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MAINSTORMING 2019

ENVIRONMENT & GEOGRAPHY II

Shankar IAS AcademyTM

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INDEX

ENVIRONMENT	3	4.3	Implementation Hassles in the Forest Right Act	31	
1. POLLUTION.....	3	4.4	Understanding Sustainable Development - Chennai-Salem Highway Case	32	
1.1	World Air Quality Report 2018.....	3	4.5	Seashore as 'Land' - Maharashtra.....	33
1.2	NGT Order on Noise Pollution	4	4.6	Banning of Fossil Fuel-Driven Vehicles.....	35
1.3	Corporate Average Fuel Efficiency Norms – Vehicular Pollution.....	5	4.7	Maharashtra Civil Disobedience Movement - GM Crops	36
1.4	Plastic waste management – A responsibility	6	5. RESOURCE MANAGEMENT.....	37	
1.5	Monitoring Pollution - Technological Solutions.....	7	5.1	Rain Deficit and Water Stress.....	37
1.6	Decline in Diesel Vehicles - Assessment of Challenges and Options	8	5.2	Addressing India's Water Crisis	38
1.7	Decline in Diesel Vehicles - Maruti Announcement.....	10	5.3	Towards Water Security.....	40
2. GLOBAL WARMING AND CLIMATE CHANGE.....	11	5.4	Mission Kakatiya - A Model to Address Water Scarcity	42	
2.1	Global Environment Outlook Report – UNEP 11	5.5	Water Governance - Chennai's Water Crisis	43	
2.2	Global Environment Outlook - Lessons for India	13	6. BIODIVERSITY	44	
2.3	Climate Change and India's Nutritional Security	13	6.1	IPBES Report.....	44
2.4	State of the Global Climate in 2018 - WMO Report.....	15	6.2	Status of Tigers in India, 2018 Report	46
2.5	Global Concentration of Atmospheric CO ₂	16	6.3	Deforestation in Amazon Forests.....	47
2.6	ILO report: Global warming to impact jobs in India	18	6.4	Biodiversity Challenges - Role of Indigenous People	49
2.7	Achieving COP21 NDC targets	19	6.5	Protecting Seed Sovereignty - PepsiCo Case	50
2.8	Carbon Tax for Emission Reduction.....	20	7. DISASTER MANAGEMENT	51	
2.9	Project WASCAL.....	21	7.1	Oil Spill Disaster in the Solomon Islands ...	51
2.10	Discussion on Climate Change Plans - UN Secretary General.....	22	7.2	Lessons from Fani Cyclone.....	52
3. RENEWABLE ENERGY.....	23	7.3	Surat Fire Tragedy.....	54	
3.1	Enhancing Accessibility of Rooftop Solar Program	23	7.4	European heat wave	54
3.2	Managing the Transition to Renewables..	25	7.5	Understanding Assam Floods	56
3.3	CEA's Plan on Renewable Energy	26	GEOGRAPHY	57	
4. GOVERNMENT POLICIES/INTERVENTIONS	27	8.1	Development of a Weak El Nino	57	
4.1	Draft Indian Forest Act, 2019	27	8.2	Stalagmites of Meghalaya Cave - Predicting Northeast Monsoons	58
4.2	Cutting down of Forests Right Act (FRA), 2006	30	8.3	IMD Monsoon Forecast, April 2019.....	60
			8.4	Cyclone Fani - An Unusual Storm.....	61
			8.5	Monsoon and Lightning	63
			8.6	Overcoming Obstacles in river Interlinking	64
			8.7	Cyclones in the East Coast - Cyclone Titli .	65
			8.8	Having Two Time Zones for India.....	66

MAINSTORMING 2019

GEOGRAPHY AND ENVIRONMENT II (MARCH 2019 TO JULY 2019)

ENVIRONMENT

1. POLLUTION

1.1 World Air Quality Report 2018

Why in news?

'IQAir AirVisual 2018 World Air Quality Report' was recently published by NGO Greenpeace and IQ Air Visual.

What are the highlights?

- The report was a compilation of air quality data from public and private monitoring sources.
- It asserted that 7 of the world's top 10 cities with the worst air quality in 2018 are in India.
- 15 of the 20 cities worldwide ranked the worst on air pollution metrics are in India.
- Gurugram, which borders Delhi, was identified as the city with the worst air quality in the world in 2018.
- It has an annual average concentration of pollutant PM 2.5 at 135.8 micrograms per cubic meter (ug/m³).
- It is however an improvement as compared to 145.6 ug/m³ in 2017 in Gurugram.
- Gurugram was followed by Ghaziabad at the second position with an annual average concentration of 135.2 ug/m³ in 2018.
- The position for number four was held by Faridabad, followed by Bhiwadi and Noida.
- Noida at position six on the list was succeeded by Patna followed by Lucknow with an annual average concentration of 115.7 ug/m³.
- Delhi continues to be extremely hazardous city to live in, with annual average fine particulate matter (PM_{2.5}) of 113.5 ug/m³.
- **Permissible limits** - The National Ambient Air Quality Standards define the permissible limit for the concentration of PM 2.5 at 40 ug/m³.
- On the other hand, the World Health Organisation (WHO) defines the same at 10 ug/m³.

What do other insights show?

- The Ministry of Heavy Industries and Public Enterprises commissioned a study recently on the factors of pollution in Delhi.
- In Delhi, dusty sources such as roads, construction sites and bare soil add about 42% of the coarse particulate matter (PM₁₀) in summer, and 31% in winter.
- Similarly, PM₁₀ from transport varied between 15% and 18% across seasons.
- Vehicles contribute 18-23% of PM_{2.5} which is a more unhealthy particulate that penetrates the lungs.
- Biomass burning was estimated to make up 15-22% and dusty sources 34% of PM_{2.5} during summer.
- These insights provide a road map for action; the Delhi government has done well to decide on inducting 1,000 electric buses.

What are the shortfalls?

- Despite multiple reports putting air quality standards across India at 'hazardous' levels, little or nothing is being done either by the centre or the states.
- The monitoring of air quality in real time across cities and towns in India is far from adequate or uniform.
- The National Clean Air Programme was recently launched for 102 cities and towns, including the capital.



- It talks only of long-term benefits of air pollution mitigation programmes beyond 2024, and not a dramatic reduction in near-term pollution.

What should be done?

- An annual target for reduction has to be set to make governments accountable.
- Achieving this requires the political will to reform key sectors such as the transport, biomass and construction.
- A transition to electric vehicles for all commercial applications, with funding from the Centre's programme for adoption of EVs should be a priority in cities.
- Cutting nitrogen and sulphur emissions from industrial processes needs a time-bound programme supervised by the Environment Ministry.
- It is crucial at this point to ensure that India's future generations are not confined to cities which double up as gas chambers.

Rank	City	2017 AVG	2018 AVG
1	 Gurugram, India	145.6	135.8
2	 Ghaziabad, India	144.6	135.2
3	 Faisalabad, Pakistan	-	130.4
4	 Faridabad, India	123	129.1
5	 Bhiwadi, India	-	125.4
6	 Noida, India	134	123.6
7	 Patna, India	118.5	119.7
8	 Hotan, China	91.9	116
9	 Lucknow, India	119.2	115.7
10	 Lahore, Pakistan	133.2	114.9

1.2 NGT Order on Noise Pollution

Why in news?

The National Green Tribunal (NGT) has directed the Central Pollution Control Board (CPCB) to prepare a noise pollution map and remedial action plan.

What are the provisions in place?

- Legal provisions to prosecute the noisemakers already exist.
- Section 2 (a) of the Air (Prevention and Control of Pollution) Act, 1981, includes noise in the definition of pollutants.
- Also, noise pollution control rules were framed in 2000 under the amended and updated Environment Protection Act, 1996.
- It specifies the ambient standards for different places in respect of permissible noise.
- But unfortunately, these have remained only on paper.
- Though noise monitoring mechanisms were established in a few cities, these were hardly ever put to any gainful use.

What has the NGT directed?

- The NGT has asked the CPCB to categorise cities on the basis of their noise profile and identify the noisy hotspots.
- The CPCB has also been asked to propose remedial plans for the noise pollution, within 3 months.
- NGT has also called upon police departments in all states to procure sound monitoring devices.
- They are also directed to assist the pollution control authorities in their efforts to mitigate noise pollution.
- Manufacturers of public address systems and sound amplification equipment should provide inbuilt noise meters and data loggers in their products.
- This would help regulators to establish violation and fix responsibility.

What are the risks with noise pollution?

- Prolonged exposure to any sound louder than 80 decibels, even if it is music, can impair hearing, breathing and thinking processes.
- Besides this, it also affects overall human health and productivity.



- Noise beyond 120 decibels can cause biochemical changes in human bodies.
- It would raise cholesterol and blood pressure, with the associated health risks.
- According to the WHO, hearing loss due to excessive noise cost \$750 million to the global economy every year.

What are the sources?

- Like environmental pollution, noise pollution, too, is the outcome of human activities.
- Industrialisation, urbanisation and modern lifestyle, all contribute to noise pollution.
- Factories, airports, railway stations and busy roads usually have noise levels much above the safe standards.
- Indiscriminate honking with pressure horns, excessively loud music systems in cars, homes, dance bars and other public joints are also the causes.
- Use of loudspeakers at full volume at religious, social and political gatherings worsens this menace.

What lies ahead?

- Unlike air and water pollution that receive attention and even have some corrective action, noise pollution largely remains unaddressed.
- Given the diversity of noise pollution, only multifaceted, yet situation-specific approach can work.
- The strategies have to include measures ranging from awareness creation to punitive action.
- Religious bodies should be sensitised about the ill-effects of the loud sound to get them to change the noise-generating customs.
- [Thiruvananthapuram, Kerala makes prior permission obligatory for setting up public sound systems.
- It also bars placement of loudspeakers beyond 300 metres from the venues of religious, social or political events.]
- The youth, who face the greatest risk of irretrievable hearing damage from personal music systems, also need to be targeted specifically.
- Most importantly, pollution control bodies need to treat noise pollution on par with other kinds of pollution.

1.3 Corporate Average Fuel Efficiency Norms – Vehicular Pollution

What is the issue?

- The government is considering advancing the 2030 deadline for Indian manufacturers to switch over to electric vehicles in bikes and three-wheelers segments.
- With manufacturers opposing it, targeting cleaner air through stricter CAFE norms instead is suggested.

