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MAINSTORMING 2018

GEOGRAPHY & ENVIRONMENT

Shankar IAS Academy™

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MAINSTORMING – 2018

Geography and Environment

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GEOGRAPHY AND ENVIRONMENT

1. GEOGRAPHY

Distribution of Key Natural Resources

1.1 Risks in Shale Gas Extraction

What is the issue?

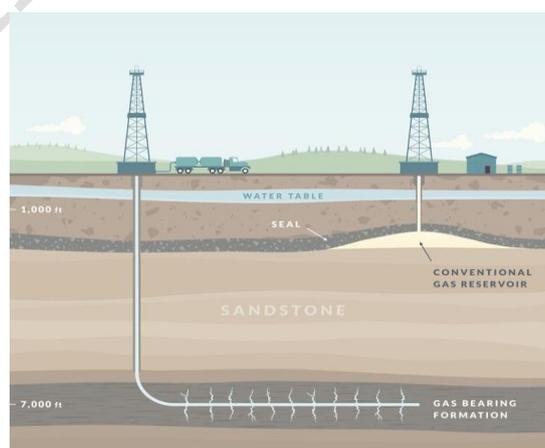
- Fracking is the technique used for extracting hydrocarbon resources from 'shale reservoirs' by drilling deep horizontal wells.
- But there is considerable evidence to suggest that this method is detrimental to the environment, and governments need to exercise restraint.

What are shale reservoirs?

- Apprehensions that fossil fuels will be depleted by 2050 have been challenged by some experts who've argued that there are still vast unexplored reserves.
- Among the reserves that count for augmenting energy supplies is 'shale gas' and 'shale oil' both of which are estimated to be abundant underground.
- Hydrocarbons are conventionally found at about 1,500 m depth, but shale gas and oil are usually found at depths of about 2,500-5,000 m.
- They are classified as an unconventional hydrocarbon source and their extraction requires deep vertical drilling followed by horizontal drilling.
- **Pioneers** - In the U.S., shale gas has been commercially exploited for two decades, and which has caused their fuel costs to drop considerably.
- Shale discovery has also benefitted the US politically, as it effectively destroyed the clout of "Organisation of the Petroleum Exporting Countries" (OPEC).
- Similarly, if India commercially exploits shale deposits, it could meet its ever-increasing energy demand, and decrease its fuel import bills.

What is fracking?

- Unlike conventional reservoirs, porosity of shale is very less – which therefore gives out little flow output after merely perforating (opening) the well.
- Hence, to increase the porosity of the reservoir and facilitate flows, the reservoir rock is fractured by using 'hydraulic fracturing' (fracking).
- In this method, high volumes of water mixed with certain chemicals are pushed down the well, to break the rocks and release the trapped resource.
- Fracking has proved to be an economically viable tool in extracting shale gas.
- **India's case** - The government introduced a policy on shale gas and oil in 2013, permitting national oil companies to engage in fracking.
- Under the first phase, shale gas blocks were identified in Andhra Pradesh, Arunachal Pradesh, Assam, Gujarat, Rajasthan and Tamil Nadu.
- However, environmental groups have strongly criticised this move, which they say will have adverse environmental impacts.
- Notably, countries like Germany and France and subnational governments like Scotland have banned fracking.



What are the environmental risks of fracking?

- Fracking consumes large amounts of water (about 1.5 crore lts/well) and is bound to impact irrigation and other local requirements.
- Additionally, this water is mixed with as much as 260 chemicals and pumped into the reservoir at high pressure to create cracks in the rocks.



- The US experience shows that as many as 260 chemicals were used, of which 83 have been identified to pose a risk to human life and environment.
- The disposal of the water used for fracking is another big challenge as such vast quantities has to be reprocessed before draining them out.
- Further, about 25-90% of the fluid that is pumped in is lost within the reservoir and is not retrieved back.
- This unrecoverable volume hence puts the nearby underground water sources at a high risk of contamination – some cases have already been documented.
- Fracking also has other impacts such as increased air emissions (including greenhouse gases) and seismic activity – as recognized by some EU studies.
- While some do contest the risks of fracking, the evidence currently seems to be pointing otherwise, which hence calls for a rethink.

1.2 Coal Fields in Jharia

Why in news?

Continuous underground fires in the coalfields of Jharia, Jharkhand, have led to steps being planned to move train operations out and rehabilitate residents.

What has been the problem in Jharia over the years?

- Unsafe and illegal mining has led to fires in coal deposits under the surface of the Jharia coalfields in Jharkhand's Dhanbad district, which span over 160 square kilometres.
- They now pose a risk to the population living on the surface, could lead to cave-ins and gas spills and are threats to rail transport.
- While the first subterranean blaze was noticed in 1916 and various reports and studies have sounded the alarm over the years, authorities began seeking a comprehensive solution only in the early 2000s.
- Most of the affected mines date back before Independence and nationalisation (private owners ran collieries earlier), when the thrust was on production and profit, with little regard for safety.

What is the extent of the problem?

- When the coal mines were nationalised in 1971, at least 70 mining areas within Jharia were on fire.
- The problem later spread to seven more mining zones.
- The number of affected areas has reduced to about 67, as around 10 fires have been extinguished using different methods.
- Rail routes, including the key Dhanbad-Chandrapura line that is currently in focus, fall in the affected region.
- One arterial route, Dhanbad-Patherdih line, was closed down in 2007.
- The Adra (West Bengal)-Gomoh line is functional, but on a slightly diverted route.
- The Jharia Rehabilitation and Development Authority (JRDA, formed by the Centre) has now been asked to look into the possibility of putting prefabricated structures at the resettlement site to increase the number of houses as quickly as possible.

Why is the Dhanbad-Chandrapura line important?

- Unlike a couple of the other affected rail lines, the nearly 41-km Dhanbad-Chandrapura line is used by 37 pairs of daily train services, which include express, mail and passenger trains.
- If the rail line is shut, it could lead to revenue losses close to Rs 2,500 crore. Besides, creating a new diversion alone is expected to cost around Rs 3,000 crore.

1.3 Cauvery Delta Region Shrinks

Why in news?

Recent study concluded that the Cauvery delta region has shrunk and the cultivable lands are increasingly deteriorating into waste lands.

What was the grim picture presented?

- The researchers have tracked land use and changes to land cover to show that the delta region has shrunk by 20%.



- It is due to anthropogenic factors such as diversion of land for non-agricultural purposes, as well as factors linked to climate change.
- The drastic reduction in crop cover and a 13-fold increase in wastelands between 1971 and 2014 indicate a worrisome phenomenon.
- The study also reported the increase in mangrove cover (14 times since 1971) in the region as sea water ingress (entering) has grown in the coastal areas.
- This means more and more cultivable agricultural land is coming under sea water and the soil is turning saline.
- Due to sea water ingress, there has been a substantial rise in shrimp farming along the coast, which is detrimental to agricultural practice.
- With 72% of the low-lying land in the State falling under the delta region along the coast, the land is at greater risk of submergence as a result of rising sea levels.
- The Cauvery delta has witnessed a decline of 80% in sediment deposit over the last century.

What are the major concerns?

- A noticeable consequence of climate change has been the cycle of drought and flood that coastal areas have been enduring.
- The rain occurs within a span of a few days, resulting in heavy flooding.
- The fields get flooded and the crops are destroyed.
- On the other hand, there is the prevalence of droughts.
- All these factors have resulted in a drastic reduction in land under crop cover.
- Also, the delta region has clay soil, of which 52% is cracking clay, which is very vulnerable if it doesn't receive continuous irrigation.
- The study also points to the decline of dairy as a secondary occupation, with the cattle population registering a steep decline.
- With the Cauvery delta region accounting for 30% of the food grain production in the State, it is imperative that the crisis needs to be solved sooner than later.

What are the government interventions?

- The Tamil Nadu State Climate Action Plan, drafted in 2014, anticipates many of the challenges that the report has raised, and envisages a slew of measures to make agriculture sustainable.
- Promotion of drought- and flood-tolerant varieties of paddy, micro-irrigation to promote efficient use of water and use of bio-fertilizers to improve soil health are among the proposals.
- However, there is no clarity on the extent to which these proposals have been incorporated in government interventions.
- Several schemes have been announced by the State for the farmers' welfare, it remains unclear as to who is benefitting from them.
- State has placed greater focus on promoting efficient use of water in agriculture through the expansion of the System of Rice Intensification (SRI).
- However, wasteland reclamation work is currently concentrated in the dry regions of Tamil Nadu and not in the Cauvery delta regions.
- The State government's 2017-18 policy note on agriculture admits that agricultural production has been severely affected due to natural factors such as cyclones and drought.
- Again, it lacks clarity on the specific resources that would be dedicated to developing such 'climate-smart' practices.
- Collective farming scheme was proposed, which aims to promote farmer-producer groups with a corpus fund of Rs 5 lakh per group.
- This will help reduce the vulnerability of small and marginal farmers to natural hazards as it allows them to pool their resources and scale up farm production.

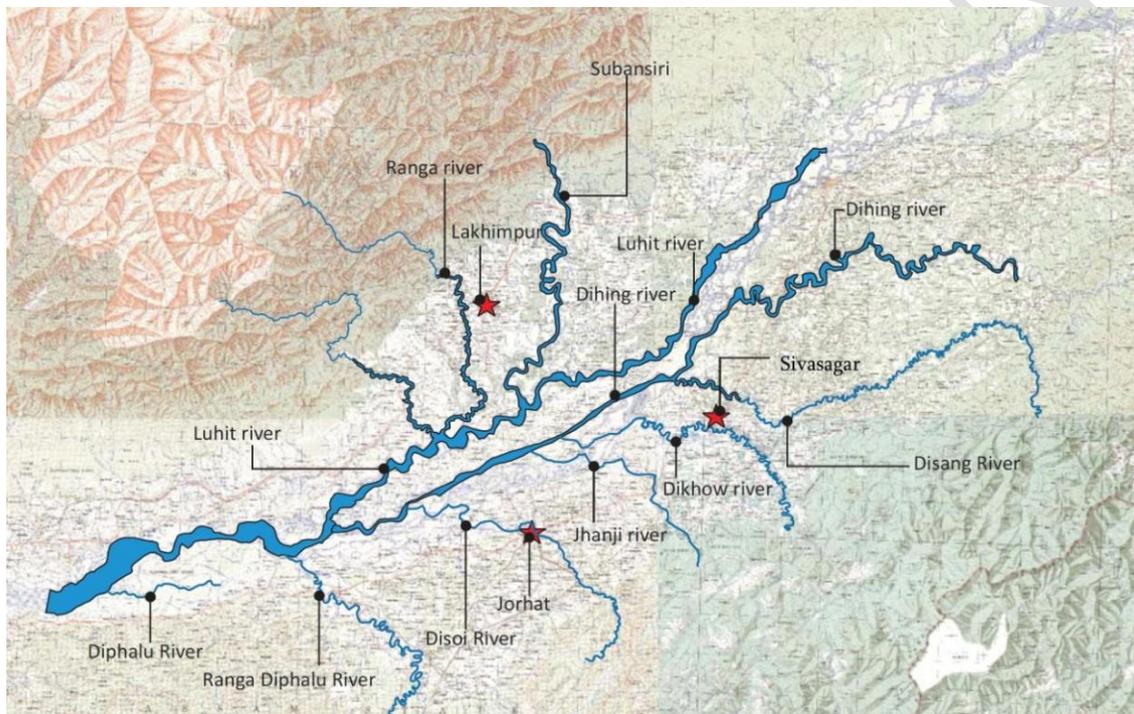
1.4 Worries about Brahmaputra

What is the issue?

- China plans to build a 1,000-km tunnel to divert water from the Brahmaputra in Tibet to the dry Xinjiang region.
- This has created worries about Brahmaputra getting dried up, especially in Assam.

What constitutes the drainage route of Brahmaputra?

- Out of the total length of the Brahmaputra of 2,880 km, 1,625 km is in Tibet flowing as Yarlung Tsangpo.
- 918 km is in India and known as Siang, Dihang and Brahmaputra.
- The rest 337 km in Bangladesh has the name Jamuna till it merges into Padma near Goalando.
- As a trans-Himalayan tributary, Yarlung is substantially fed by snow and glacial melts, in addition to rainfall.



Why India shouldn't be worried?

- There fears are hardly based on objective data-based analysis.
- Melting snow contributes merely 15-20% of the total volumetric discharge of the river.
- Catchment - With the Himalayas acting as the barrier, Tibet is a rain shadow region with an annual precipitation of about 300mm.
- As the tributaries cross the Himalayan crest line, the annual average precipitation reaches about 2000 mm.
- Hence, a very large component of the total annual flow of Brahmaputra is generated to the south of the Himalaya in India.
- Flow Rates - While the total annual outflow of the Yarlung River in China is estimated around 31BCM, the same for Brahmaputra towards the end at Bahadurabad in Bangladesh is about 606 BCM.
- Further, the peak flows at the 'Tsela Dzong' measuring station near the great bend in Tibet, is about 10,000 cumecs.
- But the peak flow at downstream Guwahati is around 40,000 cumecs and at Bahadurabad in Bangladesh is 50,000 cumecs.
- Similarly, during the lean season, flows at the mentioned locations read 400 cumecs, 4000 cumecs, and 5000 cumecs respectively.

- Implication – The above data implies that the Brahmaputra gets fatter and mightier as it flows further downstream.
- This is also because of the contributions of various tributaries like Dibang, Lohit, Subansiri, Manas, Sankosh, and Teesta.

Can water diversion affect sediment flow?

- Currently downstream Brahmaputra carries a huge sediment load on its run towards the sea.
- River volume in the Yarlung River is not sufficient to generate and transport large sediment load.
- Notably, the annual suspended sediment load near the Arunachal border in Tibet is around 30 million metric tonnes.
- This is miniscule when compared to 735 million metric tonnes at Bahadurabad in Bangladesh.
- Therefore, the large sediment load is created only in the downstream region in India.

Important Geophysical Phenomena

1.5 Dust Storm Proves Catastrophic

What is the issue?

- Dust-storms, thunderstorms, and lightning at many places in northern, central and eastern India killed as many as 100 people in 1 day.
- While the weather events are common around this time of the year, the number of casualties was unusually high in the current storm.

What had happened?

- Rainstorms and dust-storms arise from similar meteorological conditions.
- They are almost always preceded (caused) by a spell of intense heat – the affected areas indeed had heat-wave like conditions lately.
- Thunderstorms or hail occur when the atmosphere has moisture, and dust-storms occur when moisture is absent.
- Indian Meteorological Department (IMD) routinely issues alerts and the current weather events too, had been predicted, and warnings were issued.
- **The Factors** - Such storms occur due deviation from the normal temperature difference (locally) between the upper and lower atmosphere.
- Moist easterly winds from the Bay of Bengal reached up to Himachal Pradesh, which was also receiving dry winds from the north-westerly direction.
- These two systems destabilised the equilibrium between the upper and lower layers of atmosphere – making it conducive for the thunderstorm.
- The final trigger, however, is the development of a large scale air-circulation system that developed over Rajasthan a couple of days earlier.

Why so many death?

- While it seems odd, a large number of deaths over a few days have been reported earlier too, like in the June 2016 lightning – which killed over 300.
- Notably, lightning is the biggest killer in India among natural calamities and accounted for as much as 2641 casualties in 2015.
- Nevertheless, the recent storm was unusually catastrophic because it occurred over a large area over a short span of time.
- In most cases, storms (like lightning) do not kill by themselves– but they trigger incidents that result in deaths.
- Walls or homes collapse, and people are electrocuted after power lines snap, or after they are caught in fields filled with water.

How useful are the predictions?

- People in the poorest, most densely populated areas are the most vulnerable.
- Also, while meteorological predictions are for broad geographical areas and timeframes, events are however localised both in time and space.



- It is not yet possible to predict a thunderstorm or lightning at a precise location — say a village or a part of a city.
- As the exact times these events will hit can't be predicted, alerts and warnings usually merely telling people to expect these events, and to take precautions.

What are the mitigation measures needed?

- Public infrastructure needs to be upgraded and construction of huge structures must be regulated in the northern region by allowing for wind breakers.
- The Indian Meteorological Department (IMD) has to convey early warnings to centre, the states concerned as well as disaster management teams which helps in coordination and rescue work.
- Administrators and personnel has to be adequately qualified to handle rescue and rehabilitation to reduce the damage to the vulnerable lives.
- Awareness should be spread to people in the hotspot regions to take precautions against extreme weather and renovate old buildings which may not be safe in such weather conditions.

1.6 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 unsustainable manner.

6 failures in the run up to 2015 floods - CAG

- Wireless communication facility was no functioning at the dam.
- Water resources department, despite recommendations, did not install Automatic Weather stations.
- Failure to create a flood protection wall near the Adyar River.
- Water resources Department didn't conduct any survey to assess the siltation situation in Adyar river between 2011 and 2016
- The government didn't consider the construction of 2 check dams that was recommend by the North East Monsoon Expert Committee.
- Similarly the state government didn't consider the construction of the two tanks above the Chembarabakam Lake.



1.7 Re-curving Cyclones

Why in news?

Scientists have revealed that re-curving cyclones play an important role in sensing the movement of cyclones.

What is the movement of Cyclones in Indian context?

- The cyclone ones that typically strike the Indian neighbourhood in the northern hemisphere rotate anticlockwise.
- Their normal behaviour is to derive strength from the moisture in waters such as the Bay of Bengal, move west, incline in a northerly direction and peter out into the sea or land, depending on their origin.
- Eg. Mora, which formed over the Bay of Bengal on May 26.
- It rapidly strengthened on May 28, with the India Meteorological Department classifying it as a “depression” and eventually as a cyclonic storm.
- It kept north, almost parallel to the Myanmar coast and then made landfall in Bangladesh and blew over Nagaland.

What is a Re- curving cyclone?

- On its way to diminish, if cyclone gets a sort of second wind by deflected right or eastwards is known as re-curving cyclone.
- This is due to air currents in the local atmosphere that push cold air from the poles towards the equator and interfere with cyclone formation.
- In the southern hemisphere, the cyclones spin clockwise and therefore also re-curve in the opposite direction.
- During the monsoon months, cyclones in the Western Pacific move westwards towards India and aid the associated rain-bearing systems over the country.
- However, in the years of a re-curve, they do not give as much of a push to the rain as they do in the good monsoon years.

What is its relevance with Ockhi cyclone?

- A challenge with re-curving cyclones is that it is hard for weather models to pick them early on as was the case with Ockhi.
- August rains in India was dampened, which was 13% short of Cyclone Ockhi.
- The whirlwind that arose in the Bay of Bengal and revved up over Sri Lanka was expected to pass over Lakshadweep and then ease into the Arabian Sea, far away from India’s west coast.
- However, the cyclone ended up sharply swerving into parts of Maharashtra and Gujarat.
- It did not blow in very strongly because there it had not gained as much moisture from the Arabian Sea like it had over the Bay of Bengal and the Indian Ocean boundary.
- And though it wreaked havoc in Kerala and Tamil Nadu, and destroyed several beaches in Goa when it curved back to the land.

What are its implications?

- In general, cyclone activity in India peaks around November, by which time, the summer monsoon has already passed.
- Rarely do re-curving cyclones pose a mortal threat to Indian coasts and Cyclone Ockhi raised hackles because it had already left a certain amount of damage and threatened Gujarat and Maharashtra.
- Long-term data suggest that while there has been an increase in the number of tropical cyclones in India’s neighbourhood there is no clear trend in re-curving ones.

1.8 Role of Aerosols in Indian Monsoon

Why in news?

- Researchers from Indian Institute of Tropical Meteorology, Pune, think that aerosols may be weakening the rainy season.

What is an Aerosol?

- Aerosols are minute particles suspended in the atmosphere.
- When these particles are sufficiently large, we notice their presence as they scatter and absorb sunlight.
- Their scattering of sunlight can reduce visibility (haze) and redden sunrises and sunsets.
- Aerosols are short-lived, unlike greenhouse gases that persist and accumulate in the atmosphere for longer period.
- The bulk of aerosols — about 90% by mass have natural origins. Ex: Volcanoes.



- The remaining 10% of aerosols are considered anthropogenic, or human-made, and they come from a variety of sources.
- Automobiles, incinerators, smelters, and power plants are prolific producers of sulfates, nitrates, black carbon, and other particles.
- Deforestation, overgrazing, drought, and excessive irrigation can alter the land surface, increasing the rate at which dust aerosols enter the atmosphere.

What are the direct effects of Aerosols?

- Aerosols interact both directly and indirectly with the Earth's radiation budget and climate.
- Different aerosols scatter or absorb sunlight to varying degrees, depending on their physical properties. Although most aerosols reflect sunlight, some also absorb it.
- Aerosol's effect on light depends primarily on the composition and color of the particles.
- Pure sulfates and nitrates reflect nearly all radiation they encounter, cooling the atmosphere.
- Black carbon absorbs radiation readily, warming the atmosphere but also shading the surface.
- Brown carbon or organic matter has a warming influence on the atmosphere depending on the brightness of the underlying ground.
- Salt particles tend to reflect all the sunlight they encounter.
- In addition to scattering or absorbing radiation, aerosols can alter the reflectivity, or albedo, of the planet.

What are the indirect effects of Aerosols?

- As an indirect effect, aerosols in the lower atmosphere can modify the size of cloud particles, changing how the clouds reflect and absorb sunlight, thereby affecting the Earth's energy budget.
- Aerosols also can act as sites for chemical reactions to take place.
- The most significant of these reactions are those that lead to the destruction of stratospheric ozone.
- On a global scale, these aerosol "indirect effects" typically work in opposition to greenhouse gases and cause cooling.
- Broadly speaking, aerosols are thought to suppress precipitation because the particles decrease the size of water droplets in clouds.

What did the IITM Pune study say?

- A study by IIT Kanpur that came out in April, previously found that higher aerosol loading results in delayed but more rainfall over Central and Northern India.
- But, this recent research by IITM Pune focusses on effect of aerosols on Indian monsoon.
- Monsoon is weakening over the last 50 years. The recent research report that a mix of GHGs, aerosols and changes in forest and agricultural cover was affecting the strength of the monsoon.
- Their computer simulations suggest that aerosols may be a far more important factor than GHGs and it is the major cause of weakening of the monsoon.
- A good monsoon is produced by the difference in temperature between land and sea.
- But, the dust clouds shield the earth from the sun's rays, depressing land and sea temperatures and reducing the variation between the two.
- Because of this, the Indian monsoon is getting weakened by aerosol

1.9 A Normal Monsoon - Not For Crops

What is the issue?

- Indian Metrological Department has recognised the 2017 south-west monsoon rainfall as 'normal' in statistical terms.
- However, the spatial and temporal distribution of rains shows a different picture.

What is a normal monsoon year?

- Long-Period Average (LPA) rainfall of India for the entire monsoon season is around 887 mm.
- IMD deems a season 'normal' if the all-India quantum of rain falls within a 10% range of the LPA.
- In this south-west monsoon season (June to September), India has received a total 841.3 mm of rain.
- This is short of the LPA by 5%.
- Thus, statistically south-west monsoon for 2017 has turned out to be normal.

Why is it not 'normal' for agriculture?

- IMD categorises India into 36 meteorological sub-divisions for measuring the spatial spread of rainfall.
- In this monsoon, 5 of the 36 sub-divisions received excess rains, 25 received normal rains and 6 witnessed deficient rains.
- Also, the first two months of the season witnessed an excess rainfall than the latter two.
- Thus, however the quantum of rainfall this season was normal, the distribution was quite unusual.
- Notably, the spatial and temporal distribution of rains decides the crop prospects.

What could the impact be?

- Spatial variation - This year's monsoon has been deficient in some key food-bowl States, affecting crop production. E.g.
- Deficient rains in Uttar Pradesh and Punjab is bound to affect kharif rice production.
- Deficient rains in Madhya Pradesh would impact rabi wheat crop and pulses output.
- Patchy distribution in Madhya Pradesh and Haryana could affect oilseeds' prospects.
- Besides, there are wide variations within each state between growing regions.
- Temporal variation - This year witnessed excess rains in June and July contributing to good sowing and coverage of the kharif crops.
- However, August and September months saw below normal rains, impacting the eventual output by reducing crop yields.
- Also, rainfall in these two months decides reservoir storage and soil moisture and eventually helps planting of the winter crops.
- Notably, the rabi season and winter crops has been equally important to the agricultural prospects in recent years.
- Therefore, dry spells in the latter half of this monsoon, taken with deficient rains in key rabi growing regions, has reduced rabi prospects.

1.10 Haze Over Delhi

Why in news?

- Haze loomed over Delhi and its adjoining areas for over a week.
- The air quality index reflected a "severe" degradation in air quality in Delhi.

How has pollution been in Delhi?

- Delhi witnessed high pollution levels in the recent winter.
- Stubble burning in the neighbourhood regions was cited as the main reason.
- Smoke from brick kilns and vehicular emissions added to the air pollution.
- The weather patterns in winter season contributed for the sustenance of the pollution.
- However, the current haze, in summer, cannot be attributed to these.

What are the reasons?

- Delhi now witnesses high levels of dust, causing haze, reducing visibility.
- It also resulted in particulate matter (PM) levels shooting to over 8 times the normal range.
- Dust storms originating from Rajasthan and wind direction are said to be the cause.
- But besides this, local sources of pollution are also said to be the reasons.

How to address this?

- Emergency measures will have to be soon initiated and all construction activity stopped.

- Delhi government has been directed to carry out water sprinkling to bring down the PM levels.
- Modelling and measurements to evaluate the exact sources of the dust particles are essential to deal with it.
- Cities like Delhi require a green belt around it to reduce pollution levels.
- But greening open spaces or reforestation of land largely remain as concepts.
- Delhi needs long term planning and systematic research on dealing with the perpetual problem of pollution.

1.11 Swell Waves

- National Disaster Management Agency (NDMA) issued a high energy swell wave alert along the Indian Coastline.
- High energy swell waves, with heights between 2 m and 3 m and periods between 17-22 seconds are likely to be experienced in the seas around India.
- Swell waves are massive ripples that form on the sea due to winds.
- In a way it is the collections of waves produced by storm winds raging hundreds of miles out to sea, rather than the product of local winds along beaches.
- The low-lying coasts of Kerala and West Bengal are particularly vulnerable.

1.12 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.
- One of the largest dead zones forms in the Gulf of Mexico every spring.
- Nutrients such as nitrogen flow from North America's Corn Belt through streams and rivers before ending up in the Gulf.
- The dead zones or Oxygen Minimum Zones (OMZ) 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.

Urbanization and their Problems

1.13 Problems of Urbanization

What is urbanization?

- Urban area is where most of people work in secondary or tertiary (service) sectors.
- Urban areas include statutory towns, census towns and outgrowths.
- Census towns are area with the
 1. minimum population of 5000
 2. 75% male workers engaged in non-agricultural activities&
 3. population density of minimum 400 persons per sq.km.
- A Statutory Town is one with a municipality, corporation, cantonment board or notified town area committee.
- Out Growths are viable units such as a village or part of a village contiguous to a statutory town.
- Examples of out growths are Railway Colonies, University Campus, port areas, etc.
- Urbanisation is the process of shifting from rural inhabitation to urban inhabitation in a particular time and place.

What are the reasons for urban population growth?

- **Health** -Increase in size of cities is usually not substantially due to high birth rate, though total births in a city do have a bearing on the growth.



- There is a less birth rate per year due to relatively less total fertility rate (TFR) of women due to better education, prevalence of small family norms.
- The infant mortality rate (IMR) Per thousand births, under five child mortality rate (CMR) Per thousand births as well as maternal mortality ratio per lakh births are much lower in urban areas than in rural areas.
- **Migration** -Migration (both from rural and other urban areas) contributes hugely in population growth in cities.
- Migration occurs usually due to both 'pull' and 'push' factors.
- Pull factors of cities include mainly the new and better opportunities for livelihood in both organised (public and private) and unorganised sectors.
- Employment -Migration from villages (rural to urban migration) or from small towns (urban to urban) given a fixed population size for a period in a specific city,
- Push factors in villages are primarily, lack of livelihood employment opportunities.
- **Society** -Various restrictions on the basis of bondages and regressive customs, especially on the women, lower castes and communities are not much emphasised in urban corridors.
- In the last five-six decades it is also a trend that due to the problem of extremists and naxals in villages, many families have migrated en masse to urban centres in the same State or other developed State/or national capital.

What are the Problems of urbanization?

