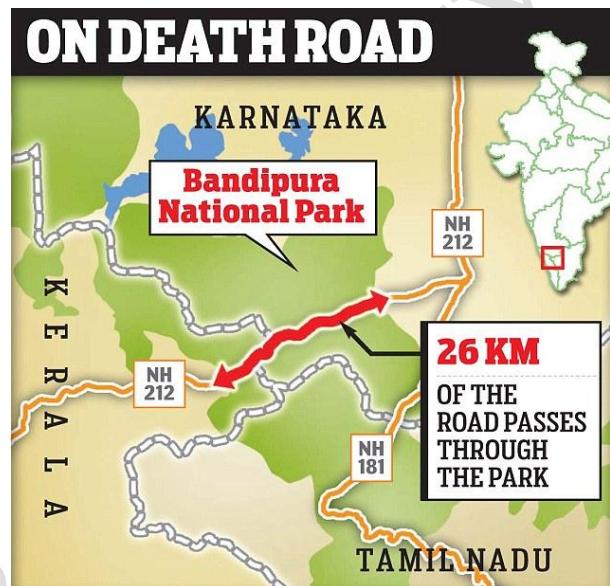
- Speeding vehicles on the highway were taking a toll on the reserve's animals.
- This included tigers, elephants and several other endangered species.
- Karnataka High Court thus, in 2010, banned traffic between 9 pm and 6 am through the highway.
- Road kills have dropped by nearly six times after it was imposed.
- Neighbouring Tamil Nadu has imposed a similar measure in the Mudumalai Wildlife Sanctuary.

What is the contention?

- The Kerala government has contested the restriction, in the Supreme Court.
- It said it was an inconvenience to those travelling from Wayanad (Kerala) to Karnataka and also hampering the state's economic development.
- However, the Karnataka High Court order does offer a middle path.
- It suggests an alternate road to the standards of NH 212 to take care of Kerala's concerns.
- The National Tiger Conservation Authority has also spoken in favour of such a solution.
- This is an ongoing case in the Supreme Court.

What is the Centre's proposal?

- Before the arrival of SC judgement, the Centre now tries to relax this ban.
- The Centre has asked the Karnataka government to give consent to open the road 24x7 with certain mitigation measures.
- The proposal included elevating the road over four 1-km stretches to provide wildlife passageways below.
- It also proposes to fence the entire highway passing through the reserve with 8-foot-high steel wire barriers.
- **Rationale** - The argument for not going for a new alternative road is that it would be 30 km longer and pass through hilly terrain.
- It thus increases travel time, fuel consumption, and pollution.
- Also, it is argued that as traffic endangers wildlife even during the day, fencing and passageways are a better idea.



What are the larger concerns?

- **Plan** - Underpasses are unlikely to suffice in dense wildlife-rich forests where too many animals compete for space.
- For territorial animals, just four openings in a 24-km stretch may not suffice.
- They may have to use a passageway in their neighbour's territory to move between two halves of its territory (split by the highway).
- This may endanger them through the resultant habitat and prey loss.
- **Threat** - Roads, railway lines and irrigation canals become barriers that hinder wildlife movement.
- This is especially worse at night when bright headlights blind even swift species like cats.
- This, in turn, contributes to habitat loss, fragmenting wildlife populations and restricting their gene flow.
- **Global examples** - Roads have destroyed tropical rainforests in South America, Asia and Africa too.
- Though under severe pressure, the Amazon rainforests still hold over 1 million sq km of no-go zones.
- In North America and Europe, where road network is extensive and wildlife density lower, wildlife passageways are more common.

- Such features are seen in Malaysia and Kenya as well, and in South Africa, night traffic is prohibited.

What is the policy in this regard?

- National Board for Wildlife (NBWL) is the apex advisory body to the central government on all wildlife-related matters.
- In 2013, the NBWL objected to any new roads through protected forests.
- It was however open to the widening of existing roads only if alternative alignments were not available.
- It nevertheless mandated adequate mitigation measures irrespective of the cost.
- The government accepted this as the policy in 2014.
- Recently, the NBWL made it mandatory for every road/rail project proposal to include a wildlife passage plan.
- This has to be as per guidelines framed by Wildlife Institute of India.
- However, passageways have their own limitations in dense forests.

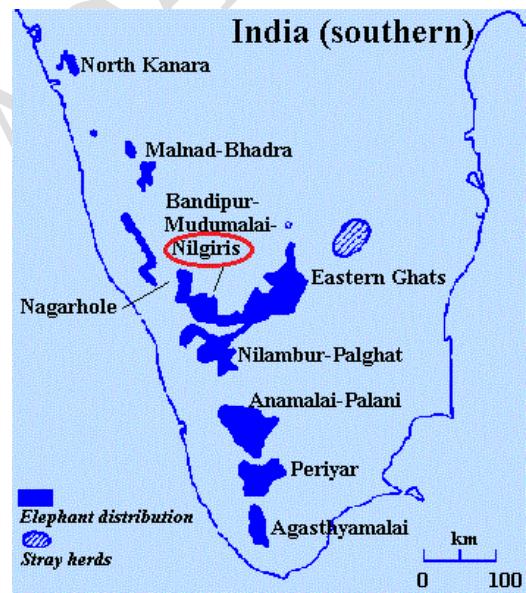
4.12 SC Order on Nilgiris Elephant Corridor

Why in news?

Supreme Court recently directed the TN government to seal resorts and hotels in the Nilgiris elephant corridor.

What is the Court's order?

- The Tamil Nadu government has to seal or close down within 48 hours, 11 resorts and hotels.
- These were constructed on the elephant corridor of Nilgiris in violation of law.
- Owners of other resorts and hotels in the area were asked to place their documents of approval before the Collector within 24 hours.
- The Collector will verify the documents and check if a resort or hotel has been constructed with proper prior approval.
- If not, then the same should also be closed down within 48 hours.



What is the status of elephant corridors?

- As estimated, there are 101 elephant corridors, of which almost 70% are used regularly.
- Nearly three-quarters of the corridors are evenly divided among southern, central and northeastern forests.
- The rest are found in northwest Bengal and the northwestern region.
- Some of these passages are precariously narrow, at only a hundred metres wide.
- Nilgiris** - There are an estimated 6,500 elephants in just the Brahmagiri-Nilgiris-Eastern Ghats ranges.
- Most of the resorts in the Nilgiris have come up right under the gaze of the Forest Department.
- The majority continue to function without the requisite permissions.
- This must be thoroughly investigated to check whether there was any wrongdoing.
- The grey area of mushrooming home-stay structures, which are just hotels on forest fringes, also deserves scrutiny.

What is the need?

- Forests that have turned into farms and unchecked tourism are blocking animals' paths.
- Animals are thus forced to seek alternative routes resulting in increased elephant-human conflict.

- Weak regulation of ecotourism is severely impacting important habitats.
- It particularly affects animals that have large home ranges, like elephants.
- The movement of elephants is essential to ensure that their populations are genetically viable.
- It also helps to regenerate forests on which other species, including tigers, depend.
- Elephant corridors are also crucial to reduce animal fatalities due to accidents and other reasons.
- So fragmentation of forests makes it all the more important to preserve migratory corridors.
- Ending human interference in the pathways of elephants is more a conservation imperative.
- The Supreme Court's order is thus a necessary step to restore the ecology of these spaces.

4.13 Private Conservancy Rules

Karnataka recently drafted *Private Conservancy Rules* in a bid to increase forest area through private land.

- Under the rules, anyone who has a minimum of 100 acres of land bordering a national park can convert it to a "Wildlife Private Conservancy".
- Of this land, 5% can be used to construct buildings for ecotourism; the rest has to be kept for flora and fauna.
- The purpose is to establish a safe corridor for wild animals between two forest areas.
- The rules state that all forest, wildlife and environment laws and rules will be applicable in these private reserves.
- It also suggest that in case of untoward incidents, no compensation will be given by the government and the resort owner will be held responsible.
- Agriculture, horticulture, plantation crop lands and other landscape areas can be brought under private conservancy and declared as 'private forests.'
- The management of private wildlife reserves will consist of a management committee which will be responsible for conserving, maintaining and managing the reserve and advise the chief warden on all issues.
- The panel will comprise three members - owner of the private wildlife reserve, a wildlife conservationist and the jurisdictional forest officer.
- Under existing rules, only farming and horticultural activities are allowed within 10 kilometre surrounding forest land.

4.14 Deep Ocean Mission

- The Central government has drawn up a 5-year plan to explore the deep ocean.
- Ministry of Earth Sciences has been tasked with coordinating the exercise.
- The ministry has recently unveiled the blueprint of "Deep Ocean Mission".
- The mission proposes to explore the deep ocean similar to the space exploration started by ISRO about 35 years ago.
- The Exclusive Economic Zone (EEZ) allotted to India (2.2 million sq.km) in the international waters will be covered under this mission.
- The focus will be on technologies for deep-sea mining, underwater vehicles, underwater robotics and ocean climate change advisory services.
- Under this mission, the key deliverables are
 - i. Offshore desalination plant that will work with tidal energy, and
 - ii. Developing a submersible vehicle that can go to a depth of at least 6,000 metres with three people on board.

5. RESOURCE MANAGEMENT

5.1 NITI Aayog's Report on Water Management

Why in news?

NITI Aayog has released Composite Water Management Index

What is the Index About?

- The NITI Aayog's Composite Water Management Index ranks States on water management on the basis of nine parameters.
- The report assesses States on restoration of surface and ground water, development of watersheds, participatory irrigation, sustainable farming and urban water supply and sanitation.
- According to the report 600 million people face high-to-extreme water stress, 75 per cent of the households do not have drinking water.
- 84 per cent do not have piped water access 70 per cent of India's water is contaminated.
- The report stated that even when water is available, it is likely to be contaminated, resulting in nearly 2,00,000 deaths each year

What are the concerns spotlighted by the report?

- The report without going into the methodology on how States have been assessed, is just concerned about quick results in water management, as it is about the performance of States on ease of doing business.
- Even as India relies increasingly on groundwater for its irrigation and livelihood needs, with rivers running dry or being reduced to sewers.
- It has recently come to light that uranium contamination is commonplace.
- With water levels dropping to 1,000 feet in dry regions of peninsular India in particular, fluoride contamination too is on the rise.
- Places Gujarat, Madhya Pradesh, Andhra Pradesh, Karnataka and Maharashtra in the top five.
- Meanwhile, free electricity in developed states for agriculture has led to a precipitous decline in the water table, despite the State being endowed with surface water.
- Resource intensive farming practices, encouraged by faulty policies are prime reasons for depletion of water resources.

What measures needs to be taken?

- The Centre expects a new groundwater management regime as well as a technology partnership with Israel to make a difference.
- Water management needs hard political choices, such as pricing water use and weaning farmers away from paddy and sugarcane in dry, rainfed regions.
- Apart from this the report should expand the scope of its inquiry to look at socio-economic aspects.
- A socio-political consensus is also needed to restore rivers and watersheds, by checking over-development of eco-sensitive spots, sand mining and dumping of municipal and industrial waste.

5.2 Water Stress in India

What is the issue?

- The NITI Aayog's water management index was released recently.
- This, along with a NABARD sponsored study on water productivity of different crops depicts the country's increasing water stress.

What are the highlights of NITI Aayog's report?

- The current water crisis in the country is said to be the worst in history.

- NITI Aayog maintains that about 600 million people face high to extreme water scarcity.
- This is almost half the population of the country.
- About 200,000 people die every year due to lack of safe water.
- The crisis will escalate with the water availability dwindling to merely half of the effective demand by 2030.
- Groundwater resources (40% of total water supply) are also predicted to deplete rapidly.
- This may accentuate water paucity in both rural and urban areas.
- Some 21 cities, including Delhi, Bengaluru and Hyderabad, will almost run out of groundwater by as soon as 2020.
- If these come true, around 40% of the population will lose access to water.
- Also, the gross domestic product (GDP) will take a hit of about 6%.

What does NABARD's study reveal?

- It holds the overuse of water in the agricultural sector responsible for the present adversity.
- Over two-thirds of the nation's available water is consumed in the farm sector.
- In this, about 80% goes just to three crops — rice, wheat and sugarcane.
- The most intensive cultivation of these water-guzzling crops is high in water-stressed regions.
- E.g. sugarcane in Maharashtra, rice and wheat in Punjab and Haryana.
- The report attributes the water crisis to unsustainable cropping trends.
- This in turn is attributed to ill-advised incentives
 - i. liberally determined minimum support prices
 - ii. assured marketing through open-ended procurement
 - iv. subsidised or free supply of water and power

5.3 Water Theft in India

What is the issue?