What are the CAFE norms?

- CAFE (Corporate Average Fuel Efficiency/Economy) norms aim at lowering fuel consumption (or improving fuel efficiency) of vehicles.
- It is achieved by lowering carbon dioxide (CO₂) emissions.
- Thus, it serves the twin purposes of reducing dependence on oil for fuel and controlling pollution.
- Corporate Average refers to sales-volume weighted average for every auto manufacturer.
- The norms are applicable for petrol, diesel, LPG and CNG passenger vehicles.
- The CAFE regulations are in place in many advanced as well as developing nations, including India.
- CAFE regulations in India came into force from April 1, 2017.
- Under this, average corporate CO₂ emission must be less than 130 gm per km till 2022 and below 113 gm per km thereafter.
- In other words, it requires cars to be 10% or more fuel efficient between 2017 and 2021, and 30% or more fuel efficient from 2022, in terms of CO₂ emission.



Why is it important to India?

- Global automakers are attracted to make investments in India as vehicle penetration is still low here compared to developed countries.
- Also, pollution caused by the ever-increasing number of vehicles on road is worsening the air quality in many cities.
- Upgrading to stricter fuel standards is one way to tackle air pollution.
- In this context, CAFE norms assume importance in the light of their ability to reduce the carbon footprint of the auto industry.
- Stricter CAFE targets can also lead to manufacturers moving to electric or strong hybrid vehicles over the medium to long-term to comply with the norms.
- This can complement other efforts at ensuring cleaner air through measures such as the -
 - i. implementation of the BS VI emission norms from April 2020 onwards
 - ii. the plan to shift to mass use of electric vehicles by 2030
 - iii. incentives under the FAME (Faster Adoption and Manufacturing of Hybrid & Electric Vehicles) scheme
- [While CAFE regulations focus on reducing CO₂ emissions, BS VI focusses on other harmful exhaust from vehicles.]

What does India's Auto Policy specify?

- The Draft National Auto Policy given in early 2018 calls for developing a roadmap for reduction in CO₂ emissions through CAFE regulations.
- It aspires to match Indian CO₂ reduction targets to those set by developed countries by 2025.
- The Auto Policy also contemplates economic penalties for manufacturers who do not meet the targets.
- It also envisages a system where credits (for achieving more than the mandated fuel efficiency) can be banked and traded.

1.4 Plastic waste management – A responsibility

Why in News?

The Central Pollution Control Board (CPCB) has pulled up 52 companies for not specifying a timeline or plan to collect the plastic waste that they generate.

What is the current situation?

- The companies that have been pulled up include Amazon, Flipkart, Patanjali Ayurved Limited, etc.,
- CPCB has warned these companies, stating that they hadn't yet registered at the online portal and disclosed their disposal plans.

What is the basis for these actions?

- These companies are pulled up because they haven't followed the norms under the,
 1. Plastic Waste Management Rules, 2016 (amended in 2018)
 2. Environment Protection Act, 1986
- The CPCB also stated that failing to do so would invite action against the defaulters which may include fines or imprisonment.

What does the Plastic Waste Management Rules, 2016 aim to?

- **Increase minimum thickness** of plastic carry bags and sheets from 40 to 50 microns.
- **Expand the jurisdiction of applicability** from the municipal area to rural areas.
- **Extended producers' responsibility** - To bring in the responsibilities of producers and generators, both in plastic waste management system and to introduce collect back system of plastic waste by the producers/brand owners.



- **Collection of plastic waste management fee** through pre-registration of the producers, importers of plastic carry bags/multi layered packaging and vendors selling the same.
- **Gainful utilization of waste** - By promoting use of plastic waste for road construction or energy recovery, or waste to oil etc.
- **Responsibility on waste generators** - To pay user charge as prescribed by local authority, collection and handing over of waste by the institutional generator, event organizers.
- **Responsibility of local bodies and Gram Panchayat** - To set up, operationalise and co-ordinate the waste management system.
- **Responsibility of retailers and street vendors** - To not sell, or provide commodities to consumers in carry bags, or plastic sheet, or multi layered packaging.

What can be done?

- The solutions can be **packaging innovation** and **upscaling waste segregation**, collection and transmission.
- **Recovering materials** from garbage should be a high priority, considering that India is the third highest consumer of materials.
- **Recycling** plastics extends their life and provides a substitute for virgin material. But recyclable waste is shouldn't be mixed with other articles.
- **Making** municipal and pollution control **authorities accountable** is also equally important.

What can online retailers do?

- Online retailers have not felt compelled to take back the plastic articles inside cardboard boxes.
- These companies can **form waste cooperatives** in India, employing informal waste-pickers.
- In such a model, consumers will respond readily if they are incentivised to return segregated plastic waste.

1.5 Monitoring Pollution - Technological Solutions

What is the issue?

- Increasingly, new technologies are making it easier and cheaper to monitor the environment, in India and globally.
- India, now, has to take efforts to pinpoint the specific sources of pollution in real-time and adopt the appropriate technologies for that.

What is the shortfall in approach?

- India has been monitoring air pollution for many years now, but with little effect on pollution levels across India.
- The ambient pollution is being captured by a multitude of monitoring instruments, both by civil society and the government.
- But such monitoring cannot identify the specific sources of pollution.
- So the key monitoring gap is not about pollution in the aggregate, but specific sources.
- It is also difficult to enforce laws on polluters, or to bring to task those in the government not enforcing the laws.

How should monitoring be?

- There are three components of monitoring that need to be achieved - universality, identifiability and timeliness.
- - In a vast country as India there **Universality** are number of units that are unregistered.
- Besides, there are many that are registered but which may not be as polluting units, and yet others may be mis-categorised.



- In other words, the government records cannot be the sole source to decide on the units to monitor, and those not to.
- Monitoring on a large expanse and all point sources is essential for effective action.
- Only this would enable clear differentiation between units that conform to the pollution norms and those that do not.
- **Identifiability** - There has to be a built-in method in the technology adopted, for confirming the initial identification of the polluter, to avoid errors in identification.
- **Timeliness** - Simply installing pollutant-ameliorating equipment does not mean it is being used.
- Floor managers may be using the wrong practices, be lax, or the unit management may find it too expensive to operate, or the input materials may be contaminated.
- So constant monitoring is an essential element of good monitoring.

What is the challenge?

- There are hundreds of coal power plants, tens of thousands of brick kilns, and hundreds of thousands of construction sites.
- Measuring pollution levels at each of these point sources in real time and capturing divergence from the expected norm and making further investigations are quite challenging.

What are the possible technological solutions?

- Remote sensing technologies including those by satellites are a good solution to the limitations in monitoring.
- Satellites can monitor large expanses on a 24x7 basis; industrial chimneys, coal power plants, all units that emit fumes can be imaged at different wavelengths.
- It ensures universal coverage and helps capture pollution points such as unregistered units that are otherwise invisible to the government.
- It can red-flag potentially polluting entities if they diverge any time of the day and night.
- Though these red flags may not constitute proof, it can constantly identify units for further investigation.
- The data could be made available in the public domain as well, beyond government and regulator.
- With public accessibility, independent researchers can build their own algorithms for evaluation of potential polluters.
- It can involve individual experimenters in universities, research institutes or even amateurs towards a cleaner environment as well as can accelerate skill formation in an emerging technology.
- Moreover, economies of scale and scope are both very high with deployment of artificial intelligence.
- Depending on the bandwidths being captured, the same image can be used both to monitor different kinds of pollutants and the varying sources.
- E.g. illegal garbage dumps could be sources of both plastics and methane, both of which can be monitored
- Other possible areas include riverbed sand mining, stone mining, and illegal fishing in “no entry” zones, all of which can be captured by satellites.

1.6 Decline in Diesel Vehicles - Assessment of Challenges and Options

What is the issue?

- Across the world, the popularity of diesel as a powertrain for passenger vehicles is on the decline.
- The government and auto makers in India should work together to ensure a smooth transition to other options.

What are the recent developments?

- Europe, diesel vehicles' biggest market (53% of all cars sold is powered by diesel), is fast giving up on diesel.
- France, where diesel cars account for 70% of its overall fleet, saw more petrol cars being sold in 2017.



- In Germany, the share of diesel cars fell from 48% in 2012 to 33% in 2018.

How is diesel use in India?

- India's love for diesel powertrains peaked in 2012-13.
- That was a time when diesel cars accounted for 47% of all passenger vehicles sold in the country.
- The trend was driven more by cheaper diesel prices than other reasons, as it was lower than petrol by as much as Rs. 25 per litre.
- However, government de-controlled diesel prices in 2014.
- As the price differential between diesel and petrol narrowed, the preferences changed.
- Today, only 23% of the cars sold have diesel powertrains.

How have the emission norms evolved?

- Globally, the initial stages of emission norms focussed on carbon-di-oxide emission. E.g. Euro-I to Euro-IV emission norms
- So diesel engines performed well on this account as they emitted lower CO₂.
- Diesel cars were increasingly promoted in most European countries with incentives.
- As emission norms evolved, it became clear that particulate matter (PM) and Oxides of Nitrogen (NO_x) were equally dangerous.
- Notably, diesel engines emit higher levels of PM and Nox than petrol engines.
- So Euro-V norms were introduced in 2010 focussing on reducing PM, and Euro-VI norms came into force in 2015 targeting NO_x.

What is the challenge now?

- Indian government too has decided to shift from BS-IV to BS-VI emission norms from April 2020.
- This will directly impact diesel engines the hardest.
- The manufacturers have to tackle both PM and NO_x in one go, with a complex exhaust system.
- This will lead to cost escalation of up to Rs. 1.50 lakh depending on the size of the engine.
- Resultantly, only costly SUVs will be able to absorb this cost and less-expensive, small, compact and entry level diesel versions will be out of the market.
- Manufacturers who have set up large diesel engine capacity will have to compensate for fall in domestic demand by pushing exports.

Is shifting to petrol feasible?

- Shifting to petrol powertrains will have another challenge for the manufacturers, which is the CAFE norms.
- The CAFE (Corporate Average Fuel Efficiency) norms came into force from April 2017.
- It requires cars to be 10% or more fuel efficient between 2017 and 2021, and 30% or more fuel efficient from 2022, in terms of CO₂ emission.
- The move is targeted at reducing the carbon footprint of the automobile industry.
- Diesel cars had been helping manufacturers meet these norms.
- But the shift to petrol would increase the CO₂ emission and the manufacturers would have to produce more fuel efficient petrol cars or electric/hybrid vehicles.