- **Noise Pollution** - There is a large number of high level of noise pollution due to vehicles.
- Primary sources of noise pollution in large urban areas are road traffic, aircraft, trains, constructions activities and industries.
- Delhi has been ranked second in the world in terms of both most noise and maximum hearing loss
- There is a close positive relationship between urban noise pollution and hearing loss.
- **Air Pollution** -As per Central Pollution Control Board report (August 2016), 41 Indian Metros faced bad air quality in 60% of total days monitored.
- Long term exposure to fine particulate matter (PM_{2.5}) contributed to 42 lakh premature deaths in 2015 in the whole world out of which India and China together shared 52%
- Except a few cities in South India, most of Indian cities do not comply with National Ambient Air Quality Standards
- **Air pollution** primarily leads to respiratory, cardiac and blood pressure problems, especially among the young and old ones.
- **Water Scarcity** -There is uneven distribution of water by regions, nations and sub-nations.
- One of the Millennium Development Goals was to reduce the proportion of people without access to safe drinking water by half by 2015 but we could not achieve this major goal.
- In urban India, we have water scarcity in different ways and proportions in different cities.
- In four metros (Kolkata, Delhi, Chennai & Mumbai) 90 crore litres of dirty water is thrown out in rivers daily but only 30% is treated.
- Water scarcity has often led to riots among common people in slums and undeveloped colonies where population density is very high.

How the issues can be addressed?

- **Air pollution** - As directed by NGT, all diesel vehicles of 15 years of age or more should not be allowed in cities.
- Only Bharat VI compliant vehicles should be produced and registered and only clean fuel should be allowed for use in vehicles.
- There is a need to switch from diesel to petrol and CNG fuel.
- Waste and biomass burning needs to be stopped to reduce NO₂.
- Use of kerosene stoves should be strictly banned in cities.



- Use of cycles and battery rickshaws (with safety devices) should be encouraged and like many European countries cycle tracks should be constructed for cycle users.
- **Water pollution** - Rain water harvesting should be popularised by giving subsidies; and all old ponds/ tanks should be revived;
- There should be well-planned tree plantation drives in cities every year and students, govt. officials, voluntary organisations, etc. should be involved genuinely.
- Every citizen should be entitled to get adequate safe drinking water as a part of the right to food in both urban and rural areas.
- Swachh Action Plan should also comprise of devices and mechanisms for preventing water, air and soil pollution.
- **Noise pollution** -There should be a ban on use of high power loud speakers, D.J. etc. in residential and institutional areas to check noise pollution;
- For construction works there should be the well planned norms to cover, to check noise and air pollution, and not to obstruct road with construction materials.

2. ENVIRONMENT

Climate Change

2.1 Suva Expert Dialogue

Why in news?

The two-day Suva Expert Dialogue on loss and damage, a part of intersessional climate summit at Bonn, ended recently.

What was the outcome?

- The dialogue was organised to deliberate on issues in the mechanisms set up so far to address losses and damages caused by climate change impacts.
- Over the course of the deliberations, participants circled around longstanding issues and gaps in the loss and damage addressal systems within the UNFCCC framework.
- Differential vulnerability, highly variable impacts and novel conditions of current climate-related risks demands fair and just redressal mechanisms for losses and damages.
- The aspect of "risk creation" due to human activity was also introduced in the discussions.
- Finance even emerged the single biggest concern among participants.
- One financial instrument that got a lot of attention was that of climate or weather-based insurance systems.
- But Insurance schemes and initiatives the world over have faced roadblocks in terms of affordability of premiums and the access of payouts.
- As extreme weather events have become more common and devastating, insurance premiums have gone out of reach of small and marginal farmers.
- **Forecast-based compensations** - One option that was put forth was that of forecast-based compensations where funds could be released to aid the preparedness of populations to deal with climate events.
- The need was also expressed to move from deterministic to probabilistic approaches to deal with the impacts of climate change in the current age.
- Another gaping hole in the loss and damage mechanisms currently in place is slow onset events.
- Given the predictable but unavoidable nature of slow onset events, insurance is scarcely an option to address them.

Warsaw International Mechanism (WIM)

- It is a specialised forum formed in 2013 to address climate induced loss and damage.
- It has three major functions: enhancing knowledge and understanding on loss and damage, strengthening dialogue among stakeholders and provide support to vulnerable victims.
- Within WIM, few notable initiatives have been launched including Fiji clearing house on risk transfer, taskforce on displacement and expert group on non-economic losses.

2.2 UN Environment Emissions Gap Report 2017

Why in news?

The UN Environment Emissions Gap Report 2017 was recently released.

What are the highlights?

- It warns that a big carbon emissions gap exists between the present climate commitments, and what needs to be done to limit increases in global average temperature to less than 2° Celsius or a more ambitious 1.5° C by the year 2100.
- It says that full implementation of the unconditional Nationally Determined Contributions (NDCs) could result in a temperature increase of about 3.2° C by 2100 relative to pre-industrial levels.
- Even the full implementation of conditional NDCs would only marginally lower that projection by about 0.2°C.
- The Paris accord pledges only a third of what is needed to avoid climate catastrophe.
- CO₂ emissions have remained stable since 2014, driven in part by renewable energy, notably in China and India.
- This has raised hopes that emissions have peaked.
- But, the report warns that other greenhouse gases, such as methane, are still rising.
- Fossil fuels and cement production account for about 70% of greenhouse gases.
- A large part of the potential to close the emissions gap lies in the 6 factors that hold a total potential of up to 22 giga tonnes of equivalent carbon dioxide (GtCO₂e) per annum. They are
 1. solar energy,
 2. wind energy,
 3. efficient appliances,
 4. efficient passenger cars,
 5. afforestation and
 6. Stopping deforestation.

What should be done?

- Adopting new technologies in key sectors, at investments of under \$100 per tonne of emissions, could cut them by up to 36 gigatonnes per year by 2030.
- This is more than sufficient to bridge the current gap.
- Strong action on plugging other greenhouse gases, such as hydrofluorocarbons, through the Kigali Amendment to the Montreal Protocol could contribute.

2.3 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
 - a. floods and droughts
 - b. forest fires
 - c. islands losing ground to rising sea waters
 - d. water scarcity
 - e. 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 wakeup call for nations to relook and reassess the climate strategies.

2.4 World Bank Report on Climate Change Impacts

Why in news?

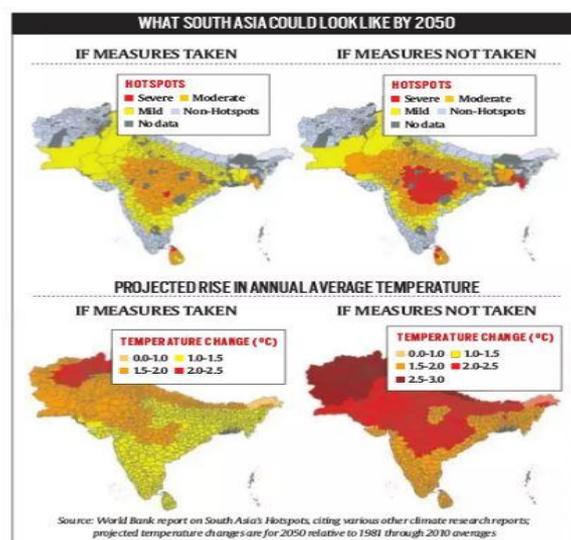
World Bank has released South Asia's Hotspots - The Impact of Temperature and Precipitation Changes on Living Standards report.

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.
- It 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.

2.5 Economic Impact of Climate Change

Why in news?

World Economic Outlook was recently released by the International Monetary Fund.

What are the highlights of the report?

- An analytical chapter highlights some of the damaging macroeconomic impact of weather shocks, particularly for low-income countries.
- 1 °C increase from a temperature of 22degree Celsius reduces the growth of median emerging market economy by 0.9% in a year.
- Its impact on the median low-income developing country is even higher.
- The growth doesn’t recover quickly after a weather shock and takes evens decade to fully recover.
- Countries located in areas with higher temperature are highly vulnerable to the impact of global warming.
- The resultant loss of output and lower productivity also affects capital formation.
- The overall impact is a considerable bearing on the medium- to long-term growth prospects of the country.

What makes India more vulnerable?

- India, being a **tropical country**, is more susceptible to changes in temperature.
- Also, in India, about 50% of the population directly or indirectly depends on **agriculture** for a livelihood.
- The existent distress in the farm sector and the state governments' response with loan waivers have already strained their **fiscal condition**.
- Furthermore, the production of kharif crops is expected to decline.
- The possibility of adverse weather events is likely to increase in the future posing a greater challenge.



- The impact of climate change in agriculture is thus expected to reverberate in other sectors of the economy and affect the overall growth prospects.

What should be done?

- **India**- India, which is considerably better, still has to strengthen its **macroeconomic stability** to deal with temperature shocks.
- India has considerably reduced its dependence on the monsoon as evident from avoiding a runaway inflation even after two successive years of drought.
- However, more needs to be done to enhance **productivity** in the agriculture sector.
- India can work on **programmes** that will help improve the quality of land and reduce the risk of climate change. Ex: Use employment under the MGNREGA to enhance soil and water conservation.
- India also needs to strengthen its overall capability by investing in and adopting new **technology**.
- **Global** - Emerging market and low-income economies will have to build significant macroeconomic resilience so as to reduce the impact.
- Right policies and institutions in place may help attenuate the effects of temperature shocks, to some extent.
- In all, it is essential for the countries to realize that steps to minimize the impact of climate change will have to be taken both at individual country and global levels.

2.6 Climate Change Impacts

Why in news?

According to recent research biggest impacts of climate change is likely to be felt along coastlines across the world.

What are the recent findings on climate change impacts?

- A new study by scientists of IIT Bombay has now concluded that the impacts of climate change on India's coasts.
- The Impacts are in terms of coastal sediment transport, shoreline erosion and overall coastal vulnerability, could be far worse than previously understood.
- The amount and rate of erosion of coastlines is generally studied using data from the past and extrapolating the changes into the future.
- One of the key variables the researchers relied on was projected wind-generated waves around Indian coastline.
- Wind vectors influence wave height as well as direction, and also the currents that in turn affect the rates of coast sediment transport and erosion.

What are the concerns for India's coastline?

- With a nearly 7,500-km coastline, India has a lot to worry, but sea-level rises around the Indian coastline are likely to be relatively small compared to many other regions.
- Climate change can erode coastline more intensely than ever rising sea levels.
- It is likely to reshape the coastlines and potentially inundate or even submerge many low-lying areas.
- Potential climate-change impacts on five Indian beaches and found that the rates of transport and erosion could be much higher than estimated.

What will be the impacts of climate change?

- Different locations would face different kinds of impacts, Local geo-morphology as well as factors like whether the coastline is uninterrupted or is interspersed with barriers like harbours or river-mouths play a role.
- Winds are likely to intensify and there is likely to be greater attack on beaches and coasts in the future than so far imagined, this will lead to a greater vulnerability of the coastline.
- This can have far-reaching implications for the efforts to safeguard of coasts.



2.7 Rising Indian Ocean

How is global warming affecting oceans?

- There are two broad mechanisms at work.
- Heat trapped in the atmosphere due to rising sea levels makes water expand.
- Melting ice sheets begin to add water to the world's oceans.
- NASA's satellite data shows that the seas on average have risen 85 mm since 1993, adding about 3.5 mm annually.

What is peculiar about the Indian Ocean?

- The Indian Ocean has been rising rapidly, particularly since 2004.
- It was **specific to a smaller stretch called the North Indian Ocean**, which consists of the Bay of Bengal, the Arabian Sea and a large part of the Indian Ocean until the 5 degree S latitude.
- North Indian Ocean sea levels actually dipped between 1993 and 2004, at about 0.3 mm per year, but after 2004, the rise was 6 mm annually.
- Such a fluctuating trend hasn't been observed for the Pacific Ocean and the Atlantic Ocean.

Why did this happen?

- The North Indian Ocean is surrounded by land on all sides, except an outlet on the southern side.
- This influences the rate at which heat is absorbed and flushed out from within the system.
- Wind flows, which led to warm water welling up on the Indian Ocean surface, changed directions every decade and probably influenced sea level patterns.

What does this imply?

- This means a rise in average global temperature doesn't mean a concurrent rise in sea levels everywhere.
- Every year in the last decade has broken temperature records that have held for over a century.
- But researchers believe that **North Indian Ocean levels may see a fall over the next decade**(like seen between 1993 and 2004).

2.8 Urban heat islands

- Rapid urbanisation combined with changes in land use pattern leads warming of urban spaces compared with surrounding non-urban areas this is called the urban heat island effect.
- Urban migration, concrete jungles, decrease in dense vegetation and cultivable land area, encroachments in water bodies will influence urban heat islands.
- For instance, Delhi is 4-12°C warmer due to the urban heat island effect.

2.9 Conference of Parties (Cop23) – Bonn

What is the issue?

- The 23rd Conference of Parties to the United Nations Framework Convention on Climate Change concluded recently.
- While minor advances have been made, there are still some concerns with financing and the review mechanism.

What are the key outcomes?

- The Conference seems to have left some room for satisfaction with the following:
 - i. alliances were formed for phasing out coal
 - ii. decision to putting up green buildings and accelerating eco-mobility
 - iii. recognising gender in dealing with the issue, in a Gender Action Plan
 - iv. decision to get indigenous people (adivasis) have a say in climate talks

Talanoa Dialogue

- It is facilitative dialogue among member of Conference of Parties of Paris Agreement to be taken in 2018.
- It is a year-long process to take stock of the collective efforts of Parties in relation to progress towards the long-term goal of economy-wide absolute emission reduction and to inform the preparation of nationally determined contributions.
- Talanoa is a traditional word used in Fiji and the Pacific to reflect a process of inclusive, participatory and transparent dialogue.



- v. decision to look into the greenhouse gas emissions from agriculture
- Above all, the developing countries stood as a solid bloc demanding a balanced deal.
- The key demands centred on getting agreed upon and including in the official agenda the 'pre-2020 actions'.
- This is mainly in reference to the obligations of the developed countries under the 1997 Kyoto Protocol that still has three years to run.
- There was also a demand for fixing a deadline for the ratification of 2012 Doha amendments to the Kyoto Protocol to give a legal shape to the 'pre-2020' commitments.
- An important outcome of CoP 23 is the 'Talanoa Dialogue'.

What are the continuing contentions?

- **Loss and Damage** - In Warsaw, Poland, COP-19, 2013 established the Warsaw International Mechanism for Loss and Damage.
- This was in relation with the key obligations to be fulfilled by big emitters for the economic and non-economic losses of climate change.
- It intended at addressing the destruction likely from climate change, including extreme events (such as severe storms) and slow-onset events (such as sea-level rise).
- The Paris Agreement also recognises loss and damage and calls for enhanced action and support from the parties.
- However, in CoP 23, loss and damage was not included in the agenda for the Paris rule book.
- The rule book intends to provide operational guidance for fulfilling the ambition of the Paris Agreement and providing clarity on countries' efforts to reach the global goal.
- It has to be finalised by 2018, according to the Paris Agreement's timeline.
- There are no funds yet on loss and damage and the discussion on this has been postponed to 2018.
- This was rightly a big bone of contention with poor and developing economies.
- **Finance and Technology** - Another aspect of support from rich countries is about providing finance, technology, and building capacity for poorer countries.
- This is intended both to protect themselves from the effects of climate change and to help them move along a low-carbon pathway.
- Without these support means for implementation, the targets set by each country in Paris are hard to achieve.
- The earlier promise of \$100 billion each year by 2020 into the Green Climate Fund has also not seen much inflow to meet the goal.
- Sadly, COP-23 did not result in any substantial agreements on financial support.
- Important decisions on the key issue of finance were moved forward to be discussed at the next meeting to be held in Katowice, Poland in 2018.
- **Emissions** - The science on climate change has not been given focus in CoP 23.
- Greenhouse gas emissions appeared to have stabilised for the past few years, probably due to some economic reasons.
- However, emissions rose by 2 % in 2017 perhaps due to additional electricity drawn from coal power plants in China.
- The key question of when coal will be phased out globally has gone unaddressed in the meeting.

2.10 Soils to Sequester Carbon

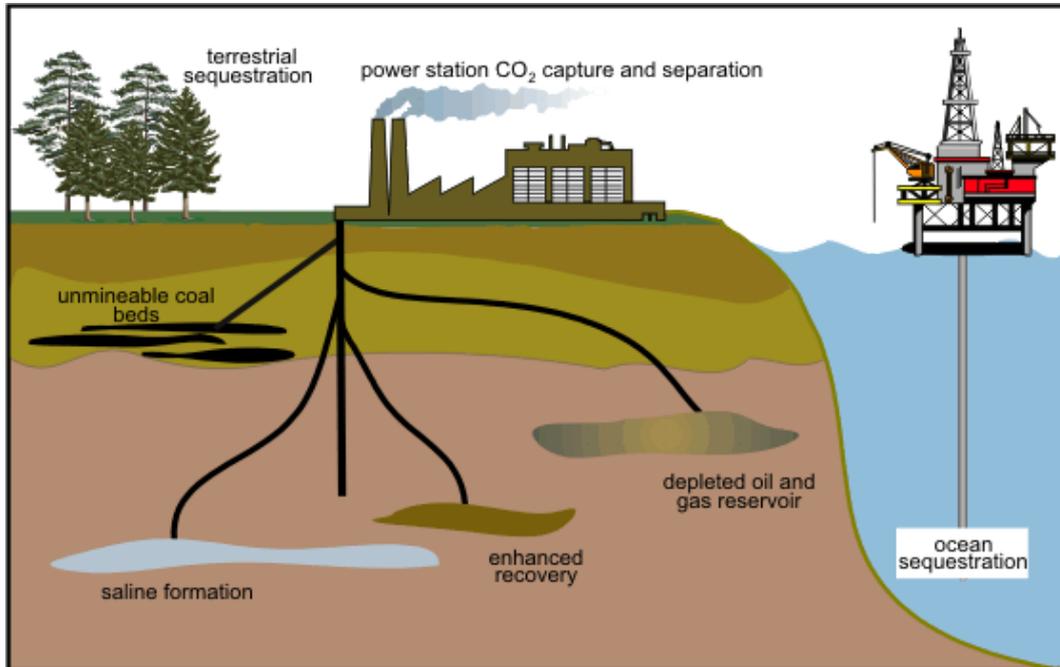
What is the issue?

The ability of soils to sequester carbon should be given a serious focus by policymakers in the context of climate change actions.

What is carbon sequestration?

- It is the process by which carbon dioxide is removed from the Earth's atmosphere and then stored in liquid or solid form.

- It could involve both natural and artificial processes to remove and store carbon.
- Significant carbon pools on earth are found in the earth's crust, oceans, atmosphere and land-based ecosystems.
- The prime purpose of artificially doing this is to mitigate or delay global warming and avoid extreme climate change.



What is the need for focussing on soils?

- **Agricultural Practices** - After the changes undertaken as part of the Green Revolution, crop yields increased for several decades.
- But parallelly there has also been a dramatic increase in the use of chemicals as pesticides, herbicides and fertilizers.
- The resultant degraded soils are getting to be a prime reason for undermined agricultural yields in many places now.
- **Industrial changes** to agriculture have led to a range of adverse effects including:
 1. loss of biodiversity
 2. elimination of beneficial microbes and insects
 3. reduction in yield
 4. contamination of water bodies and soils
 5. increasing toxicity, etc
- **Global Warming** - Currently, the world is on a path to be about 3°C warmer than pre-Industrial times.
- This is despite adhering to 2015 Paris climate deal commitments.
- Atmospheric concentrations of carbon dioxide have crossed limits and oceans are already turning acidic.
- But, policies are largely focussed on reducing greenhouse gas (GHG) emissions from electricity sector, transport and industry.
- The policy shortfalls call for a renewed focus in understanding how soils can serve as carbon sinks to address the increasing pressures.

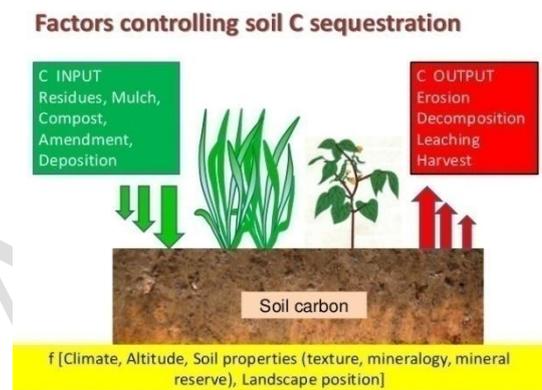
How effective are soils as carbon sinks?

- **SOC** - Soil organic carbon (SOC) comes from plants, animals, microbes, leaves and wood, mostly found in the first metre or so.
- Soils contain around 2,300 Gt (1 gigatonne = 1 billion tonnes) of organic carbon, making this the largest terrestrial carbon pool.

- **Benefits** - Increasing SOC through various methods can improve soil health.
- It can contribute to agricultural yield, food security, water quality, and also reduce the need for chemicals.
- It helps address carbon mitigation and also improve conditions of fresh water, biodiversity, land use and nitrogen use.
- Moreover, carbon sequestration in soils has the potential to offset GHG emissions from fossil fuels by up to 15% annually.
- Utilising this option would thus offer the breathing time before other technologies can help transiting to a zero-carbon lifestyle.

How is it achieved?

- There are many conditions and processes that determine changes to SOC content.
- These include temperature, rainfall, vegetation, soil management and land-use change.
- Thus, increasing Soil Organic Carbon involves adopting sustainable agricultural practices to keep these factors in balance.
- The approaches to increase SOC include:
 - i. reducing soil erosion
 - ii. no-till-farming
 - iii. use of cover crops
 - iv. nutrient management
 - v. applying manure and sludge
 - vi. water harvesting and conservation
 - vii. agro forestry practices, etc



What should the government do?

- India does have a large number of successful **sustainable agricultural practices**.
- The **knowledge of farmers** who have successfully experimented with these methods must be considered in research and policy.
- State-level policy makers should identify the **kinds of support** needed by farmers with small holdings to transition from existing practices.
- There is also a need for revising the existing **fertiliser subsidy policy** and promoting organic fertilizers.
- The ability of soils to sequester carbon is thus a win-win strategy for farmers, people and for climate change.

2.11 Internal Climate Migration

What is the issue?

- There is presently an increased internal migration across the world due to political and economic instability.
- Beyond this, the internal migration due to climate change is potential of getting to be a major concern for nations.

What is the looming danger?

- Some of the slow onset climate events would be droughts, effects from sea level rise and water shortages.
- These may certainly drive many more to leave their homes and move to safer places.
- Such migration may be a choice in the initial stages.
- However, as the stress becomes more severe, the decision to move may be forced.
- E.g. people are compelled to leave their island nations in the Pacific and Indian Oceans with gradual rise in sea levels
- These climate exiles are an ongoing process.
- Notably, it would likely increase out-migration over time.

Which regions are vulnerable?

- A recent report by the World Bank on internal climate migration highlights the possible migration reality.
- In Latin America, South Asia and Sub-Saharan Africa over 140 million people would be forced to move within borders by 2050.



- This would be as a result of slow onset climate events alone.
- In the worst-case scenario, about 40 million of these migrants would be in South Asia.
- This is the most populous of the regions studied, with a number of climate change effects anticipated.

How would South-Asia be affected?

- South Asia is characterised by **rain-fed farmland** in large parts of the region.
- Variability in the **monsoons** and **warmer temperatures** is sure to lead to **crop failures**.
- This will lead to **migration** from the Gangetic plains and from the rice-growing northeast of Bangladesh and the inundated coasts.
- The numbers on forced internal migration in South Asia could increase six-fold between 2020 and 2050.
- This will continue to rise beyond 2050 without appropriate climate action.
- But even with inclusive development and climate-friendly scenarios, tens of millions would still be forced to migrate.
- This normally makes people **migrate to big cities**.
- However, those along the coast such as Mumbai, Chennai, Chittagong and Dhaka will themselves be vulnerable.
- **Storm surges** and other effects from **sea level rise** make these coastal cities unfavourable.

What are the concerns?

- The **poor** would be the worst affected by these slow onset events.
- Most of them would migrate out of rural areas to nearby urban settlements such as **cities and the peri-urban surroundings**.
- Such **“hotspots”** of in and out migration would be stressed for natural resources, public services and livelihoods.
- In India, the areas between Chennai and Bengaluru could be the potential spots.
- In India, there are already signs of **unplanned and frontier-led growth** in peri-urban areas.
- Planning that ignores the **ecosystem services** provided by local natural resources generates further problems for the vulnerable.
- The implications of internal migrations will significantly affect **development** in these areas and the lives of vulnerable people.

2.12 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.

Atmospheric brown cloud

- This cloud is made up of 'black carbon' containing soot and smog.
- It is the result of stubble burning, wood fires, smokestacks and fossil fuel exhaust.
- Dust kicked up by winter agriculture, vehicles and wind are sources as well.
- This high altitude haze covers the Indo-Gangetic plains for much of the dry season.
- It penetrates deep into the high valleys.
- It rises up over the plains and some of it settles on Himalayan snow and ice.
- They absorb the heat and melt much faster.

- 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.

Environmental Laws, Policies, Reports and Indices

2.13 Amendments to Environment Protection Act

Why in news?

The Union government is planning to make changes to the Environment (Protection) Act of 1986.

What are the present provisions?

- The maximum fine that can be imposed on a polluting industry or other entities is Rs.1 lakh along with a jail sentence of up to five years.



- Even this requires the government agencies to first file a complaint with a magistrate at the district level and secure a favourable order against the polluter.
- At present, there are powers to shut down a polluting industry or an operation of a part of the industry temporarily.
- Currently, a violation of the Environment Protection Act is treated as a criminal offence.
- There is a felt need to have graded response to the pollution problem without everything ending up in court.

What are the proposed changes?

- The level of fines for a polluting industry from Rs.1 lakh to Rs.1 Crore to be increased.
- The fine is to be imposed without going through a judicial process prescribed in the current law.
- A designated officer would be the final authority to decide the money that needs to be recovered from the polluting entity.
- There is also a plan to make pollution a civil offence for which the government can demand costs from the polluters without going to the courts.

What are the shortfalls?

- The proposed changes lack understanding of why repeated attempts over the past failed to bring a change in pollution levels in the river. This includes the recent Namami Gange project's output.
- The river is a community asset and polluting it has disastrous health effects. This cannot be overlooked because a polluting industrial unit is happy to pay Rs.1 Crore.
- Undermining judicial review could give scope for official-polluter nexus, instead of reducing pollution.
- Change can start with more efficient execution of the existing rules than amending them or bringing new ones.

2.14 Draft National Forest Policy - 2018

What is the issue?

- Ministry of Environment, Forests and Climate Change has recently released the “Draft National Forest Policy, 2018” for public comments.
- This is a positive as a new forest policy that is in tune with the changed realities was long overdue.

How has India’s forest policy evolved?

- Currently, the “National Forest Policy of 1988” is the primary document that drives India’s forest outlook.
- This dates back to the times when climate change was a fuzzy concept, and even before economic liberalisation was undertaken.
- While Forest Rights Act was passed in 2006, a comprehensive new forest policy that covers the new evolving concerns was needed.
- Hence, the present draft on climate change concerns has factored in climate change concerns and management plans forest and wildlife.
- It also talks of “safeguarding the livelihood of forest dependent people” and envisions raising the country’s forest cover from 25% to 30% of its land area.

How did 1988 forest policy address this?

- In a paradigm shift, the 1988 Forest Policy recognised the multiple roles of forests.
- Significantly, it prioritised environmental stability over revenue maximisation.
- It acknowledged the rights of forest-dependent communities on forest produce.
- Also, the policy emphasised people’s involvement in protecting and regenerating forests.
- It thus formally recognised the limitations of state-managed forestry.

What is the post-1988 experience?

- **Devolution of control** - Joint forest management (JFM) was initiated in the 1990s to facilitate people’s involvement.
- Foresters created thousands of village forest committees.
- But their autonomy and jurisdictions were severely limited.



- Donor money was spent on plantations but activities were stopped once funds ran out.
- “People’s participation” by executive order was too weak.
- What was actually required was substantive devolution of control over forests
- **Community rights** - The Forest Rights Act (FRA) of 2006 created a historic opportunity for such devolution.
- Its community forest resource provisions gave communities rights to both access and manage forests.
- **Forest Diversion** - FRA also democratised the forest diversion process.
- It mandated community concurrence for forest diversion once community forest rights are recognised.
- E.g. the Adivasis of Niyamgiri in Odisha exercised this provision to prevent bauxite mining in their sacred hill tracts.

What are the concerns with the new draft forest policy?