Illegal water trade is thriving in most Indian cities and is crippling most of the Indian cities' water distribution networks.

What do the reports say?

- The Central Groundwater Board underlines that the water level has declined in 64% of the total monitoring wells.
- A new study by researchers at IIT Guwahati reveals that only six out of 22 river basins in the country have the potential to cope with the threat of climate change, particularly droughts.
- The NITI Aayog in its report on 'Composite Water Management Index' (2018) has underlined that nearly 600 million Indians faced high to extreme water stress.
- It also quoted that about 2,00,000 died every year due to inadequate access to safe water.
- The World Bank, in its report 'India's Water Economy: Bracing for a Turbulent Future', had clearly outlined that dams in India have the capacity to store only about 30 days of rainfall.
- This shows that the water storage capacity of innumerable small water bodies has eventually declined due to centuries of neglect and mismanagement.
- All these indicate that water stock is not adequate for future use in India.
- However, the country's growing water scarcity is not only due to climate change and constant competing demand from various sectors, but due to **rampant water theft** as well.

How does it happen?

- **Multinational Firms** - It is reported that many multinational beverages and packaged water business firms steal groundwater in many places.
- The gram panchayat authorities in Palakad district of Kerala allege that a multinational company draws 6.5-15 lakh litres of groundwater per day against the permissible limit of 2.4 lakh litres.
- Some multinational firms in Meghalaya, Andhra Pradesh, Kerala, Tamil Nadu and Rajasthan have reportedly suspended their bottling operations following massive protests by villagers.
- Hotels, marriage halls, recreation clubs, manufacturing firms and building contractors in many areas lift water illegally from nearby ponds and lakes mostly during night, thereby reducing the availability of water for the poor and livestock.
- **Residencies** - Residents in illegal multi-storied buildings and vast slums that are not connected to any official water pipelines are generally involved in stealing water.
- For instance, a housing society in Mumbai, which did not possess any occupation certificate, was reportedly penalised by BMC in 2017 for stealing water from its pipelines for almost 25 years.
- **Industrial Units** - About 2,000 to 10,000 private water tankers reportedly operate illegally on a daily basis in Delhi, Mumbai, Bengaluru and Chennai supplying loads of water mostly to industries.
- It is estimated that as much as 50 lakh litres of groundwater is extracted by the tanker mafia daily and sold to industrial units and construction sites in Gurgaon.
- According to the Centre for Science and Environment, around 20,000 illegal bore-wells were dug by tankers in Gurgaon.
- This could be the main reason why the annual groundwater draft of 0.39 BCM (billion cubic meters) is very high in Delhi as against the net availability of 0.31 BCM as per CGWB data.
- **Unaccounted water** – Analysis of various city development plans in India shows that water theft and unauthorised water connections gives rise to a high level of unaccounted water.
- A recent study on Water Governance (2013) reveals that unaccounted water in Delhi amounts to around 50% of the total water pumped into the system, whereas it is 35-40% in Hyderabad and Bengaluru.
- **Illegal diversion** - Water theft is so severe that in the worst situations, this can lead even to a lack of drinking water.
- The World Bank in its report, ‘The Challenge of Reducing Non-Revenue Water in Developing Countries’, reveals that 48 million cubic meters of drinkable water escape daily from official supply networks, which is enough to provide water for 200 million people.
- The same report on India had clearly highlighted that 40-60% of water in Mumbai is lost through illegal diversion.

5.4 Ground Water Extraction Guidelines

Why in news?

The Central Ground Water Authority (CGWA) has notified the new water-extraction guidelines recently.

What does the revised guidelines reveal?

- It has introduced the concept of Water Conservation Fee (WCF).
- The WCF payable varies with the category of the area, type of industry and the quantum of ground water extraction.
- It is designed to progressively increase from safe to over-exploited areas and from low to high water consuming industries as well as with increasing quantum of ground water extraction.
- Through this design, the high rates of WCF are expected to discourage setting up of new industries in over-exploited and critical areas.
- It also acts as a deterrent to large scale ground water extraction by industries, especially in over-exploited and critical areas.

- The WCF would also compel industries to adopt measures relating to water use efficiency and discourage the growth of packaged drinking water units, particularly in over-exploited and critical areas.
- It encourages use of recycled and treated sewage water by industries and a provision of action against polluting industries.
- It mandates requirement of digital flow meters, piezometers and digital water level recorders, detailing the quantum of extraction.
- Also, water audit should be conducted by industries abstracting ground water of 500 m³/day or more in safe and semi-critical and 200 m³/day or more in critical and over-exploited assessment units.
- Industries should undertake rooftop rain water harvesting and measures should be adopted to ensure prevention of ground water contamination in premises of polluting industries/ projects.
- There is also an exemption from requirement of No Objection Certificate for –
 1. Agricultural users
 2. Users employing non-energised means to extract water
 3. Individual households (using less than 1-inch diameter delivery pipe)
- Other exemptions have been granted to strategic and operational infrastructure projects for Armed Forces, Defence and Paramilitary Forces Establishments and Government water supply agencies.

What are the concerns?

- **Regulation** - The guidelines do not make any effort to ensure efficient and need-based utilisation of water for irrigation, which uses nearly 90% of the extracted groundwater.
- The domestic sector has also been exempted from any restrictions.
- Only 5% groundwater that is accessed by the industrial sector is proposed to be regulated for careful use.
- **Approval** - Some of the well-advised norms that are already in place have been relaxed for no good reason.
- Many commercial ventures, including beverages and drinking water bottlers, do not only consume water in bulk but also waste it in substantial measure.
- The power of issuing no objection certificates (NOC) for many kinds of industrial units has now been vested with district magistrates instead of the CGWA.
- Since the civic authorities lack wider perspective on this matter, they can be expected to be quite lenient in letting the commercial ventures tap it unchecked.
- **Norm relaxation** - The existing provision for mandatory recharging of groundwater by bulk consumers has also been diluted.
- They are now bound only to undertake rooftop water harvesting and not large-scale field projects for rainwater harvesting.
- **Fund utilisation** - The new guidelines propose water conservation fees (WCF) on groundwater use to generate resources for the state governments' water harvesting schemes.
- However, there is no guarantee that these funds will actually be used for this purpose.
- **Usage cap** - Though water charges have been levied, there is no cap on water withdrawals.
- Thus, this step will not suffice to discourage wasteful use by cash-rich consumers.
- **Re-use** - The new rules have virtually done away with the obligation to reuse the extracted water.
- This will result in the rampant overexploitation of this resource, causing a sharp dip in water table in many areas.

What should be done?

- India is already the world's largest user of groundwater, tapping annually about 253 billion cubic metres (BCM) of water.
- This is equivalent to 25% of yearly withdrawals at the global level.
- As many as 1,034 of India's total 6,584 groundwater blocks have already been categorised as "over-exploited".

- Among the rest, 253 blocks are in “critical” and 681 in “semi-critical” categories and some others hold only saline water.
- Water tapping in these areas needs to be kept below the level of annual recharge through natural or artificial means.
- However, the recent guidelines are unlikely to help check wasteful and injudicious use of rapidly vanishing groundwater because of several loopholes.
- Thus, exceptional care is needed not only to thwart its indiscriminate use but also to incentivise its replenishment with rainwater.
- Otherwise, large parts of the country would soon face severe shortage of water even for domestic and drinking purposes.

5.5 Problem of Ghost Gear - Fishing

What is the issue?

- The problem of ghost gear in Indian oceans is getting to be a serious concern.
- India should emulate innovative solutions from across the world to tackle this.

What are the recent happenings?

- Ghost gear is any fishing equipment that has been lost, discarded or abandoned in water bodies.
- The problem of ghost gear has grown from a fishing outcome that people had not heard of to one that is now difficult to ignore.
- In March 2018, fishermen hauled 400 kg of fishing nets out of the sea in a few locations off Kerala’s south coast.
- Reportedly, many divers regularly make underwater trips just to extract nets that have sunk to the ocean floor.
- It covers the regions off India’s coasts, ranging from Tamil Nadu to Maharashtra.

What is the impact?

- Ghost nets are often ‘ghost fishers’ as ocean currents carry them for thousands of km across the ocean floor.
- E.g. discarded Indian and Thai fishing nets have been fished out of Maldivian coasts
- They entangle, injure and drown marine life and damage live corals along the way.
- The Olive Ridley Project is a U.K. registered charity that removes ghost nets and protects sea turtles.
- The project, between 2011 and 2018 alone, recorded around 600 sea turtles being entangled in ghost gear near the Maldives.
- Of this, 528 were Olive Ridleys, the same species that come in thousands to Odisha’s coasts to nest.
- Other casualties worldwide include whales, dolphins, sharks and even pelagic birds.
- In 2016, another study found over 5,400 marine animals belonging to 40 different species entangled in ghost gear, or associated with it.

What are the concerns?

- The analysis showed a huge gap in data from the Indian, Southern and Arctic Oceans, and thus prompted on future studies to focus on these areas.
- But even after two years, there are still no data pertaining to the extent of prevalence of ghost gear off India’s coast.
- Data is crucial because the detrimental effects of these nets also spillover into other countries and oceans.
- The government is currently preparing a national ghost net management policy.
- But besides ghost nets, the larger concern is the bigger violations wherein large vessels do fishing where they are not supposed to.
- Unless this is checked, implementing a policy on the management of ghost nets is hard.

- The consequences of overfishing, using nets of the smallest mesh size, and illegal fishing are far less visible, but are more worrying.
- Entire fishing communities are affected by these actions.
- Especially in developing countries like India where the demand for fish keeps rising, the impact is serious.

5.6 Composite Water Management Index

- The index is developed by NITI Aayog and it ranked states on how well they managed water.
- It is released by the Ministry of Water Resources.
- It comprises 9 broad sectors with 28 different indicators covering various aspects of groundwater, restoration of water bodies, irrigation, farm practices, drinking water, policy and governance.
- According to the recent report, Gujarat, Madhya Pradesh and Andhra Pradesh have managed water resources efficiently.
- Meghalaya, Uttarakhand and Nagaland are the bottom three states in the index.
- While Tripura has emerged as top performer in north-east, Rajasthan has emerged as the best performer in the incremental progress over last two years.
- Some of the other important findings from the recent report are,
 1. India is facing its “worst” water crisis in history and that the demand for potable water will outstrip supply by 2030, if steps are not taken.
 2. 21 cities, including Delhi, Bengaluru, Chennai and Hyderabad, will run out of groundwater by 2020, affecting 100 million people.
 3. Critical groundwater resources, which accounted for 40% of the water supply, are being depleted at “unsustainable” rates and up to 70% of the supply is “contaminated”.

6. BIODIVERSITY

6.1 Reviving Principle of 'Commons'

What is the issue?

- There is a decline in the natural and biodiversity resources, despite concerted global efforts to conserve them.
- There is an urgent need to revive the principle of 'Commons' in biodiversity management at global level and in India.

What is the Convention on Biological Diversity for?

- The Convention on Biological Diversity (CBD) entered into force in December 1993.
- The CBD's three main objectives are:
 - i. the conservation of biological diversity
 - ii. the sustainable use of the components of biological diversity
 - iii. the fair and equitable sharing of the benefits arising out of the utilization of genetic resources
- The 14th meeting of the Conference of Parties to the CBD took place at Sharm el-Sheik, Egypt with 196 countries in November 2018.
- Governing biological resources (or biodiversity) at different levels for the world's sustainable future was a key agenda.
- The meeting had come at a significant time when -
 - i. it was the CBD's 25th year of implementation
 - ii. countries had approximately 350 days to meet global biodiversity targets
 - iii. a report had come that humans have mismanaged biodiversity so badly that 60% of resources (which can never be recouped) have been lost

What is the principle of ‘Commons’?

- Natural resources are a set of resources such as air, land, water and biodiversity that do not belong to one community or individual, but to humanity.
- For thousands of years, humans have considered natural resources and the environment as a global public good.
- Under the principle of ‘Commons’, resources are largely managed by the communities themselves, for centuries.
- The developments as part of establishment of civilisations as well as today's agricultural development are a result of such ‘Commons’.

How did it change?

- The urge of those with money and power to privatiser the natural resources for individual prosperity disturbed the principle of ‘Commons’.
- It took the forms of property management principles, intellectual property rights and others.
- In a way, the CBD also contributed to states now owning the resources, including their rights on use and management.
- As a multi-lateral environmental agreement, it has provided legal certainty to countries through the principle of sovereign rights over biodiversity.
- The intent of the CBD and having sovereign rights was to manage resources better.
- But the results of such management have been questionable as the common property resource management principles are being compromised.