What lies before India?

- India will have to promote electrification and hybridisation more seriously.
- Its vision of 100% electrification of passenger vehicle sales by 2030 may be aspirational but achieving even a third of that target necessitates a massive change.
- As, in India where bulk of the cars sold is small cars, the cost of electrification may just not work out.

- Though battery costs have come down substantially over the years, it is still not low enough by Indian standards.
- Government should move forward with the Faster Adoption and Manufacturing of Electric Vehicles (FAME)-2 norms.
- This should incentivise the manufacturer rather than the buyer.
- For goods movement, the only option is to reduce the share of road transportation and to focus on coastal shipping and inland waterways.

1.7 Decline in Diesel Vehicles - Maruti Announcement

Why in news?

Maruti Suzuki has recently announced that it will stop manufacturing diesel vehicles from April 1, 2020.

What are the other recent developments?

- Mahindra & Mahindra is also working on plans to start offering petrol engine options across its entire range, except the Bolero.
- Tata Motors seems to have decided against offering the diesel option in its flagship Tiago hatchback and Tigor sedan after April 2020.
- All these firms have had strong exposure to the diesel platform.
- The announcement by Maruti, the country's largest vehicle manufacturer, is likely to mark the end of diesel cars in India.
- Diesel has also lost its shine in Europe, the world's biggest market for diesel cars.

What is the reason?

- The Indian car-buyers' like for diesel powertrains lasted nearly a decade.
- In 2012-13, diesel cars accounted for 48% of passenger vehicle sales in the country.
- The main reason was the sharply lower price of diesel as compared to petrol, which was Rs 25 per litre at its peak.
- However, this changed when the decontrol of fuel prices started in late 2014.
- The price difference has since come down to under Rs 6.5 per litre.
- Consequently, diesel cars accounted for just about 22% of overall passenger vehicle sales in 2018-19.
- Also, the sentiment for diesel is not good in the wake of the Volkswagen emissions scandal.
- [Volkswagen cars being sold in America had a "defeat device" - or software - in diesel engines.
- It could detect when they were being tested, changing the performance accordingly to improve results.
- So the device appears to have put the vehicle into a sort of safety mode; but once on road, the engines switched out of this test mode.
- Resultantly, the engines emitted nitrogen oxide pollutants up to 40 times above what is allowed in the US.]

Is emission norm playing a role?

- The main reason behind Maruti Suzuki's announcement is, in fact, not the fuel price differential.
- Instead, the new emission norms that will come into effect on April 1, 2020 is a key factor
- A prohibitively high cost is involved in upgrading diesel engines to meet the new BS-VI emission norms.
- The difference in the price of a petrol and a diesel car, now around Rs 1 lakh on average, could go up to Rs 2.5 lakh.
- So leading carmakers are increasingly moving away from the diesel options.

What are the challenges involved?

- With the BS-VI norms, the attempt is to entirely bypass one stage - BS-V.

- The decision to leapfrog directly from BS-IV to BS-VI makes diesel unviable for both oil companies and automobile makers.
- While petrol vehicles would also need upgrades to transition, these are limited to catalysts and electronic control upgrades.
- But for diesel vehicles, the upgrades are more complicated and entail higher costs, apart from the technical difficulties.
- Carmakers, to meet stringent BS-VI norms, would have to put three pieces of equipment all at the same time. These are:
 - i. a DPF (diesel particulate filter)
 - ii. an SCR (selective catalytic reduction) system
 - iii. an LNT (Lean NOx trap)
- This is vital to curb both PM (particulate matter) and NOx (nitrogen oxides) emissions as mandated under the BS-VI norms.
- Adapting the three critical components to India-specific conditions of driving is challenging.
- It's because, the running speeds in India are much lower than in Europe or the United States.
- The optimisation and fitment of the DPFs and the SCR module could take an estimated three-four years.
- With step-by-step transition, diesel cars could have been fitted with a DPF in the BS-V stage, and with the SCR in the BS-VI state.
- But now, the entire cost will have to be borne in one go, alongside the operational difficulties.
- Besides the constraints faced by carmakers, there is also the issue of ability of the oil companies to manage the transition.

2. GLOBAL WARMING AND CLIMATE CHANGE

2.1 Global Environment Outlook Report – UNEP

Why in news?

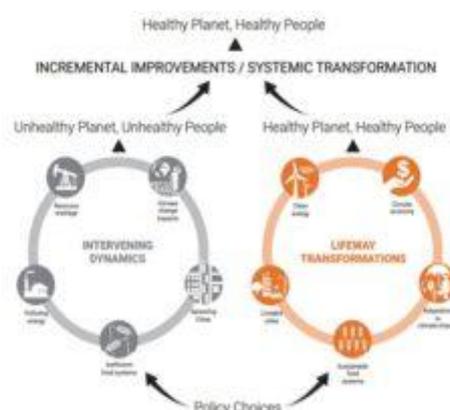
The sixth edition of the Global Environment Outlook (GEO-6) from the UN Environment Programme (UNEP) on the theme “Healthy Planet, Healthy People” was released recently.

What is the report for?

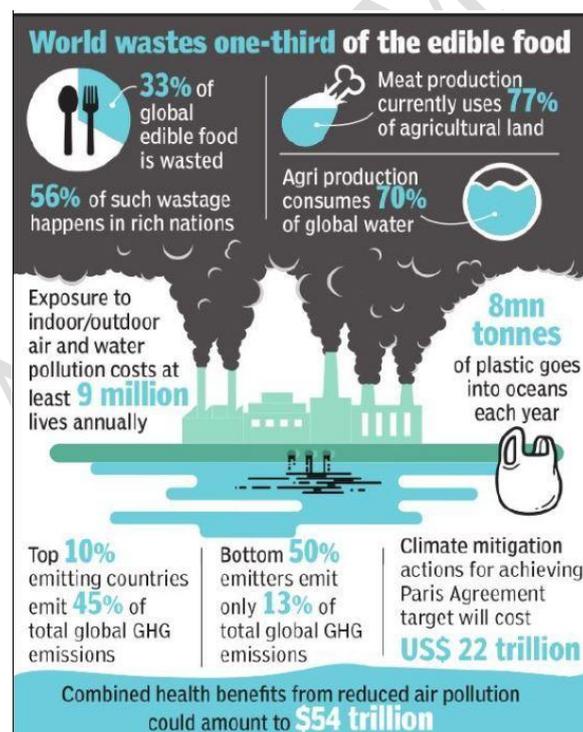
- World leaders came up with the Paris climate deal in 2015, with promised actions to cut emissions, to limit global temperature rises to 1.5 °C.
- But the health impacts of pollution, deforestation and the mechanised food-chain are less well understood.
- There is also no international agreement for the environment, similar to what the Paris accord does for the climate.
- The GEO thus partly addresses this gap by bringing the attention of world nations to the impact of environmental problems on humans.

What are the report highlights?

- **Premature deaths** - A quarter of all premature deaths and diseases worldwide are due to manmade pollution and environmental damage.
- The report notes on deadly smog-including emissions, chemicals polluting drinking water, and the destruction of ecosystems crucial to the livelihoods of many.
- These are driving a worldwide epidemic that hampers the global economy.



- **Inequality** - The GEO depicts a widening gap between rich and poor countries.
- The top 10% of populations globally, in terms of wealth, are responsible for 45% of GHG emissions, and the bottom 50% for only 13%.
- Pollution impacts are, however, borne more by the poorer citizens.
- Rampant overconsumption, pollution and food waste in the developed world leads to hunger, poverty and diseases elsewhere.
- **Health** - Poor environmental conditions cause approximately 25% of global disease and mortality, with around 9 million deaths in 2015 alone.
- Nearly 1.4 million people die each year from preventable diseases with lack of access to clean drinking supplies.
- E.g. diarrhoea and parasites linked to pathogen-riddled water and poor sanitation
- Air pollution alone causes 6-7 million early deaths annually.
- Chemicals pumped into the seas cause "potentially multi-generational" adverse health effects.
- Land degradation through mega-farming and deforestation occurs in areas of Earth which are home to 3.2 billion people.
- Unchecked use of antibiotics in food production will result in drug-resistant superbugs becoming the world's number one cause of premature death by mid-century.



What does it call for?

- **Economy** - Urgent action at an unprecedented scale is necessary to arrest and reverse the present environment situation.
- There is an urgent need for retooling of the global economy to more sustainable production lines.
- Without this, GDP growth may become meaningless against the cost of lost lives, work hours and associated treatment expenses.
- **Human behaviour** - The world is unsustainably extracting resources and producing unmanageable quantities of waste.
- The report thus called for a root-and-branch detoxifying of human behaviour.
- E.g. By 2050, the world will likely have to feed 10 billion people, but that does not mean that the production has to be doubled.
- The world currently throws away a third of all food produced; this is driven by 56% of food in richer nations going to waste.
- So food waste, which also accounts for 9% of global greenhouse gas emissions, could be slashed.
- The report also advises adopting less-meat intensive diets.
- The report also called for a rapid drawdown in greenhouse gas emissions and pesticide use to improve air and water quality.

What lies ahead?

- The GEO was unveiled at the UN Environment Assembly in Nairobi, Kenya.
- It is likely to add to the debate over who bears the greatest responsibility for the damage already borne by Earth.
- Some developed nations, led by the United States, had threatened not to "welcome" the GEO report.

- This is a procedural but nonetheless significant hurdle, for the nations to agree on the necessary cuts in waste, overconsumption and pollution.

2.2 Global Environment Outlook - Lessons for India

What is the issue?

- The Global Environment Outlook from the UN Environment Programme (UNEP) was released recently.
- It necessitates that India rethinks on its model of growth and recognises the human cost involved in environmental concerns.

What are the concerns in India?

- The report notes that East and South Asia have the highest number of deaths due to air pollution.
- Reportedly, air pollution killed about 1.24 million in India in 2017.
- The linear model of economic growth depends on the extraction of ever-higher quantities of materials.
- This eventually leads to chemicals flowing into air, water and land.
- This results in ill-health and premature mortality, and affects the quality of life.
- The burden is particularly worse for those unable to insulate themselves from these effects.
- Also, as India's population grows, agricultural yields are coming under stress due to increase in average temperature and erratic monsoons.
- The implications of these forecasts for food security and health are all too evident.
- This is, in particular, serious for the 148 million people living in severe weather 'hotspots'.