- **Production forestry** - In the past, production forestry has led to replacing
 - i. natural oak forests with pine monocultures in the Himalayas
 - ii. natural sal forests with teak plantations in central India
 - iii. wet evergreen forests with eucalyptus and acacia in the Western Ghats
- All this had significantly affected forest diversity.
- It has dried up streams and undermined local livelihoods.
- **Ecology** - The stress on commercially important species like eucalyptus and poplar raises concerns for the ecology.
- These species are known to be water-demanding, with deep root systems that deplete groundwater.
- Also, poplar and eucalyptus have negative allelopathic properties i.e. they do not encourage vegetative growth under their cover.
- Non-indigenous plantation species to meet afforestation targets and timber requirements would be counterproductive to public investments in such initiatives.
- **Livelihoods** - There are about 1.3 lakh villages in and around India’s forests.
- An estimated 350-400 million people depend directly on these forests for sustenance, involving in management and protection.
- The new policy fails to acknowledge this symbiotic relationship between the tribal people and forests.
- **Community Participation** - There is little about decentralised governance in the draft policy.
- Local communities would have challenged the production forestry model if they had had a say in forest governance.
- **PPP** - The 1988 policy clearly states that the requirements of the local communities should not be sacrificed for the sake of forest based industries.
- However, the PPPs in the new policy go against this and will entail more forest destruction.
- It is a way of granting the private sector access to public resources.
- The profits and benefits are also thus likely to end up in corporate hands.
- **Mechanism** - The draft policy talks of “ensuring synergy” between gram sabhas and JFM committees.
- But the actual need is to replace JFM committees with statutorily empowered gram sabhas.
- Harmonization with other laws like the FRA could certainly leave scope for concern in administrative jurisdictions.
- It may put environmentalists and bureaucracy at loggerheads as the former may see it as an attempt to weaken the role of gram sabhas.
- In all, the new Policy seems to be falling back to the practice of state-managed forestry of the 1950s as well as shifting focus from community and ecology to industry and raw materials.

How effective are forests in addressing climate change?

- While the exotic vs. indigenous species debate is raging, some researchers claim that mere regeneration of forests isn’t enough to check global warming.
- The efficiency of the “carbon cycle in forests” (which varies from forest to forest), is said to be a key factor for climate change mitigation.
- India has largely lacked nuanced studies to map forests and their carbon cycle potential and the draft policy doesn’t offer a roadmap to address these.
- Such concerns need to be addressed while finalising the new forest policy.

2.15 Need For Proper Implementation of FRA

What is the issue?



- Many forest dwellers across India are in vulnerable condition due to improper implementation of Forest Rights Act (FRA).
- Respective governments need to take measures in this regard.

What is Forest Rights Act?

- The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 or FRA was a landmark legislation that sought to restore the rights of forest dwellers over land, community forest resources and habitats, and the governance and management of forests.
- It concerns the rights of forest-dwelling communities to land and other resources, denied to them over decades as a result of the continuance of colonial forest laws in India.
- The Act grants legal recognition to the rights of traditional forest dwelling communities, partially correcting the injustice caused by the forest laws.

What is the significance of FRA?

- The community forest titles enable all the villagers, including landless people, to access, use and sell minor forest produce and use other forest resources.
- There are evidences that after recognition of community forest rights, the household incomes from bamboo harvesting has increased.
- There are possibilities of reverse migration and reduced forest fires due to regular patrolling and monitoring by the villagers.
- Thus FRA can contribute to their livelihood and sustainable management of forests.

What is the implementation status of FRA?

- The Ministry of Tribal Affairs' latest database reveals that out of 41,89,827 claims for land rights made by forest dwellers, only 18,24,27 have been accepted by the authorities.
- In some cases titles have been given over less area than what was legitimately claimed by forest dwellers.
- Of the total forest rights titles issued so far, the majority are of individual forest rights and only less than 4 per cent titles recognise community forest rights.
- Instead of addressing the implementation problems, governments across the country have introduced conflicting policies that go against the spirit of the FRA.
- Many of these rules place the governance of forests in the hands of committees that are constituted and controlled by the forest department.

What are the consequences of non-implementation of FRA?

- There are land related conflicts galore across the country arising due to the non-implementation of the provisions of the Forest Rights Act.
- There were diversion of forests for industrial and development projects without settling forest dwellers rights and without their free and prior informed consent has been indiscriminately carried out.
- Majority of the land conflicts (two-third) in India are related to common lands rather than private lands.
- If unsolved these conflicts will increase and will impact hugely on the economic system if the government fails to address them in a rapid manner.

What measures needs to be taken by the government?

- The government should realise that the Forest Rights Act can enhance the livelihood of people and promote sustainable forest management through collective action with legal sanction, scientific inputs and social process.
- Implementation of the Forest Rights Act will help to resolve many existing conflicts and uplift the economic and social status of forest dwellers.
- The government should understand the potential of the FRA to address rural distress and not subvert its provisions.
- The state governments across the country should bring amendments to their forest law, especially laws related to minor forest produce.

2.16 Draft Coastal Regulation Zone (CRZ), 2018

Why in news?

The draft Coastal Regulation Zone (CRZ), 2018 was recently released by the Ministry of Environment and Forests (MoEF).

What are the key features?

- **HTL** - The High Tide Line (HTL) shall be demarcated by the National Centre for Sustainable Coastal Management (NCSCM).
- This shall be reckoned as a universal standard for the HTL for all regulatory purposes under notification, 2018.
- **Hazard line** - Hazard line mapping will be carried out by Survey of India.
- However, the Hazard Line has been delinked from the CRZ regulatory regime.
- It shall be used only as a tool for Disaster Management and planning of adaptive and mitigation measures.
- **CRZ** - CRZ limits on land along the tidal influenced water bodies has been proposed to be reduced.
- It would be reduced from 100 meters or the width of the creek to 50 meters or the width of the creek, whichever is less
- **NDZ** - A No Development Zone (NDZ) of 20 meters has been proposed.
- This will be stipulated for all Islands close to the main land coast and for all Backwater Islands in the main land.
- **CRZ-III** - For CRZ-III areas, two separate categories have been proposed.
- These are CRZ-III A and CRZ-III B.
- CRZ-III A comprises areas that have population density of 2161 per sq km as per 2011 Census.
- These will have NDZ of 50 meters from the HTL as against 200 meters stipulated in the CRZ Notification, 2011.
- CRZ-III B comprises rural areas with population density of below 2161 per sq km as per 2011 Census.
- CRZ-III B areas shall continue to have an NDZ of 200 meters from the HTL.
- **Procedure** - The procedure for CRZ clearances has been simplified.
- Delegations for recommending/according CRZ clearances to the projects/activities have been made at various levels.
- Only such projects/activities, which are located in the CRZ-I & IV areas, shall be dealt with for clearance by the MoEFCC.
- For all other project activities in CRZ-II/III areas, clearance would be at the level of the CZMA (Coastal Zone Management Act).
- **Floor Space Index** - As per CRZ, 2011 Notification, for CRZ-II areas, Floor Space Index (FSI) had been frozen at 1991 Development Control Regulation (DCR) levels.
- In the Draft CRZ, 2018 Notification, it has been proposed to de-freeze this.
- Permitting FSI for construction projects, as prevailing on the date of the new Notification is proposed.
- **Tourism** - Temporary tourism facilities have been proposed in Beaches.
- These include shacks, toilet blocks, change rooms, drinking water facilities etc.
- Such temporary facilities are also proposed to be permissible in the No Development Zone (NDZ) of the CRZ-III areas.

Coastal Regulation Zone

- Under the Environment Protection Act, 1986, the MoEF issues notification for regulation of activities in the coastal area.
- Coastal land up to 500m from the High Tide Line (HTL) comes under the Coastal Regulation Zone (CRZ).
- Also, a stage of 100m along banks of creeks, estuaries, backwater and rivers subject to tidal fluctuations is called CRZ.
- CRZ along the country has been placed in four categories:
- **Category I (CRZ -I)** - Areas that are ecologically sensitive and important, areas between the Low Tide Line and High Tide Line.
- **Category II (CRZ -II)** - Areas that have already been developed up to or the shoreline.
- **Category III (CRZ -III)** - Areas that are relatively undisturbed and those which do not belong to either Category I or II.
- **Category IV (CRZ-IV)** - Coastal stretches in the Andaman and Nicobar Islands, Lakshadweep and small islands, except those designated as CRZ I, CRZ II and CRZ III.

- These will be taken up on the seaward side of the roads where there is a National or State Level Highway passing through the NDZ.
- On the landward side, Resorts/Hotels and other tourism facilities have been proposed to be permitted.
- These will however be subject to the extant regulations of the concerned State.
- **Mangroves** - The draft proposes some compensatory measures in cases where roads are constructed through mangroves.
- A minimum 3 times the mangrove area affected/ destroyed during the construction shall be taken up for compensatory plantation.
- **Mining** - Regulated limestone mining will be permitted.
- This will be subject to strict Environmental safeguards, in areas adequately above the height of HTL.
- This would be based on recommendations of reputed National Institutes in the Mining field.

What are the concerns with the draft?

- **Fisherfolk** - There are concerns that the draft has opened up fragile inter-tidal areas to real estate agents.
- It seems to be favouring the large-scale industry at the cost of fishing communities.
- This will affect how common areas used by fisherfolk are managed.
- **CRZ**- A major change pertains to the CRZ limits on land along “tidal influenced water bodies”.
- The proposed limit has been reduced from 100 metres to 50 metres or the width of the creek, whichever is less.
- This dilution will help builders and could make the coast more vulnerable to development.
- **Authority** - The draft seems to have shifted some of the powers already vested with the MoEF.
- It makes the National Centre for Sustainable Coastal Management (NCSCM) the final authority to lay down standards for HTL.
- Earlier the demarcation was carried out by one of the agencies authorised by MoEF, on recommendations of the NCSCM.
- Also, only those projects located in CRZ-I and CRZ-IV shall now require MoEF clearance.
- All other projects shall be considered by Coastal Zone Management Authorities (CZMAs) in the states and union territories.
- These are perceived as a dilution of regulation and control over the coastal areas.
- **Hazard Line** - The 2011 notification placed a lot of importance on the hazard line.
- The 2018 notification takes away the protection that the hazard line could provide.
- The hazard line has been delinked from the CRZ regulatory regime.
- It, instead, merely states that the hazard line should be used as a tool for disaster management.
- This means that one can build in these areas after preparing an environment assessment report.
- It has to just state that certain precautions have been considered.
- **Bifurcation of CRZ-III areas** - CRZ-III areas have now been divided into two categories.
- The accuracy of data that is used for classification is being questioned.
- As per 2011 Census [data], only state-wise population density is available.
- So the process of narrowing down to the coastal region population is unclear.
- Revenue records are not available of how many people live in some of the CRZ-III areas.
- Some of these common areas are used by fisherfolk to dry fish and park their boats.
- Opening these up would affect their livelihood related activities.

- **Strategic projects** - The draft allows for construction of roads and roads on stilts, “by way of reclamation in CRZ-1 areas”.
- This can only be in exceptional cases for “defence, strategic purposes and public utilities”.
- This is to be recommended by the CZMA and approved by the Ministry.
- However, it does not explicitly state what strategic projects are.
- **Implementation** - As per the National Green Tribunal, it has been 7 years since the deadline set by 2011 notification to submit CZMPs has passed.
- It is delayed due to opposition from fisherfolk, and some states have requested an extension.
- Given this, the fact that the new draft would come into force once the states update their CZMPs seems flawed.

2.17 Policy Challenges in Coal Mining

What is the issue?

- Many policy changes were introduced in the past 3 years including the introduction of e-auctions for captive coal blocks in early 2015.
- But the coal sector continues to remain reel under stress – which calls for a design overhaul to ensure viable allotments.

What is the present scenario?

- Of the 5 rounds of auctions held till date, response to 3 has been lukewarm, and the last one (Tranche V) got cancelled.
- Of the 72 coal blocks auctioned and allotted so far, only a handful have started operations – which has resulted in severe coal shortage.
- Even for the mines allotted to government undertakings, many are yet to finalise mining plans and appoint operators.
- Alos, several cases have been filed regarding various aspects of the auction.
- So far, policy focus has been to get the allotted blocks on stream at the earliest and increase production by allotting more blocks.

Is shortage affecting the power industry?

- Coal India’s production grew just 3% to 554 million tonnes last fiscal, compared with 7% and 9% in 2015 and 2016, respectively.
- The company was recently asked to increase supplies to overcome the alarming shortage at thermal plants.
- Notably, the plant load factors (PLFs) at thermal plants plunged to 60% last fiscal from 77% in 2010.
- Any increase in PLF or capacity enhancement by addition of newer plants will put pressure on currently poor coal supplies.
- Significantly, a number of variables like in “increase in renewable & increased electrification” are shaping demand for thermal power.

What are the present challenges?

- **Commercial Mining** - The current design of coal-block auctions for the non-power sector is an ascending system and the government sets a floor price.
- The bids then escalate in line with the wholesale price index – which was noticed in the exorbitant bids of the first 2 auctions.
- Subsequently, as the price of imported coal plunged it rendered these mines unviable and disincenitized production.
- **Power sector Mining** – In captive power sector mining, a reverse auction method was followed, where sealing prices for output coal is set.
- The block allocation went to any miner who offers the most discounted price from CIL’s coal output prices – thereby facilitating a negative bidding.

Captive Mining

- It is a concept where blocks are allocated dedicatedly for a specific industry.
- Any excess production arising out of such blocks needs to be sold to ‘Coal India Ltd’ at pre-determined prices.
- This is practiced to secure supplies for critical sectors like thermal power plants.
- Commercial Mining mines aren’t restricted in their sale of output and the miner is free to sell their produce to the most profitable buyer.



- Here, the allottee power generation company bears the mining cost and a forward premium, which can't be reflected in its output pricing to the discoms.
- Blended under-recoveries on that account are 50-80 paise per kWh and this increases as mining costs and forward premiums rise.
- Also, the lack of power purchase agreements has been an impediment.
- **Failing Targets** - If Coal India were to increase production by 10% annually, it could producing ~ 700 mtpa & Singareni Collieries can add about 100 mtpa.
- This means that the huge chunk of the 1.5 btpa goal by 2020, will have to come from captive and commercial mining through private entities.
- This would require significant policy, pricing and institutional reforms.

2.18 WHO Pollution Report - India

What is the issue?

- WHO report on most polluted cities highlights the worrying pollution scenario in Indian cities.
- It makes it imperative to analyse the reasons for the Indo-gangetic plain being polluted the most.

What is the case with India?

- 14 of the 15 cities with the highest levels of PM 2.5 pollutants in 2016 were in India.
- These 14 towns and cities are mostly part of northern India stretching from west to east.
- It covers from Jodhpur (No. 14) in Rajasthan to Gaya (No. 4), Patna (No. 5), and Muzaffarpur (No. 9) in Bihar.
- The report identifies the **Indo-Gangetic plain**, along with **Rajasthan and the Kashmir Valley**, as having the worst air in the world.

What is the anomaly?

- Delhi, Agra and Kanpur are evidently known to have very high levels of air pollution.
- But places like Varanasi, Muzaffarpur, Gaya, and Srinagar do not have a high concentration of polluting industries.
- They neither are notable for other common sources of pollution, such as vehicular emissions.
- But a steady rise in the particulate matter all over the Gangetic plains is being noticed for the last one decade or so.

What make the Indo-Gangetic plain vulnerable?

- **Trapped** - The Gangetic plains are like an enormous valley, trapped on both sides.
- It lies between the Himalayas in the north and the Vindhyas in the south.
- Resultantly, pollutants are unable to disperse very far.
- Also, this region is land-locked and does not have the advantage of the coast.
- So pollution cannot dissipate quickly as in, say, Mumbai or Chennai.
- **Populated** - The region is one of the most densely populated in the world.
- The demand for energy sources, and the consequent burning of fuels, is extremely high.
- This naturally releases a large number of pollutants and particulate matter.
- **Wastemanagement** - A lot of the smaller cities have poor waste management.
- There is a lot of burning, solid fuel use, moving from non-motorised to motorised transport, etc.
- **Secondary sources** - Neither Gaya nor Muzaffarpur, not even Delhi and Kanpur, produce even half of the pollutants measured in these cities.
- Most of the particles at Gaya and Muzaffarpur are actually transported from "up-wind" states.
- It is shown that more than 60% of the particulate matter found in Kanpur has been generated elsewhere.
- **Humidity** - As they move along, these particles gain in size and mass.



- The high levels of humidity in this region is very conducive to the formation of secondary aerosols.
- Water facilitates the reaction between the emitted gases whose molecules form clusters and slowly nucleate into particles.
- Gases released from industries or vehicles, too, condense and are converted into particles.
- **Wind Direction** - In this region, wind predominantly blows from north-west to east for most part of the year.
- This is more so in the winter, carrying along with it pollutants generated elsewhere.
- But once the pollutants enter the Gangetic region, they get trapped, and remain suspended over the area.

How to address this?

- Air pollution does not recognise borders.
- Improving air quality demands sustained and coordinated government action at all levels.
- North India is not the only part of the world with these or similar geographical constraints.
- There are international models in such states/regions which have laws empowering governments to invoke stringent measures whenever required.
- E.g. California, a valley with a propensity for pollution to build up, was the first state in the US to enact an anti-pollution law back in the 1940s.

2.19 World Water Development Report

Why in news?

- The United Nations World Water Development Report (WWDR) was released ahead of World Water Day (March 22).

What is the report on?

- The WWDR is an annual and thematic report that focuses on different strategic water issues each year.
- It aims to provide decision-makers with the tools to implement sustainable use of our water resources.
- The development of the WWDR is coordinated by the *World Water Assessment Programme (WWAP)*.
- The report is a joint effort of the UN agencies and entities which make up UN-Water.
- The latest report was released at the 8th *World Water Forum* in Brasilia, hosted by Brazil.

What are the highlights?

- **Water** - Global demand for water has increased six-fold over the past 100 years and continues to grow at the rate of 1% each year.
- Demand for water is projected to rise faster in developing countries.
- The report highlights that more than 5 billion people could suffer water shortages by 2050.
- This could be due to the effects of climate change, increased demand and polluted water supplies.
- Climate change will put an added stress on supplies because it will make wet regions wetter and dry regions drier.
- **Drought** - It is arguably the greatest single threat from climate change.
- Drought and soil degradation, the biggest risks of natural disaster, are likely to worsen.
- **Water quality** - Pollution has worsened the water bodies and water is expected to deteriorate further in the coming two decades.
- This would be mainly due to agriculture runoffs of fertiliser and other agrochemicals.
- They load freshwater supplies with nutrients that lead to the growth of pathogens and choking algae blooms.
- Industry and cities are also a significant problem.
- About 80% of industrial and municipal wastewater is discharged without treatment.
- **Threat** - Water scarcity can lead to civil unrest, mass migration and even to conflict within and between countries.



- The report thus warns of conflict and civilisational threats unless actions are taken.

What is the concern with the present approach?

- For too long, the world has turned first to human-built, or 'grey', infrastructure to improve water management.
- In doing so, it has often brushed aside traditional and indigenous knowledge that embraces greener approaches.
- But accelerated consumption, multi-faceted impacts of climate change and increasing environmental degradation is the reality now.
- All these call for new ways of managing the competing demands on freshwater resources.

What are the suggestions?

- **Water** - Reducing the stress on rivers, lakes, aquifers, wetlands and reservoirs is important.
- Water shortage cannot be offset by groundwater supplies, a third of which are already in distress.
- Nor is the construction of more dams and reservoirs likely to be a solution.
- The report emphasises a shift away from watershed management.
- It calls for a wider geographic approach that takes in land use in distant areas, particularly forests.
- Although farmers have long seen trees as a drain on water supplies, the vegetation helps to recycle and distribute water.
- Evidently, the São Paulo (Brazil) drought of 2014-15 has been linked to Amazon deforestation.
- The key for change, even for the water problem, will be agriculture.
- **Agriculture** - This is the biggest source of both water consumption and pollution.
- The report thus emphasises the importance of **nature-based solutions**.
- Nature-based solutions can be personal – such as dry toilets – or broad landscape-level shifts in agricultural practices.
- In agricultural practices, it is essentially an approach to rely more on soil and trees than steel and concrete.
- It calls for shift to “conservation agriculture”.
- This would make greater use of rainwater rather than irrigation, and regularise crop rotation to maintain soil cover.
- This is crucial to reverse erosion and degradation, which currently affects a third of the planet's land.
- The suggestions imply that the potential savings of such practices exceed the projected increase in global demand for water.
- This would ease the dangers of conflict and provide better livelihoods for family farmers and poverty reduction.

2.20 Asian Water-Bird Census

What is the issue?

- Asian Waterbird Census (AWC) that surveys sites across 23 countries (including Australia) was recently conducted.
- The trends highlight the dangers facing water birds and their habitats.

How does the migratory bird landscape look?

- Every winter, the thousands of wetlands that dot India, transform from muddy slips of water to harsh bird parties.
- Ducks and geese from Ladakh and Tibet swim through aquatic vegetation, and wader on half-submerged banks, and 'oriental darters' spear the water for fish.
- While the data for the current census isn't out yet, the census by energetic citizens over the years has pointed to some clear trends.
- India has the biggest species diversity among the regions sampled by AWC, tallying to a mean figure of 1.8 million water birds over 300 sites.
- Chilika Lake in Odisha alone supports a staggering half-a-million water birds.
- Most of these water birds are migratory and winter in India's wetlands.
- For instance, the bar-headed goose, breeds in Mongolia, Tibet and Kyrgyzstan and crosses the Himalayas and Hindu Kush to reach India.



Are the bird numbers declining?

- There has been a noticeable decline in several species visiting India over the years, which is concerning.
- The Oriental darter (long necked), which was once a common sight in many wetlands, numbered just 4,000 in the sites that got surveyed currently.
- The Indian skimmer (with a bright orange bill) – which can ‘skim’ over water to snap up fish, were counted to be just 300.
- Sarus crane, the world’s tallest flying bird, often found in pairs or small groups, accounted for as little as just about 100 birds over several years.
- These are mainly because, the wetlands, which are cherished equally by local residents, and birdwatchers are in peril.

What is the status of wetlands in India?

- The National Wetland Atlas, prepared by the ISRO in 2011, found that India has over 2 lakh wetlands, most which aren’t notified as such.
- They thus run the risk of being destroyed and many court cases across the country reflect the precarious existence of wetlands.
- The iconic East Kolkata Wetlands, which is also designated ‘Ramsar wetland’ of international importance, is being steadily eaten up by construction.
- Like in many cities, this wetland too is becoming a sewage canal, and a case has been filed with the National Green Tribunal (NGT).
- In Delhi-NCR, birdwatchers have filed a case to protect the Basai wetland, which is fed by sewage but continues to harbour almost 300 bird species.
- Similar cases were also filed to conserve Najafgarh jheel (a riverine wetland).
- Also, Sukhna Lake in Chandigarh, Deepor Beel in Guwahati, and the lakes in Nainital, are all choked by sewage, garbage and encroachment.
- Notably, the new “Wetland (Conservation and Management) Rules, 2017” has made matters worse as it denounces manmade water bodies as wetlands.
- The previous rules had stated that manmade water bodies like tanks and salt pans are also wetlands (these do support bird populations in reality).

2.21 Environmental Performance Index, 2018

What is the issue?

- India ranks 177 among 180 countries in the Environmental Performance Index 2018.
- A drop in the index from previous year calls for a relook at the country's environmental policy.

What is the Environmental Performance Index?

- EPI is a biennial report by Yale and Columbia Universities along with the World Economic Forum.
- The report ranks 180 countries on 24 performance indicators.
- It is spread across 10 categories covering environmental health and ecosystem vitality.
- Switzerland leads the world in sustainability, followed by France, Denmark, Malta and Sweden in the recent EPI.

What is India's status?

- India is among the bottom 5 countries on the index, at 177th place.
- This is a drop of 36 points from 141 in 2016.
- Emerging peer economies, Brazil and China, ranks 69 and 120, respectively.
- In the environmental health category, India is at the bottom of the list.
- And in terms of air quality it is placed third last.

- The overall drop is attributed to poor performance in the environment health policy and high pollution related deaths.
- Pollution from solid fuels, coal and crop residue burning, and emissions from motor vehicles are the major causes.
- Population growth, industrial production and automotive transportation continue to increasingly degrade the air quality.

Why is environmental degradation a serious concern?

- Environmental degradation is beyond being seen as just a cost of development.
- **Health** - The report highlights air quality as the leading environmental threat to public health.
- In India, deaths attributed to ultra-fine PM_{2.5} pollutants have largely risen over the past decade.
- Air pollution is causing an estimated 1.4 million premature deaths in India.
- **Economy** - The above rate translates to a welfare loss equivalent to around 8% of India's GDP in 2013.
- In addition, the cost of lost labour productivity was nearly 0.8% of GDP.
- Even these estimates do not reflect a true picture of the impact.
- This is because the lack of scientific understanding of several other key ecological impacts limits the impact assessment.
- Sadly, the poor are affected disproportionately because of environmental degradation.

What are the measures in this regard?

- The government has set some ambitious targets for environmental protection in the recent years.
- It includes:
 - i. strict environmental standards for coal-fired power plants
 - ii. target to implement Bharat Stage VI emission norms from April 1, 2020
 - iii. efforts to produce and sell electric vehicles in the country by 2030
 - iv. revision of National Solar Mission, accelerating transition to renewable sources of power
 - v. accordingly, revising the target for setting up solar capacity from 20 GW to 100 GW by 2021-22
 - vi. assurance to clean up highly polluted Ganga by 2018

What are the shortfalls?

- Unfortunately, there appears to be a big gap between policy goals and action.
- India seems to be moving in the right direction on solar targets.
- However, balancing it with other goals is seriously lacking.
- Evidently, the promise of implementing strict power plant emission norms by December 2017 has been relaxed.
- Annual electronic waste collection target for electronics manufacturers was set at 30% of the products sold in the market.
- However, this has now been relaxed to 10%.
- The automobile industry has stated that full conversion to electric vehicles was realistically possible only by 2047.
- This is in contrast to the government's targets.
- CAG, in a recent report, highlighted the lag in developing an action plan and poor fund utilisation in the clean-up of the Ganga.

What should be done?

- The environmental costs of development should be duly recognised in addressing environmental problems.
- Transition to renewables, especially solar energy, should be accelerated by offering subsidies.
- On the other hand, the more polluting fuels should be priced higher.



- Strict environmental standards for coal plants should be put in place.
- Similarly, the transition to electric vehicle use should be aided by higher pricing of petrol and diesel.
- Existing environmental laws and regulations should be implemented properly with more political will.
- The country's poor environmental performance calls for taking forward the environmental targets more seriously.

2.22 Environmental issues with GST

What is the issue?

The non-inclusion of diesel and non-fixed fertiliser rates shows GST is not environmental friendly.

What are the serious environmental issues with GST?

- The commodity value chain is inseparably linked to a more fundamental production process i.e the ecological production process.
- Goods and services provided for free to human communities by the ecosystem also comes under taxable product.
- The GST imposed on commodities that are pivotal to livelihoods for forest tribes in India might not be too beneficial for the value-chain either.
- **Infrastructure** - GST will bring about more transportation of goods and demand for infrastructure.
- If road infrastructure growth brings about reasonable land use conversions without factoring in ecological concerns, the net result may not be ecologically favourable.
- **Clean energy** - Diesel is not clean fuel and it does not come under GST taxation, but under proposed structure there is 5% tax on solar and wind energy.
- The carbon tax (or coal cess), which was thought to be a source of funding for clean energy projects through the National Clean Energy Fund, will now feed the GST Compensation Fund — a fund meant to compensate various state governments for any loss in revenue arising out of the goods and services tax.
- With the costs for coal projected to fall by almost 7%, the GST regime clearly moves the “terms-of-trade” in favour of coal from the cleaner sources of energy.
- **Chemicals** - On the other hand, a 12% GST on fertilisers, up from the 4-8% rates escalates the prices of fertilisers.
- As per certain estimates, the prices for urea, the most commonly used fertiliser, may increase by ₹300 to ₹400 per tonne.
- Most States did not levy any value-added tax (VAT) on micronutrients, organic manure and bio-fertilisers, the 12-per cent GST rate will mean a rise in retail prices of these minor fertilisers.
- **Tobacco** -The tax on tendu leaf, a Minor Forest Produce (MFP) used to roll beedi, which is the financial lifeline of many tribes of Central India is now set at 18%.
- When the government has already imposed 28% on finished beedi with the health concerns with tobacco consumption looming large.
- The 18% GST on collected tendu leaf selling goes against the fundamental essence of equity under which Forest Rights Act (FRA) of 2006.
- This act exempted incomes obtained from sale of non-timber forest products from taxation.
- GST on tendu leaves is akin to taxing ecosystem services, which provide livelihood to poor.

2.23 Environmental Cess Vs GST

What is the issue?

- GST has abruptly replaced Clean Energy and Swachh Bharat levies.
- This has disrupting the budgetary allocations for environmental protection.



How did GST impact Cess?