Why are ‘Commons’ significant?

- **Globally** - A third of the global population depends on ‘Commons’ for their survival.
- Around 65% of global land area is under ‘Commons’, in different forms.
- Nearly 2, 90,000 million metric tonnes of carbon (MtC) are stored in the collective forestlands of indigenous peoples and local communities.
- Significantly, ‘Commons’ support pollination (the cost estimated to be worth \$224 billion annually at global levels).
- **India** - In India, the extent of ‘Commons’ land ranges between 48 million and 84 million hectares, constituting 15-25% of total geographical area.
- ‘Common’-pool resources contribute \$5 billion a year to the incomes of poor Indian households.
- Nearly 53% of India’s milk and 74% of its meat requirements are met from livestock kept in extensive ‘Commons’ systems.
- Around 77% of India’s livestock is kept in grazing-based or extensive systems and dependent on ‘Commons’ pool resources.

What is India’s ‘Commons’ scenario?

- Despite their significance, ‘Commons’ in India have suffered continued decline and degradation.
- There is 1.9% decline every five years in the area of ‘Common’ lands in India.
- But microstudies show a much more rapid decline of 31-55% over 50 years.
- This is affecting the health of systemic drivers such as soil, moisture, nutrient, biomass and biodiversity, in turn aggravating food, fodder and water crises.
- As of 2013, India’s annual cost of environmental degradation has been estimated to be Rs. 3.75 trillion per year which is 5.7% of GDP.

Why is it a concern?

- ‘Commons’ becoming uncommon is a major socio-political, economic and environmental problem.
- ‘Commons’ as resources are no longer relevant only for rural communities.

- They are now a major provider of livelihood options for both urban and peri-urban populations.
- The sovereign rights legally provided under the CBD are not for the states to do away with ‘Commons’-based approaches.
- The state can have oversight over resource management.
- But keeping people away from using and managing ‘Commons’ is against effective governance of ‘Commons’.

What is the way forward?

- There needs to be a review of current governance of biodiversity and natural resources.
- Discussions under the United Nations should focus on how and why ‘Commons’ have been negatively impacted by seemingly conservation measures.
- In addition to seeking more money, time and capacities to deal with biodiversity management, there is a need to re-introduce more strongly, the principles of ‘Commons’.
- It would be appropriate in many places to put resource management in the hands of the people.

6.2 Declining Megafauna species

Why in news?

A research published in the journal *Conservation Letters* showed that at least 200 species of “megafauna” are decreasing in number.

What is the background?

- The researchers were part of an international collaboration that built a list of megafauna based on body size and taxonomy.
- The species qualified for the list were species unusually large in comparison to other species in the same class.
- The mass thresholds were 100 kg for mammals, ray-finned fish and cartilaginous fish and 40 kg for amphibians, birds and reptiles.
- Megafauna species are more threatened and have a higher percentage of decreasing populations than all the rest of the vertebrate species together.

What does the research reveal?

- Over the past 500 years, humans’ ability to kill wildlife at a safe distance has become highly refined.
- Hence, 2% of megafauna species have gone extinct in the period.
- Humans’ meat-eating habits may be pushing at least 150 species of the planet’s largest animals towards the threat of extinction.
- e.g Chinese giant salamander is one of only three living species in an amphibian family that traces back 170 million years.
- Considered a delicacy in Asia, it’s under siege by hunting, development and pollution.
- Nine megafauna species have either gone extinct overall, or gone extinct in all wild habitats, in the past 250 years.
- Direct harvest for human consumption of meat or body parts is the biggest danger to nearly all of the large species with threat data available.
- Thus, minimising the direct killing of these vertebrate animals is an important conservation tactic.
- Users of Asian traditional medicine also exert heavy tolls on the largest species through the consumption of various body parts.
- This might save many of these iconic species as well as all of the contributions they make to their ecosystems.
- In addition to intentional harvesting, a lot of land animals get accidentally caught in snares and traps, and the same is true of gillnets, trawls and longlines in aquatic systems, along with their habitat degradation.
- When taken together, these threats can have major negative cumulative effects on vertebrate species.

- In the future, 70% will experience further population declines and 60% of the species could become extinct or very rare.
- The report warned that preserving the remaining megafauna is going to be difficult and complicated.
- There will be economic arguments against it, as well as cultural and social obstacles.
- But if we don't consider, critique and adjust our behaviours, our heightened abilities as hunters may lead us to consume much of the last of the Earth's megafauna.

What does the EAT-Lancet report reveal on human diet consumption?

- Transforming to healthy diets by 2050 will require drastic changes.
- Global consumption of healthy foods, such as fruits and vegetables, will need to double, while overconsumption of foods like added sugars and **red meat** will need to be more than halved.
- At the same time, it will be equally important to take a differentiated approach for healthy and sustainable diets in developing countries and for poor populations.
- For many developing countries and the poor, under-nutrition and access to healthy foods remain persistent challenges.
- Small amounts of **animal-sourced foods** (ASFs) (like dairy, eggs, fish or chicken) for young children and women during pregnancy and lactation **are crucial** for nutrition and health, especially in poor populations.
- There is a strong association between reduction in stunting and ASF consumption.
- Hence, healthy and sustainable diets may look different from country to country and animal sourced foods serve as an inevitable part to tackle malnutrition among poor populations.

6.3 Decline in Insect Population

What is the issue?

- A study titled 'Worldwide decline of the entomofauna: A review of its drivers' was published recently.
- Insect populations are declining sharply worldwide, which could potentially cause the collapse of the planet's ecosystems.

What are the key findings?

- More than 40% of insect species could become extinct in the next few decades.
- The extinction rate is eight times faster than that of mammals, birds and reptiles.
- In addition to this, one third of insect species are endangered.
- Insect biomass is declining by 2.5% a year; there is a threat that all of the planet's insects could go extinct within a century.
- Large numbers of specialist insects, which fill a specific ecological niche, and general insects are declining.
- On the other hand, a small group of adaptable insects are rising in numbers, but nowhere near enough to arrest the decline.
- An earlier study found that flying insect populations in German nature reserves declined by more than 75% over the duration of a 27-year study.
- This indicates that die-off is happening even beyond areas affected by human activity, in locations meant to preserve biodiversity.

Why are insects important?

- Bugs make up around 70% of all animal species.
- The study stresses on the importance of insect life on interconnected ecosystems and the food chain.
- The ecosystem at the bottom level which includes insects has to be in balance.
- Insects have been at the structural and functional base of many of the world's ecosystems, since their rise almost 400 million years ago.

- In a way, insects are the small creatures that run the world.
- In the event of any imbalance, the "bottom-up" effects of insect loss would be serious.

What is the likely impact?

- The decline in insect population and extinction could potentially cause the collapse of the ecosystems with a catastrophic effect on life on Earth.
- If there are no insects as moderators of other pest populations, insect populations would increase and ruin crops and make them difficult to grow.
- Species that rely on insects as their food source and the predators higher up the food chain which eat those species are likely to suffer more.
- An immediate danger is the loss of insectivorous birds, and the risk of larger birds turning from eating insects to eating each other (birds).
- The pollination of both crops and wild plants would also be affected, along with nutrient cycling in the soil.
- [Some 80% of wild plants use insects for pollination while 60% of birds rely on insects as a food source.]
- Lepidoptera, the order of insects that includes butterflies and moths, seems to have suffered the most.
- Bees (belonging to the Hymenoptera order) have been equally hard hit by the current decline in insect numbers.
- Most insects are particular about the kind of soil they inhabit; their absence can be a serious indicator of soil health too.

What are the causes for the decline?

- The major causes for the decline in insect numbers include -
 - i. habitat loss
 - ii. conversion to intensive agriculture, use of agro-chemical pollutants
 - iii. urbanization
 - iv. pollution, particularly from pesticides and fertilizers
 - v. biological factors such as pathogens and introduced species
 - vi. climate change

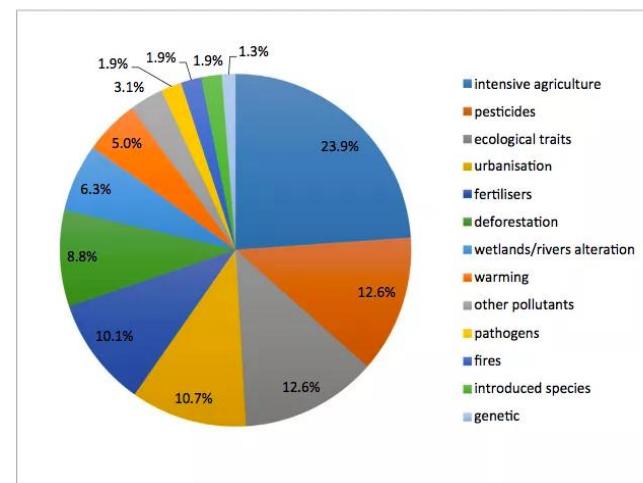


Fig. 6. Main factors associated with insect declines – see also Fig. 5.

What is to be done?

- The findings call for an immediate and decisive action to avert a catastrophic collapse of nature's ecosystems.
- Overhauling existing agricultural methods is essential at this stage.
- Particularly, a serious reduction in pesticide usage and its substitution with more sustainable, ecologically-based practices is needed.

6.4 Inter-Species Social Behaviour

Why in news?

Recent scientific study on birds has revealed new insights on inter-species social behaviour among animals.

What is the recent research on inter-species?

- 'Birds of a feather flock together' is an old adage to explain some well-observed aspects of social behaviour among humans and animals.
- Social behaviour among animals have been researched for a long time, but was restricted to focus on intra-species social interactions.

- This had led scientists to have a fairly sophisticated understanding of group behaviours.
- However, relatively less is known about the socialising of certain animals including birds and mammals with individuals of other species.
- A recent Research by Centre for Ecological Sciences at the Indian Institute of Science in Bengaluru offers new insights on inter-species social behaviour among animals.

What are the significant revelations of the study?

- Scientists have tried to get clarity on the difference between mixed-species socialisations and same-species interactions and ascertain the motivation for mixed-species socialising.
- It was generally thought that in same-species social interactions, all individuals get similar benefits and in mixed-species interactions, different groups get different benefits.
- But the study revealed that most cases of mixed species socialisation was similar to that of single species groups and the benefits received from both the groups were also similar.
- Therefore, when the motivation for joining mixed species group rather than same species group were studied, it was found that gaining concrete benefit like having same predator.
- And quality of such benefit like how soon can an individual spot a predator, were factors for choosing mixed species group.
- Some birds took into account the cost of competition while deciding whether to join a flock of different species, such as different food habits but share same predator.
- It was also found that birds considered their flight behaviour and skills while joining another group, so as to coordinate their activities together as a flock.
- A combination of these and probably more were the motivations behind birds' decision to restrict themselves to flocks of their own species or join other groups.
- These revelations would be helpful in protecting the species of the interacting group of any cascading effects if the other group of species become extinct or change behaviour.

7. DISASTER MANAGEMENT

7.1 Defining a National Disaster

What is the issue?

- Unprecedented rains in Kerala and associated devastation has led to calls for declaring the floods a national calamity.
- It is imperative at this juncture to look into how calamities are actually classified as a national disaster.

What is a "disaster" legally?

- A "disaster" is defined as per the specifications in Disaster Management Act, 2005.
- Accordingly, a "disaster" means a catastrophe, mishap, calamity or grave occurrence in any area.
- This could arise from natural or man-made causes, or by accident or negligence.
- It should result in
 - i. substantial loss of life or human suffering (or)
 - ii. damage to, and destruction of, property (or)
 - iii. damage to, or degradation of, environment
- It should either be of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area.
- By this, a natural disaster may include an earthquake, flood, landslide, cyclone, tsunami, urban flood, heatwave, etc.

- It may also include a man-made disaster of nuclear, biological and chemical nature.

What is a national disaster?

- The central government has examined proposals in the past to define a national disaster.
- However, there is no provision, executive or legal, to declare a natural calamity as a national calamity.
- Hence there is no fixed criterion to define any calamity as a national calamity.
- In this regard, the 10th Finance Commission (1995-2000) examined a proposal.
- The proposal was to term a disaster “a national calamity of rarest severity” if it affects one-third of the state's population.
- The panel did not define a “calamity of rare severity”.
- But it stated that a calamity of rare severity would necessarily have to be adjudged on a case-to-case basis.
- It would have to take into account:
 - i. the intensity and magnitude of the calamity
 - ii. the level of assistance needed
 - iii. the capacity of the state to tackle the problem
 - iv. the alternatives and flexibility available within the plans to provide relief, etc
- Accordingly, 2013 Uttarakhand flood and 2014 Cyclone Hudhud in Andhra Pradesh were classified as calamities of “severe nature”.