What should India do?

- India could save at least \$3 trillion in healthcare costs if it implemented policy initiatives consistent with Paris climate goals.
- India should increasingly recognise the human cost of poorly enforced environment laws.
- Policies should aim at curbing the use of fossil fuels and toxic chemicals across the spectrum of economic activity.
- Monitoring of air quality in cities through scaled-up facilities would bring about a consensus on cutting emissions of greenhouse gases.
- It would provide the impetus to shift to cleaner sources of energy.
- All older coal-based power plants in India should conform to emission norms at the earliest.
- Otherwise, they should be shut down in favour of renewable energy sources.
- Transport emissions are a growing source of urban pollution, and a quick transition to green mobility is needed.
- In the case of water, the imperative is to stop the contamination of surface supplies by chemicals, sewage and municipal waste.
- As the leading extractor of groundwater, India needs to make water part of a circular economy.
- Water should thus be treated as a resource that is recovered, treated and reused.
- New storage areas could act as a supply source when monsoons fail, and help manage floods when there is excess rainfall.

2.3 Climate Change and India's Nutritional Security

What is the issue?

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



What is the looming threat?

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

How vulnerable is India?

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

How serious is nutrition and climate change link?

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

What should be done?

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

2.4 State of the Global Climate in 2018 - WMO Report

Why in news?

The World Meteorological Organization (WMO), the UN's weather agency, released its annual report, State of the Global Climate in 2018.

What are the highlights?

- **Climate indicators** - The report highlighted the worsening impact of climate change across the world.
- It showed how the world was degenerating on key climate indicators.
- These include the following:
 - sea levels rose at a record pace last year
 - vast ocean stretches continued to become acidic
 - Ivery high land and ocean temperatures over the last 4 years
 - most monitored glaciers are retreating
- **Emissions** - All of the above are linked to the rising anthropogenic carbon dioxide (CO₂) emissions.
- The CO₂ levels, were at 357 parts per million (PPM) when the WMO statement was first published in 1994.
- It kept rising to reach 405.5 PPM in 2017, and is expected to increase even further in 2018 and 2019.
- **Extreme weather events** - WMO underlined the extreme weather events experienced all over the world in 2018.
- This included the severe flooding in Kerala in August 2018, which led to economic losses estimated at \$4.3 billion.

HOW CLIMATE CHANGE PLAYED OUT IN 2018

SEA LEVELS RISE

Global Mean Sea Level for 2018 was around 3.7 millimetres higher than in 2017, and the highest on record

OCEAN ACIDIFICATION

In the past decade, the oceans absorbed around 30% of anthropogenic CO₂ emissions. Absorbed CO₂ reacts with seawater and changes the pH of the ocean. This process is known as ocean acidification, which can affect the ability of marine organisms

DEPLETING ARCTIC ICE

Arctic sea-ice extent was well

\$4.3 bn

The WMO report identified the floods in Kerala as one of the main indicators of extreme weather events due to climate change, leading to economic losses of \$4.3 billion

below average throughout 2018 and was at record-low levels for the first two months of the year. The Greenland ice sheet has been losing ice mass nearly every year over the past two decades

- Rainfall in Kerala in August was 96% above the long-term average.
- A cold wave also affected parts of India; 135 deaths in just 10 ten days in January in Uttar Pradesh were attributed to cold.

What are the notable climate change impacts?

- **Warming** - 2018 was ranked among the top 10 warmest years in Africa, Asia, Europe, Oceania and South America.
- Sea-surface waters in a number of oceans were unusually warm in 2018, including much of the Pacific.
- The greatest rates of ocean warming were seen in the southern ocean, with warming reaching the deepest layers.
- In November 2017, a marine heat wave developed in the Tasman Sea (in South Pacific Ocean between Australia and New Zealand) and persisted until February 2018.
- Sea-surface temperatures in the Tasman Sea exceeded 2 °C above normal, setting a record.
- **Ocean acidification** - As ocean acidification rises, marine biodiversity is at a major risk.
- Since the middle of the last century, there has been an estimated 1%-2% decrease in the global ocean oxygen inventory.
- Hundreds of sites are known to have experienced oxygen concentrations that impair biological processes or are lethal for many organisms.
- **Sea level** - The global mean sea level for 2018 was around 3.7 mm higher than in 2017 and the highest on record.
- Rapid ice mass loss from ice sheets is the main cause of the global mean sea-level rise.
- **Arctic sea-ice extent** was significantly below average throughout 2018.
- The report referred to monitoring of glacier mass-balance by the World Glacier Monitoring Service for 19 mountain regions.
- It noted that 2017-18 was the 31st consecutive year of negative mass balance for the glaciers monitored.
- This refers to glaciers losing more mass than they receive.
- **Rainfall** - Although weak La Nina conditions were noticed at the beginning of 2018, the effect on precipitation was the opposite of what had been expected.
- E.g. several floods occurred in California, an unexpected event during La Nina
- The Indian monsoon brought less rainfall than normal to the Western Ghats and the eastern parts of the Himalayas, but higher than normal in the Western Himalayas.
- The all-India rainfall for June to September 2018 was around 9% below the long-term average.
- In all, the report calls for urgent support to poor people and countries in tackling climate impacts that are forcing millions out of their homes.
- Rich countries must lead the transition to a greener economy and assist developing countries to follow suit.

2.5 Global Concentration of Atmospheric CO₂

Why in news?

On May 11, 2019 global concentration of carbon dioxide in the atmosphere was measured to have crossed the 415 parts per million (ppm) mark for the first time.

What are the recent observations?

- The levels are as measured from Mauna Loa observatory in Hawaii.
- On every subsequent day from May 11, the daily average atmospheric concentration of CO₂ has remained over that level.
- The rapidly rising concentration is one of the key indicators of the manner in which the planet has been warming up.



- The higher the concentration of CO₂, the greater the greenhouse gas (GHG) effect that causes the Earth's atmosphere to heat up.

How has CO₂ concentration been?

- For several thousand years, the carbon dioxide concentration remained constant at around 270-280 ppm.
- The industrial revolution started to slowly push this level up.
- When direct measurements began at the Mauna Loa observatory in 1958, concentrations were around 315 ppm.
- It took nearly 50 years for it to reach 380 ppm, a mark first breached in 2004, but thereafter the growth has been rapid.
- Currently, the carbon dioxide concentration is growing at more than 2 ppm per year.
- Scientists say the growth rate is likely to reach 3 ppm a year from this year.

How is the emission scenario?

- The increase in CO₂ concentrations in atmosphere is caused by the emissions, mostly from man-made processes.
- However, in recent years, the growth in global carbon dioxide emissions has slowed down considerably.
- It remained almost flat between 2014 and 2016, and increased by 1.6% in 2017 and about 2.7% in 2018.

What raises the CO₂ concentrations then?

- The rapid rise in the atmospheric concentrations is due to the fact that CO₂ has a very long lifespan in the atmosphere, 100 to 300 years.
- So, even if the emissions were to reduce to zero all of a sudden, it would have no impact on the atmospheric concentrations in the near term.
- About half of emitted carbon dioxide is absorbed by plants and oceans, leaving the other half to go into the atmosphere.
- An addition of about 7.5 billion tonnes carbon dioxide to the atmosphere leads to a 1 ppm rise in its atmospheric concentration.
- In 2018, the global emission of carbon dioxide was estimated at 37.2 billion tonnes (about 18.6 billion tonnes after absorption).
- The absorption of carbon dioxide by plants too follows a predictable seasonal variability.
- Plants absorb more carbon dioxide during the summer.
- So a lower amount of carbon dioxide is added to the atmosphere in the summer months of the northern hemisphere.
- This variability is reflected in the very rhythmic seasonal fluctuation of atmospheric concentration of carbon dioxide.

How does it affect the temperature?

- The global community's effort is to keep the rise in average surface temperatures below 2°C higher than during pre-industrial times.
- The carbon dioxide concentration level corresponding to a 2°C rise in global temperatures is generally understood to be 450 ppm.
- At current rates of growth, that level would be reached in less than 12 years i.e. by 2030.
- Until a few years ago, it used to be understood that this milestone would not be reached till at least 2035.

What lies ahead?

- A recent Intergovernmental Panel on Climate Change report called for a net zero emissions of all GHGs by 2075 to attain the 2°C target (by 2050 for the ambitious 1.5°C target).
- Net zero is achieved when the total emissions is neutralised by absorption of carbon dioxide.

- This is done through natural sinks like forests, or removal of carbon dioxide from the atmosphere through technological interventions.

2.6 ILO report: Global warming to impact jobs in India

Why in news?

The report “Working on a warmer planet: The impact of heat stress on labour productivity and decent work” was released by International Labour Organisation (ILO).

What does the report say?

- In 2030, **2.2% of total working hours** worldwide will be lost because of higher temperatures.
- The **global productivity losses** would be around **80 million full-time jobs** (equivalent to economic loss of US\$ 2,400 billion).
- The projection of 34 million jobs losses in India would make it the worst affected.
- A third of the southern Asian countries have already incurred losses greater than 4%
- This is a **conservative estimate**, assuming that the global mean temperature does not rise more than 1.5°C

How it was worked out?

- The report defines heat stress as **heat in excess of what the body can tolerate** without suffering physiological impairment.
- It generally occurs at temperatures above 35°C, in high humidity.
- **Excess heat during work** is an occupational health risk and restricts workers’ physical functions and capabilities, work capacity and thus, productivity.
- **Assumptions and basis** for the projections are,
 1. Global temperature rise of 1.5°C by the end of the century,
 2. Labour force trends.
- **What are the projections for India?**
- India to lose the most working hours is southern Asia in 2030.
- It lost 4.3% of working hours in 1995 because of heat stress.
- It is projected to **lose 5.8% of its working hours in 2030**, which corresponds to 34 million jobs.
- The report projects losses in working hours as
 - 1) 9.04% in agriculture (in shade),
 - 2) 5.29% in manufacturing,
 - 3) 9.04% in construction, and
 - 4) 1.48% in services.
- Most of the impact will be felt in the **agricultural sector**.
- More working hours are expected to be lost in the **construction sector** (where heat stress affects both male and female workers).
- Most areas have drought like conditions so there will be more **migration of agricultural workers to urban areas** – usually to work in the construction sector.
- There has been **no direct job loss at present**, with distressed workers switching from one vulnerable sector to another.
- **What is the bigger picture?**
- **Globally**, the two sectors projected to be **hit worst are agriculture and construction**, with agriculture worse affected.
- **In agriculture** – 60% of working hours will be lost due to heat stress by 2030.