- GST subsumed several central & state levies under it.
- Among them were three environment-related cesses - Swachh Bharat Cess, Clean Energy Cess and the historical Water Cess on water consumption by industry and local authorities.
- Unless the nodal ministries are compensated for revenue loss, the Cess-targeted schemes will suffer.

What are specifics of the cesses discussed above?

- **Water cess** - Introduced under the Water (Prevention and Control of Pollution) Cess Act 1977, it was to augment the resources of the Central and State pollution control boards to address water pollution.
- Water cess is the second most important source of revenue for State Pollution Control Boards next only to consent fees.
- The loss of this revenue will be a huge setback for boards which already suffer from poor technical capacity and autonomy.
- Even if the loss is made good through budgetary allocation, the channelling of money through State budgets will make the boards even more vulnerable to the discretion of State governments.
- It is to be noted that State governments have a dismal track record of empowering the pollution watchdogs.
- **Swachh Bharat Cess** - The Centre collected ₹12,500 crore in 2016-17 through this Cess for the Swachh Bharat Abhiyaan (SBA) which aims to make India open-defecation free by 2019 and improve the appalling state of waste management in the country.
- While it is clear the programme will require significant public expenditure to meet the targets, it will be interesting to see whether budgetary allocations are maintained after the abolition of the cess.
- **Clean Energy Cess** - Levied on coal at the rate of ₹400/tonne in 2016 (progressively increased from ₹50/tonnes in 2010), it amounted to a staggering ₹28,500 crore in 2016-17.
- Touted as a tax on carbon, it met almost 50% of the budget of the ministry of new and renewable energy for 2016-17.
- This is despite the fact that MNRE is only one of the beneficiaries along with the ministries of water resources, environment and drinking water and sanitation from the fund.

CESS

- Unlike usual tax, a cess is levied to raise funds for a specific purpose.
- The proceeds are first credited to the Consolidated Fund of India, and the Centre may, after due appropriation by Parliament, utilise such sums of money for purposes designated under the cess.
- While in principle a cess is to be levied till the time the Government gets enough money for the specified purpose, several cesses, by virtue of their broad-based objectives, have continued for year.
- Hence they've become an important source of revenue for certain ministries

What has the government's actions perceived?

- The abolition of these cesses when the Government is projecting itself as a global leader in clean energy seems both symbolically and financially ill-timed.
- More shockingly, the coal cess is being continued at the same rate under the GST but will now contribute to the 'GST - Compensation Fund', a corpus meant for compensating States for revenue losses arising from the shift to the new indirect tax regime
- It remains to be seen if Budget 2018-19 will adequately compensate ministries for the loss of revenue but the fact that these cesses were unceremoniously abolished shows that environmental issues aren't a policy priority for the government.

Conservation of Forest resources, Biodiversity and Wildlife

2.24 Concerns with Increasing Plantation Forest Cover

Why in news?

Forest Survey of India (FSI) has released the 2017 State of Forest Report.

What is FSI?

- Forest Survey of India (FSI) is an organisation under the Ministry of Environment & Forests.
- Its principal mandate is to conduct survey and assessment of forest resources in the country.
- The Forest Survey of India organize the training programmes to state sponsored forest personnel.
- FSI releases State of Forest Report biennially based on satellite imageries.
- According to the State of Forest Report, the definition of forest cover includes all lands more than 1 hectare in area with a tree canopy of more than 10 per cent, irrespective of land use, ownership, and legal status.

What are the recent findings of report?

- This report has found that the forest cover is by and large stable, between 2015 and 2017, a mere 0.21 per cent change is noted.
- Forests cover is around 21.54 per cent of the land area of the country, this area includes trees growing in the government's forestland and in private lands.
- Out of 21.54 per cent of the land that is under forest cover, only 3 per cent can be classified as very dense, the tree canopy density of 70 per cent or more.
- The report also finds that between 2015 and 2017, the category of forests classified as "very dense" has increased by some 9,000 square km.
- While moderately dense forests have decreased and there is some increase in open forests.

What are the insights from the report?

- According to government estimate, the annual production of timber from recorded forestlands is 4 million cubic metres.
- Timber-growing potential in the country in lands outside recorded forests, comes to some 74.5 million cubic metres.
- Which makes it clear Private players are growing forests for monetization.
- In fact, almost 30 per cent of the growing stock an indicator of forest health and productivity is outside the "recorded" forests and this is increasing, faster than the growing stock in the lands controlled by forest department.
- The difference is the "nature" of tree species, while the growing stock in forests is mainly Sal, teak, or pine, timber species, outside it is mango, coconut, Neem, and bamboo horticulture and plantation species.

What are the concerns with classifying forests?

- It is not possible to say how much the area under forests in the "recorded" forests is, because not all state governments have completed digitising the boundaries of these lands.
- In fact states have "lost" substantial areas previously recorded as forests and are not "found" when the records are digitised.

2.25 Threats for Aravallis

Why in news?

A study found that deforestation of the Aravalli range leads to the expansion of the Thar Desert towards Delhi and Haryana.

What is the present state of Aravalli range?

- Recent study spotted about a dozen well-marked gaps in the Aravallis where the forest cover has almost totally vanished.

- The protective belt is now facing disintegration due to felling of trees to make room for urbanisation and mining projects.
- The area under human settlements on these hills has expanded from 247 sq km in 1980 to 638 sq km in 2016.
- Industries, which were almost non-existent in 1980, now occupy about 46 sq km.

What are the actions taken for conservation of Aravallis?

- The National Conservation Zone (NCZ), as defined in the Delhi NCR Regional Plan 2021, covers the entire Aravalli range.
- It includes its forests, water bodies and groundwater recharge areas.
- In this zone, construction is allowed only on 0.5 per cent of the area and that too only for regional parks and sanctuaries.
- Construction for commercial, residential, tourism and real estate purposes is strictly barred.

What are the concerns with conservation policies?

- The stakeholder states shows indecisiveness towards stopping or reversing the damage being done to the range.
- Haryana state government raises a dispute over demarcation of aravalli range in its state, citing the notification issued by the environment ministry.
- It is done with the clear intention of restricting remedial action to stretches in Gurugram alone.
- The stand is hard to justify since rejuvenation action is needed in the whole of the Aravallis.
- Haryana's non-cooperation in respecting the NCZ can prove costly for it as well as its neighbours.

What are the impacts of degrading Aravallis?

- Loss of vegetative cover will lead to the natural drifting of Thar Desert towards the northwest.
- Increased desertification of the National Capital Region (NCR) and its adjoining areas can lead to more environmental hazards.
- These include more dust in the air, greater unpredictability of climate, meagre recharging of groundwater, and drying up of several natural water bodies.
- The area under perennial water courses in this region has contracted by nearly one-third and that under seasonal water flows by an even more alarming 97 per cent.
- Groundwater resources of urban hub of Gurugram are under severe strain.

Aravalli Range

- It is a range of mountains running in North West direction between Delhi and Palanpur in Gujarat.
- It constitutes a vital corridor between Asola Bhatti Sanctuary in Delhi and Sariska Tiger Reserve in Rajasthan.
- The 700km long range and its thick forest cover protects National Capital Region and fertile plains of India from effects of Desert
- Range of mountains running in North West direction between Delhi and Palanpur in Gujarat.
- It constitutes a vital corridor between Asola Bhatti Sanctuary in Delhi and Sariska Tiger Reserve in Rajasthan.
- The 700km long range and its thick forest cover protects National Capital Region and fertile plains of India from effects of Desert

2.26 National Wildlife Action Plan

Why in news?

The Union Environment Ministry has released the third National Wildlife Action Plan (NWAP) for 2017-31.

What are the highlights?

- The NWAP 2017-31 is India's roadmap to conserving wildlife for the next 15 years.
- Under this there are 250 projects.
- Erstwhile, programmes related to wildlife were focussed on and around national parks and sanctuaries.
- The key strategic change in the new plan is adopting a "landscape approach" in conservation of all the wildlife — uncultivated flora (plants) and undomesticated fauna (animals) — rather than the areas where they occur.



- This means that now the strategies would be based on the landscape of the region that may not be limited to a reserve forest system alone.
- Maximum participation of people has also been made in this plan.
- It will be done through,
 1. Man-animal conflict mitigation,
 2. Adapting to climate change,
 3. Managing eco-tourism,
 4. Developing human resources,
- Strengthening research and monitoring through modern technology such as radio collars and drones.
- 90 % of the fund under Compensatory Afforestation Fund Management and Planning Authority (roughly Rs. 45,000 crore) will go to the states.

2.27 New Biodiversity Areas in Goa

Why in news?

Birdlife International, a conservation organisation, has recognised three new sites in Goa as hotspots for protection.

What is hotspot for protection?

- A hotspot is a biogeographic region that is both a significant reservoir of biodiversity and is threatened with destruction.
- This areas supports many of the world's plant, bird, mammal, reptile, and amphibian species.

What is the significance of this notification?

- The new list now added
 1. Bondla Wildlife Sanctuary,
 2. Navelim Wetlands and
 3. Netravali Wildlife Sanctuary.
- The sites have been added to the list of "Important Bird and Biodiversity Areas" by birdlife international.
- The inclusion of these ecological hotspots in a new book comes after systematic data collection by the Goa Bird Conservation Network (GBCN).

What are other important biodiversity areas in Goa?

- Goa earlier had four recognised biodiversity areas:
 1. Bhagwan Mahavir Wildlife Sanctuary and Mollem National Park,
 2. Carambolim Wetlands,
 3. Cotigao Wildlife Sanctuary
 4. Mhadei Wildlife Sanctuary.

What is the role of GBCN?

- GBCN is a NGO, which is monitors and takes conservation measures of the birds of Goa.
- BirdLife International encourages national and State governments to recognise the areas as sites of vital importance for conservation of wildlife.
- It empowers local community-based conservation initiatives.
- The Forest Department has already provided support to GBCN in setting up the long-term bird monitoring project, which has completed one year in Cotigao Wildlife Sanctuary.
- The information will help the Forest Department in planning their management strategies.

2.28 Survey by Conservation Assured | Tiger Standards

Why in news?

The Conservation Assured | Tiger Standards (CA|TS) recently published a report titled 'Safe Havens for Wild Tigers'.

What is the report on?

- CA|TS report was on the results of a survey of site-based tiger conservation across Asia.
- The survey assessed the current management methodologies at 112 sites located in 11 tiger-range countries, including India.
- The survey is the first and largest rapid assessment of site-based tiger conservation across Asia.
- It has been driven by 11 conservation organisations and tiger-range governments that are part of the CA|TS coalition.
- The results show whether or not governments are investing sufficient funds into tiger conservation.
- This study also shows the reality of the progress made under the St Petersburg Declaration.

What are the key findings?

- Only 13% of the tiger conservation areas met the global standards of an accreditation system.
- Of the 112 global sites surveyed, only 12.5% was currently able to meet the full CA|TS criteria.
- Nearly half of the assessed sites reported fairly strong management, although improvements are needed.
- South Asian and East Asian countries like Bangladesh, Bhutan, China, India, Nepal and Russia had management plans.
- The remaining 35% did not have management plans and showed relatively weak management.
- Notably, a majority of these are in Southeast Asia, including Cambodia, Indonesia, Malaysia, Myanmar and Thailand.
- Three of the 13 tiger range countries, Laos, Vietnam, and Cambodia have lost all their tigers.

What are the concerns?

- Basic needs remain weak for all tiger conservation areas surveyed.
- These include enforcement of laws against poaching, engaging local communities and managing conflicts between people and wildlife.
- Staff capacity to patrol the sites effectively and anti-poaching enforcement remain weak, despite the serious threat of poaching.
- Only 16 of 112 sites had intelligence-driven anti-poaching processes in place.
- Ineffective management of tiger conservation areas had led to the extinction of tigers from certain key areas.

Conservation Assured | Tiger Standards (CA|TS)

- CA|TS is an important tool in the achievement of the Convention on Biological Diversity - CBD's Global Aichi Targets.
- CA|TS is a management tool which sets basic criteria such as the minimum standards for effective management of tiger conservation reserves.
- It also applies to other conservation reserves and protected areas which have tiger populations.
- It contributes to the implementation of the Programme of Work on Protected Areas.
- The CA|TS team has been working closely with the IUCN.

Tiger Range Countries

- The Tiger Range Countries (TRC) are the countries where tigers still roam free i.e. in the wild.
- The 13 tiger range countries are Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Lao PDR, Malaysia, Myanmar, Nepal, Russia, Thailand and Vietnam.
- Sometimes North Korea is also included.
- While there have been no recent tigers sightings in North-Korea, it is the only country listed which has not ratified CITES.

St Petersburg Declaration

- In November 2010, the first "Tiger Summit" in St Petersburg, Russia, endorsed a Global Tiger Recovery Programme.
- The programme aimed at reversing the rapid decline of tigers, and doubling their numbers by 2022.
- India was one of the 13 tiger range countries that participated in the gathering.
- The leaders committed to drawing up action plans to -
 1. strengthen the tiger reserves
 2. crack down on poachers
 3. provide financial assistance to maintain a thriving tiger population



What are the accredited sites?

- To date, only three sites have been awarded CA|TS Approved status.
- These are
 1. Lansdowne Forest Division in Uttarakhand, India
 2. Chitwan National Park in Nepal
 3. Sikhote-Alin Nature Reserve in Russia
- Lansdowne Forest Division, Uttarakhand, accredited in May 2017, is the third CA|TS accredited site globally and the first in India.
- It is significant since it is a crucial link between the Rajaji and Corbett tiger reserves.

2.29 Snow Leopard Conservation

Why in news?

The conservation status of snow leopard has been changed from “endangered” to “vulnerable” by the International Union for Conservation of Nature (IUCN).

What are the characteristic features of Snow leopards?

- These are rarely sighted cats that live in the peaks of central Asia including the Himalayas and Russia’s remote Altai mountains.
- Their habitat covers more than 1.8 million sq km, across 12 countries and usually found at elevations of 3,000-4,500m.
- Their coats change with the seasons from a thick, white fur to keep them warm and camouflaged in winter, to a fine yellow-grey coat in summer.
- They are threatened by poaching for their fur, infrastructure developments and climate change.
- In India this animal habitat is in Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh.

What are the criteria for endangered status?

- An observed, estimated, inferred or suspected population size reduction of $\geq 50\%$ over the last 10 years or three generations
- Area of occupancy estimated to be less than 500 km²,
- Population size estimated to number fewer than **2500 mature individuals** witness a continuous decline
- Population size estimated to number fewer than 250 mature individuals.
- Quantitative analysis showing the probability of extinction in the wild is at least 20% within 20 years or five generations
- The current move is based on the criterion that it crossed the threshold number of 2500

What will be the impact of the downgrade?

- The factors that pose a threat to the species, like trafficking live animals in Central Asia, and hostility from communities because of its attacks on livestock, remain unchanged.
- New research indicates that even when wild prey is available, the attacks on livestock by snow leopards have been on the rise.

Conservation efforts taken in India

- India has launched a programme on the lines of Project Tiger for its conservation, covering 128,757 sq. km.
- India is also a part of an upcoming international collaborative effort, the Global Snow Leopard and Ecosystem Protection Program that involves those 12 countries.
- India handled man-animal conflict by roping in communities in conservation, and compensating them for any losses.
- e.g An insurance programme was launched for the residents of Spiti Valley in Himachal Pradesh to mitigate the problem of the cat preying on goats, sheep, donkeys.



- The bigger challenge of loss of habitat owing to changing climate patterns needs continuous conservation efforts.
- There is no clear knowledge about its population health, in remote habitat in the alpine zones of the Himalayas and trans-Himalayas.
- There are possibilities of trafficking of this animal in Central Asia, and hostility from communities because of its attacks on livestock.
- A more fundamental worry is over the likely loss of habitat owing to changing climate patterns.
- So the downgrading might send a wrong message and the governments might shift their focus away from the conservation efforts.
- It is vital that the momentum of conservation should not be lost merely on account of the technicality.

2.30 SECURE Himalaya

Why in news?

The 'SECURE Himalaya' project was launched by the Union Environment Ministry in collaboration with United Nations Development Program (UNDP).

What are the highlights?

- The plan intends to conserve the snow leopards by protecting their habitats and improve the ecology of Himalayan ranges and lives of the mountain communities.
- With a total budget sanction of over \$72.3 million, it will cover Himachal Pradesh, Jammu and Kashmir, Uttarakhand and Sikkim.
- The project includes the Kangchenjunga and Teesta valley areas in Sikkim, the Gangotri-Govind and Darma Bayas valley in the Pithoragarh area of Uttarakhand, Pangl and Kinnaur in Himachal Pradesh and Changhang in Jammu and Kashmir, which are home to around 67.57 million people.
- The key focus areas include,
 1. Strengthening and improving protected area network;
 2. Landscape level approach for wildlife conservation;
 3. Control of poaching and illegal trade in wildlife;
 4. Mitigation of human-wildlife conflicts and
 5. Management of tourism in wildlife areas

2.31 State of the World's Birds Report 2018

Why in news?

The 2018 State of the World's Birds report was recently published by BirdLife International, an International NGO.

What are the findings?

- The report provides a comprehensive look at the health of bird populations globally to "take the pulse of the planet".
- It has found that the extinction crisis has spread so far that even some well-known species are now in danger.
- e.g European Turtle Dove, Snowy Owl and Atlantic Puffin.
- The report was five years in the making.
- Overall, it shows that 40% of the world's 11,000 bird species are in decline, and one in eight bird species is threatened with global extinction.
- The threat driving the avian extinction is mainly anthropogenic.
- The expansion of agriculture, as well as its intensification, 74% of globally threatened birds.
- e.g Migrating White-crowned Sparrows exposed to Neurotoxic insecticides known as neonicotinoids lost a quarter of their body mass and fat stores.
- The neurotoxin also impaired the birds' ability to navigate while migrating.
- These statistics is also warnings for the planet as a whole.

- Because the health of bird species is a good measure of the state of ecosystems in general and they are so widespread, being found in nearly every type of ecosystem.
- It also found that at least 25 bird species would have gone extinct in recent decades were it not for conservation interventions.
- Birds that were once Critically Endangered but have now been down listed to Endangered. e.g Red-billed Curassow (Brazil), Pink Pigeon (Mauritius), and Black-faced Spoonbill.
- The report suggests restoration of habitats key to birds, eradicating and controlling invasive species, and targeting the most vulnerable bird species to protect them.

2.32 Diclofenac Threat to Vultures

Why in news?

The 104 birds bred at Rani, Assam face a serious threat by Diclofenac drug used in cattle.

How is vulture population in India?

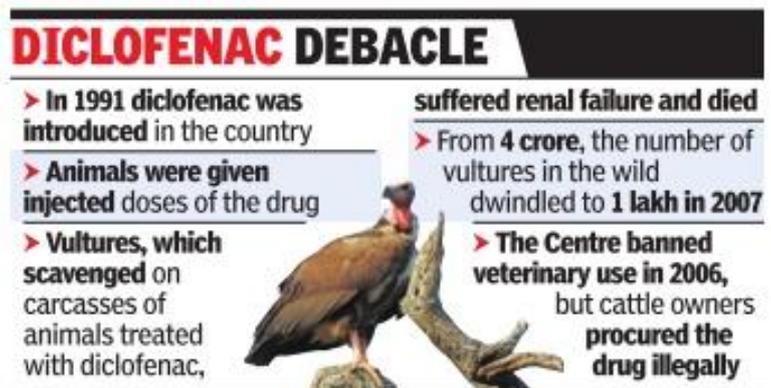
- India hosts 9 vulture species, 5 of them the highly endangered Gyps species.
- Assam is naturally a suitable habitat for vultures.
- It is home to 6 species, including winter visitors from the Himalayas — the Himalayan and Eurasian griffons.
- The Vulture Conservation Breeding Centre (VCBC) in Assam at Rani, Guwahati has 104 vultures, brought in as chicks.
- It has 30 adults and sub-adults: all oriental white-backed and slender-billed.
- These are 2 of the 6 species found in Assam that are old enough to be set free.
- The vulture population in Assam is presently battling toxic chemicals in livestock carcasses, due to Diclofenac use.

How does diclofenac affect vultures?

- Diclofenac is a painkiller, usually injected to cattle.
- The digestive system of vultures is so evolved.
- This makes it possible to tolerate bacteria and natural toxins in putrefying meat.
- But they are vulnerable to chemicals such as diclofenac.
- Diclofenac present in the carcasses of cattle, injected as a painkiller, finds way into the vulture.

What are the challenges in eradication?

- **Diclofenac** - Diclofenac for veterinary use was banned in 2005 but it was continued to be made for humans.
- BNHS pressured the government into banning the vials (containers) of 30 ml or more in 2015.
- Humans need 3-5 ml while only 30 ml or more works for cows.
- But untrained veterinarians use the 30 ml vials for veterinary use, with fatal consequences for vultures.
- The last of the 2015 stocks of the big vials expire by December 2018.
- This is thus delaying the freedom (release) for adult vultures being reared in captivity in the State.
- **Pesticides** - Even after the expiry of diclofenac stocks, there is no guarantee that the birds will be safe.
- The rampant use of pesticides by farmers and more than 70,000 tea gardens is another concern.
- Villagers generally poison carcass of dead animals with pesticides to kill dogs, jackals and leopards that are a danger to livestock.
- Unfortunately, vultures that feed on these carcasses become the unintended victims.
- Recently, around 30 vultures, most of them Himalayan griffons, died in Assam, after feeding on the poisoned carcass of a goat.
- **Life cycle** - Vultures take time to mature, pair for life, breed once a year, and live up to 70 years.
- This extended cycle make captive breeding efforts challenging.



DICLOFENAC DEBACLE

- > In 1991 diclofenac was introduced in the country
- > Animals were given injected doses of the drug
- > Vultures, which scavenged on carcasses of animals treated with diclofenac, suffered renal failure and died
- > From 4 crore, the number of vultures in the wild dwindled to 1 lakh in 2007
- > The Centre banned veterinary use in 2006, but cattle owners procured the drug illegally

2.33 Rhino Population in Kaziranga National Park

What is the issue?

- The latest rhinoceros census in Kaziranga reported a gain of just 12 rhinos since 2015, a jump by barely half a percent.
- Though marginal, this increase is seen as a healthy trend.

What was the concern?

- Kaziranga lost over 500 rhinos in the last 2 decades of the twentieth century.
- The situation improved from the 2000s when an average annual loss to poaching came down to single digit.
- Kaziranga reported a population of 1,855 rhinos in 2006.
- But after 2006 it suffered a setback with poaching taking huge tolls.

What is the recent healthy trend?

- Even as poaching made a comeback after 2006, Kaziranga reported the biggest jump in rhino numbers.
- Rhino population had a gain of 193 rhinos in just 3 years from 2006 to 2009.
- It increased by 353 between 2009 and 2015 period, despite worrying numbers on poaching.
- But since 2017, Kaziranga brought down the numbers on poaching and thus claims a healthy population gain.
- Kaziranga National Park (KNP) has counted 2,413 one-horned rhinos in the latest triennial population estimation.
- It comes closer to the goal of hitting the 3,000-mark in the Asian one-horned rhino population in Assam by 2020.
- Moreover among the female population now counted, a majority are breeding.

What are the reasons for improvement?

- Poaching has been brought down considerably by concerted efforts.
- A group of **informers** earlier used by the civil administration, to get updates on poaching operations, started turning hostile.
- In tie up with their controllers, they were apparently protecting the poachers in return for big protection money.
- This group of hostile informers have now been identified and controlled.
- It has been a practice to offer **political patronage** to monetise Kaziranga's rhinos in exchange for varied electoral services.
- The ups and downs in poaching numbers, with peaks during the election times, clearly reflect this practice.
- This decade-long tradition which affected rhino population has now been done away with by the government.



What drives poaching?

- Kaziranga and its rhinos still remain very much in the grip of both commercial and political interests.
- Rhino is far easier to poach than, say, a tiger or an elephant, and far more valuable in that sense.
- A carton of horns fetches as much as a carload of tiger derivatives or tusks would.
- These factors perpetuate the interest in rhino poaching, posing a challenge for controlling them.
- This interest had in the past made it easy for local insurgent groups to strike cashless arms deals with operators in Myanmar.

What are the administrative and legal shortfalls?

- **Local Population** - The forest administration least consider as allies the local population, mostly tribals and Muslims.
- Violent eviction drives against encroachers are common and, at least once, led to deaths caused by police firing.
- **Killing Poachers** - Hundreds of alleged poachers have been gunned down and the number of poachers killed is on the rise.
- On the other hand, expressively, only two forest staffs have ever been killed by poachers since the late 1960s.



- In 2010, Assam extended legal protection against prosecution to staff who kill poachers.
- Resultantly, from a decadal count of just 17 between 2001 and 2010, the number of poachers killed raised to over 50 in the next 5 years.
- **Neighbourhood** - The anti-migrant rhetoric against alleged Bangladeshis have alienated the minority population in villages around the park.
- Resultantly, rhino protection does not enjoy much goodwill in its neighbourhood.
- Winning their support over time can be the best insurance against poaching.

2.34 Concerns with Conservation Efforts in Gir Forest

What is the issue?

- Gujarat government has taken conservation efforts taken to protect the endangered Asiatic lion population in Gir forest.
- In recent times, various policy stands of government in Gir forest has risen concern among wildlife conservationists.

What is the significance of Gir forest area?

- The Government notified the large geographical extent of Sasan Gir as wildlife sanctuary in 1965, to conserve the Asiatic Lion.
- It covers total area of 1412 square kilometres of which 258 Km forms the core area of the National Park.
- Besides Africa, Gir National Park in Gujarat is the only place in the world where one can spot lions roaming free in the wild.
- The remarkable growth in the lion population in this landscape from about 300 in 1995 to over 500 in 2015 points to the success of conservation management over decades.

What are the recent policies being carried out in Gir forest?

- **Religious Tourism** - The state government in 2017 permitted night stays at a temple located in the core area of Gir National Park.
- This is severely affecting the landscape and altering the land-use pattern and profile of the forest region.
- **Reducing eco-sensitive zone** – According to the environment ministry guidelines, eco-sensitive zone can extend to min 10km around a Protected Area (PA), where certain development activities are prohibited.
- But for the Gir National Park, the government is taking measures to reduce the eco-sensitive zones to less than 1 km for mining and tourism.
- **Interpretation zone** – A safari park 15 km away from the PA has captive lions in enclosed natural environments.
- Government is planning to clear this zone which will result in habitat loss, change in landscape, and degradation through roads, resorts, traffic and pollution.

What are the concerns of wildlife conservationists?

- Asiatic lions are venturing out of the Protected Area (PA) and are living in wide range of habitats such as hilly tracts, coasts, pastures and farmlands.
- This is resulting in incidents of livestock depredation and of attacks on people by lions.
- There are also various reports of lions dying due to unnatural causes like railway and road accidents, electrocution, drowning in open wells.
- There is also an increasing distress due to the unregulated wildlife **tourism** around the Protected Area.
- Tourists are ready to pay huge amounts to watch lions and videos of bikes and cars chasing lions at night are being widely shared on social media.

What measures are needed to conserve the Gir forest better?

- Decisions taken in the recent times relating to decreasing eco-sensitive zones, promoting tourism, etc. has to be rolled back.
- Agro-pastoral landscape around the sanctuary is as important as dedicated management government should take measures in this regard.
- Political will, people's tolerance and the lion's resilience is also required for the future of healthy lion population.

2.35 Human Animal Conflict - Pilibhit Tiger Reserve

What is the issue?

Traditional elements of man-animal conflict along with some site-specific triggers in Pilibhit have made this young tiger reserve one of the worst conflict zones.

How prevalent is the conflict?

- In Pilibhit tiger reserve in Uttar Pradesh, tigers have killed 6 people over the last 3 months.
- This is a new high even for this notorious conflict zone.
- Tadoba (Maharashtra) and Pilibhit are the two reserves that saw the bulk of the recent deadly attacks.
- Sunderbans (West Bengal) and Corbett (Uttarakhand) are other notable conflict zones.



What are the reasons?

- **Visibility** - Unlike elephants that occupy huge space and resources and are easy to spot, the big cats are good at avoiding people and often go invisible.
- **Land Use Pattern** - A drastic change in land use is evident in most of the conflict zones. e.g—
 1. Huge influx of settlers in Sunderbans due to various historical reasons.
 2. Fisherfolk ventured deep into the channels of the Sunderbans, while honey-collectors delved into the mangrove clusters.
 3. Large scale deforestation in Pilibhit for firewood and fodder added to the causes.
- **Local reasons** - In Pilibhit, the conflict was further exacerbated by the reckless farming choices made by the local community.
- Farmland at the immediate edge of a forest creates an illusion of extended habitat for the wildlife.
- Pilibhit's widespread sugarcane fields and the choice of sugarcane and rice as prime crops have brought tigers and people dangerously close due to the absence of a functional buffer area.
- Riverbed (boulder) miners set up colonies for migrant labourers who start intruding into the tiger reserve in Corbett.
- Frequent human activities for long time inside the tiger forests greatly increase the chances of accidental encounters with the big cats.