What are the benefits of such a declaration?

- On declaration as a calamity of “rare severity”/“severe nature”, support to the state government is provided at the national level.
- The Centre also considers additional assistance from the National Disaster Response Fund.
- A Calamity Relief Fund (CRF) is set up, with the corpus shared 3:1 between Centre and state.
- When CRF resources are inadequate, additional assistance is considered from the National Calamity Contingency Fund (NCCF).
- NCCF is funded 100% by the Centre.
- Relief in repayment of loans or grant of fresh loans to the affected persons on concessional terms are also considered.

How is the funding decided?

- It works as per the National Policy on Disaster Management, 2009.
- The National Crisis Management Committee deals with major crises that have serious or national ramifications.
- It is headed by the Cabinet Secretary.
- The inter-ministerial central teams are deputed to the affected states.
- They make assessment of damage and relief assistance required.
- An inter-ministerial group, headed by the Union Home Secretary, studies the assessment.
- It then recommends the quantum of assistance from the NDRF/NCCF.
- Based on this, a high-level committee approves the central assistance.
- It comprises of Finance Minister as chairman, and Home Minister, Agriculture Minister, and others as members.

7.2 Reasons behind Kerala Flood - Post Analysis

Why in news?

According to official reports mismanagement of dams was the primary reason for the kerala floods.

What is the role of dams in water management?

- One of the major functions of dams is flood protection to attenuate the flow of water and its impact downstream.
- The golden rule followed in dam management is to maintain a flood cushion (buffer) in case of unexpectedly high rainfall.

What is the brief structure of Kerala dams?

- Kerala has 39 major dams, their maintenance is shared between the Kerala State Electricity Board (KSEB) and the Water Resources Department.
- The Periyar is the longest river in Kerala and has the highest discharge potential.
- The major dams across this river that are maintained by the KSEB are Idukki, Lower Periyar, and Madupetty.
- The water from Lower Periyar, Madupetty and Mullaperiyar drains into the Idukki reservoir consisting of the Idukki dam and the Cheruthoni dam.
- The water from the Idukki reservoir and Idamalayar drains directly into the Bhoothathankettu dam, which is the lowermost in the Periyar system, just 15 km from Kothamangalam town.

What are the primary reasons of Kerala floods?

- According to India Meteorological Department's study, the rainfall in August was only the sixth highest in the past 143 years (1875-2017) in Kerala.
- All dams in kerala reached their full reservoir level by July-end, and were thus incapable of containing the water flow from torrential rainfall in August.
- This forced the State government to open the gates of 34 major dams, thereby submerging all the major towns downstream.
- Admittedly, the change in topography due to human interventions and climate change have contributed to the sporadic and excess rainfall.
- The proliferation in illegal stone-quarrying activity has been a major reason for widespread landslides.
- The decision of the incumbent government to reduce the boundary of a quarry from residential buildings to 50 metres has facilitated the mushrooming of the stone quarrying mafia.

What are the official findings on flood?

- According to the data released by the State Disaster Management Authority, 85,300 litres of water was released every second from Kakki-Anathode dam, and 47,000 litres from Pampa dam at 4 p.m. on August 14.
- The shutters of both dams were raised at night. By 10 p.m., 4.68 lakh litres of water started gushing out of both dams.
- The State government also failed miserably in coordinating with the Tamil Nadu government on the release of water from Upper Sholayar despite the State heading the joint water regulatory board.
- Data posted by the KSEB reveals that the water released into the Periyar river basin from the Idukki and Idamalayar dams surged from 46.26 mcm/day on August 14 to 200 mcm/day the next day. This caused the towns downstream to be totally submerged.
- An analysis of spill from these dams reaffirms the gross mismanagement in the operation of dams.

What measures needs to be considered in this regard?

- The operation and maintenance of dams is governed by the guidelines of the Central Water Commission and water management protocols.
- The safety, precautions and evacuation measures to be followed while declaring different alerts (blue, orange, red) are clearly mentioned in these guidelines.

- The guidelines state that the reservoir control schedule, release procedure and gate operation procedure have to be done only after assessing the potential impact of the procedures.
- The State government and the KSEB opened 34 of the 39 major dams simultaneously, controlled release from these dams would have reduced the gravity of the calamity.
- Apart from that the disaster management system needs to be revamped by roping in experts from different areas.
- The State government must also order a judicial inquiry into the gross mismanagement of dams in the State.

7.3 Gadgil Panel Report and Kerala Floods

What is the issue?

- The recent floods of catastrophic dimensions have ravaged the state of Kerala.
- This has proved the rejection of Gadgil panel report to be a costly error for people and environment.

What was the Gadgil Panel on?

- About 8 years ago, the Centre constituted the Western Ghats Ecology Expert Panel (WGEEP).
- It is a 14-member panel under the chairmanship of noted ecologist Madhav Gadgil.
- It was tasked to look into measures to arrest the ecological devastation from human activities in the Western Ghats.
- The 1600-km-long mountain range of Western Ghats is a fragile ecosystem.
- It is regarded as one of the eight ‘hottest’ biodiversity hotspots in the world.
- Kerala accounts for nearly 18% of the biodiversity-rich Western Ghats.
- The Gadgil panel submitted its report in 2011.

What are the key recommendations?

- The Gadgil Committee divided the Western Ghats into three ecologically sensitive zones (ESZ).
- These are the highest (ESZ1), high (ESZ2) and moderate sensitivity (ESZ3) zones.
- This is in addition to the Protected Areas managed under acts such as the Wildlife Protection Act.
- It suggested that ESZ1 and ESZ2 would be largely ‘no-gone’ zones.
- So mining, polluting industries as well as large-scale development activities, including new railway lines are restricted.
- It also objected to new dams, thermal power stations or massive windmill farms or new townships in ESZ1.
- The panel however gave importance to the local communities and gram sabhas.
- They were given a larger say in deciding on matters relating to the ecology of these regions.
- It also called for
 - i. stricter regulation on tourism
 - ii. phasing out of plastics and chemical fertilisers
 - iii. a ban on diversion of forest land into non-forest applications
 - iv. a ban on conversion of public lands into private lands

What happened next?

- The Gadgil panel report was rejected by the then Union Environment Minister.
- The report was also unacceptable to any of the six Western Ghats States.
- These included Kerala, Karnataka, Tamil Nadu, Goa, Maharashtra and Gujarat as well as Pondicherry (UT).
- A year later, the government appointed a new committee under the chairmanship of K Kasturirangan.

- It was tasked to “examine” the WGEEP report.

What were the changes made?

- The Kasturirangan committee did away with the graded approach in terms of ecological sensitivity.
- It rather divided the Western Ghats into cultural lands (where there are currently human settlements) and natural lands.
- It recommended declaring cultural lands into ecologically sensitive area (ESA).
- This spanned around 60,000 sq-km or 37% of the total area.
- Recently, the Environment Ministry notified an area of around 56,000 sq km in the Western Ghats as ESA.
- In Kerala, the Kasturirangan committee had proposed an area of 13,000 sq km as ESA.
- But under pressure from the Kerala government, the notified area was brought down to less than 10,000 sq km.

Why was the Gadgil panel report rejected?

- The Gadgil panel faced stiff resistance from all political parties, particularly in Kerala.
- It was primarily because of the involvement of private land.
- A large part of the ecologically sensitive zones belonged to private citizens.
- Attempts to introduce social control over the use of private land have often been challenged.
- The restrictions may not have much of an impact on people.
- But they are often instigated, by groups with vested interests, to oppose such moves.
- Popular resistance thus increases the political considerations in implementing such regulations.

What are its implications?

- Nearly 40% of the granite quarries in Kerala in 2014-15 were located in ecologically sensitive areas.
- Significantly, a quarter of them were in the Gadgil committee-earmarked extremely sensitive ESZ1.
- These are notably some of the regions which have been devastated by the recent floods.
- The present disaster caused by heavy rainfall in Kerala could not have been completely avoided.
- But its severity could have significantly been reduced, if not for the rejection of WGEEP's proposed zoning.
- If the measures to protect the fragile environment were in place, man-made factors would not have worsened the impact.
- Development in the State in the last several years had materially compromised its ability to deal with a disaster of this proportion.

7.4 Kaziranga and Brahmaputra Floods

What is the issue?

While on one side Kerala is devastated by floods, here is why floods are crucial and beneficial for the Kaziranga national park.

Why is Brahmaputra significant for Kaziranga?

- Kaziranga National Park is a 117-year-old park and a UNESCO World Heritage Site since 1985.
- Every year, the Brahmaputra takes away portions of land from the Park.
- Resultantly, on paper the park is 1,030 sq km in area, but in reality it is 884 sq km.
- It also continues to shrink year after year.



- It affects mostly hog deer, swamp deer, wild boar and other few animals.
- These are those that fail to reach higher ground in time after floods.
- Despite the above, Brahmaputra contributes more to, than harms, the wildlife in the park.
- It gives more to the habitat of the world's largest population of one-horned rhinos.
- The unique biodiversity of Kaziranga is rejuvenated by a dynamic system that connects the Brahmaputra with its alluvial floodplains.
- But this year, the park has not been inundated, causing concerns for the park authorities.

Why are floods essential?

- Floods have long been beneficial to Kaziranga and Assam. Click [here](#) to know more.
- The deluge happens up to four times a year between April and October.
- Unlike farmlands across the Brahmaputra floodplain, monsoon floods are essential to Kaziranga's ecosystem.
- Kaziranga's plant and animal life are intrinsically linked to the floods.
- Its vast grasslands and beels (wetlands) are revitalised annually by the Brahmaputra's overflow.
- The floods help deposit mineral-rich alluvial soil.
- This facilitates growth of grass and shrubs that are the main source of fodder for herbivores.
- Besides, the floodwaters, while receding, flush out aquatic weeds and unwanted plants.

What are the concerns?

- During floods, animals in Kaziranga flee to higher grounds within the park.
- These include 111 highlands built in the late 1990s.
- Each of them is 12 ft high and large enough to accommodate up to 50 large animals.
- There are 33 more being built, each 16 ft high, with a total area of 22 hectares.
- But when 70-80% of Kaziranga is under water, the animals usually flee to the hills of Karbi Anglong.
- This is located south of the park beyond a National Highway running along its edge.
- Speed of vehicles is regulated during floods, but some animals invariably get killed.
- Of greater worry is the destruction of the hills because of indiscriminate stone quarrying.
- Some of the major quarries are on animal corridors and thus affect their movement.
- Quarrying has increased, and extracted materials have been dumped at sites adjoining the park.
- So if floods happen, Kaziranga's animals could find their escape route blocked or altered.
- Hence, while floods are good for the park, it needs interventions to make them really beneficial for environment and ecology.

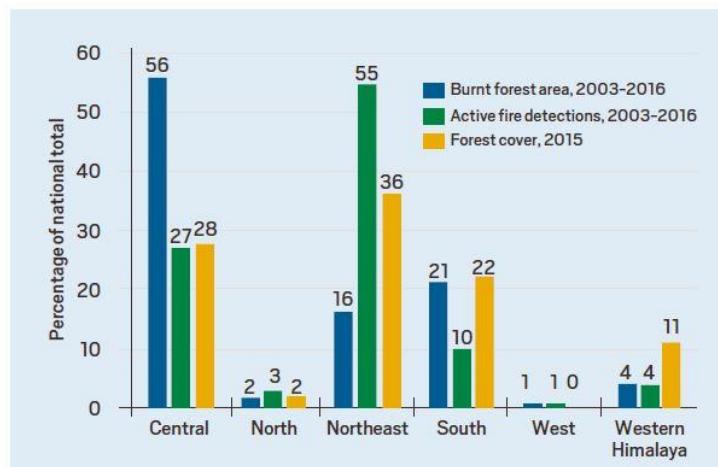
7.5 MoEFCC Report on Forest Fires

Why in news?

Ministry of Environment, Forests and Climate Change (MoEFCC) and World Bank recently released a joint report on forest fires in India.

What are the highlights?

- At least 60% of districts in India are affected by forest fires each year.
- The top 20 districts in terms of area affected by fire from 2003 to 2016 account for 48% of



the total fire-affected area and they mostly fall in Central India.