- **In construction** – 19% of global working hours to be lost.
- More inequality between low and high income countries to be seen.
- There will be worsening working conditions for the most vulnerable, as well as displacement of people.
- To adapt to this new reality appropriate measures by governments, employers and workers, focusing on protecting the most vulnerable, are urgently needed.

2.7 Achieving COP21 NDC targets

What is the issue?

- During the run-up to the Paris climate change meeting(COP-21) in 2015,each country decided the level and kind of effort it would undertake to solve the climate changeproblem.
- These actions were referred to as nationally determined contributions (NDC).

What is India'sNDC?

- India promised to take steps to **reduce** the greenhouse gas (GHG) emissions and to **adapt** to living in a warmer world. NDCs include,
 1. By 2030, there will be about 1/3rd reductions in the emissions intensity of the GDP below 2005 levels.
 2. By 2030, there will be a total of 40% of the installed capacity for electricity from non-fossil fuel sources.
 3. By 2030, it promised an additional carbon sink (a means to absorb carbon dioxide from the atmosphere) through additional forest and tree cover.
- **Trees and other vegetation** fix carbon as part of photosynthesis.**Soil** too holds organic carbon from plants and animals.

How to enhance the green cover?

- **Forest Survey of India (FSI) study** - Estimated the costs involved, and the opportunities and potential actions needed for additional forest and tree cover to meet the NDC target.
- Recently,there is a gradual increase in the forest and green cover.
- The additional increase in carbon sinks is to be achieved by restoring impaired and open forests; afforesting wastelands, Agro-forestry, etc.,
- 72.3%of the increase will be **by restoring forests and afforestation** on wastelands, with a modest rise in total green cover.
- The **green cover increase** will provide many other **benefits** like improving the water quality, storage of water in wetlands, etc.

What is the role of Natural forests?

- **A recent study in Nature** - Provides insights into what works well with regard to green cover.
- Locking up the carbon from the atmosphere in trees, ground vegetation and soils is one of the safest ways with which to remove carbon.
- Allowing land to be converted into forests naturally will sequester the carbon more efficiently than the artificial conversion of a land to a plantation or to an Agroforest.
- **A study in Science** - Estimates that it is possible to add 0.9 billion hectares of canopy cover worldwide.
- This could potentially mitigate up to 2/3rd of historical GHG emissions, which would prevent or delay the worst impacts from climate change.

Paris Agreement (COP21)

- Paris Agreement is an agreement under the United Nations Framework Convention on Climate Change (UNFCCC) to combat climate change.
- Aims of Paris Agreement are,
 1. To keep the global temperature rise of this century well below 2°C above the pre-industrial level
 2. To pursue efforts to limit the temperature increase further to 1.5°C
 3. To strengthen the ability of countries to deal with the impacts of climate change

Why is restoration type a key?

- **Studies** -Indicate that forest restoration has enormous potential in mitigating climate change.
- The amount of carbon stored depends on the type of forest restoration carried out.
- The most effective way is through **natural forest regeneration** with appropriate institutions to facilitate the process.
- **First**, India needs to ensure that deforestation is curtailed to a maximum extent.
- **Second**, the area allocated to the restoration of impaired and open forests and wastelands should be focussed on natural forests and agroforestry.
- Instead of plantations, growing food forests managed by local communities would have additional co-benefits.
- Protecting the established natural forests is important.
- Protecting and nurturing public lands and preventing their private enclosure is also paramount.
- **Active forest management by local people** has long history in India and needs to expand to meet climate, environment and social justice goals.

2.8 Carbon Tax for Emission Reduction

What is the issue?

- India is taking varied efforts to curb pollution and achieve the Intended Nationally Determined Contributions (INDC) targets under the Paris climate deal.
- In this regard, it is essential to understand the instrumental role that carbon tax could play.

How serious is pollution impact?

- Local pollutants, particularly particulate matter, cause many health-related problems.
- These include issues associated with breathing, wheezing, asthma, and aggravation of existing respiratory and cardiac conditions.
- It has been found recently that air pollution may lead to hypertension risk, particularly to women in India.
- Further, life expectancy, due to this, has reduced by 2.6 years.
- Worldwide, more deaths per year are linked to air contamination, particularly from the industrial and transport sectors.
- The situation is getting worse, particularly in megacities, including Delhi.

What is India's emission scenario?

- India is the world's fourth-largest emitter of Greenhouse Gases (GHGs) though per capita emission is low due to a large population.
- Rapid economic growth with little concern for the environment makes this a serious threat.
- India's total GHG emissions are more than 3,200 million metric tonnes, with an average growth of 6.3% in 2018.
- This constitutes around 7% of the world's total GHG emissions.
- The energy sector has a major role in this and contributes 68.7% of total emissions.
- Over a span of 24 years from 1990, this emission has increased by 180%.
- The growing energy demand and consumption have led to an emergent need to put a price on emissions.
- This would directly reduce the exploitation of natural resources and pollution.

How does carbon tax help here?

- Carbon tax primarily discourages environment unfriendly production and consumer practices by making the 'polluting sources' costlier.
- This works without any negative effect on overall employment and output levels.



- Putting a price on carbon and taxing it directly is far better than *the 'cap and trade' system*.
- This is because the carbon tax system has advantages due to its simplicity, affordability, transparency, revenue recycling and predictability of carbon prices.
- It works on the principle of 'the polluter pays'.
- The principle has been adapted globally and many countries have successfully introduced a carbon tax.
- [E.g. in Europe, Denmark, Finland, Germany, Ireland, Italy, Netherlands, Norway, Slovenia, Sweden, Switzerland, and the UK had already imposed carbon tax in the 1990s]
- Data shows that these countries generate revenue up to \$1.7 billion annually from the tax.
- Countries use the revenue generated from this on energy efficiency improvements, renewable energy support program and public expenditure.
- The U.S., Canada, Singapore too has carbon tax systems in place.
- Among developing countries, South Africa has planned to introduce the tax soon.]

What can India do?

- Clearly, the carbon tax has three benefits of -
 - i. reducing emissions
 - ii. stimulating innovations
 - iii. raising government revenue
- In all, carbon tax is the most basic economic instrument which can be used to price carbon and combat CO₂ emissions, and correct negative externalities.
- India should take up carbon tax as an effective policy instrument in reducing different local pollutants and achieving INDC targets.
- The tax proceeds may be used to -
 - i. subsidise clean fuels and fuels used in the agriculture sector
 - ii. promote electric vehicles through subsidy
 - iii. improve public transport
 - iv. build infrastructure
- India has to become a pioneer among emerging economies and impose an explicit carbon tax, and let the polluters pay.

Cap and Trade System

- Under the 'cap and trade' system, maximum emission limits are decided for the firms.
- Firms are required to buy permits if they pollute more than the prescribed limit.
- Similarly, firms can sell their permits to others if they pollute less than the limit.

2.9 Project WASCAL

What is the issue?

- Project WASCAL (West Africa Science Service Center on Climate Change and Adapted Land) is a regional climate change project.
- It is being sponsored by Germany, to combat climate change in West Africa.
- Recently, the German Research Minister pledged \$27.6 million in additional support to this regional project.

What data does the project collect?

- The WASCAL database is the foundation on which our research can be based upon.
- It helps researchers find out, how high the temperature was 5 years ago in a particular region.
- The intensity of solar radiation, the condition of the ground and many other parameters can also be measured.

What conditions are becoming more extreme?

- Only with the knowledge of exactly what climatic conditions prevail, preparations can be made for extreme weather conditions.



- Among other things, WASCAL is **working on more precise rain forecasts** for farmers.
- It is also working on to find out how much more water will be needed when the climate warms up by two degrees.
- With their relatively weak economies, African countries hardly contribute to climate change.
- However, heat, drought, floods, in short the consequences of climate change, are likely to hit the continent hard.

Who are the climate doctors in action?

- African countries already suffer from extreme climate conditions and are poorly prepared for the consequences of climate change.
- This is why the project includes the training of young scientists.
- 10 doctoral programs and 2 master's programs have been introduced at several West African universities.
- They already have 250 experts in climate change and water supply, in adapted land use, or climate change and security.
- These experts now work across West Africa to prepare political and economic players for climate change.

How is training rather than migration?

- The trained climate experts can bring a wealth of knowledge and they are highly looked upon.
- The Research Minister also likes to boost vocational training in the field of climate protection in West Africa in the future.
- The Minister also said that the practical side must come directly from industry, so that the young people are able to connect.
- These things would speed up development in Africa and pressure is not created for a new wave of migration.

What is the fundamental criticism?

- The Germany's federal government hasn't understood the drastic nature of the climate crisis.
- Germany's CO₂ emissions are contributing to sub-Saharan Africa's drought and, the climate change to the slower economic growth.
- They have to start cleaning up their own act and phase out coal.
- With that, Germany would really help the world in the fight against climate change.

2.10 Discussion on Climate Change Plans - UN Secretary General

Why in news?

Ahead of the UN General Assembly meet (in September, 2019), the UN Secretary General has convened a summit to discuss plans to address climate change.

What is the key agenda?

- The UN Secretary General is concerned that the collective climate ambition is low.
- There exists a gap between the Nationally Determined Contributions (NDCs) made under the Paris Pact and the goal of climate stabilisation.
- Launching new initiatives to close this gap is thus a key priority.
- Also, the recent IPCC report which called for limiting the global warming to 1.5 degree Celsius has added momentum to the push.
- For this goal, the world will need to move towards zero carbon emission around 2050.
- For this, heavy electrification of energy, industry and transport systems in the medium term is essential.
- Also, in the longer term, market adoption of low or near zero carbon technologies is needed.
- In this line, discussions are planned at the summit to encourage countries to move to an aggressive path of decarbonisation.



- The “industry track,” focussing on industrial decarbonisation, led by India and Sweden, is one of the plans.

What is India’s position in this regard?