2.36 Human Animal Conflict - Highway Tiger killings

What is the issue?

Wildlife Institute of India estimates that tigers in Indian reserves face destructive impact of roads and traffic.

What is the recent incident?

- Bajirao, one of India's breeding tigers from the Bor reserve, was killed in a highway hit and run accident recently.
- Bor Tiger Reserve is a wildlife sanctuary located in Wardha District of Maharashtra.
- Bor Tiger Reserve is one among the 'Satellite core area', which gives special focus on tiger protection.
- This incident highlights the absence of scientific advice to keep highways out of wildlife corridors.
- Recent study in Kanha-Pench tiger reserve corridor in Maharashtra also found that a national highway could block flow of genes between regions.

What are the possible measures?

- The Centre and the National Highways Authority of India have been repeatedly advised to realign or modify sensitive roads.
- The National Tiger Conservation Authority should insist on modification of existing roads to provide under tunnel crossings for animals.
- Users can be asked to pay a small price for the protection of vital environmental features.
- This would ensure that tigers and other animals are not isolated, and can disperse strong genetic traits to other populations.
- Curbs could be imposed on traffic on existing roads passing through sanctuaries.
- There could also be speed restraints and limitations like allowing only escorted convoys, with a ban on private vehicular movement at night.

2.37 Augmentation Program in Buxa Tiger Reserve

Why in news?

National Tiger Conservation Authority (NTCA) recently chose Buxa tiger reserve in West Bengal for the tiger augmentation programme.

What is the significance of Buxa tiger reserve?

- It has notified as a tiger reserve in 1983, located in Alipurduar district of West Bengal, parts of which border Bhutan.
- The reserve is located very close to Assam's Manas Tiger Reserve.
- Buxa consists of moist, deciduous and evergreen forests.
- It is home to at least 68 species of mammals, 41 species of reptiles and more than 246 species of birds, four species of amphibians, 73 species of fishes and over a hundred species of butterflies and moths.
- The herbivore list includes elephants, Indian gaur, chital, sambars, barking deer and hog deer.

How the augmentation program will be done?

- Forest Department officials claimed there were tigers in the reserve, almost no sighting of the big cats raised questions about their presence.
- The survey of tigers in 2011 based on DNA analyses of scat put the number of tigers at 20.
- The initial plan is to introduce six tigers at Buxa.
- Experts have consciously decided not to augment tigers in the Buxa reserve from the Sunderbans, a completely different mangrove ecosystem.
- Instead, tigers from the forest reserves of Assam, which have





a similar flora and fauna, will be introduced in Buxa.

- Experts believe that tigers are migrating from nearer Manas wildlife sanctuary through Buxa-Bhutan corridor.

What are the challenges?

- The introduction of tigers is a challenge to forest officials as there is human habitation in the area.
- There are also common clouded leopards, jungle cats and fishing cats, which occasionally surface in the tea gardens nearby.
- Chances of wild animals getting killed while crossing the tracks are high, as broad gauge rail line is passing through the reserve.
- Tourist accommodations run by both the forest department and private operators, in the reserve possess high threat to tiger habitat.

2.38 Blue Flag

- The 'Blue Flag' is a certification by the Foundation for Environmental Education (FEE) that a beach, sustainable boating tourism operator, meets its stringent standards.
- Union Environment Ministry has launched a pilot project for beach clean-up and development and is also striving for the 'Blue Flag' certification for such identified beaches.
- Under the project, each state or UT has been asked to nominate a beach which will be funded through the ongoing Integrated Coastal Management Programme.

Conservation of Water Resources

2.39 NITI Aayog's Report on Water Management

Why in news?

- NITI Aayog 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.

2.40 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.

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.



2.41 River Basin Authority

Why in news?

The centre has suggested forming of River Basin Authority.

What is the reason?

- It was to ensure that no inter-state or international river is affected by arbitrary de-silting activities.
- The Justice TS Doabia panel, which was constituted in 2012, had advocated establishing a River Basin Authority for regulation and development of waters in inter-state river basins.
- This recommendation was reiterated in the recent draft on sediment management policy.

What are the other recommendations in the draft?

- **Restrictions** - In order to safeguard the structural integrity of the barrage or a weir, dredging/de-silting/mining activity upstream of structure will not be allowed within approximately 200 metre.
- No de-silting work of more than 1 cubic metre can be carried out in any river without the approval of the authority or the Central Water Commission (CWC).
- Such activities will also not be allowed within a distance of 800 metres downstream of the structures.
- **Flood Management** - Sufficient flood plain and lakes should be provide along the river to moderate flood level and there should be no encroachment on such structures.
- The draft policy also recommends against disconnecting lakes from rivers.
- De-silting of lakes should be carried out in a way that sediment continuity is maintained.
- Stored water needs to be released during non-monsoon period in such a way that silt carrying capacity of river is maintained as “this will also improve ecology of the river.”
- **Waste Management** - Solid waste generated out of industrial processes should not be allowed to be dumped in the river, intermixing with other silt may render the same unusable for food chain use

2.42 NGT order to save Ganga

Why in news?

National Green Tribunal (NGT) gave its directions to a PIL petition of which was transferred to the NGT from the Supreme Court in 2014.

What the NGT mandates?

- An area of 100 metres from the edge of the Ganga between Haridwar and Unnao has been declared a ‘No Development Zone’.
- Till the demarcation of floodplains and identification of permissible and non-permissible activities by the State government, the ‘No Development Zone’ is to be followed.
- All industrial units in the catchment areas of the Ganga should be stopped from indiscriminate groundwater extraction.
- Mechanical mining will be banned.
- Dumping of waste within 500 metres of the river is prohibited.
- Rs. 50,000 fine will be imposed on anyone dumping waste in the river.
- It also directed the Uttar Pradesh and Uttarakhand governments to formulate guidelines for religious activities on the ghats of the Ganga and its tributaries.
- Tanneries from Jajmau in Kanpur should be shifted to leather parks in Unnao within a period of six weeks,.
- A supervisory committee was appointed to oversee implementation of the directions passed in its verdict.



2.43 New Technology for Namami Gange

What is the issue?

- The high cost of refining units slows down the progress of Namami Gange project with continued inflow of untreated wastewater.
- A new technology by the Water Technology Centre (WTC) of the Indian Agricultural Research Institute needs consideration for adoption.

What is the new WTC technology?

- It is a novel biological water purification technique that uses plants and micro-organisms to sequester impurities and decontaminate wastewater.
- The perennial plant used in this system is *Typha latifolia* which naturally absorbs pollutants.
- The plant boosts oxygen content of the watery medium around its roots to cleanse the dirty water.
- Besides, it also encourages proliferation of water decontaminating micro-organisms.
- And thus averts the need for using chemicals and aerators to improve water quality as is usually done in the conventional methods.

What are the relative advantages?

- **Effective** - The system requires no chemicals, no energy, no skilled manpower and no inputs, barring seeding the plants.
- It removes even the metallic residues to the extent of 80 to 99%, something that the conventional methods are unable to do.
- **Economic** - The cost of refining the untreated sewage released into the Ganga would come down roughly by 8 times as against the conventional methods.
- It also generates revenue to make sewage treatment a profitable activity.
- The economic returns from the treatment plants can be enhanced further by incorporating fisheries into these ventures.
- Notably, planktons and zooplanktons, which serve as nutritious feed for fish, thrive well in the water ponds of these units.
- The fish output of such integrated sewage treatment enterprises is relatively high and of good quality, being free of toxic residues.
- Also, these units can be transformed into environment-friendly eco-parks, boosting tourism by attracting migratory birds.
- **Biomass** - Instead of producing sludge, the *Typha*-based treatment units produce biomass.
- This can further be converted into good quality particle boards or energy briquettes and pellets for use as clean fuel.
- The upper parts of *Typha* can be cut every 4 months or so for this purpose and the plant regenerates again.
- **Land** - The land requirement for setting up the WTC treatment units is comparatively far meagre than conventional plants.
- **Odour** - Unlike the normal sewage treatment plants, the WTC treatment units do not emit any unpleasant odour.
- This is because the decontamination process occurs under the soil surface without the use of chemicals which generate smelly gases.

2.44 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
- liberally determined minimum support prices
- assured marketing through open-ended procurement
- subsidised or free supply of water and power

What are the possible solutions?

- The largely academic suggestions mooted in these reports to remedy the situation include the following:
- Effective pricing for water and power.
- Greater marketing support for water-efficient crops in water-constrained areas.
- A general shift from price support to cash transfer to let the actual crop prices to be determined by market forces.
- Dis-incentivising the cultivation of water-intensive crops in states like Maharashtra, Punjab and Haryana.
- Shifting these crops to water-rich eastern and north-eastern regions.

2.45 Measures to Conserve Groundwater – Punjab Model

What is the issue?

- In India groundwater is rapidly getting depleted due to various reasons.
- Union and State governments are taking various measures in this regard.

What is the status of groundwater depletion in India?

- Central Ground Water Board (CWGB) has conducted a study on Rapidly-depleting groundwater in 6584 blocks across the country.
- The CWGB assessment shows that groundwater in 1,034 of 6,584 blocks were over-exploited.
- More water was being drawn out annually than was being recharged.
- Further 934 blocks suffered from different stages of groundwater depletion.



- Tamil Nadu had the most number of over-exploited blocks but Punjab was the worst in percentage terms with over 75% of its assessed blocks falling in the over-exploited category.
- Other worst affected states were Haryana, Rajasthan and Delhi.

What are the measures taken by the union government?

- Government of India has planned to implement a Water Conservation scheme Atal Bhoojal Yojana, with a fund of Rs.6,000 crores.
- Under this scheme, ground water will be recharge and hence it will provide sufficient water for the use of agriculture purposes.
- This scheme will also revive the water bodies like rivers so that the level of ground water can be increased especially in the rural areas.
- The fund for this project will be raised by the Ministry of Finance and the World Bank.

What are the measures taken by Punjab government?

- Punjab governments initially nudged the state's farmers into increasing paddy acreage by providing nearly-free electricity for pumping out groundwater and backing intensive MSP-driven procurement of paddy harvest.
- Now the Punjab state government is looking at steps to reduce the cultivation of water-intensive paddy.
- Recently the government has launched a pilot project in three villages under which digital meters will be installed on tube wells belonging to nearly 1,000 farmers in the three villages.
- Instead of compensating the state discoms for free power supply, the state will deposit certain amount of money in the accounts of the farmers.
- The farmers will be billed directly by the Discom on the basis of actual consumption.
- The state has entered into an agreement with experts from the World Bank, Punjab Agricultural University and various state departments.
- These agencies will estimate the actual power use by farmers and how it might change following the direct benefits transfer (DBT).
- If the actual costs for farmers surpass the DBT amount, it is possible that farmers might rethink their paddy preference.

2.46 Bengaluru's Water Profile – An analysis

What is the issue?

- A recent BBC report listed 11 world cities that were “most likely to run out of drinking water” in which Bengaluru is numbered 2nd.
- While the recent verdict on Cauvery has come as a relief for the city, much more needs to be done to sustain Bengaluru's water resources.

What is the crux of the BBC report?

- **The Report** - It mentioned the acute shortage of water in Cape Town in South Africa, where people are now being rationed 50 litres daily.
- Notably, many fear that Cape Town could become the first major city to run dry in the modern era.
- Among the list of cities slated to face such crisis in the future - São Paulo in Brazil is rated 1st, which is followed by Bengaluru in India.
- Other cities on the list were Sao Paulo, Cape Town, Beijing, Cairo, Jakarta, Moscow, Istanbul, Mexico City, London, Tokyo and Miami.
- **Bengaluru's Case** - The report noted that more than half of Bengaluru's drinking water is wasted due to its outdated plumbing setup.
- Notably, 85% of the city's lakes had water, but it is reported to be polluted severely that it has become unsuitable for drinking or bathing.



- But the “Bangalore Water Supply and Sewerage Board” (BWSSB) — has refuted these by saying that the report was based on old data.

How serious is the drinking water crisis in Bengaluru?

- Bengaluru originally had multiple sources of water supply with over 200 lakes, and was gifted with abundant groundwater.
- Supplies were also added from reservoirs in the Arkavathi river basin.
- These sources are all but dead now due to the depletion of catchment areas in the wake of uncontrolled infrastructure expansion.
- Bengaluru’s 11 million Residents currently get 65 litres per capita per day (lpcd) on average, less than half the ideal amount of 150 lpcd.
- Notably, the availability of water in many of the city’s poorer areas is currently estimated to be as low as 40-45 litres-per capita-per day.
- All these factors have made Bengaluru critically dependent on the Cauvery River, which flows more than 100 km away.
- **Cauvery Allocations** - Earlier, 270 thousand million cubic feet (tmc ft) of water was allocated annually to Karnataka from the Cauvery.
- Out of this, 17.64 tmc ft was used for Bengaluru’s drinking water needs.
- In the current renewed allocation, Karnataka’s share has gone up by 14.75 tmc ft and Bengaluru’s share has gone up by 4.75 tmc ft.
- Notably, at 150 litres per person per day, Bengaluru’s present water need is estimated to be 24 tmc-ft annually, which will go up to 30 tmc-ft by 2025.
- So, even after the additional allocation from Cauvery Bengaluru will be short of 1.25 tmc ft of water per annum.
- Hence, there is little doubt that the city’s water resources must be managed more efficiently to evolve a sustained solution to the water problem.

What all have exacerbated the water situation?

- The proliferation of bore-wells in the core city areas has led to a massive depletion of groundwater beyond rechargeable limits.
- Only about 70 of the 272 lakes in and around the city from four decades ago survive now and most of the surviving ones are highly polluted. .
- The government has reclaimed dozens of lakes for bus stands, stadiums, and housing complexes, and real estate development.
- Garbage and sewage have poisoned lakes, and the concretisation of catchment areas has choked inlet channels.
- Drastic decline in water table has also led to quality deterioration of groundwater due to increasing concentrations of iron, fluoride, and nitrate.
- It is currently estimated that over 207,000 million litres of groundwater is being drawn annually while the recharge capacity is only 81,100 million litres.

2.47 Sardar Sarovar and Gujarat’s Water Crisis

What is the issue?

- The current water crisis in Gujarat has been exacerbated by irrational and wasteful water use policies.
- The famous Sardar Sarovar Reservoir on Narmada has also come under severe water strain, along with its other troubles.

What is the water situation in Gujarat?



- **Drought Situation** - Gujarat is experiencing a severe water crisis and many dams and reservoirs across the state are also drying up.
- Central Water Commission (CWC) Data shows that all 27 major reservoirs in Gujarat and Maharashtra have recorded lower water levels than last year.
- Additionally, it has also been found to be less than the average storage of last 10 years during the corresponding months.
- **Sardar Sarovar Dam**- This helps to irrigate 1.8 million hectares, and benefit 1 million farmers through a canal network that runs 75,000 km.
- With the onset of summer, water level at the Dam has dipped below the minimum drawdown level of 110.64 m, which is 25 meters less than in Sep 2017.
- Stretches of the canal network are now lying parched, and Gujarat farmers have been denied access to Narmada waters for agricultural purposes.
- More strikingly, security personnel have been deployed along the main canals of the Dam to ensure that farmers do not illegally draw water.

What are the reasons for the current situation?

- **Deficient rainfall** - A substantial area of the Sardar Sarovar Dam's (SSD) and catchment area lies in Madhya Pradesh, which had a rainfall deficit.
- Rainfall shortages in these areas affect the SSD storage as well as most of Narmada's drainage edifice in downstream Gujarat.
- But Gujarat government has asserted that the allocation to the state is based on the total water availability in Narmada basin and not just the SSD.
- Hence, it has been vouched that storage across reservoirs in Madhya Pradesh can rescue Gujarat from dire water strain.
- **Irrational use** - Data show MP and Gujarat experienced deficit rainfall from August to November but no corrective water management plan was pushed.
- The state seems to have drawn much water during Kharif, when it should have saved it for Rabi crop and the expected harsh summer.
- Also, water for riverfront and other ceremonial occasions like the water flight could've been avoided as the monsoon failure was clear.
- Significantly, officials have denied water release to the Sabarmati River front from Sardar Sarovar Dam (SSD) as some MLAs had asserted.
- But water is released for Sabarmati River to cater to domestic, drinking water and industrial requirements of Ahmadabad city, through Vasna barrage.
- **Unwarranted releases** - The timing of the release of water by upstream dams on the Narmada in Madhya Pradesh has come under criticism.
- Notably, an unusual amount of water was released upstream of Sardar Sarovar (SSD) last September, prior to the inauguration of the SSD by PM Modi.
- Official records show that the high water level was achieved on the inauguration day due to an unexplained release by the MP government.
- This proved non-optimal and water levels in the reservoir increased till it reached its highest point in late-September, and then began to dip.

What are the other troubles with Sardar Sarovar Project?

- "Narmada Water Disputes Tribunal" provides for sharing electricity generated from SSD among MP (57%), Maharashtra (27%), and Gujarat (16%).
- But there has been no power generation from the unit since June 2017 and Madhya Pradesh and Maharashtra haven't questioned this.
- While Gujarat government usually supplies water for irrigation till June, it has now been stated there will be no Narmada water for irrigation till Monsoon.
- The SSD authorities have also added that the government is not obligated to release water for the summer crop.
- There have also been some doubts raised on the structure of the dam as multiple seepages have been noted, which officials are said to be working on.

2.48 Address Sanitation Woes

What is the issue?

- Faecal sludge management (FSM), has been recognised by the Government of India as an option of sanitation.

- It has its own challenges which India needs to address to achieve its sanitation goal.

What are the stages of sanitation?

- Sanitation is intrinsically linked to health, and unless faecal waste is treated properly and disposed of safely, it will make us sick either by contaminating our sources of drinking water or getting into the food chain.
- The full cycle of sanitation has four stages
 1. Access to toilets
 2. Safe containment
 3. Conveyance either through the sewerage network or de-sludging trucks.
 4. Treatment and disposal.
- The waste needs to be handled safely at each of these stages in order to gain public health benefits.
- Sewerage refers to fully sealed underground pipes, and must not be confused with open storm water drains that are supposed to carry only rainwater.

What is FSM?

- Sewerage systems and sewage treatment plants (STPs) a preferred system in most western countries is not only expensive but are also complicated to maintain for India.
- An alternative to sewerage systems is something known as on-site systems, Septic tanks and pit latrines, which are prevalent in many Indian households, fall into this category.
- If these systems are designed, constructed and managed properly, they can be perfectly safe options.
- Safe containment, collection and treatment is known as faecal sludge management (FSM), and is being increasingly recognised by the Government of India as a viable option.

What are the practical challenges in FSM?

- Emerging evidence from across the country indicates that on-site systems are not constructed properly.
- While the designs of 'septic' tanks and leach pits have been set out in standards issued in government documents, homeowners and masons are often not aware of these.
- The most severe consequence of these poorly designed pits is the potential contamination of groundwater as they are not de-sludged at regular intervals.
- Faecal waste needs to be transported using de-sludging vehicles (and not manually) but only some States, Tamil Nadu for example, have these vehicles.
- There aren't enough treatment facilities to guarantee proper treatment of the sludge.

What are present initiatives to address this issue?

- After the National Urban Sanitation Policy (NUSP) in 2008, a national policy on Faecal Sludge and Septage Management (FSSM) was released in 2017.
- Tamil Nadu, Maharashtra and Odisha have released State-wide septage management guidelines and taken concrete steps to execute these policies.
- States which lack de-sludging vehicles have planned to procure vehicles for their urban local bodies or encouraging private players to get into this.

2.49 NASA's Report on Hydrological Change

Why in news?

NASA satellite observations of Earth have found that there is a serious decline in the availability of freshwater in India.

What are the findings of the study?

- NASA used data on human activities to map locations where freshwater is changing around the globe.
- This is the first time that observations from multiple satellites in a thorough assessment of how freshwater availability is changing everywhere on Earth.
- In some regions water supplies were found to be relatively stable, others experienced increases or decreases.



- The study found that Earth's wet land areas are getting wetter and dry areas are getting drier due to a variety of factors.

What is the reason behind this decline of fresh water?

- The factors for this phenomenon includes human water management, climate change and natural cycles.
- Distinctive pattern of the wet land areas of the world getting wetter those are the high latitudes and the tropics and the dry areas in between getting dryer.
- Pumping groundwater for agricultural uses is a significant contributor to freshwater depletion throughout the world.
- Groundwater levels are also sensitive to cycles of persistent drought or rainy conditions

What are the implications for India?

- Areas in northern and eastern India are among the hotspots where overuse of water resources has caused a serious decline in the availability of freshwater that is already causing problems.
- In northern India, groundwater extraction for irrigation of crops such as wheat and rice have caused a rapid decline in available water, despite rainfall being normal throughout the period studied.
- The extractions in these parts have already exceed recharge during normal precipitation and does not bode well for the availability of groundwater during future droughts.

Environmental Degradation

2.50 Receding Ice Shelf

Why in news?

A trillion-ton iceberg from the Larsen C Ice Shelf is being disintegrated into smaller icebergs in Antarctica.

What the Project MIDAS says?

- It is a U.K.-based Antarctic research project that has been looking at the ice shelf for many years
- Scientists from Project MIDAS have said the formation of icebergs is natural.
- And there seems no link to human-induced climate change was available in this case.
- Yet, the impact of such a loss on the stability of the ice shelf itself may not be good.

What are the impacts?

- The disintegrated icebergs and glaciers melts and flow into the nearby seas and oceans.
- It contributes to sea level rise, possibly at a slow rate.
- It highlights the need to stop continued warming of the planet from man-made carbon emissions.

What is the importance of Antarctica?

- Antarctica is a climate stabilising factor.
- Except for man-made causes, there was no anticipated factor in the natural geological cycle that would disturb Antarctica.
- The separation of an iceberg from the ice shelf shows the importance of such alarms.
- Species like emperor penguins which depend on sea ice to complete their life cycle are at risk if ice cover declines.
- Any dramatic changes will only add to the worry of irreversible effects of climate change, given that the Arctic and Greenland have also been losing ice cover.



2.51 Threat to Wetlands - Ennore Case Study

What is the issue?

- Recently the TN government conceded the Government of India-owned Kamarajar Port Ltd's (KPL) request to divert 1,000 acres of the hydrologically sensitive Ennore wetlands for industrial installations that are best built on dry land.
- The proposal is pending Central government clearance.

How significant is Ennore creek to Chennai?

- Ennore creek is a backwater located in Ennore, Chennai along the Coromandel Coast.
- It buffers the rich aquifers of the Araniyar-Kosasthalaiyar Basin from the sea.
- Located squarely in the intervening floodplains of three rivers on a high-energy coastline, Chennai is a disaster-prone location.
- Wetlands like the Ennore creek function more as shock absorbers in times of such disasters.
- This wetland's importance may not be apparent as much of the creek looks dry all the year-round.
- However, when cyclonic weather pushes the sea water landwards, or when rain waters from the two rivers drain into the sea, the creek swells to its full capacity.
- The presence of the creek prevents many parts of the city from flooding.
- It keeps salt water from invading the groundwater resources that supply huge volumes of drinking water to the Chennai city.

What are recent threats to the creek?

- In 1996, the Tamil Nadu government protected a 6,500-acre stretch of the tidal water body under the Coastal Regulation Zone (CRZ) Notification.
- However more than 1,000 acres of the creek were lost to **illegal encroachments**.
- These installations block the path of rain waters. e.g Areas that never got flooded saw waters enter homes during the 2015 Chennai floods
- If plans to fill the creek persist, the precious freshwater aquifer that Chennai draws from will be lost to salt.
- The governments are only targeting encroachments by the vulnerable poor people as a remedy rather than controlling the illegal constructions of the elite.
- It is the need of the hour to balance environmental concerns and development issues, and take appropriate policy decisions.

2.52 Wetlands Rules, 2017

Why in news?

The Ministry of Environment, Forests and Climate Change has recently notified the Wetlands Rules, 2017.

What are the notable provisions?

- **Definition** - Wetlands are defined as an area of marsh, fen, peatland or water.
- It could be natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt.
- It includes areas of marine water the depth of which at low tide does not exceed six metres.
- The rules apply to:
 - i. Wetlands categorised as "wetlands of international importance" under the Ramsar Convention.



ii. Wetlands as notified by the central and state governments and UT administration.

- **Management** - The new Rules farm out wetland management to states and union territories.
- The State or UT Wetlands Authority will have to prepare a list of all wetlands and a list of wetlands to be notified, within specified time.
- However, it is up to the states to decide which wetlands are to be notified.
- A comprehensive digital inventory of all wetlands is to be prepared within a year.
- **CWRA** - The new rules have done away with the earlier Central Wetlands Regulatory Authority (CWRA) entirely.
- CWRA has been replaced by the National Wetland Committee, which has a merely advisory role. These include -
 - i. Advising the central government on proposals received from states/UTs for “omission of the prohibited activities”.
 - ii. Prescribing norms and guidelines for integrated management of wetlands based on wise-use principle.
 - iii. Recommending trans-boundary wetlands for notification.
 - iv. Reviewing the progress of integrated management of Ramsar Convention sites.
- **Restrictions** - As per the new rules, encroachments on wetlands have been banned.
- It also prohibits solid waste dumping, discharge of untreated waste and effluents from industries and human settlements.
- It says that conservation and management would be based on the principle of ‘wise use’, which is to be determined by the Wetlands Authority.

What are the shortfalls?

- **Definition** - The 2010 Rules included in the definition of wetlands all inland waters such as lakes, reservoir, tanks, backwaters, lagoon, creeks, estuaries, etc.
- It also included man-made wetland and the zone of direct influence on wetlands.
- However, the 2017 Rules are not as comprehensive as this.
- It does not include river channels, paddy fields, human-made water bodies/tanks specifically for drinking water purposes, aquaculture, salt production, recreation and irrigation purposes.
- It also do not include wetlands under forest and coastal regulation zones..
- **Management** - There were lethargic response from states and UTs, in the past, on wetlands protection.
- So devolving management to states and UTs could be ineffective
- **Restrictions** - The term ‘wise use’ is subjective and could dilute the earlier restrictions.
- There is also no timeline specified for phasing out solid waste and untreated waste from being dumped into wetlands.
- The restrictions on “any other activity likely to have an adverse impact on the ecosystem of the wetland”, are not specified clearly in the Rules.
- **Appeal** – The older provision of appealing to the National Green Tribunal does not exist in the 2017 Rules.

Environmental Pollution

2.53 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
 - electrostatic precipitator (ESP) retrofits (components) aimed at particulate matter
 - flue-gas desulfurisation (FGD) units for reducing sulphur oxides (SO_x) emissions from power plants
- A successful reduction in emissions from power plants will depend on:
 - plant operators investing in retrofits
 - regulators permitting a full price revision for additional costs
 - 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 SO_x emissions.
- But India has many challenges in rolling out a cap-and-trade regime including:
 - low levels of monitoring of emissions
 - low capacity within state pollution control boards
 - lack of a cadre of administrators to monitor

2.54 Recognising the Human Environment

What is the issue?

- There was widespread protest in Tuticorin, TN against Vedanta's copper smelter recently.
- The incident calls for a broader understanding on the issues related with environment and business projects.

What is the problem in Tuticorin?

- The Vedanta subsidiary promised world class community engagement, environment management and CSR.
- But the proposed copper smelter was located close to human habitation.
- It generated about 400 MT of chemical gases like sulphur dioxide every day.
- These are gases that can travel for miles as in the case of Bhopal's Union Carbide.
- Resultantly, people are suffering from various ailments.
- They wanted to halt the construction of the new 1200 MT copper smelter and demand a closure of the existing facility.

What are the recent developments?

- The Labour Party in the UK asked for Vedanta Resources to be delisted from the London Stock Exchange.
- Earlier, the Church of England had withdrawn from Vedanta.
- As Vedanta had failed to respect the human rights of local people in setting up a bauxite mine in Odisha.
- The Dongria Kondh tribals protested against taking away of their hill of worship in Niyamgiri, Odisha.
- In all, investors are becoming wary of companies that are seen to be environmentally irresponsible.
- High standards of social governance are gaining significance in companies.

What are the larger concerns?

- Human environment - There is predominance of a forest department outlook in the environment ministry.
- It leads to a narrow interpretation of the environment for only its physical side - water, air, land/forests.
- Nonetheless, human beings are fundamental to any discourse about the environment.
- Divorced of this, the environment has no social value.
- EPA - The Environment (Protection) Act, 1986 came after the UN Conference on the Human Environment.
- Under it, India pledged to take steps for protection and improvement of the human environment.
- Unfortunately, the EPA has only a passing mention of the human being.
- Clearance - In most cases, environment clearance is pushed through as an ease of doing business proposal.
- The company's presentation of strong CSR credentials results in overlooking the environmental impact.
- People - No significant social impact study is undertaken, nor is people's consensus ensured.
- There is little opportunity for people to put forward the concerns in future implications of the project.