- The 16 of the top 20 districts in terms of fire frequency are located mainly in the Northeast.
- Here, forest fires tend to be concentrated in a smaller area that is subject to repeated burning.
- The peak fire season is the most concentrated (shortest) in the Northeast and the Northern state of Bihar.
- Fires in other regions, particularly districts in Central and Southern India, are more expansive.
- Districts experiencing widespread and frequent forest fires include areas of dry and moist deciduous forest.
- These include the borderlands of Chhattisgarh, Maharashtra, and Telangana that are affected by fire on a nearly annual basis.
- Notably, between 2006 and 2015, forest fires were detected in just under half (281 of 614) of the protected areas in India.

What are the proposed reasons?

- In line with other parts of the world, people are the main driver of fires in India.
- Forest fires are distributed close to people and infrastructure in India.
- Also, India's monsoons are largely responsible for the seasonal nature of forest fires in the country.
- Forest fires peak during the dry months of March or April before the arrival of the monsoon.
- The fire season mainly occurs during the four-month period between February 15 and May 15.
- Besides, the reduced contrast in land-sea temperatures had weakened the engine that drives the monsoon.
- But it is not yet clear how the drying of the monsoon has affected the intensity or frequency of forest fires.

What is the significance?

- Forest fires contribute to global warming and hence climate change, by releasing carbon stored in trees, undergrowth and soil into the atmosphere.
- Given this, the report gains significance with recent Intergovernmental Panel on Climate Change's special report on global warming.
- The findings are crucial for India's own pledge on creating additional carbon sink of 2.5 to 3 billion tonnes of Co₂-equivalent by 2030.
- In the long run, climate shifts due to anthropogenic global warming may further alter India's forest landscape and fire regime.
- Also, the MoEF issued national guidelines on Forest Fire Prevention and Management (FFPM) in 2000.
- But these are no longer being implemented in true spirit.
- The Comptroller and Auditor General (CAG) has documented the shortage of dedicated funding for FFPM at the central and state levels.
- The recent report is thus expected to be a key input in issuing a national policy on FFPM.

7.6 California forest fires

Why in news?

California is suffering the aftermath of a most devastating wildfire in its history recently.

What are the reasons?

- Forest fires have been getting worse in California in recent years, both in terms of their destructive power and their size.
- Nine of the 10 biggest fires by area have taken place in the past two decades, according to the California Fire Service.
- Many experts point out that **climate change** has made things worse, leading to higher temperatures, lower humidity, earlier springs and changes in wind and rainfall patterns.

- The scale has been huge this year because of the hot, dry summer conditions persisting into the autumn.
- According to the US Drought Monitor, 18% of the state is currently experiencing severe drought, which is exacerbating the seasonal weather patterns that make it difficult to fight fires in the state.
- Experts have said that climate change is also making conditions more favourable for wildfires in the American West.
- This could be true since climate plays a vital role in determining fire patterns and intensity and, in turn, fire influences the climate system through the release of carbon.
- Researchers project that moist, forested areas are the most likely to face greater threats from wildfires as conditions in those areas become drier and hotter, becoming more flammable.
- Add to this is the fact that winter seasons, when it rains or snows, are getting shorter.
- California has two fire seasons, wherein the first is from June to September, which is driven by warmer, drier weather in Western California.
- The other is from October to April, which is driven by strong gusts called the Santa Ana winds in Southern California.
- These winds spread three times faster and burn closer to urban areas.
- A report by the US Department of Agriculture in 2010 noted that by that year more than 11 million people out of a population of some 37 million in California were living in such areas and flagged the fire risks this posed.
- This made more and more people to move out of the main urban centres and into rural or semi-rural areas.
- Also, houses are often built of combustible materials such as wood.
- California state law does require homeowners to take steps to protect their properties from fire hazards, including clearing or reducing vegetation near properties.
- However, lack of public awareness, enforcement and the availability of up-to-date information about the areas put those people at most risk.

Does forest management play a role here?

- California has always been prone to wildfires every dry season.
- However, the US President recently attributed the cause as the result of forest mismanagement, though many scientists have linked it to climate change.
- Nearly 60% of California's forested areas are managed by national agencies such as the US Forest Service, the Bureau of Land Management and the National Park Service.
- There is a significant amount in private hands as well.
- The actual amount managed by the California state authorities is small, but the California Department of Fire and Forestry Protection is responsible for putting out fires and prevention measures in privately owned areas.
- Hence, concerns have been voiced about whether there has been enough emphasis on longer-term fire prevention.
- There is also a demand on sensible management of the environment and better land use to avoid catastrophic burning.
- There are also large numbers of dead trees in parts of the state, due to drought and disease, which poses a serious fire risk that needs to be addressed.
- A report by an independent state oversight agency already outlined recommendations such as increased prescribed burning and dedicating more money and jobs toward forest management in California.
- However, it has been pointed out that the recent fires have started in open scrub or grassland rather than in forests.
- Hence the blame on forest mismanagement was criticised by some experts who say that the bigger picture of climate change and population shifts in the state was getting ignored.

What are the lessons for India?

- India's forests are also facing similar challenges.

- According to the 2017 State of Environment Report of the Centre for Science and Environment, there were 15,937 forest fires in India in 2015 and the number rose to 35,888, a 125% spike over two years.
- In 2017, the maximum number of forest fires were reported in Madhya Pradesh (4,781), followed by Odisha (4,416) and Chhattisgarh (4,373).
- A National Institute of Disaster Management report on forest fires says 50% of the country's forests are prone to fire.
- Such uncontrolled fires not only burn down the vegetation but also the surface organic matter, increasing the frequency of flooding and soil erosion.
- In addition, wildlife patterns and habitat are also disrupted.
- India's firefighting potential is not as good as it should be.
- **Estimation** - The statistics on forest fire damage are poor, and so it is difficult to arrive at accurate losses from the forest fires.
- **Allocation** - Nearly 46-65% of the money allocated under the forest management schemes has not been released in the last two years.
- This is despite the replacement of the Intensification of Forest Management Scheme with the Forest Fire Prevention & Management Scheme in December 2017.
- **Management** – The country lacks fire protection planning knowledge and incentive.
- Foresters still fight forest fires using outdated methods, when systematic modern fire management techniques and methods have been adopted in the rest of the world.
- India also doesn't have a strong and clear national policy on how to tackle forest fires.
- In the age of climate variability, such lack of preparedness can put India's forest wealth at a huge risk.
- Thus, India does need to take adequate measures addressing these issues to avoid California type catastrophe in the future.

7.7 Disaster Management - Cyclone Gaja

Why in news?

Recently, Cyclone Gaja made its landfall between Nagapattinam and Vedaranyam in Tamil Nadu.

How severe is the disaster?

- The impact was not considered to have been this severe in the initial days after the cyclone struck as the death toll was relatively low.
- But Cyclone Gaja is a major disaster, and its economic impact in Tamil Nadu is comparable to that of the tsunami of 2004.
- **People** - The suffering, the loss, and the displacement are of an enormous magnitude.
- People are distraught as houses have collapsed, farms lie ruined, water sources are contaminated and electricity supply remains disrupted.
- The Tamil Nadu government has estimated the number of people rendered homeless at 3.7 lakh, and houses destroyed at 3.4 lakh.
- **Livelihoods** - The cyclone has crippled agriculture and livelihoods, felling thousands of productive trees and killing livestock.
- The districts of Tiruvarur, Nagapattinam, Thanjavur and Pudukottai are the severely affected.
- These are the fertile Cauvery delta districts which are considered the granary of the state of Tamil Nadu.
- The cyclone swept in wind and water, destroying lakhs of trees.
- These include commercial coconut, banana, cashew, mango, jackfruit, casuarina, betelvine, eucalyptus, teak and sugarcane on thousands of hectares.
- Between 60% and 80% of the coconut trees in the region have fallen.

- Notably, these contribute a quarter of India's coconuts with the highest unit yield.
- Unlike paddy or many other crops, bringing coconut plantations back to life will take years.
- The paddy crop of the samba/thaladi seasons was also damaged in some places.
- Boats and huts of fishermen were destroyed. Nearly a lakh tonne of stocks in salt pans in Vedaranyam in Nagapattinam district were washed away.
- **Ecosystem** - The Point Calimere Wildlife Sanctuary, a Ramsar site (a wetland of international importance for conservation), was ravaged.
- Carcasses of blackbuck, spotted deer, feral horses and birds were washed on the shores of Karaikal in Puducherry.

How prepared was the State?

- Tamil Nadu was more prepared than before to deal with Cyclone Gaja.
- More than 15 years ago, efforts were on to professionalise disaster management through a dedicated national and State organisation.
- It appears to be paying off, with bureaucracies acquiring higher efficiency in terms of early warning and impact mitigation.
- The National Cyclone Risk Mitigation Project was started by the Ministry of Home Affairs.
- This has been working to reduce the impact of such catastrophic events on Andhra Pradesh, Odisha, West Bengal, Tamil Nadu and Gujarat.
- Notably, these are classified as States with higher vulnerability; most western coastal States are in the next category.



What were the impact and the State response?

- Cyclone Gaja took a toll of at least 45 lives.
- The severe cyclonic storm damaged infrastructure, property and agriculture.
- It has affected some southern districts, felling tens of thousands of trees and also 30,000 electricity poles along the coast.
- It also hit residents in some central Kerala districts.
- State Disaster Management Authority issued a stream of alerts ahead of the cyclone.
- It helped coastal residents move to camps and adopt safety measures.
- State's measures after the cyclone, to clear roads, remove fallen trees and repair power infrastructure and communications, helped restore some stability.
- Tamil Nadu's political parties have acted in a mature manner, keeping partisan criticism aside the relief and rehabilitation works.
- The government has to now secure without delay the financial relief.
- Rs. 10 lakh has been promised for families of the dead, besides the compensation for lost crops, trees and livestock.
- Also, provision of emergency health intervention and rehabilitation assistance to rebuild lives has to be ensured.

7.8 CAG report on Chennai floods

Why in news?

- The CAG report, 'Flood management and response in Chennai and its suburban areas', was recently tabled by the government in TN Assembly.

What are the highlights?

- It has found fault with the government on many counts, with adverse criticism over Water Resources Department (WRD).
- It categorized the flood as a “man-made disaster”.
- It has held the government of Tamil Nadu responsible for the scale of the catastrophe.
- The report said that there was indiscriminate discharge of water from the Chembarambakkam reservoir, in excess of inflows, which burdened the Adyar river, leading to floods in the city and its suburbs.'
- There was no proper supervision mechanism as there was no record available on any communications between the Section Officer (in-charge of the tank) with government officials.
- The report also charged that even if there was communication, the fact remains that the actual inflow and outflow was not regulated as per Central Water Commission (CWC) norms.
- The WRD had the opportunity to store 0.268 thousand million cubic feet (tmc) more at the tank on December 1, 2015 at 2 pm when the discharge was increased from 12,000 cusecs to 20,960 cusecs.
- So the discharge could have been maintained at 12,000 cusecs for another six hours.
- The indiscriminate discharge was done to save patta land allowed in the foreshore area from submergence.
- This excess discharge of water continuously for 21 hours on December 1 and 2 into the Adyar river, coupled with surplus water from upstream tanks and catchment areas, caused a huge flow of flood waters into the river.
- The report also charged the WRD for not taking up desiltation of the river.
- In the absence of an Emergency Action Plan (EAP) and due to the government's failure to update its system / manuals as per CWC guidelines, the water was released in an unsustained manner.

7.9 National Disaster Risk Index

- Union Home Ministry has prepared a draft report on the Disaster Risk Index with the support of **United Nations Development Programme (UNDP)**.
- It ranks states based on the economic vulnerabilities due to disaster and actions taken to mitigate it.
- It does not talk about the possibility of a natural disaster.
- The index takes into account many factors like the exposure of population, agriculture and livestock, along with the environmental risk.
- The disasters taken into consideration include cyclones, earthquakes, landslides, etc.
- Maharashtra has been ranked at the top of the list of Indian states, vulnerable to natural disasters, followed by West Bengal, Uttar Pradesh, and Madhya Pradesh.
- Among the Union Territories, Delhi is the most vulnerable to such disasters.
- States like Andhra Pradesh and hill states are ranked relatively lower in the index.
- Capacity building by Gujarat, Tamil Nadu, Assam, Tripura and Himachal Pradesh have made significant progress in Disaster Risk Reduction (DRR) by building resilient infrastructure.
- Among districts, Maharashtra's Pune tops the list with a vulnerability factor of 9.48 on a scale of 10.
- Pune is closely followed by Bengal's North 24 Parganas and South 24 Parganas. Bangalore and Gulbarga in Karnataka also make the list.

GEOGRAPHY

8.1 Polar Vortex

Why in news?