- As per government data, India may be on track to achieve its NDC target of emissions intensity well ahead of time.
- The period between 2005 to 2014 has seen consistently higher economic growth (around 6-7%) than the rate of growth in emissions (around 3.8%).
- Falling energy costs of renewables have made it possible for incomes and jobs to be protected while lowering the emissions.
- However, over a third of the emissions is generated by the harder-to-abate sectors.
- Notably, this will witness high growth rate in the next decade, leading to three to four times increase in energy demand.
- While the energy intensity of these sectors may fall because of improved energy efficiency, their emissions intensity may remain high.

What are the challenges ahead for India?

- The fall in India’s emissions intensity of GDP may not be sustainable.
- So attempts are essential to address the carbon intensity of these sectors in the long term.
- But heavy industries such as iron and steel, cement, aluminum, plastics, and long distance transport heavily depend on fossil fuels.
- The challenge is that technologies to replace such fuels are either not ready for commercial-scale application or simply not available.
- Typically, industry is hesitant to adopt better but costly technology because of concerns about market share.
- A common aspirational goal has to be established on a scientific basis.
- This will enable industry to make investment decisions on a level-playing field.
- In the process, cost of newer technologies may also come down over the medium term.

What can the UN summit provide for?

- The summit could help build three levels of coalitions in a push for the above discussed transformation.
- A voluntary coalition of industries having the desire to accelerate to low or zero carbon technologies could be formed.
- These coalitions could adopt sector-wide goals by 2023 based on the best-available technology using life-cycle methods.
- The second coalition could consist of countries interested in promoting decreased carbon intensity through specific schemes.
- E.g. the perform, achieve and trade scheme for energy efficiency in India
- A coalition of industries and countries could also be formed to push for international agreements.
- This can aim at promoting technology solutions in harder-to-abate sectors through working groups and partnerships.
- India could choose to join the coalition that would facilitate its sectoral actions as part of a long-term low carbon national growth strategy.

3. RENEWABLE ENERGY

3.1 Enhancing Accessibility of Rooftop Solar Program

Why in news?

Cabinet Committee on Economic Affairs approved phase 2 of the grid-connected rooftop solar programme.



What is Grid-Connected Rooftop solar programme about?

- The Grid connected rooftop solar programme is implemented by the Ministry of New and Renewable Energy, with a focus on the residential sector.
- The development objective of the Grid-Connected Rooftop Solar Program Project for India is to increase installed capacity of grid-connected rooftop solar photovoltaic (GRPV) and to strengthen the capacity of relevant institutions for GRPV.
- The program environmental objective (PEO) is to achieve reductions in greenhouse gas (GHG) emissions through the displacement of thermal energy with solar energy.
- The operation supports the government's rooftop solar PV program.

What are the challenges in rooftop solar programme?

- India has set an ambitious target of achieving 40 GW of rooftop solar capacity by 2022.
- However, while there has been progress on rooftop solar installations among industries and commercial consumers, the uptake among residential consumers has been slow.
- Enthusiasm for rooftop solar energy largely comes from those with higher disposable incomes and who live in their own houses.
- In India electricity utilities are not very supportive of consumers generating their own power, as this would impact their revenues.
- Urban residential electricity consumers are still hesitant to consider rooftop solar power for their homes, due to lack of information.
- For residential urban consumers, one of the key barriers to installing rooftop solar systems is that they do not know who to contact to understand the processes to be followed and permissions required.
- There is no single source to access information, evaluate benefits and disadvantages, and examine if any government support (such as a financial subsidy) is available.
- Most of the technical information provided by various sources, including the government, tends to be Internet-based.
- Instead of internet sources a significant majority of consumers seek face-to-face discussions and recommendations from friends and family.

What measures needs to be taken?

- **Awareness** -Objective information must be put out through various avenues, so that it is accessible to all segments of the population and in local languages.
- Information must be made easily available to the consumers on the amount of shadow-free roof area needed for generating a unit of electricity and pricing; operating the system, after-sales maintenance and support; and reliable rooftop solar vendors.
- **Skill Development** -The local electricity linesmen, electricity inspectors, and other nodal officials in the electricity department also have key roles to play.
- Building their capacities to disseminate such information and handle consumer queries and concerns, and providing basic training in billing and metering for solar power can go a long way in improving consumers' experience.
- **Capacity Building** - Information kiosks can be set up in public institutions like banks to offer information on the technology, as well as on practical issues such as guidance on selecting vendors.
- Consumer rights groups, rooftop solar system vendors, and resident welfare associations (RWAs) in larger cities are beginning to organize campaigns and workshops to generate awareness and create a dialogue with consumers.
- However, awareness building sessions need to be socially inclusive and should take place during periods when consumers are likely to be at home.
- The uptake of rooftop solar across economic categories is also contingent on policies that make it more accessible and affordable.



3.2 Managing the Transition to Renewables

What is the issue?

- The rise of renewables has implications for the finances of power distribution companies (Discoms).
- It calls for managing the transition strategically to prevent the negative impacts on small and rural consumers.

What was the earlier approach?

- For the most part of the 20th century, planning broadly involved estimating future electricity demand.
- The focus was on adding larger conventional power generation and connecting these to load centres through transmission lines.
- Electricity was supplied to consumers by a monopoly, a vertically integrated utility.
- Pricing was based on the principle of cross subsidy.
- So large industrial and commercial consumers paid higher tariffs to ensure affordable tariffs for agriculture and households.

What is the emerging trend?

- Energy choices are rapidly changing, largely due to national policy initiatives and global techno-economic changes.
- There is an increasing share of renewable energy in the supply mix due to -
 - i. competitiveness of renewables
 - ii. reducing costs of battery storage
 - iii. rising costs of coal-based power
- In the long run, this is likely to drive electrification of other sectors such as transport, cooking, and industrial processes.
- It would gain pace as an effort to addressing issues of local air pollution, energy security and rising energy import bill.
- In all, these trends can effect a paradigm change in the energy sector.

What is the current limitation?

- Currently, the government focus is very limited in critically evaluating and prioritising needs, anticipating risks and preparing for them.
- This can lead to serious long-term implications in terms of resource-lock-in and dependency.
- This is especially true considering the long life and capital intensive nature of the investments in the power sector.

What are the implications?

- The emerging trends in renewables and storage create numerous opportunities for large consumers.
- However, this could end the revenue that these high paying consumers were so far providing.
- In turn, this could mark the end of the current business model of the electricity distribution companies (Discoms).
- Given the uncertain demand, power purchase (accounts for more than 70% of the cost of supply) will become more complex and riskier.
- Simultaneously, the loss of cross-subsidising consumers would sharply increase either the tariff for small, rural, and agricultural consumers, or the State subsidy.
- If not managed appropriately, these changes can lead to -
 - i. severe financial stress for Discoms
 - ii. poor supply quality for small consumers
 - iii. stranded assets, and bailouts, with implications for the banking sector

What does it call for?

- There is an urgent need for fundamental changes in the way Discoms plan and operate.
- Increasingly, markets and competition would need to play a substantial role.
- Allowing large consumers to choose their suppliers for the long term helps them reduce costs, and also enable rational capacity addition.
- Solarising agricultural feeders can help in capping subsidy while providing day-time reliable supply to farmers.
- These measures can allow Discoms to focus on improving supply and service to small and rural consumers.
- Alongside, discoms should avoid adding new baseload capacity without rigorous demand-supply analysis.

How can the data deficiency be met?

- The gaps and discrepancies in public availability of crucial data should be addressed.
- To assist the government in policy and decision making, an analytical agency needs to be set up.
- This agency, tentatively called the Energy Analysis Office (EAO), should involve multiple ministries.
- It should be empowered to collect and reconcile data, analyse trends, publish reports and suggest policy interventions.
- The agency would leverage as much as possible from existing technical agencies in the sector.
- Two important prerequisites for it to be effective are policy relevance and independence from political influence.
- For this, the EAO could be placed under the administrative control of the Executive.
- But the Parliament should be made to approve its budget and review its work.

3.3 CEA's Plan on Renewable Energy

Why in news?

Central Electricity Authority (CEA) has set up a new division to oversee developments in renewable power.

What is the capacity of renewable energy in India?

- India's current renewable power capacity stands at 78,316.39 Mw, which includes 35,625.97 Mw of wind power and 26,384.30 Mw of solar.
- On May 1, renewable energy was 12 per cent of the total power generation in the country.
- In terms of million units of energy production, renewable has seen a 10 per cent growth over last year.

What are the hurdles in the renewable energy?

- Power is transmitted across regions through high-tension electricity lines that are managed from the back-end.
- This entire infrastructure constitutes grids that can lose stability if power source is intermittent and its flow is not planned.
- The major hurdle in the successful integration of renewable energy is the difference in the actual and forecast energy generation.
- This impacts the planning of the whole system, including backing down or increasing conventional energy in the grid to balance renewable.

What is the plan of CEA in renewable energy development?

- Central Electricity Authority (CEA) is the apex technical body for the power sector, has set up a new division which will oversee day-to-day developments, capacity addition and grid integration of renewable power.
- With the share of renewable power in the country's energy generation increasing, the CEA plans to put out daily data on green power, as it does for thermal, hydro power and coal-based power.

- In order to map the intermittent solar and wind energy, the CEA will source data from the Renewable Energy Management Centers (REMCs), which are being set up across the country.
- These centers will collect data, help in integrating renewable energy with the grid, and maintain grid balance in the area.
- It is a first such attempt to bring all renewable energy generation control operations under a standardized framework, consistent across all states and regions in real time.
- CEA's new division will also put out data on forecasting and scheduling of renewable energy, which is key to its integration in the grid and healthy energy mix.

How CEA's plan will address hurdles in power sector?

- The CEA in 2017 envisaged to set up one REMC each in the south, west and north regions along the resource-rich states.
- There are 11 REMCs across the country, west and south REMC are functioning well and they will take regular data from them.
- To bring about large-scale renewable evacuation, REMCs will act as the nodal point for all renewable generators to schedule their generation via a dedicated scheduling system.
- Best-in-class forecasting and standardized real-time scheduling framework will enable grid operators to look into the future and make efficient real-time decisions integrating renewables without compromising on grid stability.
- The CEA already has a sub-portal which tracks installed capacity sector, state- and fuel-wise, now renewables added along with hydro, thermal and nuclear.