What should be done?

- **Government** - It must mandate a social impact study prior to the public hearing.
- This should include the likely impact on health of people in the influence zone of the project.
- It should consider the nature of the likely effluents and the already existing health sensitivities.
- Quality of available water and impact of the expected discharges should be accounted.
- The methodology of waste disposal and its impact on water and air should be studied.
- Government should ensure that public hearing takes place only after the general consent of all villages.
- **Company** - Company must define the affected zone of the project.
- It should include villagers whose land is being acquired and who will be under the environmental influence.
- It should reserve 15-24% initial shareholding for villagers who are in the affected zone.
- This portion could be allocated as social/sweat equity.
- The company should announce benchmarks for water, air and soil quality.
- It should also commit to pay compensation for any breach of these.
- Companies must re-examine their entire CSR framework.
- They can recruit village-level representatives to engage better with the villagers.
- In all, there is a need for a bottom-up approach of social and civic engagement, with prime focus on the human environment.



2.55 Environmental Threats to Delhi

What is the issue?

- Haze loomed over Delhi and its adjoining areas for over a week.
- The causes and consequences of it demand a more holistic approach in responding to this environmental problem.

How is the dust pollution scenario in Delhi?

- Air quality - For over five days, a thick layer of dust hung over Delhi.
- It kept the air quality 'severe', the worst category in the pollution index.
- It was odd because it happened in the peak summer.
- Summer is generally considered the off-season for air pollution in Delhi.
- Pollutant - The major air pollution threat in Delhi is from the tiny PM_{2.5} particles.
- However, during the summer, PM₁₀ is found to be the primary pollutant.
- The summer average for PM₁₀ in Delhi was found to be 5 times the national average.
- About 40% of PM₁₀ particles (with diameter less than 10 micron) was dust.
- Dust - Windblown dust consists of soil, sand and rock particles.
- Besides, it also contains "re-suspended" dust kicked up by vehicles, digging or construction.
- The dust hosts toxic materials, including, heavy metals such as lead, chromium and nickel.

What are the causes?

- The recent phenomenon was triggered by a dust storm that began over Rajasthan.
- It was carried by strong westerly wind.
- The dusty blanket spread itself over Punjab, Haryana, Delhi and western UP.
- It was kept close to the surface by the anticyclonic flow of winds.
- Anti-cyclones swirl clockwise in the northern hemisphere.
- It pushes the local air down and prevents outside air from entering the region.

What are the changing conditions?

- The recent dust haze is notably not a onetime incident resulting just from desert storm.
- The phenomenon could be aggravated by desertification around Delhi the uncontrolled urban development climate change.
- Delhi's summer aandhis, like Kolkata's kaalbaisakhis, are localised events.
- However, the recent development is different in scale and impact.
- Strangely, all of North India was enveloped.
- These climatic conditions cannot any longer be seen in isolation.

Why is desertification a serious issue?

- What - Desertification is the process of relatively dry land becoming increasingly arid.
- It refers to a condition of reduction of water supplies and lowering of water table in the soil.
- The factors range from loss of vegetation and overexploitation of soil to climate change.
- Scale - The rate of desertification in India is said to be at 23 hectares of dryland per minute.
- Nearly 70% of India's area is dry land.
- A third of this is affected by degradation and a quarter by desertification.
- Rajasthan and Delhi were among the worst affected.
- Impact - Delhi has historically had a barrier of trees.
- This exists in the form of the Delhi Ridge and the linked Aravalli range.
- But nearly 12 vegetative gaps in southern Haryana are increasingly prone to desertification.
- The forest cover in Haryana, UP and Rajasthan is also found to be declining.
- Significance - Preventing desertification is crucial because failing on this would result in more dust.



How to address this?

- Preparing for more climate related incidents in the future should be a priority.
- Australia and several countries in sub-Saharan Africa and West Asia carry out dust fall monitoring.
- Measuring dust deposits in the air alongside ambient air monitoring can be done.
- The data would help in the mitigation processes.
- Projects like the African Union-led “Great Green Wall for the Sahara and Sahel Initiative” could be taken up.
- It aims to create a mosaic of trees across North Africa, Sahel and the Horn.
- Vegetation buffers could be positioned between residential and industrial areas or roads.
- The urban design of Delhi should be rethought.
- Greening has to be done intelligently; roads need to be designed with tree cover.
- The Aravalli and the Ridge need to be protected.
- This in turn will protect the water table and benefit the city throughout the year.

2.56 Firecracker Ban in NCR

Why in news?

Supreme Court recently reinstated the 2016 temporary ban on the sale of fireworks in Delhi-NCR.

What is the Chemistry of fireworks?

- Explosive fireworks depend on four primary ingredients — oxidiser, fuel, colouring agents & binder.
- The oxidisers release oxygen to allow the explosion to take place. Ex: Nitrates, chlorates.
- The fuel for burning is usually charcoal.
- Colouring agents like aluminium compounds are for brilliant whites, barium nitrate for greens.
- Binders are used to hold the mixture of the firework together in a paste while burning.
- Also, other metals like titanium & strontium are added to regulate the speed of the burning reaction.

What are the existing guidelines?

- Currently, guidelines exist for four types of explosive firecrackers — atom bombs, Chinese crackers, garland crackers and maroons.
- The guidelines for these were drawn up by PESO in 2008.
- According to these guidelines, the sulphur, nitrate & aluminium power contents must not exceed 20%, 57%, & 24% respectively.
- In July 2016 the SC ordered that no firecrackers shall contain antimony, lithium, mercury, arsenic and lead.

What are the criticisms against the judgment?

- **Judicial overreach** - Air quality related policy and its implementation are best left to the legislature and the executive.
- The courts should ideally be stepping in only when there is neglect.
- As the governments are already working to stop polluting practices, SC's intervention is seen as a problematic overstep.
- **Previous experience** - The 2015 verdict that banned stubble burning in Punjab has proven ineffective.
- The governments concerned still hesitate to implement the same due to their inability to get farmers on board.
- Only alternative approaches like making stubble itself a remunerative commodity have contributed to reduced burning, not the ban.
- **Rationality** - Much bigger factors like vehicular pollution, industries and unpaved roads factors contribute more to the disastrous air quality of Delhi.
- So the focus on fireworks alone seems disproportionate.

SC's previous views on cracker ban

- **2015 Verdict** - A case seeking ban crackers throughout India was filed.
- It highlighted the health hazards & environmental impact of crackers.
- But SC categorically refused to ban people from bursting firecrackers.
- The court felt that it might be "dangerous" to infringe into the common man's right to enjoy his religious festivities.



- Nevertheless, it ordered for time stipulations (10pm – 6am).
- **2016 verdict** - The 2016 case sought a cracker ban specific to Delhi NCR.
- The court imposed a ban in the wake of increased particulate matter concentration in the lower atmosphere above Delhi.

2.57 Contributors to Delhi Air Pollution

What is the issue?

- The union Ministry of Environment and Forests had published a white paper in 2003.
- It reported that in the time between 1970 & 2000, the contribution of vehicles to particulate matter in Delhi's air rose from 23% to 72%.
- The four major government studies carried out since then have differed on the relative contribution of sources of particulate matter in Delhi's air.

What are the findings?

- **IIT-Delhi, 2007** - The study was commissioned to specifically understand the contributions of vehicle of different types to vehicular air pollution.
- A key finding was that “tempo contribute maximum amount of concentration of NOx and PM (58%) followed by trucks (24.1%), buses (12%), cars/taxis (9.7%), small trucks (3.7%) and tractor, trailer (0.18%).”
- It concluded that “control on emissions of pollutants from vehicular traffic necessitates the control on the new registration of commercial diesel vehicles in Delhi”.
- **NEERI, Nagpur 2008** - The study was commissioned after the need for “better understanding” of air pollution sources was “recognised” in the Auto-Fuel Policy Document, 2002.
- The study identified road dust as the biggest contributor (52.5%) to particulate matter in Delhi's air, followed by industries (22.1%).
- It attributed only 6.6% of particulate emissions to vehicles.
- For NOx, the study found industries contributed 79% and vehicles 18%.
- Vehicles were the main source of CO and hydrocarbons: 59% and 50% respectively.
- **SAFAR, 2011** - System of Air quality Forecasting and Research (SAFAR) project was developed for air quality forecasting during the Commonwealth Games.
- The study reached the “surprising” conclusion that road dust from paved and unpaved roads contributed the largest share to air pollution (55%), followed by residential sources (15%), transport and vehicular pollution (13%), industrial sources (12%), and power (5%).
- Particulate pollution is a major problem for Delhi specially during winter and fire event festival and that the situation with regard to gaseous pollution (such as NOx and sulphur oxides) was “reasonably better”.
- **IIT-Kanpur, 2016** The study carried out sampling during the winter of 2013-14 and the summer of 2014. It had five components: air quality measurements, emission inventory, air quality modelling, control options and an action plan.
- For PM_{2.5}, the source apportionment, according to the study, was: road dust (38%), vehicular pollution (20%), domestic sources (12%), industrial sources (11%), concrete batching (6%), hotels and restaurants (3%), municipal solid waste burning (3%), diesel gensets (2%), industrial area sources (2%), and cremation, aircraft and medical incinerators (1% each).
- For NOx emissions, industrial point sources (52%) and vehicles (36%) were the biggest contributors, followed by diesel gensets (6%), the study found.

2.58 Delhi's Pollution Crisis

Why in news?

The deteriorating air quality and suffocating smog have led to closure of primary schools in Delhi.

What are the causes?

- **Smog** - Smog refers to a smoky fog (smoke+fog) and is a kind of air pollution.
- Fog is a hazy condition which is a result of suspension of water droplets close to the ground.



- Smog, on the other hand, is a mixture of pollutants in the atmosphere which consists of fine particles and ground level ozone.
- When pollution is high, nitrogen oxides and dust particles interact with sunlight to form ground-level ozone, leading to hazy smog.
- This condition is a result of a range of factors including:
 - i. geography of the place.
 - ii. sunlight
 - iii. calmness of winds.
 - iv. post-harvest crop burning.
 - v. firing of brick kilns.
 - vi. dust from construction sites and unpaved roads.
 - vii. vehicular pollution.
 - viii. domestic and industrial emissions.
- **Wind** - Smog occurs in a location that is far away from the actual source of pollution after the hazardous pollutants have drifted away in the wind.
- Delhi experiences two kinds of winds in winter which are:
 - i. wind carrying pollutants from stubble burning in Punjab.
 - ii. wind bringing in moisture from Uttar Pradesh.
- These two winds collide in the upper atmosphere above region.
- However, Delhi and its neighbouring areas have nearly still wind conditions near the ground, which is due to prevailing anti-cyclone conditions around the region during winter.
- The two winds, combined with the near still wind conditions, effectively trap the pollutants leading to persistent smog.
- **Crop burning** - The smog that envelops the region is exacerbated by the burning of biomass in nearby Punjab and Haryana.
- The post-monsoon burning of rice and wheat residue releases maximum aerosols.
- And this contributes to the volume of PM_{2.5} in the air.

What should be done?

- The Delhi government has taken various measures in the past including:
 - i. The ban on Deepavali crackers.
 - ii. Shift to compressed natural gas for commercial vehicles.
 - iii. Restricting car use to odd and even number plates on alternate days.
- However, air quality index has touched extremely hazardous levels in some parts of Delhi, turning into a public health emergency.
- The burden of such chronic problems has outweighed the benefits conferred by the above measures.
- Therefore, besides these minor corrections, the Centre and States must urgently address farm residue burning in north India.
- A workable solution demands a coordinated effort from the governments of Delhi, Punjab, Haryana and Uttar Pradesh, assisted by the Centre.
- Delhi's unique weather conditions require a comprehensive, well informed solution to the pollution crisis.

2.59 Viable Solution for Stubble Burning

Why in news?

- Paddy stubble burning is found to be a major contributor to Delhi's air pollution.
- Bans and fines are unlikely to be effective.
- To devise a policy with a chance to succeed, one needs to understand the reasons why farmers prefer burning.



Why stubble burning is bad?

- It causes smoke and particulate pollution that can move over long distance.
- It also implies loss of nutrients in soil.
- One tonne of straw when burnt releases 3 kg of particulate matter, 60 kg of carbon monoxide, 1,460 kg of carbon dioxide, 199 kg of ash and 2 kg of sulphur dioxide.
- In Punjab alone, 15 million tonnes of paddy straw is burnt every year, generating 45 million tonnes of particulates.
- Even after a stiff fine by Punjab and Haryana farmers still chose the option stubble burning.

Why farmers choose stubble burning?

- When manually harvested, the crops can be cut at the bottom and the stalks could be sent for other uses such as paper mills, animal bedding, etc.
- But manual harvesting has become very expensive as labourers charge around Rs 4,000/acre and take three to four days.
- So at present, paddy harvesting is done by combine harvester machine, which finishes it in half an hour and charges Rs 1,200/acre.
- But it leaves two thirds of the stalks on the ground.
- So stubble burning is the cheapest and quickest way to get their fields ready in time for the sowing of next crop.
- It kills weeds including those resistant to herbicides.
- It also kills slugs and other pests.

What are the alternate uses of stubble?

- Properly cut Stubble can be used to make bio-char or cellulosic ethanol, burn in a power plant or plant the next crop without tillage.
- Bio-char is a fine-grained, carbon-rich, porous product remaining after straw has been subjected to pyrolysis at low temperatures in an environment with little or no oxygen.
- Bio-char can improve water retention and increased soil surface area when used with other fertilisers.

What can be a viable solution?

- A farmer's economic compulsions dominate his decision to burn stubble.
- Incentives from power generators and ethanol manufactures to farmers bringing stubble will provide solution for this.
- Super SMS (straw management system) is an attachment that fits onto the combine harvesters for paddy, spreads residue evenly over the field.
- It should be deployed while cutting the stubbles.
- Initiatives should be taken to market biochar as a nutrient and private players should be involved for the infrastructures required.

2.60 NGT's Order on Odd-Even Rule

Why in news?

National Green Tribunal (NGT) directed the Delhi government to implement the odd-even car rationing scheme.

What is odd-Even Scheme?

- Odd- even vehicle rule was implemented in 2015 in order to control pollution.
- It means that cars running with number plates ending in even numbers will be allowed to run on even days.
- The odd-even rule earlier exempted certain cars and vehicles which include all ambulances, hybrid and electric vehicles, VVIP and embassy vehicles, cars driven by women drivers, and two wheelers.
- Vehicles running on CNG will also be exempt from the odd-even rules.
- Vehicles not complying with the odd-even scheme will be heavily fined.

What are NGT's decisions on odd-even scheme?

- Earlier the NGT questioned Delhi government to give justifications on implementation of the scheme, as the pollution level started to fall.
- Now the NGT directed the Delhi government to implement the scheme, but on a condition that there would be "no exemption to any person, officer or individual, including two-wheelers from the odd even scheme".



- Delhi government has also announced that this time it will not be exempting women drivers from following the odd-even plan as the Green Court questioned the logic behind the same.
- The emergency services vehicles like ambulances and fire brigades were exempted from the scheme.

Why two wheelers are not exempted this time?

- Two-wheelers contributing 20% of vehicular pollution, the NGT observed.
- The two-wheelers are much more in number than other class of vehicles.
- They emit serious pollutants like carbon monoxide and hydrocarbon which are not emitted or negligibly emitted by the petrol vehicles.

2.61 The Case for Dis-incentivizing Parking Spaces

What is the issue?

Delhi's administrators have conveniently stated that the only solution to the air pollution lies in curtailing stubble burning in the neighboring states.

How menacing are private cars?

- Our urban planning guidelines have been incentivizing private car ownership at the expense of congestion and deteriorating environmental quality.
- Notably, at the present congestion levels, Delhi wastes around \$1.6 million worth of fuel every day, while air pollution results in eight deaths per day.
- The Capital currently has more than 157 cars per 1,000 residents, and is expected to go up to 380 cars per 1,000 people by 2025.
- Since car owners gain from these but the costs are borne by everyone, our urban policies are essentially hurting those who rely on public transport.
- As more vehicles would among other issues, add to the pressure on our roads, it is imperative for urban policy in India to dis-incentivize car ownership

What can be done?

- **Parking Spaces** – Low-cost public parking and housing policies that mandate for minimum parking lots in residential buildings need to be done away with.
- Even in residencies where people can't afford their own vehicle, parking spaces are mandated, which drives up housing costs considerably in cities.
- Also, access to parking was found to induce residents to drive more in private cars, even for trips to areas which are well served by public transport.
- As detrimental effects of treating parking as a public good are being realized, many cities across the world have already recalibrating their policies.
- Notably, National Urban Transport Policy (NUTP) of 2006, had argued for a fee based parking model for Indian metros, but hasn't found favour with authorities.
- **The Future** - In order to make owners internalize the costs of driving private vehicles, cities need to charge at least the basic market price for parking spaces.
- This requires more effective enforcement of parking rules by cities in addition to more transparent and effective collection mechanisms for parking fees.
- For a brighter future, it is time for urban policies to be driven less by the priorities of the influential elite, and more for the welfare of everyone.

2.62 BS-VI Fuel Norms

Why in news?

Union government announced that BS-VI fuel will be available in Delhi by April 2018.

What is BS-VI emission norm?

- By moving to BS-VI, the country will be using the highest specifications of fuel standard available in the world right now.



- Bharat stage emission standards (BSES) are emission standards instituted by the Government of India.
- India first notified its auto emission norms in 1991 and then revised these in 1996 and later in 1999 when the BS norms were announced.
- It is to regulate the output of air pollutants from internal combustion engines and Spark-ignition engines equipment, including motor vehicles.
- The standards and the timeline for implementation are set by the Central Pollution Control Board under the Ministry of Environment & Forests and climate change.
- All new vehicles manufactured after the implementation of BS norms have to be compliant with the regulations.
- In 2016, the Indian government announced that the country would skip the BS-V norms altogether and adopt BS-VI norms by 2020.

What are the implications of this move?

- Taking into account the serious pollution levels in Delhi and adjoining areas, Petroleum Ministry decided for preponed BS-VI grade auto fuels in NCT of Delhi.
- Bharat Stage VI (BS-VI) fuel will now be available with effect from 1 April 2018 in Delhi.
- Union government is also examining the possibility of introducing BS-VI fuel across the national capital region by 1 April 2019.
- This measure is expected to help mitigate the problem of air pollution in NCT of Delhi and surrounding areas.
- The move is also in line with India's commitment under the Paris Climate Change Agreement to reduce its vehicular emission as part of the effort to cut emission intensity of the gross domestic product.
- The government statement does not mention any plans on seeking automakers to sell only BS-VI vehicles in the city.

Why this move is significant?

- This new fuel norms is expected to reduce the PM 2.5, which are tiny particles in the air that reduce visibility and cause the air to appear hazy when levels are elevated.
- The levels of poisonous, highly reactive gases that form when fuel is burned at high temperatures such as NO_x, or oxides of nitrogen, are also expected to reduce.
- The early introduction of BS-VI fuel gives confidence to the auto industry in migrating to manufacturing only BS-VI compliant vehicles on a pan-India basis.

What are the practical challenges with BS-VI fuels?

- The BS-IV norms were announced in April 2010 but it took nearly six years from then for the entire country to make the switch to these standards.
- If the BS-VI fuel had to be available across the country by April 2020, as was already targeted, then oil companies had better increase supplies gradually because an overnight ramp-up might not be feasible.
- Different automobile companies will have to source BS-VI fuel for testing new vehicles, from different refineries which are ready to produce higher-grade oil.

BS – IV vs BS – VI

- The main difference between BS-IV and BS-VI (which is comparable to Euro 6) is in the **amount of sulphur in the fuel**.
- BS-VI fuel is estimated to bring around an 80% reduction in sulphur content – from 50 parts per million (ppm) to 10 ppm.
- Another major difference is NO_x. BS-VI is expected to cut NO_x emissions from diesel cars by nearly 70% and from cars with petrol engines by 25%.

Particulate Matter (PM)

- PM or particle pollution is a mixture of small particles including black carbon, mineral dust, sulphate, nitrates, ammonia, sodium chloride, and liquid droplets in the air.
- WHO classifies particulate matter into two broad types - PM₁₀ and PM_{2.5}, indicating the diameter of the particles in microns.
- Chronic exposure to both PM₁₀ and PM_{2.5} can lead to cardiovascular and respiratory diseases, as well as lung cancer.
- PM_{2.5} can cause skin diseases and reduction in life expectancy. It can cross into the blood, causing damage in many organ systems, .
- In Delhi, the ground-level ozone and PM 2.5 play a significant role in formation of smog.



2.63 Ban on Petcoke

Why in news?

Union government had banned the use of petcoke and furnace oil in Uttar Pradesh, Haryana and Rajasthan.

What is Petcoke and Furnace oil?

- **Petroleum coke** or petcoke is a carbonaceous solid delivered from oil refinery coke units or other cracking processes.
- It is a bottom-of-the-barrel residue while refining crude oil, which is high-calorific value petroleum residue, helps to conserve natural resources.
- It is over 90 percent carbon and emits 5 to 10 percent more carbon dioxide (CO₂) than coal on a per-unit-of-energy basis when it is burned.
- It can contain vanadium, a toxic metal which is toxic in tiny quantities, 0.8 micrograms per cubic meter of air.
- It is a key input material for cement producers and a highly polluting fuel.
- It is sometimes a source of fine dust, which can get through the air passage and lodge in the lungs, causing serious health problems.
- **Furnace oil** - It is a dark viscous residual product used as a fuel in different types of combustion equipment.
- It is obtained by blending residual products from various refining processes with suitable diluents to obtain the required fuel oil grades.
- It is used in special applications such as
 - In marine engines and slow speed engines for power generation
 - For drying tea leaves
 - In gas turbines for power generation
 - As a feed stock for fertilizer manufacturing
 - In thermic fluid heaters and hot air generators.

What is the need for this move?

- When it comes to sulphur content, petcoke with 75,000 ppm (parts per million) is clearly one of the dirtiest fuels on earth.
- Even coal, the biggest contributor to greenhouse gas emissions, has just 4,000 ppm of sulphur.
- The demand for it shot up when global prices fell sharply after many developed countries chose to export the fuel rather than consume it.
- India's consumption of petcoke in 2016-17 stood at 23.25 million tonnes with imports accounting for a significant share of it.
- This move is taken as a part of the efforts to curb the suffocating level of air pollution in the NCR region.

What are the practical challenges with this move?

- Indian petcoke typically has high sulphur content as the refineries are tuned to refine the cheaper crude which is typically heavier and dirtier.
- The refineries have been improving the quality of petrol and diesel to meet the automotive emission norms over the years.
- For instance, Bharat Stage VI fuel will have just 10 ppm of sulphur as against 10,000 ppm in mid-1990s.
- Better quality petrol and diesel means higher sulphur content in residues such as petcoke.
- Making alternate products such as bitumen or value-adding petcoke by installing hydrogenation systems will involve large investments.
- Many public-sector companies have just created petcoke capacity at significant cost on seeing rising demand for the fuel.
- Refiners are investing lot of money to upgrade their processes to produce the cleaner BS-VI fuel.



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.

2.64 Understanding Air Quality Index

Why in news?

- National capital region smog pollution reaches hazardous levels.

What the Air Quality Index (AQI)?

- AQI is a number used to communicate to the public how polluted the air currently is or how polluted it is forecasted to become.
- As AQI increases, an increasingly large percentage of the population is likely to experience increasingly adverse health effects.
- Different countries have their own air quality indexes, corresponding to different national air quality standards.
- The AQI is most commonly used by Central Pollution Control Board (CPCB) to describe ground-level ozone levels.
- The classifications of air quality are part of a 6 grade, colour coded taking into account 8 pollutant levels.
- These pollutants are:
 1. Ground-level Ozone or O₃
 2. Particulate Matter (soot and dust) - PM 2.5 and PM 10
 3. Carbon Monoxide or CO
 4. Sulphur Dioxide or SO₂ and
 5. Nitrogen Dioxide or NO₂
 6. Ammonia or NH₃

How it is calculated?

- The pollutants in the affected air are given a weight based on a formula.
- That weight depends on the kind of impact it has on human health, each of the pollutants is given a weight.
- The worst of these weights is given as a composite air quality.
- So instead of giving six different numbers, six different colours, it throws up one single colour, one single number.
- The index will throw up one number which will be given to the public.
- People will know the health of their air quality based on this number and one associated colour code.

Colour	Level of Health Concern	AQI Values
Green	Good	0 to 50
Yellow	Moderate	51 to 100
Orange	Unhealthy for sensitive groups	101 to 150
Red	Unhealthy	151 to 200
Purple	Very Unhealthy	201 to 300
Maroon	Hazardous	301 to 500

2.65 Rising Light Pollution

Why in news?

Earth's artificially lit outdoor surface at night grew by about 2%, resulting in increasing light pollution.

What is light pollution?

- Light pollution, also known as photo pollution, is the presence of anthropogenic light in the night environment.
- It is exacerbated by excessive, misdirected or obtrusive uses of light, but even carefully used light fundamentally alters natural conditions.
- As a major side-effect of urbanization, it is blamed for compromising health, disrupting ecosystems and spoiling aesthetic environments.

What are the consequences of Light pollution?

- Light pollution has ecological consequences, with natural light cycles disrupted by artificial light introduced into the night time environment.
- Increased sky glow can affect human sleep
- In addition to threatening 30 percent of vertebrates that are nocturnal and over 60 percent of invertebrates that are nocturnal, artificial light also affects plants and microorganisms.
- It threatens biodiversity through changed night habits, such as reproduction or migration patterns, of many different species: insects, amphibians, fish, birds, bats and other animals."

What does recent data imply?

- Every year earth is getting brighter than earlier years; it underscores the concerns about the ecological effects of light pollution on people and animals.
- The rate of growth observed in developing countries was much faster than in already brightly lit rich countries.
- With few exceptions, growth in night time light was observed throughout South America, Africa and Asia.
- Light remained stable in only a few countries, although the researchers said the satellite sensor's blindness to some LED light may mask an actual increase.
- Eg. Australia's lit area decreased due to wildfires. Night time light declined in War-hit Syrian and Yemen.

What are the reasons of increasing light pollution?



- US National Oceanic and Atmospheric Administration weather satellite data may understate the situation because its sensor cannot detect some of the LED lighting that is becoming more widespread, specifically blue light.
- Experts had hoped the growing use of highly efficient LED lighting might lessen energy usage worldwide.
- The new findings indicate use of artificial lighting instead is growing, increasing energy demand.
- City transitions of its street lighting from sodium lamps to LED, indicates that savings in energy are being offset by either new or brighter lights in other places.

2.66 Rising danger of plastics

What is the issue?

- UN Environment Programme's Clean Seas Campaign called for a global ban on microbeads in personal care products.
- In India, recently The Bureau of Indian Standards (BIS) has classified microbeads as “unsafe” for use in cosmetic products.
- Increasing use of plastics and especially micro-plastics is developing into a major cause of concern for the environment.
- It is also getting dangerous as plastics are making way into the food chains of even birds, animals and fishes.

What are microbeads?

- Microbeads are **smaller forms of plastic**, no greater in size than 5 mm.
- Microbeads are added as an exfoliating agent to cosmetics and personal care products, such as soap, facial scrub and toothpastes
- Microplastic sources also include breakdown of discarded bags and plastic packaging, particles from vehicle tyres, synthetic fibres from textiles, etc.

What are the concerns?

- Microbeads escape the filtration and treatment processes for waste water and end up in sites of nature.
- This is resulting in significant global impacts on wildlife from marine environment pollution.
- World's coastal countries currently do not have the concerned recycling policies nor the technical capabilities, and so large quantities of plastic are not recycled and enter landfill.
- The durable properties of plastics make them persistent and slow to degrade in the environment entering the food chains.

2.67 Plastic roads in India

What is the issue?

India has a huge potential of using its plastic waste for laying plastic roads.

What are plastic roads?

- Roads constructed from mix of aggregate (sand and stone chips), bitumen and shredded plastic.
- The new material mix is reported to have superior binding.
- But plastic roads are quite the rage in the European Union which has taken on massive environmental conservation and pollution mitigation goals.

What is the status of plastic roads in India?

- India has already built some 21,000 miles of roads using plastic waste.
- The civic authority in Bengaluru has experimented with plastic roads building some 600 km of thoroughfare.
- The Centre even issued a set of guidelines for plastic blending in rural roads programme, the Pradhan Mantri Gram Sadak Yojana.
- Researchers in Tamil Nadu, has developed plastic blended water-resistant blocks, it can be used to line canals and other flowing water bodies.
- Plastic based roads are catching up in many other cities in India.