A record-breaking cold wave has swept through the US Midwest, with 22 states hitting sub-zero temperatures.

What is the condition at present?

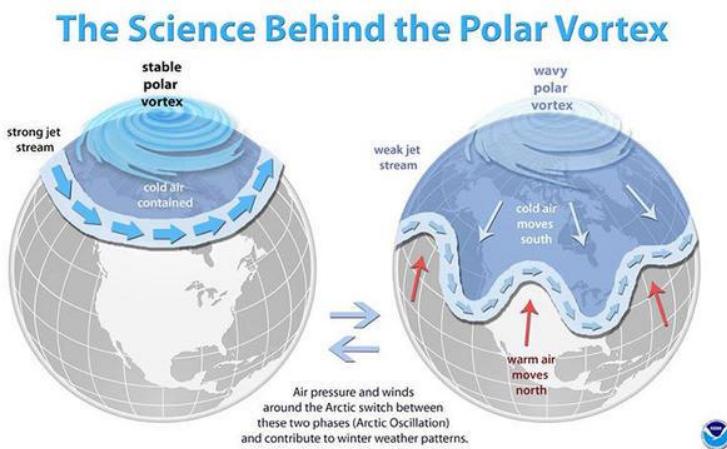
- Among cities, Chicago dropped to a low of -30°C , slightly above the city's lowest-ever reading of -32°C from 1985.
- Minneapolis recorded -32°C .
- The extreme cold has been caused by a blast of Arctic air, which in turn is a result of what is known as a "polar vortex" event.

What is a polar vortex?

- The polar vortex is a large area of low pressure and cold air surrounding both of the Earth's poles.
- The system has a whirling mass of cold air circulating in the mid- to upper-levels of the atmosphere, flowing counter-clockwise.
- This flow of air helps in containing the colder air within the poles.

What is a "polar vortex" event?

- Normally, when the vortex is strong and healthy, it helps keep a current of air (the jet stream) travelling around the globe in almost a circular path.
- This current contains the cold air north of it and the warm air south of it.
- But in winter, in the northern hemisphere, the polar vortex sometimes becomes less stable and expands.
- This occurs when there is a lack of a strong low-pressure system, resulting in jet stream losing the hold to keep it in line, and becoming wavy.
- So a wave of cold air will be pushed down south.
- This is called a polar vortex event, defining the "breaking off" of a part of the vortex.



Where does it happen?

- A polar vortex event is not confined to the US.
- Portions of Europe and Asia also experience cold surges connected to the polar vortex.
- The risk lies in the magnitude of how cold temperatures will get when the polar vortex expands, sending Arctic air southward into areas that are not usually that cold.

8.2 Earthquake Swarm in Palghar, Maharashtra

Why in news?

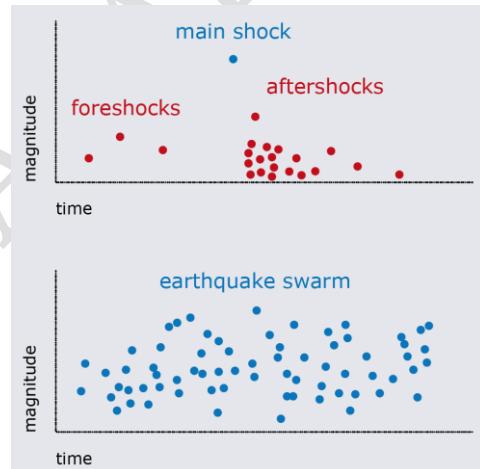
The Palghar district in northern Maharashtra has been witnessing an unusual frequency of earthquakes since November, 2018.

What happened recently?

- Dahanu town in Maharashtra's Palghar district has been hit by some 30 low-intensity earthquakes since November 2018.
- Palghar was rocked by a series of minor earthquakes (6 tremors) on a single day recently.
- The magnitudes of the quakes ranged between 3 and 4.1 on the Richter scale.
- Many aftershocks of lesser magnitude have also been observed in the area.
- Data collected so far point to an “earthquake swarm”.

What is an “earthquake swarm”?

- It is a series of many (sometimes thousands) low magnitude earthquakes without a discernible main shock.
- They occur in a localised region and over a period of time ranging from days, weeks to even months, without a clear sequence of foreshocks, main quakes and aftershocks.
- When seismic energy piles up inside the Earth and is released in small amounts from certain points, such a series of earthquakes can occur.
- Sometimes, these are also accompanied by acoustic or sound emissions.



What is the case with the Deccan region?

- In India, sequences of low-intensity quakes are common in areas that have been hit previously. E.g. Saurashtra in Gujarat, Koyna in Maharashtra
- But they are also seen in areas without a history of seismic activity and, swarms are normal in peninsular India.
- Notably, no mining activity has been found and there are no small reservoirs too to explain the cause for the quakes.
- Deccan Plateau is not an earthquake-prone zone because of its hard rock crust, as seismic waves travel faster in hard rocks which helps the tremors dissipate faster.
- But there is also loose soil which makes the waves stay longer, release more energy and cause more damage.
- Earthquake swarms are not limited to the Peninsula. In 2016, a series of 58 earthquakes were recorded in the Rampur area of Himachal Pradesh.
- This Himalayan swarm was later attributed to low strength of the earth's crust in the area which could not hold the tectonic energy.

What is the need for caution?

- Many major earthquakes in the region have been preceded by earthquake swarm activity as foreshocks.
- E.g. Latur and Koyna earthquakes in 1993 and 1967 respectively
- It is not certain yet if the current quakes had been caused by seismic activity, hydro-seismicity due to water percolation post-monsoon, or magmatic activity in the region.
- So without more data, it would be premature to draw a definite conclusion.
- Also, identifying the quakes as a swarm would suggest there is little threat of a deadlier one hitting in the near future.
- The possibility of either the quakes now subsiding or of a big one coming is not ruled out yet.

- Significantly, kachcha homes, about a third of the buildings in areas hit by the quakes, would be especially vulnerable in a large quake.
- So a more closer and scientific look into the causes of the earthquakes is essential now.
- The district authorities must draw up a community disaster management plan, with Standard Operating Procedures.

8.3 Magnetic North Pole Shifting

Why in news?

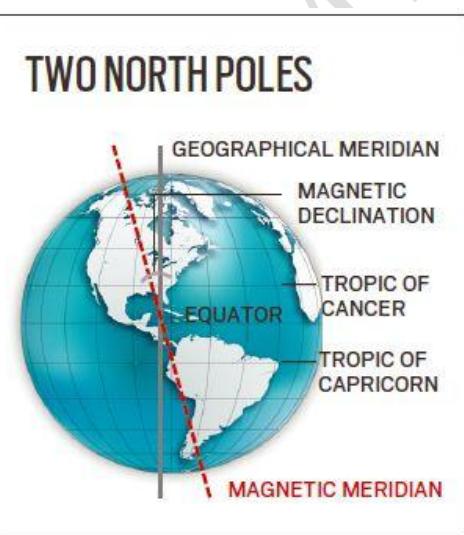
The magnetic north pole is, reportedly, drifting fast away from the Canadian Arctic and towards Russia.

What are the two poles on earth?

- The Earth has two pairs of north and south poles.
- The geographic poles are defined by the axis around which the planet rotates, and these are fixed.
- The Earth behaves much like a giant bar magnet and this behaviour defines its magnetic north and south poles.
- But these are not static as the geographic poles. [A compass points towards magnetic north.]

What causes the magnetic field?

- The origin of Earth's magnetism lies in its outer core which is a more than 2,000-km layer that surrounds the central core or the innermost part.
- The outer core is comprised of liquid iron and some other metals like nickel.
- This liquid iron is in constant motion due to Earth's rotation and various other reasons, and this motion produces a magnetic field.

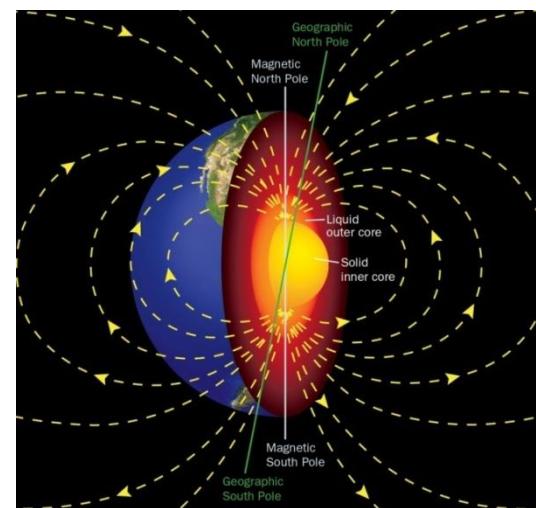


How have the positions changed?

- The constant motion is the reason for the magnetic poles to not coincide with the geographical poles.
- It is also why the Earth's magnetic behaviour is far more complex than that of a simple bar magnet.
- Resultantly, the magnetic north poles and south poles move around sometimes erratically.
- Over large periods of time, they change their locations significantly, sometimes even interchanging their positions.
- Around 780,000 years ago, the magnetic north pole was getting somewhere near where the magnetic south pole currently is.
- But this time period of shift in positions is not fixed.

What is the recent development?

- In 1831, it was discovered that the magnetic north pole was located somewhere over northern Canada.
- Since then, the magnetic north pole has been moving hundreds of miles across the Canadian Arctic towards Russia.
- It has now been found that the pace of this movement has suddenly increased, quite significantly.
- It has been moving from about 14-15 km per year till the 1990s to about 55 km per year in the last few years.
- This, now, led to scientists updating the World Magnetic Model (WMM) that tracks this movement.



- Every 5 years, a new and updated version of the WMM is released; the current update is a year ahead of the schedule.
- The faster movement of the magnetic north pole had made WMM so inaccurate that it was about to exceed the acceptable limit for navigational errors.

What is the significance?

- Given the extremely hot temperatures, the phenomena happening inside the earth can only be studied indirectly or through computer modelling.
- So the causes for the fast movement are uncertain yet.
- But the shifting of magnetic north pole would throw some new insights into the phenomena happening deep inside the Earth's surface.

What is the consequence?

- A standalone school compass would not be affected by this change. It will reorient itself to the new resultant magnetic north pole.
- But given its less precise nature and deflections due to local magnetic fields, this is no longer used for modern requirements of navigation.
- The compasses that are used in modern instrumentation are much more sophisticated, digital and more accurate.
- The entire transportation sector, especially aviation and shipping, depends on correctly knowing the position of magnetic north.
- Similarly, it is crucial for militaries, for firing their missiles or for other purposes, and other civilian applications as well.
- The compasses now have to be recalibrated to reflect the change in the magnetic north pole.
- The WMM has released a set of software that will update these instruments to the new positions of the magnetic north pole.



8.4 Dard Aryans of Ladakh

Why in news?

A delegation of the Dard Aryans recently submitted their charter of demands to Minister of State for Tribal Affairs.

Who are the Dard Aryans?

- The word 'Dard' is derived from a Sanskrit word, 'Daradas', which means people who live on hillsides".
- They inhabit Dha, Hanu, Beema, Darchik and Garkone villages in Leh and Kargil districts and are together called the Aryan valley.
- The people of this region have unique physical features, social life, ethnic culture and language.
- Researchers believe that the 'Aryans of Ladakh' or the 'Brokpas' are descendants of Alexander's army and had come to the region over 2,000 years ago.
- They do not document their history.
- They participate in a six-day festival, 'Arya Utsav', wherein the tribe follows liberal customs and kissing in the public is considered normal.

What are their customs?

- They are mainly dependent on agriculture and the apricots grown here are considered among the best in the world.

- There are 12 varieties of grapes in the region and Grape-wine is very popular in the “Aryan valley”.
- They rear goat and sheep for milk and meat.
- Their festivals are based on the solar calendar.
- They worship trees, rivers and mountains.

What are their concerns?

- The tribe is considered threatened due to their depleting numbers, which, at present, is around 4,000.
- They are “educationally and economically backward”.
- The perceive threat to the heritage of the community owing to modernisation, migration and religious conversion.
- Over the last few decades, many of them have embraced Islam or Buddhism.
- The community prohibits marriage with outsiders to keep the gene pool intact.
- Of late, the Dard men have been migrating to other parts of the region (in search of livelihood) and marrying outside the tribe.
- Thus, the tribe is struggling to find a balance between modernity and traditional values.
- Also, after the Kargil War, development work in this region has been restricted, since it borders Pakistan-occupied Kashmir.

What are their demands before the government?