4. GOVERNMENT POLICIES/INTERVENTIONS

4.1 Draft Indian Forest Act, 2019

Why in news?

The draft Indian Forest Act, 2019 was recently released by the Union government, proposing an overhaul of the Indian Forest Act, 1927.

What is the objective?

- The Indian Forest Act, 1927 was imposed by the British rulers to take over Indian forests and use them to produce timber.
- It has been criticized for years for providing immense discretion and powers to the forest bureaucracy.
- Forest officials could govern areas declared as forestlands of different classes and summarily arrest and prosecute forest-dwellers.
- The Act curtailed and extinguished the rights of millions of forest dwellers, to address which the new law has been drafted now.
- But the draft law largely retains as well as enhances the policing and quasi-judicial powers that forest officials enjoyed under the original act.

What are the key features?

- **Powers** - The draft law proposes to restore higher management powers and a degree of veto power with the forest bureaucracy over the Forest Rights Act, 2006.
- Forest officials would be able to -
 - i. deny or extinguish rights over traditional forests of tribals, even those already recognised under the FRA
 - ii. reduce or restrict tribals and forest dwellers' access to forest produce (which they own under the FRA)
 - iii. diminish the role of gram sabhas (village assemblies) by running a parallel system of "village forests" wherein officials would have the last say

- Also, the powers to investigate, search and seize property, hold inquiries by forcing attendance of witnesses and evidence have been retained and in parts enhanced.
- Moreover, the Centre will be able to intervene in the states on matters of management of forestlands.
- It can overrule the states on several counts when it deems fit.
- **Commercial use** - The government had earlier proposed as a policy, to open forests to private commercial plantations.
- Facilitating this, the draft law proposes to open any patch of forests it deems fit for commercial plantations.
- The law allows the government to assign forests to non-state entities but not lease it or use it as collateral to raise funds.
- **'Production forests'** - Introducing legal provisions for commercial forestry, the government proposes to create a new class of forests called 'production forests'.
- It can as well declare any forests as conservation area for the purpose of enhanced carbon sequestration.
- The conservation areas will also be opened to active forest management for enhancing vegetational growth by reforestation and afforestation.
- **Infrastructure** - The State Government/UT Administration shall -
 - i. develop the infra-structure for standardized lock-up rooms for housing the accused
 - ii. provide for transportation of accused
 - iii. provide necessary articles for restraining the accused(s), armouries, safe custody of arms, ammunitions, etc
- The State/UT should provide these to the Forest-officers for implementing the provisions of the Act in each forest division of the country within 2 years.
- **Offence** - Certain offences that were bailable earlier have been proposed to be made non-bailable.
- The onus of proving innocence in several cases has been left on the accused who are to be presumed guilty till proven otherwise.
- The accused has to prove that s/he is in lawful possession of forest land, forest produce, and has not committed any offence against the Act.
- **Protection** - The draft law also proposes to provide indemnity to Forest-officer using arms, etc to prevent the forest offence.
- This is in addition to the immunity provided under section 197 of Code of Criminal Procedure 1973 for certain categories of Public Servant.
- The immunity under the draft forest law is higher than what other government officers are usually provided.
- It is similar to the one provided under laws imposed in conflict zones, such as the Armed Forces (Special Powers Act).
- But proceedings against the officers can begin if an inquiry by an authority to be notified by the State Government for the purpose is taken up.
- Even state governments would not be permitted to grant sanction for prosecution without first constituting an inquiry.
- **Case** - Any person, forest officer, any officer of the State Government cannot withdraw forest offence cases registered under the Act.
- This is to dissuade political executives to incite masses against the provisions of the Act.
- E.g. many State Governments have withdrawn cases registered under the Indian Forest Act, 1927 to draw political benefits
- **Collective punishment** - The colonial provision of collective punishment of communities for crimes committed by individuals under the forest law has been retained.
- This applies when fire is caused wilfully or by negligence in a reserved forest, or when theft of forest produce or grazing by cattle occurs.



- The State Government may then suspend the exercise of all rights of pasture or to forest-produce to all dwellers in the region, for a specified period.

What is the centre's rationale?

- Forest officials often contend that they remain the only face of administration over these vast difficult-to-access territories.
- They have to deal with the difficult challenge of retaining the quality and extent of forest cover.
- This becomes especially challenging in the face of high population pressure and development activities.
- It is in this light that the Centre proposes to enhance forest officials' police powers and capacities over forestlands.

What are the concerns?

- The draft Indian Forest Act, 2019 is short of being a transformative piece of legislation.
- It reinforces the idea of bureaucratic control of forests, providing immunity for actions of forest officials.
- The hardline policing approach is reflected in the provisions of infrastructure for the accused, collective punishment, etc.
- The enhancing of powers of forest bureaucracy is likely to alienate tribals and also fuel left-wing extremism in Central Indian region.
- Such provisions invariably affect poor inhabitants, running counter to the empowering and egalitarian goals.
- The draft Indian Forest Act must be redrawn to rid it of the bureaucratic overreach.

How could the new law be reworked?

- The original law, the Indian Forest Act, 1927 suited the objectives of a colonial power with extractive uses for forests in mind.
- The new law enacted should thus make a departure from that and be aimed to expand India's forests.
- It should ensure the well-being of traditional forest-dwellers and biodiversity in these landscapes.
- Forest health can be improved only through collaboration.
- Any new forest law must, therefore, aim to reduce conflicts, incentivise tribals and stop diversion for non-forest uses.
- The need is for a paradigm that encourages community-led, scientifically validated conservation.
- This is critical as only 2.99% of India's geographic area is classified as very dense forest.
- The rest of the green cover of a total of 21.54% is nearly equally divided into open and moderately dense forest. - State of Forest Report 2017.
- So all suitable landscapes should be recognised as forests and be insulated from commercial exploitation.

What are the other tasks ahead?

- India's forests play a key role in moderating the lives of adivasis and other traditional dwellers, as well as everyone in the subcontinent.
- They have a wider impact in terms of climate and monsoons.
- But for decades now, the Forest Department has resisted independent scientific evaluation of forest health and biodiversity conservation outcomes.
- Also, environmental policy has weakened public scrutiny of decisions on diversion of forests for destructive activities.
- Impact assessment reports are mostly not taken seriously, and the public hearings process has been diluted.
- So the government needs to launch a process of consultation, beginning with the State governments.
- It must be ensured that a progressive law is adopted by all States, including those that have their own versions of the existing Act.
- The Centre must consult all stakeholders and communities, including independent scientific experts.

4.2 Cutting down of Forests Right Act (FRA), 2006

What is the issue?

- There is a proposal to cut down the Forests Right Act, 2006.
- It is said that it will only weaken the conservation regime and affect the rights of forest dwellers.

What is the Forest Rights Act (FRA)?

- The FRA is a **piece of social legislation** which aims to address the historical injustice that our forest dwelling communities have had to face for nearly 150 years.
- It provides them with security of tenure over land for cultivation and habitation through **individual rights**.
- It also provides access to a variety of resources through more than a dozen types of **community forest rights**.

What do the provisions mean?

- It **empowers forest dwelling communities** to protect, regenerate, conserve and manage any community forest resource which they have been traditionally protecting and conserving.
- It has the provision for **creating critical wildlife habitats** within protected areas.

What are the legal challenges?

- The very constitutionality of the FRA was challenged in the Supreme Court in 2008 by some conservation organisations.
- The court's order of February, 2019 puts FRA in a state of temporary disuse; this highlights the very tardy implementation of the FRA by the State governments.
- One of the key arguments is that, FRA is beyond the legislative competence of Parliament as **'land' is a state subject**.
- **If this argument is accepted**, the Wildlife Protection Act and the entire architecture of forest laws will have to be dismantled as ultra vires as all of them deal with 'land'.
- The Supreme Court (SC) order directs the eviction of forest dwellers whose claims have been rejected under the FRA.
- Many State governments have admitted to the SC that their implementation of the FRA has been incomplete and flawed.
- This rejects the misguided and unmeritorious nature of this whole legal challenge becomes very clear.

What does the FRA hold in it?

- The FRA is not land distribution legislation, as how it has been criticised now.
- It very clearly states that **forest dwellers** (Scheduled Tribes or Other Traditional Forest Dwellers) are only entitled to claim both individual and community forest rights.
- It is claimed only through a clear process of submitting a claim and after its verification and subsequent approval or rejection.
- For the rejected cases, an appeal process has been outlined.
- It aims to **only confirm tenure and access rights** which in some sense the forest dwellers have been exercising de facto but under severe restrictions and control.
- It is in fact the **failure of the state** to settle pre-existing rights under existing forest and conservation laws that created the situation of historical injustice.

What are the provisions often suppressed by critics of FRA?

- The FRA **does not sanction any fresh clearance of forest**, as individual rights over land will only be granted if the forest dweller was in possession of that parcel of land on December 13, 2005.
- It also **limits the extent of land that can be granted** to the area that was occupied on December 13, 2005.
- It places an upper limit of 4 hectares per claimant for individual rights.

What can be done?

- The FRA has potential to strengthen the conservation regime across India by **recognising rights of forest dwellers** over land and community forest resources.
- **Democratising the forest governance and conservation** should be done by the providing the rights and authority to local communities and gram sabhas.
- So, the FRA will **empower gram sabhas** of the forest dwelling communities to halt the destruction of forests.
- Implementing the FRA in letter and spirit with empathy for forest dwellers will be a decisive step by India to achieve conservation justice.

4.3 Implementation Hassles in the Forest Right Act

Why in news?

Supreme Court's order to evict tribal people who claim the forest land has temporarily stayed.

How the Forest Right Act of India empowers the tribal population?

- India hosts nearly 200 million tribal and other traditional forest dwellers who derive their livelihoods mainly from forest resources.
- The effective implementation of the Scheduled Tribes and other Forest Dwellers (Recognition of Forest Rights) Act, 2006, which recognizes the individual as well as community rights over forest resources.
- It empowers the communities to use, manage and govern forests for their livelihood as well as for the conservation and protection of forests.

What are the issues in the proper implementation of FRA?