What are the advantages of plastic roads?

- Safer disposal of plastic is ensured than melting it down and releasing copious quantities of toxic fumes.
- It is a cheap input that could pull down road construction cost.



- Can be efficiently used for rural road building and smart city plans.
- The bitumen usage is cut because of plastic thereby reducing the carbon footprint of road construction.
- It has greater durability than asphalt-concrete roads because they don't absorb water.

2.68 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.

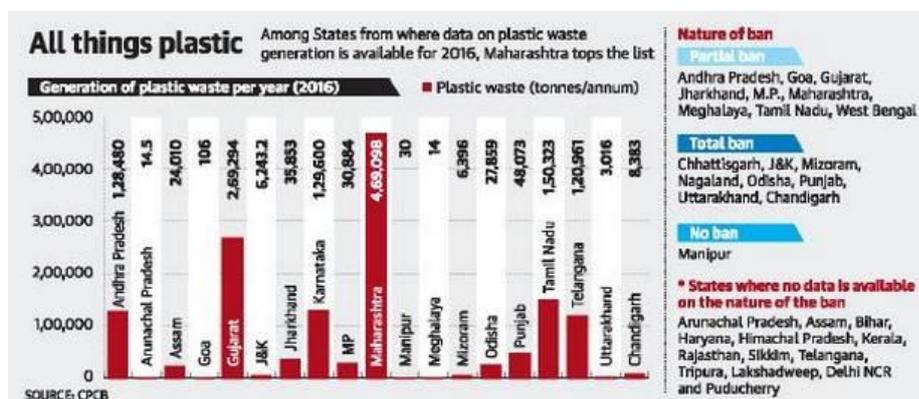
What is the countrywide status on plastic management?

- 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.

2.69 Plastic Waste Management – Indian Scenario

What is the issue?

- There is a need for coordinating and systematising the efforts for reducing the use of and the ban on plastic.

What is the need?

- India generates an estimated 16 lakh tonnes of plastic waste annually.
- Every piece of plastic ever disposed of is damaging the earth.
- Plastic persists in the environment for generations.
- A fraction of the plastic disposed of is recycled.
- But most of it eventually ends up in the ocean.
- It stays in the earth, floating in the ocean or in dump sites outside city limits.
- It may be broken down into microparticles and in the food chain.
- Plastic waste, mixed with organic and sanitary matter, reduces its recyclability drastically.
- The best way to reduce plastic pollution is to reduce and phase out its consumption.

What are the measures taken?

- India’s Plastic Waste Management Rules, 2016 specified some regulations.



- Ban- It called for a ban on plastic bags below 50 micron thickness.
- It also called for phasing out, within 2 years, of the manufacture and sale of non-recyclable, multi-layered plastic.
- Following this, more than 20 Indian States have announced a ban on plastic bags.
- Bengaluru announced a complete ban on the manufacture, supply, sale and use of thermocol and plastic items.
- This was irrespective of thickness, and included carry bags, banners, buntings, flex, flags, plates, clips, spoons, etc.
- The exceptions are plastic for export, packaging material for use in forestry, milk packets and hospitals.
- There are stiff fines that cover manufacturing and disposal.
- However, Central Pollution Control Board (CPCB) report highlighted that this ban was barely effective.
- Companies - The responsibility for collection of used plastic and multi-layered plastic sachets lies with producers, importers and brand owners.
- The onus of disposal and recycling of products and materials is with producers, rather than on taxpayers and governments.
- Companies should have already submitted plans, in 2016, for waste collection systems.
- This is based on extended producer responsibility (EPR).
- It could be done either through their own distribution channels or with the local body concerned.
- However, none of this has happened at any perceivable scale.
- Companies say that plastic waste is too complex or pretend to be completely unaware of these rules.

How to address this?

- Citizens need to be made aware of these rules for better implementation.
- Governments need to work with citizens to collect fines in case of violations.
- Mandatory segregation and recycling of plastic waste must be implemented before it is eventually phased out.
- Companies - Companies need to be held accountable in terms of their environmental and social responsibilities.
- Several companies produce the same type of packaging.
- So, instead of each collecting and recycling only its own packaging, companies can collectively implement EPR.
- Geographically dividing a region into zones and handling the waste generated could be an option.
- This also reduces collection, transportation and recycling costs.
- Segregation - In order to realise the potential for recycling, waste must first be segregated at source.
- This includes separation of dry (plastic, paper, metal, glass) and wet (kitchen and garden) waste at source.
- Research - There should be research on waste generation quantities and trends.
- It should also contribute to find innovative alternatives to plastic.
- There is also a need for strategies to deal with the plastic that has already been disposed of.

2.70 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.

2.71 Fire in Bellandur Lake

What is the issue?

- Bellandur Lake in Bengaluru saw a major fire.
- The lake exemplifies the larger woes that plague our urban clusters.
- The ever surging foam & pollutants in Bellandur Lake in Bengaluru has triggered much debate.
- The lake is just one of the many victims of our reckless hazard urban planning & development.

What is the status of Bellandur Lake?

- Spread over 906 acres in south-eastern Bengaluru, Bellandur Lake is the city’s largest lake with a catchment area of nearly 279 sq km.
- The dramatic growth of Bengaluru over the last two decades has led to massive amounts of domestic and industrial waste flowing into the lake.
- Encroachments of over 90% of its catchment area by settlements, and the dumping of garbage on its shores, have throttled the flow of water into it.
- All this has rendered the lake highly polluted and killed its biodiversity over time due the insane levels of toxicity.
- The lake’s water is currently unusable even for irrigation, and the lake’s surface is infamous for gigantic froth clouds that cover its entire surface.

What is the problem with Bellandur Lake?

- During rains, the stinking froth and foam rises as high as 10 to 12 feet from Bellandur.
- It spread onto the streets, endangers traffic and enters shops and homes across the road, causing huge inconvenience to those living in the area.
- This is due to a mix chemicals and untreated sewage mixing in the lake.
- A few months earlier, the area was engulfed in smoke as garbage dispersed around the lake was set ablaze.



- In 2015, the lake itself was on fire, creating enormous fear and anxiety in the minds of the people.
- The Central Pollution Control Board - (CPCB) had opined that the sustained inflow of untreated sewage and industrial effluents as the principal forces behind the phenomena of froth and fire.
- Out of 480 million litres per day (MLD) of wastewater discharged to the lake, only 308 MLD is treated.

What caused the current fire?

- Recently there was a massive fire that raged over a 5 acre area of the lake for several hours and required over 5000 fire-fighters to extinguish.
- The “Pollution Control Board (PCB)” suspects mischief in triggering the fire.
- But some experts have asserted that chemicals and large amounts of methane in the lake may have resulted in an accidental spreading over a vast area.
- Notably, the Lake has witnessed small occasional fires in the past too.
- Inflammable higher hydrocarbons and organic polymers from nearby industries is the main culprit in fuelling the fires.
- Additionally, the large-scale frothing and vegetation (which causes methane formation) is due to phosphorus from detergents used domestically.

What is reason behind phenomenon?

- As untreated sewage finds its way to water bodies, it feeds the excessive growth of water-weeds (like hyacinth in Bellandur), which blankets the entire water surface.
- There two inter-dependent phenomenon that arise out of this.
- **Eutrophication** - Excessive presence nutrients in a body of water, which causes a dense growth of plant life is called eutrophication.
- This also leads to the excessive growth of microbes (that eventually decompose organics) which in turn increases the Biological Oxygen Demand (BOD) and depletes the dissolved oxygen content.
- Depletion of dissolved oxygen kills aquatic life.
- **Foam Formation** – when organic matter naturally breaks down, it releases fatty acids that float to the surface.
- These act as natural surfactants, facilitating bubbles formation which often persists for a long time resulting in a foamy surface.
- Also, most surfactants in Indian detergents are not biodegradable and end up in the untreated sewage mix as potent foam generators.

How did the US deal with foaming in their lakes?

- **Surfactants Control** – In the late 1950s in the US - lakes, rivers, and sewage treatment plants experienced foam formation, caused by synthetic laundry detergents.
- Now, the foaming agent of all detergents in the market is legally bound to be biodegradable in the US.
- Hence, quickly lose their ability to cause foaming and are unable to produce long-lasting foam.
- **Nutrient Regulation** – The problem of excessive nutrients in water was first identified when Lake Erie, on the US-Canada border, turned green due to algal bloom.
- It is phosphorus in detergents entering wastewater acts as a nutrient that promotes the growth of water plants.
- Both countries rapidly responded with an international treaty in 1970 which, has since 1973, limited the phosphorus content in their detergents to a maximum of 2.2 per cent.

2.72 Waste Management

What is the issue?

- A landfill collapse in Ghazipur, UP, has killed two people and caused injuries to many.



- The incident calls for addressing the problem of over-stressed landfills and adopting proper waste management techniques in cities.
- It demands a scientific approach to the problem, to keep check on any such tragedies in future and to capitalise through waste management.

What led to this tragedy?

- The Solid-Waste Management Rules, 2016 prescribes certain conditions for landfill sites:
 1. a landfill site must not exceed 20 meters in height.
 2. it must not be older than 22-25 years.
 3. it must have a clay-lining at the bottom to save the land and ground water.
- As against these specifications, the Ghazipur dump-yard is 50 metres high and almost 33 years old.
- The other two un-engineered" dumping grounds in Delhi include Okhla and Bhalaswa sites.
- Experts say that Ghazipur, Okhla and Bhalaswa could not be called "landfill sites" but just "dumping yard", as they do not follow the prescribed norms.
- Joint-efforts of rains, fire and excessive pressure due to running out of space led to the recent collapse of the site.

What is desired?

- The Ghazipur tragedy calls for solving the unending waste management problems in Indian cities.
- The 'un-engineered' dumping sites in the name of landfills should be transformed into "**decentralised processing centres**".
- ex: Bio-methanisation plant could be an option.
- These centres should carry on **segregating waste at source** into recyclables, organic wastes and toxic wastes.
- Non-profits and educational institutions could be roped in to engage in **public awareness** campaigns.
- Rather than having a one-size-fits-all approach, the waste problems of urban India should have a **region centric approach** based on the needs, demands and resources.

How is waste management approached in India?

- The reality is that except for few Indian cities, most of the cities only '**dump**' waste and not '**manage**' them as such.
- Solid Waste Management Rules, 2016 are hardly being followed by the cities.
- National records reveal that out of the collected 80% of the generated waste, only a mere 28% is being processed.
- Urban local governments leave the task of value extraction to the informal system of garbage collectors and recyclers.
- These informal systems are inefficient in recovering resources in discarded materials as they are just dumped.
- Moreover, the Swachh Bharat programme, intended to address all these, focuses too narrowly on individual action rather than a collective systematic approach.

Why is waste management so important?

- The volumes of wastes generated are estimated to grow in the coming years.
- A mere shifting of collected waste from the cities is increasing the **pressure on the suburban areas**.
- Moreover the **stench** from the landfill is a serious cause of concern for the people living in the colonies adjacent to it.
- It is also being the cause for many deadly **diseases** like tuberculosis, typhoid, dengue, malaria and encephalitis.
- Further, the methane gas produced by bio-degradable waste causes **fire**, and people are the forced to inhale the poisonous gases from the **smoke** emitted.
- Additionally the unregulated use of **plastics** is polluting the rivers, lakes and sea, and is being ingested by cattle feeding on dumped refuse.
- All these firmly increase the need for addressing the issues with waste management.



What should be done?

- Tonnes of waste generated should necessarily be treated as a **potential resource**.
- **Segregating the waste** at the source into dry and wet is a prerequisite for adopting a scientific mode of waste disposal.
- The wet waste or organic refuse can be used for **composting** or production of **methane** for household use or power generation, and the dry waste can be sent for recycling.
- Furthermore, the municipal bodies should adopt an **integrated system** for transporting and very importantly scientifically **processing** the waste segregated at source.
- India should also make some **regulations** on the use of **plastics**.
- Central Pollution Control Board should undertake periodic assessments of the preparedness of urban local bodies in this regard.
- Above all, managing waste also requires a behaviour modification among citizens and institutions.

2.73 Ecological Impact of Coal Transportation - Goa

What is the issue?

- Ideas for reducing the ecological footprint of coal are majorly focused at the mines level.
- Pollution caused by the transport of coal hasn't got the deserved attention.

What is Goa's case?

- Coal is mainly imported into India at Marmugoa port (Goa) from Australia, Indonesia and South Africa.
- Goa Pollution Control Board's 2015-16 report, states that the PM10 reading of Mormugao port exceeded permissible limits.
- Official records also show that coal in excess of permissible limits is being handled at the Mormugao port.
- This coal is mainly used up in steel plants of Karnataka and transport happens by road or rail.
- 34,200 tonnes of coal is transported each day through the rail route from the Marmugoa to various destinations in Karnataka.
- The nearly 400-km journey of this fossil fuel has been found to have profound ecological impacts and is risking habitations.
- Coal dust has also pushed up incidents of respiratory disorder and is threatening fragile forests, paddy fields, streams and rivers.

Renewable and Clean Energy

2.74 Clean Energy for Rural Economy

What is the issue?

- Lack of access to electricity remains a huge barrier for rural businesses.
- It is high time that the potential for clean energy innovations is tapped effectively.

What is the dire need?

- The rural economy is underserved by existing electricity sources.
- It relies on human labour or fossil fuels such as diesel.
- It thus affects livelihood through various income-generation opportunities.
- Clean energy innovations for agriculture and non-farm micro-enterprises could help.
- It can complement the government's electrification strategy which is more household-oriented.
- This can be achieved by leveraging distributed renewables coupled with energy efficiency.

What are the concerns in agriculture?

- About 40% of the agriculture produce is wasted before reaching consumers.
- The market value of the produce does not get reflected in the farmer's revenues.

- Moreover, their real incomes remain low because of rising cost of agri-inputs.
- These include seeds, fertilisers, pesticides, irrigation equipment and services, among others.
- These issues are amplified in the case of small and marginal farmers (86% of cultivators in India).
- The fragile economic condition makes them more vulnerable to the effects of climate change.

How can clean energy help?

- Innovative technologies could reduce input costs and deliver higher farm outputs, better market opportunity.
- These may include clean energy-based cold chain, seed sowing, fertiliser application, pesticide spraying, or irrigation.
- This will also aid innovations such as solar-powered milking machines, and charkhas (spinning wheels).
- In this context, just 3 activities have a total market potential of about \$40 billion.
- These are pesticide spraying, rice transplanting, and harvesting of grain crops.

How is the non-farm sector?

- The non-farm sector also suffers from lack of reliable electricity access.
- The enterprises include that on custom tailoring, food processing, poultry and livestock rearing, and hairdressing, etc.
- Lack of electricity has limited the number of non-farm activities undertaken in rural areas.
- These are indicative of the latent demand in India's rural non-farm economy.
- Clean energy-driven and energy-efficient machines could help meet existing demand.
- It can as well offer hope for addressing latent demand.
- The rural population could find more viable non-farm activities to supplement farm incomes.

What are the lacunae?

- Billions of dollars worth of market opportunities remains untapped.
- The path from concept to commercialisation faces technical failure and market failure.
- The deployment of these innovations at scale continues to be plagued by high upfront cost of distributed renewable low and fragmented rural demand paucity of long-term debt to end-consumers missing incentives to adopt energy efficient practices

2.75 Augmenting Offshore Wind Power

Why in news?

Ministry of New and Renewable Energy (MNRE) has recently declared revised targets for offshore wind power capacity addition.

What is the recent move?

- The National Off-Shore Wind Policy was notified in 2015.
- The recently firmed up offshore wind power target is 5 GW by 2022 and 30 GW by 2030.
- MNRE had earlier invited Expressions of Interest (EoI).
- This was for the first 1 GW offshore wind power plant off the Gujarat coast.
- About 35 major players, global as well as local, in the offshore wind energy sector responded.
- The National Institute of Wind Energy (NIWE) is designated the official agency to develop offshore wind power.
- Challenge - There are difficulties in installing large wind power turbines in open seas.
- As, offshore wind turbines are of much larger dimensions and capacities than onshore turbines.

What are the relative advantages?

- Offshore wind power requires a higher initial cost.
- However, it has several benefits over its onshore counterpart.
- Power output from these plants is steady, almost free from interruption.
- In fact, it tends to increase a bit in the evenings to coincide with peak consumer demand.



- Per unit power production is relatively high and the maintenance cost is low.
- India also has a strong wind power equipment manufacturing base, although it needs a revamp.
- Importantly, offshore windmills do not need land.
- So, land acquisition, a major challenge for most terrestrial infrastructure projects is ruled out.
- Offshore wind power is, therefore, ideally suited for a land-short country like India.

What are the prospects?

- **Potential** - Preliminary studies have shown good wind potential in both southern tip of the Indian peninsula and the west coast.
- There is substantial scope off the coasts of Tamil Nadu, Gujarat and Maharashtra.
- **Global** - Globally, 17-18 GW of offshore wind power has been installed.
- UK, Germany, Denmark, Netherlands and China are the leading countries.
- There has also been a fall in offshore wind tariff in the recent years in some of these markets.
- Investment - Government has assured a level-playing field to all investors, domestic and international.
- There is thus a favourable power tariffs and policy environment for private investment.
- **Cost** - There is constant inflow of new cost-cutting and output-enhancing technologies.
- This would improve the sector's competitiveness as against the conventional power sector.
- This is expected to sustain the economic viability of these ventures.

2.76 Hurdles in Realising Roof Top Solar Plants

Why in news?

- Union government is working on a “rent a roof” policy to support its plan to generate 40 GW of solar power by 2022.

What is “rent a roof” policy?

- Under the policy, a developer will take rooftops on rent and will offer lease to each household, and then feed the solar power to the grid.
- This policy works under net-metering system, by which a consumer is only billed for the electricity consumed after deducting the power generated from one's solar rooftop panels that is supplied to the grid.
- Union government aims to give the discoms financial incentives for every MW of rooftop capacity created in their area of operation.
- However, to avail themselves of incentives, discoms should create the capacities through tariff-based competitive bidding.
- The proposed scheme seeks to shift the game from captive players to energy companies (independent power producers, or IPPs).

What are the hurdles?

- Most of the discoms in India are State government-owned and are hesitant to take up such projects due to of their nature of self-protection from instant financial turmoil.
- These companies have refused to buy any surplus power from them.
- Therefore, factories and commercial establishments, like shopping malls, put up only as much rooftop solar capacity as would satisfy their demand, even if they have the space and wherewithal for more.
- As for individuals, rooftop solar has are not being attractive proposition as there is no clear government policy stand on installation and maintenance of roof top solar plants.
- There is also absence of policy direction on ‘net metering’, which would allow owners of captive rooftop plants to sell surplus power to the grid.
- In a tariff-based competitive bidding scenario, individual and small producers will be at a disadvantage.
- Competitive bidding process would also culminate in a power purchase agreement and a PPA is not particularly appropriate for a sell-only-surplus situation



2.77 Re-modeling our DISCOMs

What is the issue?

- Disruptions in technology, regulations, and business models are forcing power distribution companies (DISCOMs) to take stock of their future.
- DISCOMs need to get innovative and redesign their tariff structure and business model to tide over this impasse.

What are the problems in plaguing the Indian DISCOMs?

- Indian DISCOMs are financially strained - at the end of FY16, total outstanding debt was Rs 4,146 billion and annual losses were Rs 657 billion.
- There are significant challenges in the sector that demonstrate how short-term measures will not suffice to hold off the long-term collapse.
- **Purchase agreements** - 75-80% of a DISCOM's costs are in power purchase and many are locked into expensive agreements (PPAs) for decades.
- Improper planning, and technical constraints in operating the grid, has been costing as much as Rs 200 billion annually.
- **Cross Subsidisation** - DISCOMs charge "commercial and industrial (C&I) consumers" very high tariffs.
- This is to compensate for subsidies provided to residential and agricultural consumers, for whom tariffs are kept artificially low for political reasons.
- High tariffs combined with unreliable supply have rendered Indian industry uncompetitive in global markets.
- To counter this, industries were forced to build capacity for captive electricity generation – which accounted for as much as 17% of all DISCOM sales in Fy17.
- Notably, C&I consumers currently have new options for distributed generation of renewable energy - like installing solar systems in their premises.
- Hence, by charging exorbitant tariffs and providing unreliable power supply, DISCOMs will eventually drive away their best paying consumers.
- **Government Initiatives** - "Power for All, Make in India, and speedy deployment of renewable energy" are further complicating the sector's woes.
- There is a need for DISCOMs to rethink their business models and reorient towards a more sustainable future.

What is the way ahead?

- **C&I Consumers** - Make in India, as conceived, has a focus on high value-add sectors such as electronics and ICT, aerospace, and defence manufacturing.
- Additionally, a vast majority of the MSMEs (which are mass employers) too are dependent on electricity for their production processes.
- Considering India's growth rate, there is hence a need for higher electricity-intensity and improved reliability for units.
- A rationalised tariff structure would help to retain existing consumers and draw in new market entrants for DISCOMs.
- **Power for All** - This is dependent on many factors that range from engineering and execution challenges like:
 - Electrifying 3.3 million household per month.
 - Ensuring that reliable and regular power is supplied
 - Metering and billing the consumption effectively.
- For DISCOMs, addition of these new consumers will be saddled with more financial burden due to the subsidies that they'll have to be provided.
- Agricultural and residential consumers together account for 50% of the sales volume but only 30% of the revenue.
- But there are indications that a considerable chunk of the rural masses are willing to pay higher for uninterrupted and quality power supply.
- To cater to this aspiring group of consumers, DISCOMs have to reduce power procurement costs and upgrade their infrastructure.
- **Renewables** - New renewable energy projects offer hopes for reducing costs and increasing revenue for DISCOMs.
- Renewable energy is also important for India's battle against climate change, and the full potential of this domain needs to be exploited.
- Private roof-top installations have started producing significant amounts of power lately, but DISCOMs are largely seeing this trend negatively.



- DISCOMs see individual generators are predated their revenues, which needs to change by co-opting them with a more positive approach.
- Notably, these private generators produce and consume at the same time and are charged based on a two-way metering which indicates net power intake.

2.78 National Biogas and Manure Management Programme

- The government has fixed an annual physical target of setting up 65,180 biogas plants for the current year 2017-18 under the NBMMP.
- It aims at setting up of family type biogas plants for providing biogas as clean cooking fuel and a source of lighting.
- The slurry produced from biogas plants as a by-product is an organic bio-manure for enhancing crop yield and maintaining soil health.
- It helps in reducing the environment degradation and prevents the emissions of Green House Gases (GHGs) such as Carbon Dioxide (CO₂) and Methane into the atmosphere.
- About 49.6 lakh household size biogas plants already installed under the programme
- In Tamil Nadu new biogas plant designs were introduced under the NBMMP such as floating design Shakti Surabhi Model, Solid-State Deenbandhu design model of biogas plants.

2.79 Issues with the Electric vehicles

Why in news?

- Electric vehicles (EVs) seem to be gaining in prominence as part of the renewable energy zeitgeist
- The government's stress on clean energy is commendable but it should let the market decide the winning technology

What is the background of the issue?

- In May, Nagpur became the first Indian city to have an electric car fleet with about 100 EVs.
- The state-run power giant NTPC set up its first EV charging stations in Delhi and Noida.
- Importantly, these are not isolated initiatives; they are underwritten by broader policy shifts.
- Power ministry has announced that government officials and agencies will soon be using only EVs, Public buses are also expected to go electric.
- Niti Aayog, has already put out a road map for India's mobility transformation that has three core elements: "shared", "electric", and "connected".
- The goal, according to the power ministry, is to have no diesel or petrol car sales in the country by 2030.

What are the Pros and cons with the initiative?

- Mainstreaming electric vehicles will require an overhaul of the country's energy and transport infrastructure.
- For example, EV charging stations will have to be set up on a war footing, and electricity generation will have to improve significantly.
- EV technology (especially the battery) will have to become much cheaper before it can perform well in a price-sensitive market like India.
- If these challenges can be tackled effectively and India can leapfrog to EV technology, then of course, the benefits to be had are numerous.
- According to the Niti Aayog report, switching to EVs as part of the larger "shared, electric, and connected" mobility paradigm will cut India's energy demand by 64%, its carbon emissions by 37%, and save the country \$60 billion in energy bills by 2030.

What is issue with government's strategy?

- Niti Aayog recommends that to push EVs, the government must subsidize the EV industry while penalizing conventional cars.
- It calls for lowering taxes and interest rates for loans on EVs while limiting the sale and registration of conventional cars, and using taxes from diesel and petrol car sales to create electric charging stations.



- It also suggests the government open a battery plant by the end of 2018.
- The Ministry of power has claimed that the plan is to let market forces decide how the EV industry will shape up and that the government is only offering a helping hand until the industry can find its feet.
- The issue is the kind of support the government is offering.
- For instance, hydrogen-powered fuel cells offer an equally eco-friendly option.
- Both lithium-ion and hydrogen fuel cells are zero emission, and the hydrogen-powered fuel cells can in fact be recharged faster.
- They also give more mileage than the lithium-ion batteries commonly used in EVs today.
- Certainly, fuelling stations for hydrogen-powered fuel cells are much more expensive,
- But in that case, there is no greater push for CNG vehicles.
- They are cheap, almost as clean as EVs, and the related infrastructure is already in place.
- The government has made its choice, it is choosing only the winning technology which is globally growing.

Environmental Impact Assessment

2.80 Environmental Clearance for Neutrino Observatory

What is the issue?

- India-based Neutrino Observatory (INO) is proposed to be established in the Tamil Nadu section of the Western Ghats for furthering research.
- As the site is being mapped in an eco-sensitive, environmental clearances and other compliances are to be strictly adhered to.

What is the INO project?

- India-based Neutrino Observatory (INO) is a particle physics research project to primarily study the elusive sub-atomic particles called neutrinos.
- A neutrino (ν) interacts only via weak short range subatomic forces and gravity, which makes it very hard to detection it.
- Neutrinos typically pass through normal matter unimpeded and undetected, and its rest mass is almost zero (1 millionth of an electron).
- 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 ft) below the Western Ghats stretch near Theni for establishing the research site.
- The site will underlie more than 1000 meters of overhead rock that will effectively shield it from natural cosmic radiation from outside.
- The observatory is said to symbolise India's quest for research in particle physics and demonstrate intent to nurture centres of excellence.

Has environmental clearance been secured?

- The project has become controversial as the proposed site lies close to the Mathikettan Shola National Park, which is a biodiversity hotspot.
- About a year ago, the National Green Tribunal (NGT) had suspended the environmental clearance granted to the INO.
- But recently, the NGT verdict on the Rs. 1500 crore project was overturned and has been cleared by the Union Environment Ministry as a special case.
- The approval is only conditional and it needs the consent of the Tamil Nadu Pollution Control Board and the National Board for Wildlife.
- The Expert Committee had laid down 17 conditions for granting approval, but the clearance process was shabby and needs to be bettered.

What are the problems with the environmental clearance?

- The approval was done under category B of the Schedule to the "Environmental Impact Assessment" (EIA) Notification, 2006.



- But it should have been ideally been treated as category A as the project lies just 4.9 km from an eco-sensitive national park.
- Additionally, EIA was done by the Salim Ali Centre for Ornithology and Natural History, which is an “unaccredited agency”.
- While the project is indeed important, treating it as a special case to bypass the environmental clearance protocol sets a wrong precedent

2.81 River Linking Plan Challenges

What is the issue?

- Union government is planning for a large scale river linking plan.
- Several issues must be sorted out first before the plan is taken up.

What is the river linking plan about?

- The Union government is all set to begin work on an estimated \$87 billion plan to connect around 60 of India's largest rivers.
- Work is now set to link the Betwa and Ken rivers which pass through Uttar Pradesh and Madhya Pradesh
- Once complete, it is expected to help end farmers' dependence on fickle monsoon rains, bring millions of hectares of cultivable land under irrigation.
- It will also help generate thousands of megawatts of electricity.

What are the challenges for the project?

- **Constitutional Mandate** - Water is listed as entry 17 in List II of the Seventh Schedule of the Constitution.
- While the government has initiated discussions to bring the subject under the concurrent list, it may not be an easy task to achieve.
- If there are changes in the political dispensation in various States, the government in a State that is upstream may refuse to share water with downstream States.
- **Water resource accounts** - This will provide an accounting framework that enables the integration of specialised physical resource sector data with other information on the economics of water supply.
- India is technically poor with respect to data related to the water sector.
- Unlike other countries, the Central Statistics Office has neither attempted nor funded studies to gather data on water tables at an all-India or State level.
- The absence of a well-informed water policy reflects a knowledge governance gap.
- **Agricultural commitment**- There is a dearth of studies in the Indian context unlike other countries addressing the water resource gap by analysing water flows embodied in agriculture products.
- At a sub national scale, Virtual Water flows are not consistent with relative water scarcity.