- They have demanded that the government set up a tribal hostel and declare the “Aryan valley” a heritage village to boost tourism.
- Besides, they have also asked for–
 1. A Dardi post be filled at J K Art, Culture and Language Academy in Kargil
 2. A regional Study Centre for Dardi Tradition
 3. A Cluster Model Village at Garkon to boost the cultural heritage of the Dard Aryans.
- The tribe is already part of the Scheduled Tribes list and hence has been protected adequately under the constitution.
- But the only way to sustain them is by giving them special status and helping make them self-sufficient so that they don’t have to migrate.

8.5 Inter-Linking of Rivers

What is the issue?

- The Special Committee for Inter-Linking of Rivers has recently submitted its progress report.
- In this backdrop it is essential to understand what interlinking seeks to achieve.

What was the committee for?

- The SC directed the Centre to set up a special committee following writ petition on ‘Networking of Rivers’ in 2012.
- The court directed the committee to submit a bi-annual report to the Cabinet.
- It also directed the Cabinet to take appropriate decisions.

What is the mandate?

- The status reports are meant to be in accordance with the National Perspective Plan.
- This plan was formulated in 1980 by the Ministry of Irrigation (now Water Resources).
- The plan was in relation to inter-basin transfers.
- It comprises of two components: peninsular rivers development and Himalayan rivers development.

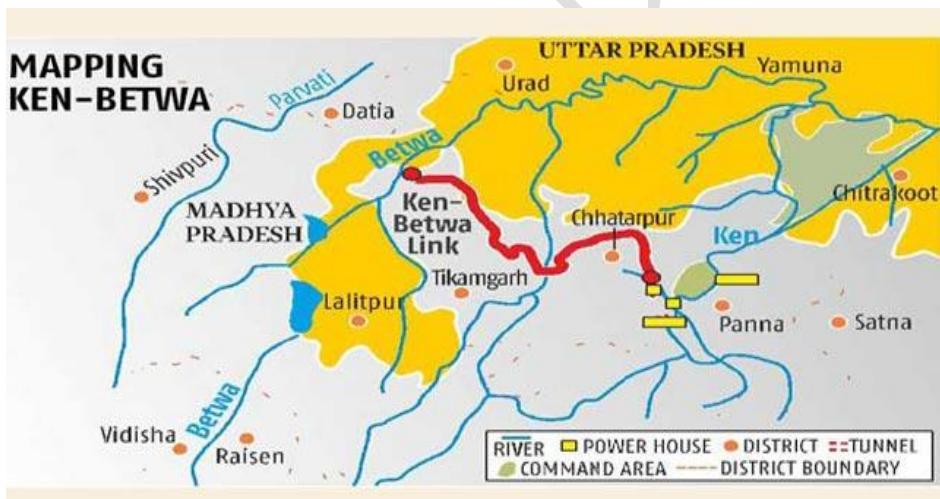
- India also has a National Water Development Agency (NWDA) (1982).
- It conducts surveys and sees how feasible the proposals for interlinking river projects are.

What is Inter-Linking of Rivers programme?

- A national water grid aims to connect various surplus rivers with deficient rivers.
- It aims to transfer excess water from water-rich to water-deficit regions.
- This is to help improve irrigation, increase water for drinking and industrial use.
- Mitigating drought and floods to an extent are also part of the objectives.

What are the contents of the recent report?

- The status report of three priority links was shared with the Cabinet. These are:
 - i. Ken-Betwa
 - ii. Damanganga-Pinjal
 - iii. Par-Tapi-Narmada
- **Ken-Betwa** - The project aims to link the rivers Ken (in the Bundelkhand region) and Betwa and thereby divert the surplus waters of Ken to Betwa.
- Both the rivers are flowing through Uttar Pradesh and Madhya Pradesh.
- It goes for meeting the water requirements in the water-deficit Betwa basin.
- Dams will be built across the Ken for storing and transferring water through the link canal.
- **Damanganga-Pinjal** - The project aims to divert excess water from rivers in western India.
 - It is to meet the domestic and industrial water requirements of Greater Mumbai.
 - It proposes to move available water at the proposed Bhugad reservoir across the Damanganga and also at the proposed Khangihill reservoir across the Vagh (a tributary of the Damanganga).
- **Par-Tapi-Narmada** - This proposes to transfer water from Western Ghats to water-deficit regions of Saurashtra and Kutch.
 - This would be done via seven reservoirs proposed in northern Maharashtra and southern Gujarat.
 - It is an attempt to save water at the Sardar Sarovar project.
 - The recent committee report also talks on the status of other Himalayan and peninsular links.



What are the concerns?

- There are significant environmental concerns associated with inter-basin transfer.
- The ecology of every river is unique.
- Letting the waters of two rivers mix may affect biodiversity.
- Besides, it involves construction of a massive network of canals and dams, which would lead to large-scale displacement of people.
- It may make changes to agricultural patterns, and affect livelihoods.
- In addition, rainfall patterns are changing due to climate change.
- So the basins now supposed to be surplus, might cease to be so in few years.

- There are financial concerns as well, related to the projects.
- In 2001, the total cost for linking the Himalayan and peninsular rivers was estimated at Rs 5,60,000 crore.
- The cost is now likely to be substantially higher.
- Also, the cost-benefit ratio might no longer be favourable.

8.6 South-West Monsoon 2018

What is the issue?

Severe rainfall deficiency in the Northeast has caused an overall deficiency in the country at the end of the current south west monsoon season.

How was rainfall this monsoon?

- **Northeast** - Northeast region witnessed a severe rainfall deficiency of 24% this southwest (S-W) monsoon season.
- India Meteorological Department said that it was “very rare” for such a large deficiency in the Northeast.
- In the 116-year period from 1901 to 2017, only in 4 years (1992, 2005, 2009 and 2013) has the deficiency in the Northeast exceeded 20%.
- Northeast deficiency has caused an overall 9% rainfall deficiency in the country at the end of the season.
- **Others Regions** - The distribution of rainfall across Northwest, Central India and Southern Peninsula was “satisfactory”.
- The deficiency in these areas was marginal with 2% each in Northwest and Southern Peninsula, and 7% in Central India.
- So if the Northeast had received normal rainfall, the all-India rainfall would have been 96% of the Long Period Average.
- Long Period Average (LPA) is the average annual rainfall for the period 1951-2000.

What is the cause for deficiency?

- Starting from the extreme south-western tip of the peninsula, the Southwest monsoon progresses inland.
- But the monsoon trough that usually moves towards the Northeast did not happen this year.
- Sea surface conditions over the Equatorial Pacific (El Niño conditions) did not have any adverse effect on the rainfall.
- The IMD has thus planned a detailed scientific analysis on the causes by the end of December 2018.

Why is 2018 S-W monsoon unique?

- **Rainfall** - The 2018 monsoon has been characterised by “large day-to-day variability” within the season.
- Many cities in the country received almost their entire rainfall of the season within a short time.
- This added up to just a few days to a few weeks within the four-month season (June 1 to September 30).
- E.g. in 22 cities with sizeable populations, 95% of the monsoon precipitation occurred over 3 days to 27 days on average.
- Many intense rainfall events during the season have led to flooding like the Kerala floods.
- The season also witnessed formation of a large number of low pressure systems over Bay of Bengal and their westward movement across central India.
- **Water in dams** - The spatial distribution of this year’s rainfall is also reflected in the storage capacity of the country’s reservoirs.
- Country’s major reservoirs at present have 117% of the live storage of the corresponding period last year.
- This is 105% of the average water storage over the last 10 years, as said by the Central Water Commission (CWC).

- Of the five regions, storage in reservoirs in Northern, Eastern, Central and Southern regions is higher than last year.
- Storage in the Western region is less than the storage of last year and also less than the 19-year average storage.
- **Agriculture** - The overall crop acreage during the kharif season is higher by 2.6%.
- This is in comparison to the country's highest ever acreage/record food production during 2017.
- The resultant acreage is largely the result of a good soil moisture distribution across the country.
- Adequate soil moisture available over northern parts of India may help the rabi crop during 2018-19.

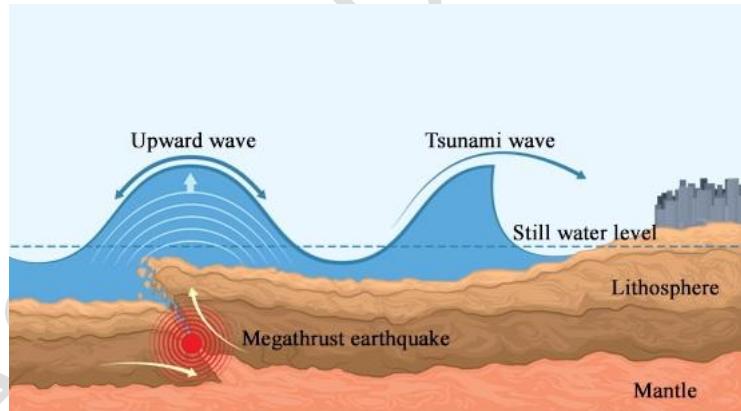
8.7 Indonesia Tsunami - Causes

Why in news?

After a major 7.5-magnitude earthquake, tsunami hit Palu, a city in the Indonesian island of Sulawesi, recently.

What caused the 2004 tsunami?

- **Vertical earthquakes** - Catastrophic tsunamis are often triggered by 'megathrust earthquakes'.
- These occur at subduction zones when one tectonic plate is forced under another.
- It causes massive chunks of the earth's crust to move vertically.
- Such movements on the ocean's floor cause huge volumes of water to be displaced suddenly.
- They thus throw up giant waves that can travel very fast across great distances.
- E.g. the December 2004 Indian Ocean tsunami.
- It had waves up to 100 ft high which was triggered by a megathrust earthquake of 9.1-magnitude in Sumatra.

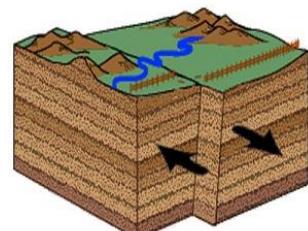


What is the present Indonesia case?

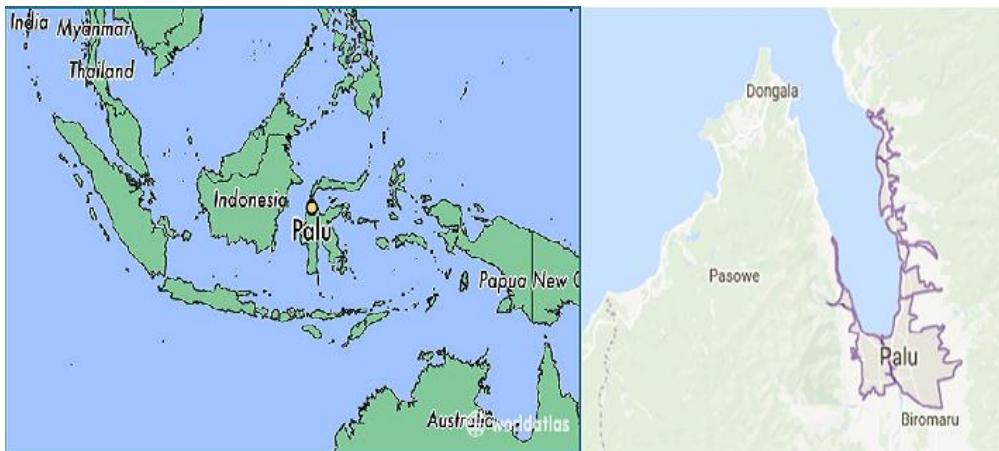
- **'Horizontal' earthquakes** - The recent 7.5-magnitude quake in Indonesia was triggered by what is called a 'strike-slip fault'.
- In this type of quake, the earth's movement is largely horizontal which would not normally trigger a tsunami.
- However, it is possible for a strike-slip fault to also have some amount of vertical motion that could displace water.
- Or the fault's rupture zone may pass through an area where the seafloor rises or drops off.
- In such cases, when the fault moves during the quake, it pushes seawater in front of it.
- Notably, in Indonesia's case, the fault's rupture zone was estimated to be about 70 miles long, suggesting a large possibility for the above.
- **Landslide** - Another possibility is that there could have been a mudslide on the ocean floor.
- This could have displaced a lot of water and created waves, causing a cataclysmic effect on the bay.
- **Topography** - The tsunami could have been impacted by Palu's location at the end of a narrow bay.

Strike-Slip Faults

- Blocks of rock move sideways or horizontally on either side of the fault plane.
- Stresses that push blocks of rock horizontally cause earthquakes along strike-slip faults.
- The San Andreas Fault is a strike-slip fault.



- The coastline and the shape of the bottom of the bay could have focused the wave energy and guided it up the bay.
- This could have increased the wave height as it approached the shore.