What needs to be done?

- The government should pay more attention to its ‘more crop per drop’ mission, and to what extent Indian agriculture follows this practice.
- Water resource accounting makes it possible to capture direct, indirect and induced water demand in the process of economic production.
- It needs to be carried out at all the major crops at sub national levels is a must for efficient planning of a scarce resource such as water.
- A full-fledged architecture to solve water sharing disputes between states is needed.

2.82 Inter-Linking of Rivers

What is the issue?

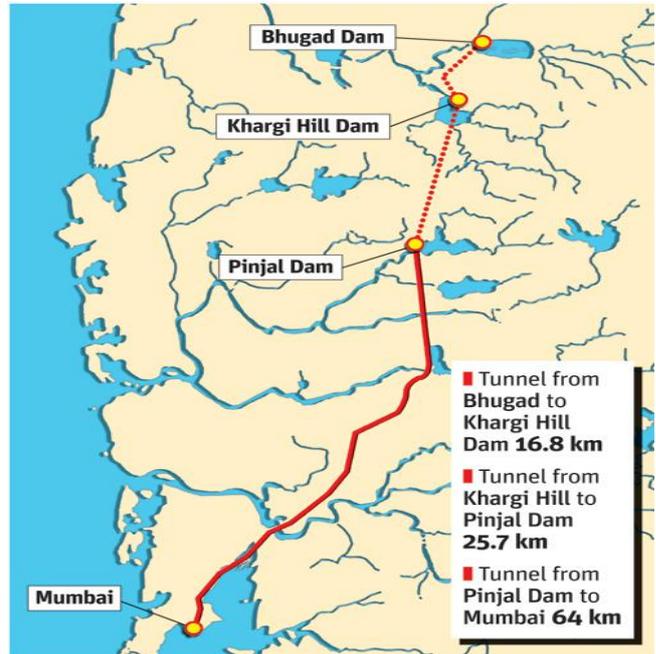
- The Special Committee for Inter-Linking of Rivers has recently submitted its progress report.
- In this backdrop it is essential to understand what interlinking seeks to achieve.

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?

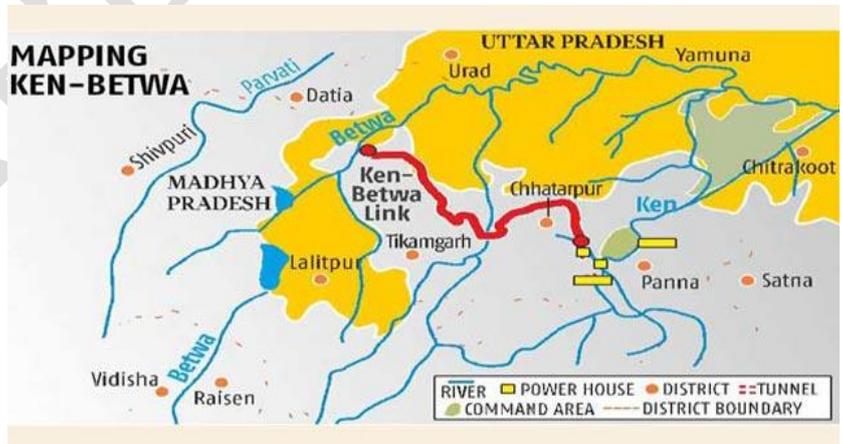
- A national water grid aims to connect various surplus rivers with deficient rivers.
- It aims to transfer excess water from water-rich to water-deficit regions.
- This is to help improve irrigation, increase water for drinking and industrial use.
- Mitigating drought and floods to an extent are also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

1. Ken-Betwa
2. Damanganga-Pinjal
3. 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 Khargihill 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.

Disaster Management

2.83 Mumbai's Infrastructural Challenges

What is the issue?

- Mumbai being one of the largest city faces various infrastructural hurdles to address natural calamities.
- Proper Infrastructure measures needs to be taken to address such issues in near future.

What are the challenges faced by Mumbai?

- Mumbai is an efficient city in some ways, but this reputation depends on fair weather, It turns into a soggy mess with the arrival of a monsoon.
- Mumbai is yet to be prepared, after the passage of a dozen years, to meet a disaster such as the July 2005 flooding caused by 99.4 cm of rain in a 24-hour period.
- Recently a spectacular collapse of a pedestrian bridge on a crucial railway line in Andheri, caused injuries and overall urban paralysis.
- This incident has happened within a year, since the ghastly stampede on a foot overbridge at Elphinstone Road station, that took over 20 lives.

What are the reasons behind such issues?

- The recurrent disasters involving infrastructure are proof of the indifference among policymakers to the city's needs, even as they speak of a 'global standard' of living.
- The city continues to attract a large number of people looking for opportunity the population rose from 11.9 million in 2001 to 18.4 million a decade later.
- Half of the poor population in Mumbai did not consider moving out of flood-prone areas, because of the uncertainty of living in a new place with severe social disruptions and reduced access to education and health facilities.
- At the same time urban managers have not invested enough in new infrastructure and have done a shoddy job of maintaining the old.
- According to one estimate, the city's Mithi river, blocked by debris and garbage, has lost about 60% of its catchment to development.

2.84 Monsoon and Lightning

What is the issue?

- In recent period, certain states of India witnessed a worrying number of lightning related deaths.



- It is essential in this backdrop to understand the association between lightning and monsoon, if any.

How has rainfall distribution been?

- It is roughly a fortnight since the start of the South-West monsoon.
- India has recorded nearly 55 mm of rain.
- This is 16% more than what is usual for this time of the year.
- The bulk of it has been over south and central India.
- The north-eastern States has so far registered a 24% deficit.

What is IMD's prediction?

- After an early onset and quick advance, the monsoon has stalled and will remain so for at least a week.
- However, several parts of north-eastern India are expected to receive substantial rain.
- Because the southern branch of the monsoon has stalled.
- It is causing heavy rain in Goa, coastal Karnataka and Kerala.
- These have seen 44 cm, nearly 49% more than what it gets in the first fortnight of June.
- This has led to widespread havoc.

How has lightning activity been?

- This year saw nearly 300 deaths due to lightning in UP, Bihar, Jharkhand and WB.
- This was however in May which is not a monsoon month.
- Because of unusual convective activity, Andhra Pradesh in April recorded nearly 36,000 lightning strikes in a single day.
- Typically that is what the State suffers in an entire pre-monsoon month.
- Despite all that lightning, no more than 10 deaths were reported.
- Therefore, even pre-monsoon rain can contribute to massive cloud buildups and trigger widespread lightning strikes.
- Thus, there is no one-to-one link between the strength of the monsoon in one year and lightning deaths.
- 2,000-2,500 deaths occurring due to lightning annually is 'normal,' as per the NCRB figures.
- It is thus early to understand if this year has seen an unusual spike.

Why is lightning a serious concern?

- Lightning is the leading cause of accidental deaths in India attributable to the forces of nature.
- Nearly 25% of accidental deaths attributable to natural causes were due to lightning.
- That lightning strikes disproportionately affect the poor is also a fact.
- So poorly built houses, staying out in the open, being in places that aren't properly electrically insulated, etc are some driving factors.
- The mere fact of working in open fields substantially increases the risk of death from lightning.

What is the challenge in early warning?

- Lightning and thunderstorms are an extremely 'local' phenomenon.
- The impact spreads no more than a few kilometres.
- Also they tend to occur rather suddenly and are therefore beyond the range of the weather radars.
- However, it is possible for the meteorological department to warn of the likelihood of thunderstorms and lightning.
- This can be given for a district or a city, about a day in advance.
- But street-level or area-wise accuracy is a tough challenge.

2.85 Cyclone Ockhi - Disaster Management

What is the issue?

- Cyclone Ockhi that struck the Kanyakumari district in Tamil Nadu and parts of Kerala has left many fishermen dead and about a thousand of them missing.
- The large-scale loss of lives and livelihood has raised serious questions about disaster management and government response.

How was the disaster response?

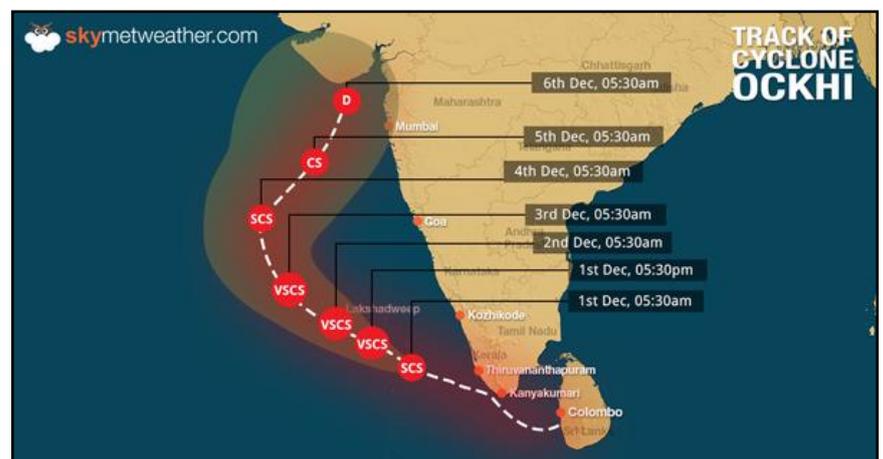
- There are three basic shortfalls in the government's response:
 - i. the cyclone warning was delayed
 - ii. the warning, when it came, was ineffective because it could not be communicated to thousands of fisherfolk who were already out at sea
 - iii. once the cyclone struck, there was no war-like mobilisation and action for rescue operation
- Moreover, the response from the Coast Guard and the Indian Navy was very poor, as per the fishermen reports.
- The seaborne vessels and helicopters and vast array of ships, aircraft and state-of-the-art technology if deployed would have prevented loss of so many lives.
- Coast Guard ships accompanied by fishermen from the villages as navigation assistants would have made easier the search process.
- This was not carried out, and even when the Coast Guard did, it only went up to about 60 nautical miles.
- It was reluctant to go beyond citing jurisdictional limitations.
- The Disaster Management legislations, policies and mechanisms largely failed in making proper response in saving the lives, thus aggravating the disaster.

Why is Kanyakumari more vulnerable?

- **Fishing** - Kanyakumari district in Tamil Nadu has one of the highest densities of fisherfolk in India.
- Given the limited quantity of fish in nearshore waters, many fisherfolk have diversified into deep-sea and long-distance fishing.
- Their fishing voyages sometimes last from ten days to more than a month.
- Thus, the Indian Meteorological Department's timing of cyclone warning just 12 hours before it hit the coast was futile.
- Moreover, there are limitations for deep sea fishers in using satellite phones and other devices to facilitate boat-to-shore communications for security reasons.
- **Geography** - How early the forecast is depends on how far the coast is from the place where the cyclone is emerging.
- Many of the big cyclones like Phailin, Hudhud and Vardah developed near the Andaman Sea from where it took about five to six days to hit the coast.
- But Ockhi originated near the south-western coast of Sri Lanka, and travelled very near the southern-most tip of the Indian mainland.
- The origin of the cyclone much closer to the Kanyakumari coast rendered the lead time for the forecast much less.

What lies ahead?

- Compensation to the victims requires the combined efforts of the Central and State governments.
- Climate change is resulting in changing weather patterns and coastal areas will need to adapt to hitherto unknown conditions, especially frequent storms.
- Disaster warning mechanism thus needs a revamp and quick-response systems should be put in place.
- The state government should certainly improve its communication systems.
- The Met department needs to become more people-friendly and learn to issue jargon-free advisories.





- Further, forming a separate Fisheries Ministry to address the issues associated with the fishermen community could prove to be a better administrative response.

2.86 Quake Prone Indian Cities

What is the issue?

- According to the National Centre for Seismology (NCS), 29 Indian cities and towns, including Delhi and capitals of nine states, fall under "severe" to "very severe" seismic zones.

How zoning is done?

- The Bureau of Indian Standards (BIS) has classified different regions in the country into zones II to V, taking into consideration earthquake records, tectonic activities and damage caused,
- The NCS, which records earthquakes and carries out studies pertaining to micro-zonation of cities, comes under the India Meteorological Department (IMD).
- The NCS has also carried out micro-zonation of cities like Delhi and Kolkata to study the possible impact of earthquake in these mega cities.
- Seismic micro-zonation is the process of subdividing a region into smaller areas having different potential for hazardous earthquake effects.

What are the available zones?

- Zone II is considered the least seismically active, while Zone V is the most active.
- Zone IV and V fall under "severe" to "very severe" categories respectively.
- Zone V includes the entire northeastern region, parts of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, the Rann of Kutch in Gujarat, parts of north Bihar and the Andaman and Nicobar archipelago.
- The Himalayan arc, stretching from the upper Assam region to Jammu and Kashmir, is known to be a high seismic zone.
- Parts of Jammu and Kashmir, Delhi, Sikkim, northern Uttar Pradesh, West Bengal, Gujarat and a small part of Maharashtra fall under Zone IV.
- Delhi, Patna (Bihar), Srinagar (Jammu and Kashmir), Kohima (Nagaland), Puducherry, Guwahati (Assam), Gangtok (Sikkim), Shimla (Himachal Pradesh), Dehradun (Uttarakhand), Imphal (Manipur) and Chandigarh fall under seismic zones IV and V.
- The cities in the Indo-Gangetic belt fall within reasonable limits of the Himalayas. So repercussions are bound to be felt there

2.87 Floods - Disaster Response

What is the issue?

- Recent floods in parts of eastern and north-eastern India have left many dead and displacing thousands.
- This has increased the need for a massive capacity-building programme to deal with frequent, destructive weather events.

What actions are required?

- Protocols followed by **State governments to deal with floods** need an urgent review.
- Catastrophic events, such as the Chennai flood of 2015, necessitate a review of the protocol followed by State governments in controlling flows from dams and reservoirs.
- Some states have not been able to use **disaster relief funds** as intended.
- The Centre has asked states to set off the unutilised portion when making fresh claims which is unfair for people in urgent need.
- **Other actions** people need on the ground include short-term housing, food, safe water, access to health care and protection for women, children and the elderly.
- With neither **social support** nor **financial instruments** available to rebuild lives, alleviating financial losses of the victims is crucial for a return to normality.
- It is essential to look at the **public health** dimension as many without the coping capacity develop mental health issues including post-traumatic stress disorder in the wake of such catastrophes, and need counselling.

- A review of the deployment of **National Disaster Response Force** teams near water bodies is required.
- This is to be coupled with data compiled by the Central Water Commission, which identifies the hotspots where better management and perhaps additional reservoirs can mitigate damage.
- Given the unprecedented events like even drought-prone regions in Gujarat and Rajasthan encountering floods, governments' response is of crucial importance.

2.88 Mumbai Floods – An analysis

What is the issue?

Flooding seems to recur almost every year in Mumbai, with this year being particularly severe.

How does Mumbai's drainage network look?

- Massive underground sewers built during the colonial era dating back to 1860-1900 are impressive with some of it still in use, but is limited to South Mumbai.
- The suburbs of Mumbai are served mostly by open drains, into which tonnes of garbage are dumped each year by citizens.
- Pre-monsoon 'desilting' exercises are carried out every year, which has proved to be ever-inadequate.
- Much of these sewer networks flow several kilometres through congested localities before discharging into the sea, often through outfalls located below mean sea level.
- This means if it's raining heavily when the tide is sufficiently high, drainage is impossible.

How to deal with the Tides?

- The problem is that Mumbai's flood waters are simply discharged in the Arabian Sea through gravity.
- There are international examples of balancing reservoirs and deep tunnel systems for underground storage of flood waters to be pumped out later when the tides are low.
- Best practices also involve adopting and conserving rainwater within a catchment area itself, through local storage and recharging alongside filtration systems.

What is unusual about the current floods?

- Although, the rainfall was only one-third of the rainfall that caused the 2005 deluge, flood water failed to recede and the reasons remain much the same.
- Dozens of de-watering pumps for localised relief also suffered technical glitches, as conceded by the municipal commissioner.
- While, even after the highest tide had subsided, flood waters in many places did not recede, which is clear validation of clogged drains.

What are the problems plaguing Mumbai's drainage?

- **Insufficient Drains** – Although the drainage capacity of the entire city isn't impressive as such, experts have explicitly conceded that at least major roads and traffic junctions fall far short of the required.
- **Brimstowad Project** – After much delay this project got a go ahead, with resources being spent on measures such as standard operation protocol, better-equipped disaster cells and forecasting systems.
- Yet, incredibly, a range of long-term measures, accepted in principle, were left incomplete.
- **Contour mapping** - Although contour maps for drains were prepared it remains incomplete for the rest of the city.
- This means, although the prediction of the drainage flow is possible, there is no data point to predict how a river's flood waters will rush out.
- **Other Issues** - Recommendations to protect the Sanjay Gandhi National Park within the city limits, construct detention basins for flood water, demarcate flood-prone zones were never undertaken
- Also, recommendations to empower the Maharashtra Pollution Control Board to ensure compliance of environmental regulations by municipalities were never undertaken.



2.89 Assam Floods

What is the issue?

In Assam, floods have claimed more than 50 lives, nearly 18 lakh have been affected by it and most of the Kaziranga National Park was submerged.

How vulnerable is Assam?

- According to the **National Flood Commission of India (NFCI)**, about 40% of the state's area is flood-prone.
- The floods caused by the release of water in the Brahmaputra's upstream have become a common monsoon bane in Assam.
- **Human-made factors** have compounded this annual problem.
- After the North East Electric Power Corporation opened up its dams to release water from the Ranganadi Hydro-electric Project, the problems have compounded.

Why the problem still persists?

- Brahmaputra changes course frequently. So it is virtually impossible to contain the river within the embankments.
- Lack of proper policy formulation and implementation.
- Increasing instance of human encroachments.
- Even within Assam, agencies which should be working together to keep the floods in check, have operated along different lines.

What are the advantages of floods?

- Floods play an important role in maintaining key ecosystem functions and biodiversity.
- They link the river with the land surrounding it, fill wetlands, increase the connectivity between aquatic habitats, and move both sediment and nutrients around the landscape.
- For many species, floods trigger breeding events, migration, and dispersal. These natural systems are resilient to the effects of floods.
- Apart from the environmental benefits, flooding also helps the economy through increased agricultural and fish production, recharge of groundwater resources etc..

Is flooding a bizarre event in Kaziranga?

- The Kaziranga national park primarily consists of alluvial grasslands, woodlands, tropical moist mixed deciduous forest, and tropical semi-evergreen forest.
- It is basically a flood plain.
- Floods are the primary means by which it keeps its own health alive and that of the animals that inhabits it.
- Not having floods or stopping them will have disastrous effect on the park and its inhabitants.
- All wildlife are known to deal with the floods from time immemorial.

What constitutes to the unnatural death of animals?

- The main problem is the human encroachment on the flood plains.
- Wild animals tend to move to high grounds at the time of floods, but these high grounds surrounding the park are obstructed by land mafias.
- The animals attempted to reach the hills of KarbiAnglong by crossing the highway.
- This led to death of many by collisions with speeding vehicles on the highway that passes alongside Kaziranga.
- Many animals are killed by the opportunistic killing of those who come across these stranded migrating animals, mainly for their meat.

2.90 A Case Study of Forest Fire in Tamilnadu

Why in news?

A massive forest fire has happened at Kurangani forest on the Western Ghats in Theni district of Tamil Nadu.

What are the causalities of the recent forest fire?

- The Kurangani fire turned into a disaster as 36 trekkers were stuck on the mountains.
- With their regular trekking route cut off by the fire, many panicked and lost their direction.



- While a number of trekkers were injured in falls, as many as 16 persons lost their lives.
- In the immediate aftermath of fire, there is a temporary loss of food and shelter, causing displacement of territorial birds and mammals, upsetting the ecological balance.

What are the reasons of forest fire?

- Forest fires may be caused by different factors like natural causes, including lightning, but 99% of the fires in the forests are man-made.
- **Encroachers** - Attempts to encroach upon forest lands, renewal of pastures or regain agricultural land at the expense of forests.
- Fire caused by poachers and timber smugglers to destroy evidence of illegal activities or merely fire by miscreants or burning of waste in illegal dumps.
- **Act of Locals** - It is also suspected that the locals might set fire in order that there may be growth of fresh grass for their cattle, or to shift cultivation patterns on the hills.
- **Careless deed** - A smouldering fire, not stamped out properly, leftover by travellers, campers and picnickers.
- It can even might be of a spark that has escaped from a deliberate one on agricultural lands or from controlled burning elsewhere.

What actions needs to be taken to respond to forest fire?

- While fires rage in forests every summer and are controlled from spreading too far by forest officials running a fire line and shearing the land of any vegetation for a significant area.
- Better monitoring of reserve forest areas and keeping a close watch on fire-prone spots have been recommended.
- State government need to appoint temporary fire watchers for this purpose at the same time government need to take measures to fill the vacancies in the forest departments.
- Forest department should have a special unit of disaster management and rescue team to respond such incidents in near future.
- Thus minimisation of loss of life has to be prioritised by the respective governments as the forests fires have the tendency to change wildlife and human habitats.

2.91 Understanding the Basics of Forest Fire Mitigation

What is the issue?

- A massive forest fire at Kurangani forest in Theni district of Tamil Nadu has caused huge causality.
- This tragedy raises several issues of approaches in fighting fires and ways of mitigating damage.

What are the available approaches in addressing forest fire?

- **Controlled burning** - The British introduced a system of controlled burning of undergrowth in safe seasons (say, during winter), so that by summer there would be nothing left to burn.
- This is an extremely destructive practice, since it wipes out insects, small reptiles, seeds, herbs and bushes.
- **Fire Line** - This method contain the fire in compartments bordered by natural barriers such as streams, roads, ridges, and fire lines along hillsides or across plains.
- A fire line is a line through a forest which has been cleared of all vegetation, the width depends on the type of forest being protected.
- Once the blaze has burnt out all combustibles in the affected compartment, it fizzles out and the neighbouring compartments are saved.
- **Counter fire approach** - This follows setting up of a counter fire, so that when a fire is unapproachable for humans, a line is cleared of combustibles and manned.
- One waits until the wildfire is near enough to be sucking oxygen towards it, and then all the people manning the line set fire to the line simultaneously.
- The counter fire rushes towards the wildfire, leaving a stretch of burnt ground, as soon as the two fires meet, the blaze is extinguished.



- **Combination method** - This is practised in combination with fire lines and counter fire.
- This is the most practical and most widely used, is to have enough people with leafy green boughs to beat the fire out.
- **Technological approach** - In this Helicopters or ground-based personnel spray fire retardant chemicals, or pump water to fight the blaze.
- These are expensive methods and make sense when one is protecting a human community, but are usually not practised in India.

What is the forest fire monitoring mechanism in India?

- A fire anywhere in the world is detected by NASA's MODIS (Moderate Resolution Imaging Spectro radiometer) and VIIRS (Visible Infrared Imaging Radiometer Suite) satellites.
- Then Forest Survey of India (FSI) analyses such data by overlaying the digitised boundaries of forest areas to pinpoint the location to the exact forest compartment.
- The FSI relays news of the fire to the concerned State, so that the Divisional Forest Officer (DFO) in charge of the forest where the fire is raging is informed.
- Earlier the time lapse between spotting the fire and the news reaching the DFO was five to six hours, but this has been reduced to about two hours recently.
- Meanwhile, news of the fire would have reached the DFO from his guards in watchtowers and on patrol and the DFO decides whom to deploy.
- There will be a master fire control room which is informed and which sends firefighters from local fire crew stations to fight the blaze.

What are few shortfalls in mitigating forest fires?

- In India Forest departments face a huge constraint of funds, major amounts of funds are used for frivolous purposes like 'planting forests', instead of investing in mitigating infrastructures.
- While communication and response time have been cut down, the actual numbers of Forest Department personnel that are sent to put out fires are woefully inadequate.
- Contract fire fighters with inadequate training are recruited due to corrupt officials and political parties.

Miscellaneous

2.92 Looming Water Crisis

What is the issue?

- Cape Town in South Africa is facing the prospect of all its taps running dry by June-July this year.
- This is a wake up call for stakeholders across the globe to assess practices of water usage.

What is the looming water crisis?

- According to the United Nations, 2.1 billion people lack access to safely managed drinking water services.
- Water scarcity already affects 4 out of every 10 people.
- 90% of all natural disasters are water related.
- Nearly 3 lakh children under five die every year from diarrhoeal diseases.
- 80% of wastewater flows back into the ecosystem without being treated or reused.
- Meanwhile, the demand for water in urban areas is projected to increase by 50-70% in the next 3 decades.

What is the New Agenda for Water Action?

- A crisis as that of Cape Town is looming large in other cities in the world as people continue to be reckless in their use of water.
- 12 world leaders (11 heads of state and a special adviser of a high-level panel on water) wrote an open letter to global leaders recently.
- They warned that the world is facing a water crisis and issued a New Agenda for Water Action.
- It observed the need to make "**every drop count**" and called for a new approach.
- The panel called for **rethinking** how people understand, value and manage water as a precious resource.
- It also demands catalysing **change** and building **partnerships** to achieve the water-related goals of Sustainable Development.



- The social, cultural, economic and environmental values of water to society need to be reassessed.
- Water needs to be **allocated** in ways which maximize overall benefits to societies.
- It mentioned the need to put in place policies to allow for at least a doubling of **water infrastructure** investment in the next 5 years.
- It called for governments, communities, the private sector, and researchers to collaborate.

What is India's water scenario?

- In India, **Bengaluru** is ranked second in the list of 11 global cities which might face the threat of running out of drinking water.
- According to a forecast by the Asian Development Bank, India will have a **water deficit** of 50% by 2030.
- Although India receives an average **rainfall** of 1,170 mm per year, it is estimated that only 6% of **rainwater** is stored.
- India's water needs are thus primarily met by **rivers and groundwater**.
- **Water scarcity** can lead to disastrous consequences impacting food production as most of the farming is rain-fed.
- Ground water caters to about 60% of the country's irrigation, 85% of rural drinking water requirements and 50% of urban water needs.
- This signifies the importance of according top priority for replenishing the aquifers.
- Millions across India still do not have access to safe drinking water.
- Some of the notable challenges and concerns include:
 - i. growing population
 - ii. lack of adequate planning
 - iii. crumbling infrastructure
 - iv. indiscriminate drilling of borewells
 - v. large-scale consumption of water
 - vi. false sense of entitlement in using water carelessly

2.93 Surprise Weathers in North-Western India

Why in news?

The Northwest, Central and Western India is likely to experience less temperatures and spell of showers for few more days.

What is the present weather condition in North of India?

- Recently India Meteorological Department (IMD) reported fairly widespread precipitation across Punjab, Haryana, Uttar Pradesh, Madhya Pradesh, and Maharashtra's Vidarbha and Marathwada region.
- There were also reported snowfall in Jammu & Kashmir, Himachal Pradesh and Uttarakhand.
- This showers are due to the interaction of western disturbances (cyclonic storms originating in the Mediterranean) and low-level easterlies.
- The current spell of rain in North and Central India will be beneficial to the standing Rabi crop, especially wheat.
- Minimum temperatures is also likely to come down by 2-3 degrees Celsius in Northwest, Central and Western India for few more days.

How this temperature will help Rabi crops?

- Usually till the last week of January both maximum and minimum temperatures will be at above normal levels in most wheat-growing areas.
- Generally this weather helps to prevent diseases like stem rot, white rust, blight, frost or aphid attacks etc. which take place during low or high temperatures, along with high humidity.
- For the crops is in the pre-flowering stage, and the light showers will help bring down temperatures, and provide much-needed water.
- The flowering transfer of pollen from the male to female parts of the flower) of the crop in northern and north-western India happens towards the last week of February.
- This ends with seed setting, and is followed by the "dough", or grain-filling, stage from mid-March.



- Even in the grain-filling stage, day temperatures should not ideally cross the low 30s, so that the starch material accumulates gradually in the kernel for it to become hard and ripe for harvesting from mid-April.

What are the concerns of the farmers?

- The present light showers also create few concerns over chickpea and lentils that are in the maturity or harvesting stages.
- Apart from that farmers and scientists are worried about a recurrence of March 2015, which saw unseasonal heavy rain, accompanied by strong winds and hailstorms, in large parts of North, West and Central India.
- The Rabi crop that was either in the grain-filling stage, or lying in the fields after harvesting, suffered massive damage.
- If rain is followed by sunshine, there can be grain shattering (dispersal before pod ripening) and harvesting losses.
- But any such concern is currently limited mainly to the pulses crop, particularly in Maharashtra and MP.

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