8.8 Concerns with IMD's Prediction

Why in news?

India Meteorological Department (IMD) has predicted a normal and well-distributed rainfall in the second half of the monsoon season.

What is the status of 2018 monsoon?

- Over 80 per cent of the country's total geographical area has already received normal or above normal rainfall, Part of the rain-deficient region of Bihar, Jharkhand and the
- Northeast, too, has received some welcome showers in the past few days.
- Though the pace of kharif sowing has so far been slower than in the last year, the estimated 7.5 per cent lag in crop planting can be made up in the next few weeks since the sowing season is still not over.
- Besides, the total water stock in the country's 90-odd major reservoirs has already swelled to about 11 per cent above normal for this time of the year.

What is the significance of IMD's prediction?

- In the last 17 years since 2001, the weather office's preliminary predictions have been on the mark on only a couple of occasions though, admittedly, the margin of error has gradually been narrowing, especially since 2010.
- This is despite perceptible advances in the IMD's short- and medium-range weather gauging capabilities, expansion of data-gathering infrastructure and availability of better-computing facilities.
- Recently IMD has predicted that second half of the monsoon August-September will have normal and well-distributed rainfall.
- The markets have, predictably, reacted positively to the optimistic monsoon outlook.

What are the issues with IMD's prediction?

- The IMD's prediction rainfall seems to have largely quelled the disquiet caused by other weather watchers by projecting sub-par monsoon rainfall this year.
- The past accuracy record of the IMD's long-range monsoon forecasts, issued normally in April every year, does not inspire much confidence.
- The major reason for the wide disparity in the monsoon outlook of the IMD's is their perception of the likely adverse impact on the rainfall of some key monsoon-influencing parameters that are threatening to turn unhelpful.

- The local private weather forecaster, Skymet anticipates below-average rains this year on the assumption that oceanic parameters are at present unfavourable for the monsoon's progress.
- The IMD, on the other hand, has stuck to its original stand that the rainfall would be normal or close to that throughout the season.
- The sharpest contrast in the forecasts by Skymet and the IMD is in the rainfall projections for the current month of August.

8.9 Flooding and Soil Degradation

What is the issue?

- The recent floods in Kerala and Parts of Kodagu in Karnataka led to soil erosion.
- The gradual loss of soil productivity can have a lasting impact on the local economy.

What impact do floods and soil erosion make?

- Soil degradation due to flooding is a serious concern.
- An estimated 14 million hectares of land suffer soil degradation due to flooding annually in India.
- E.g. After the 2009 floods in North Karnataka, 13 flood-hit districts lost around 280 million tons of top soil.
- It also led to loss of soil nutrients across 10.75 million hectares of farmland.
- Under market prices, the replacement of nutrients such as nitrates, phosphates and iron would have cost around Rs. 1,600 crore.
- Besides, the cost of replenishing the organic material lost would have cost nearly Rs. 850 crore.
- In addition, considerable amount of time and concerted programmes of recovery are needed to recover and replace the soil productivity.
- At present, soil profile of affected districts in Karnataka indicates "shallow or very shallow" soil depth.
- They also exhibit organic carbon deficiency, and low productivity of land.

Is flooding always destructive to soil health?

- Soil takes thousands of years to form through natural processes and through recent inputs by farmers.
- Floods result in this being swept away to be dumped in reservoirs or in the sea.
- However, not all floods are bad for the soil.
- E.g. floods along the banks of the Ganga, Kosi, Brahmaputra.
- These and other rivers emanating from the mountains carry with them, loosened alluvial soil.
- They wash over farmlands as well as replenish flood plains with fertile soil.
- However, in south and central India, floods wash away rich, weathered soils that are deposited in reservoirs or as sand bars along the river bed or in the sea.

How to deal with it?

- Agricultural and plantation practices to reduce the incidence of soil erosion should be employed effectively.
- Soil replenishment should be a part of the rehabilitation program in flood-affected areas.
- State agriculture universities, with the help of earth observing satellites, should assess the intensity of the problem.
- With this, consistent and long lasting effort is needed to boost the lost soil health and productivity.

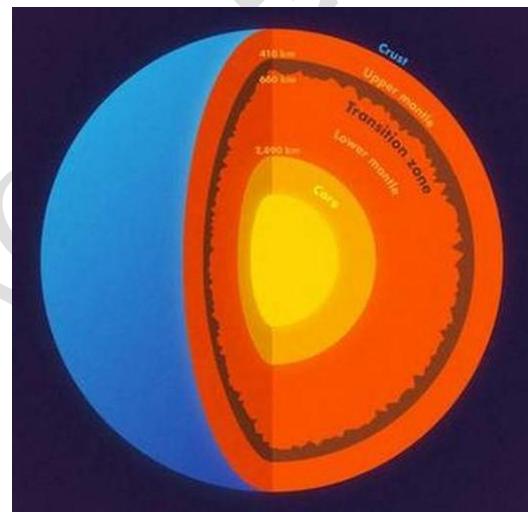
8.10 Third Pole

- It is in the region which is to the north of India and to the south of China.
- The Third Pole region spreads across the Himalaya-Hindu Kush mountain ranges and the Tibetan Plateau.

- It is called the Third Pole because it contains the third largest expanse of frozen water on earth.
- It is much smaller in area than the north or the south pole, but is still enormous, covers 100,000 square kilometres and has around 45,000 glaciers.
- Ten of Asia's largest rivers begin in the third pole.
- These include the Yellow river and Yangtze river in China, the Irrawaddy river in Myanmar, the Ganges which flows through India and Bangladesh, and the Mekong river that flows through several countries.
- It has the largest reserve of fresh water outside the two major polar regions and its waters sustain life over many thousands of miles.

8.11 660 km Boundary

- Usually p & s waves of earthquake are used to study the earth's inner layers.
- Earthquakes that are of magnitude 7.0 or higher send out shockwaves in all directions that can travel through the core to the other side of the planet.
- Just as light waves can reflect off a mirror or refract when passing through a prism, earthquake waves travel straight through homogenous rocks but reflect or refract when they encounter any boundary or roughness.
- Thus the scattering waves carry the information about the inner layer's roughness.
- Scientists used such data from a magnitude 8.2 earthquake that happened in Bolivia to find mountains and other topography that separates the upper and lower mantle around 660 km straight down.
- Lacking a formal name it is simply called "the 660-km boundary" for now.
- The layer is found to be rougher than the surface layer that we all live on i.e stronger topography than the Rocky/Appalachians is present at the 660-km boundary.
- These mountains could also be bigger than anything on the surface of the Earth.
- Also, just like the presence of both the smooth ocean floors and massive mountains in the crust, the 660-km boundary has rough areas and smooth patches.
- The boundary will have significant implications on our understanding of how our planet was formed and evolved.



8.12 Deep Earth

- It is the region that exists between 2 km and 3 km below the ocean-floor.
- It consists of about 2-2.3 billion cubic km, which is about twice the volume of the oceans combined.
- Its biosphere constitutes "Subterranean Galapagos" which includes members of all 3 domains of life – Bacteria, Archaea and Eukarya.
- Bacteria and archaea (microbes with no membrane-bound nucleus) dominate deep earth.
- Eukarya, multicellular organisms with cells that contain a nucleus as well as membrane bound organelles, found less in numbers.
- Scientists say about 70% of earth's bacteria and archaea live in the subsurface.

8.13 Blue Hole

- Blue holes are roughly circular marine cavern or sinkhole, which is open to the surface.
- It has developed in a bank or island composed of a carbonate bedrock (limestone or coral reef).

- The deep blue color is caused by the high transparency of water and bright white carbonate sand.
- Their water circulation is poor and they are commonly anoxic below a certain depth, this environment is unfavorable for most sea life, but nonetheless can support large numbers of bacteria.
- Some of the significant blue holes are
 - i. Dragon Hole - South China Sea
 - ii. Great Blue Hole - Belize
 - iii. Dean's Blue Hole – Bahamas
- Blue holes are distinguished from cenotes in that the latter are inland voids usually containing fresh groundwater rather than seawater.

8.14 Waterspouts

- A waterspout is an intense columnar vortex (usually appearing as a funnel-shaped cloud) that occurs over a body of water.
- They fall into two categories
 1. Fair weather waterspouts - usually form along the dark flat base of a line of developing cumulus clouds.
 - This type of waterspout is generally not associated with thunderstorms.
 - It develops on the surface of the water and works its way upward.
 - By the time the funnel is visible, a fair weather waterspout is near maturity.
 - They dissipate rapidly when they make landfall, and rarely penetrate far inland.
 2. Tornadic waterspouts - These are tornadoes that form over water, or move from land to water.
 - They have the same characteristics as a land tornado and are associated with severe thunderstorms, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.
 - Tornadic waterspouts develop downward in a thunderstorm.
 - If this waterspout moves onshore they may cause significant damage and injuries to people.

8.15 Reasons for Intense Rainfall in India

- NASA using its satellite data has provided an estimate of the intense rainfall that affected India in August 2018.
- The first band extends across the northern, western and eastern part of peninsula which is associated with the general monsoon circulation.
- The second band is closely aligned with the southwest coast of India and the Western Ghats.
- It appeared more concentrated and intense due to an area of low pressure embedded within the general monsoon trough.
- Another contributing factor to the heavy rains in the second band is the Western Ghats.
- Western Ghats along the West Coast of India intercept the moisture-laden air drawn from the warm waters of the Northern Indian ocean and the Arabian Sea as part of the southwest monsoon circulation.
- **Global Precipitation Measurement** – It is a joint mission of Japanese Space Agency and NASA to make frequent observation of Earth's precipitation.

8.16 Monsoon and Pollution

- Monsoon plays a critical role in flushing out pollutants over Asia apart from being an essential source of water for Indian Agriculture.
- Increasing temperature over the period amplifies the seasonal heating of the Tibetan Plateau.
- This led to increased warming in the Upper Troposphere during late spring and early summer.

- It subsequently spurred enhanced monsoon rainfall over northern India during June and July.
- Scientists have pointed out, increased loading of black carbon in spring enhances the monsoon.
- But a recent study has found that increased pollution particularly from coal burning could potentially weaken this ability of the monsoon.
- Black carbon particles from coal burning may increase cloudiness and surface cooling of sea surface which can reduce the moisture flux into the monsoon convection, i.e. weaken the monsoon.

8.17 Holocene Epoch

- The Holocene Epoch is the current period of geologic time.
- It refers to the last 11,700 years of the Earth's history, the time since the end of the last major glacial epoch, or "ice age."
- Another term that is sometimes used is the Anthropocene Epoch or "The Age of Man".
- The International Commission on Stratigraphy (ICS) had divided this Epoch into three ages – Greenlandian, Northgrippian and Meghalayan which began at 11,700 year, 8200 year and 4200 year points.
- There are controversies over this newly designated geological age, though the stratification by ICS is official.

International Commission on Stratigraphy (ICS)

- ICS is a body of geological timekeepers and is the largest and oldest constituent scientific body in the International Union of Geological Sciences (IUGS).
- Its primary objective is to precisely define global units (systems, series, and stages) which are basic for the units (periods, epochs and age) of the International Geological Time Scale.
- It sets global standards for the fundamental scale for expressing the history of the Earth.

8.18 Disappearance of Marine Clouds

- Marine clouds could break up and vanish if CO₂ in the atmosphere triples.
- It protects us from hothouse Earth conditions by reflecting sunlight back into space.
- It is the stratocumulus clouds that cover about 20 % of subtropical oceans, mostly near western seaboards such as the coasts of California, Mexico and Peru.
- These clouds cool and shade the earth as they reflect the sunlight that reflects them back into space.
- Due to the rise in Carbon Dioxide it may become unstable and disappear.
- The consequence will trigger a spike in global warming.

8.19 Glacial Lakes Outburst Floods

- Floods caused due to outbursts of lakes formed due to melting of glaciers, known as Glacial Lakes Outburst Floods (GLOF)
- These lakes are a subject of concern in the Sikkim Himalayan region as several lakes have been formed due to melting of scores of glaciers in the region.
- Retreat of glaciers in the wake of global warming is expected to increase the number of glacier lakes and also expand the size of the existing ones.
- The size of the South Lhonak lake in Sikkim, at 7000 meters was small during 1960s and it has since grown many folds.
- It is one of the fast growing lakes out of 14 potentially dangerous lakes susceptible to GLOFs in the Sikkim Himalaya region.
- To prevent any disasters due to outbursts, a project was started in that lake where in high density polyethylene (HDPE) pipes have been installed to siphon off water from the glacial lake.