- Due to the absence of a proper survey, settlement and land record, customary rights of tribal over forest land have always been under threat.
- As most of the tribal do not have required documentary evidence to possess the forest land they are considered encroachers of the land on which they live.
- State governments have not taken any systematic efforts to recognize and record the individual and community rights of forest dwellers.
- According to the Ministry of Tribal Affairs, up to September 30, 2018, 4.2 million individual and community resources claims were filed, of which, 1.9 million claims were rejected.
- Once the 150 million potential beneficiaries of FRA submit their claims, at the current rejection rates, several millions of tribal and other forest dwellers would be deprived of their customary forest rights.

What are the reasons behind the implementation hassles?

- **Lack of Resources** - The primary reason for the implementation hassle is due to lack of political commitment; lack of adequate human and financial resources with the Department of Tribal Affairs, which is the nodal agency for implementation of FRA.
- **Bureaucratic Failure** - Unkind and irresponsible forest bureaucracy which influences the decision at various levels, poor or non-functioning of district and sub-division level committees, which consider the claims filed by gram sabhas, which seriously affects tribal.
- **Recent government decisions** - Various decisions of the government affect implementation of the Act, like Environment ministry's guideline to lease 40 per cent of the degraded forest in the country to private companies for afforestation and forced plantation on land under shifting cultivation.

What are the concerns with SC's decision on forest lands?

- The Supreme Court order of February 13, 2019, asking States to evict people whose claims to forest land have been rejected by them, is a glaring example of this.
- The eviction order by the apex court was based on affidavits filed by the States.
- Union Government filed a petition before the apex court to stay the eviction order.



- Although the eviction order has temporarily stayed, the rights of tribal and other traditional forest dwellers remain highly uncertain.
- If the stay order gets vacated, above one million people will be affected immediately.

What measures are needed?

- Union government in cooperation with State governments should implement the Forest Rights Act, 2006 in its right spirit.
- If gram sabhas are involved in Compensatory Afforestation Fund Act, 2016 (CAF) Plantation Programme, about 30 million hectares of forest will come under effective protection and regeneration.
- It will also help meet the climate change mitigation goal for negative emission through additional carbon sequestration.
- Besides, 65 out of the 103 districts affected by Left-wing extremism have high individual forest right (IFR) and community forest right (CFR) potentials.
- Implementing FRA in these districts will not only lead to the development of forest dwellers but also build a relationship of trust and bond between them and the government, thereby reducing land conflict, Naxalism and underdevelopment.
- Besides leveraging modern technology to map and monitor the implementation of FRA, the forest bureaucracy must also be reformed to serve as service providers to gram sabhas.
- There is a need to provide marketing and MSP support to non-timber forest products and create institutional mechanisms to support community forest enterprises for value addition.
- It is important that the Ministry of Tribal Affairs at the Central and State levels are strengthened with human and financial resources to help implement FRA on a mission mode.

4.4 Understanding Sustainable Development - Chennai-Salem Highway Case

What is the issue?

- The Supreme Court is to hear arguments on an appeal filed against a judgment of the Madras High Court in regards with the Chennai-Salem highway.
- The highway case gains significance as it will test the judiciary's assessment of environmental and economic interests.

What is the case about?

- The case relates with acquisition of land for the proposed eight-lane expressway connecting Chennai to Salem in the state of Tamil Nadu.
- The eight-lane highway is part of the "Bharatmala Pariyojana", a centrally sponsored highways programme.
- It is aimed chiefly as a corridor for more efficient freight movement.
- The intended highway will cover more than 250 km.
- Once constructed, it will pass through many agricultural and reserve forest lands.
- The project could have a harmful impact on the forests, the surrounding water bodies and the wildlife of the region.
- Given this, the key contention is the debate over the need for an environmental impact assessment (EIA) before land acquisition.
- According to the petitioners (mostly landowners), the state had failed to obtain an environmental clearance before acquiring land.
- Subsequently, the Madras High Court quashed a series of notifications acquiring land for the project.
- The Supreme Court too had already denied the National Highway Authority of India's urgent request for a stay of the judgment.

What is the government's stance?

- The TN government argued that its power to acquire land under the National Highways Act, 1956 was unconditional.
- It maintains that there was no law mandating an EIA before efforts are made to acquire private land.
- It says that a notification under the Environment (Protection) Rules, 1986 requiring EIA did not call for such an assessment for the purposes of securing the land.

How did the idea of sustainable development emerge?

- Recognising the state of deteriorating environment, in 1987, a UN-backed committee led by the former Norwegian PM Gro Brundtland proposed some measures.
- It gave a long-term strategy which called for sustainable development, among other things.
- The core idea was to meet the needs of the present without compromising the ability of the future generations to meet their own needs.
- In India, even before a binding international norm was in place, the Supreme Court read the idea as intrinsic to India's constitutional structure.

What is the approach at ground level?

- Over time, the traditional concept that development and ecology are opposed to each other became no longer acceptable.
- The courts have invariably seen sustainable development as demanding a balancing exercise.
- It is seen as that which requires a calculation of trade-offs between the environment and the economy.
- In other words, any development would have an adverse effect on the ecology and the environment, and so a balance had to be struck.
- So, if a project would bring in results which are far more useful for the people, difficulty of a small number of people has to be bypassed.
- The convenience and benefit to a larger section of the people has to get primacy over comparatively lesser hardship.

What is the concern here?

- The prominence accorded to sustainable development may be laudable.
- But the utilitarian calculations represent a problem inherent in seeing sustainable development as an ideal model.
- In effect, a project which may not be beneficial for the environment may be justified under the utilitarian calculations.

What does the Chennai-Salem highway issue imply?

- Going by the utilitarian argument, the project could be justified by the government as it would economically benefit many.
- But it is a greenfield project where an altogether new road will be constructed on virgin land.
- So, to avoid an EIA before land was obtained would have created irreversible effects.
- This would have had a bearing not only on the environment, but also on the social and economic life of the landowners.
- The highway may further make way for new establishments, poaching of endangered species, illicit felling and transportation of valuable timber, etc.

4.5 Seashore as 'Land' - Maharashtra

Why in news?

The Maharashtra government has decided to treat a part of the Arabian Sea shoreline at Mumbai's Nepeansea Road as "revenue land".



What is the area in question?

- It is the part of the seashore lying between the low tide mark and the high tide mark in a particular part of South Mumbai.
- The part of the shoreline in question was marked as “sea” at the time of Mumbai’s last land survey.
- Since then, about 100 shanties (huts) have come up illegally on a portion of this land.
- Mumbai’s latest approved Coastal Zone Management Plan (CZMP) categorises it as an inter-tidal zone or foreshore.
- [Under The Maharashtra Land Revenue Code, 1966, ownership of foreshore areas vests in the state government.
- Revenue land, in other words, means land that is utilisable and disposable, and which can generate revenues.]
- It has been placed in the ecologically sensitive CRZ-1B category.
- The CZMP shows it as lying to the seaward side of the high tide line.

What is the recent decision?

- Maharashtra CM gave in-principle approval to a proposal for a survey, and to give a cadastral survey (CS) number to the identified portion of the shoreline.
- [A cadastral survey is done to determine the land boundaries of a city, ward, or plot.]
- The foreshore area was under water when the last survey was carried out, and exists beyond the current boundaries.
- So a survey is necessary to determine its boundaries. The survey will also effectively increase the ward boundaries.
- The Superintendent of Land Records carries out the survey and marks the new boundaries.
- After this, the Mumbai Collector’s office would be expected to decide the ownership of the newly formed land, and assign it a CS number.
- An independent property card will then be generated containing all the details.
- The CS number and the property card are essential documents for the assessment and development of any land.

What is the plan?

- Official documents show that the Revenue Department had processed the proposal for surveying the foreshore area.
- The CM has said that the “developability” of the newly surveyed “land” would be assessed in accordance with -
 - i. Coastal Regulation Zone (CRZ) norms
 - ii. rules governing construction activity in Mumbai
- Meanwhile, a developer has submitted an in situ slum redevelopment project for the land.
- This has been admitted by the state-run Slum Rehabilitation Authority (SRA).

Is it legally permissible?

- As per the CRZ notifications (2011 and 2019), no development or construction is permissible on this portion even if it is categorised as revenue land.
- Maharashtra’s environment department has clarified this.
- The 2019 notification allows only foreshore facilities such as jetties, harbours, and ports in such places.
- However, slum-dwellers on this illegally reclaimed portion of the shore have come together to form a “housing society”.
- They have authorised the developer to carry out in situ re-development.
- It is said that the decision to carry out the survey would amount to recognising illegal reclamation of the seashore.



- This, and other such claims, would expose the coastal areas to a fresh wave of construction.

What could be done?

- Instead of treating such proposals on a case-to-case basis, a policy should be framed in consultation with the affected groups and various stakeholders.
- The impact on coastal livelihoods and the environment should also be examined in this regard.
- It should be ensured that the CRZ notification under The Environment Protection Act, 1986 is followed in letter and spirit.

4.6 Banning of Fossil Fuel-Driven Vehicles

Why in news?

Government of India has planned to ban the sale of fossil fuel-driven 2&3 wheeler vehicles by 2025.

What is the Government's plan?

- Government wants to **halt production** of internal combustion vehicle,
 1. Three-wheelers by **2023** and
 2. Two-wheelers with 150cc engines and below by **2025**.
- NITI Aayog has given a two-week deadline to the industry to come up with a comprehensive **plan** for introducing electric vehicles (EVs) in the next 5 years.

What is NITI Aayog's stance?

- **Pollution** - As per a report by Greenpeace and AirVisual, India has 22 of the most polluted cities in the world, with Gurugram being the most polluted.
- Two-thirds of the pollution load is due to internal combustion engine based two-wheelers running in major cities.
- This will be reduced with the transition.
- **Dependence** – India is hugely dependent on oil imports.
- The NITI Aayog estimates savings of Rs 1.2 trillion if the transition takes place.

How did the automobile industry react?

- Industry leaders have **questioned the urgency**.
- They also have pointed out the increase in the **cost of vehicles** due to the price of batteries which constitute 40% of the total cost.
- In addition, considerable **planning and execution** are required to simultaneously develop a complete ecosystem around EVs.
- They insist such a **short-notice switch is impossible** and it would destroy an industry that's a key global exporter.
- Additionally, the industry is already facing difficulties in **coping** with the transformation to meet the **BS-VI regulations**.
- In the unorganised sector, the vast pool of mechanics would also suddenly find their services aren't greatly needed.
- Only EV manufacturers are enthusiastic about the proposals.

What should be done?

- While a move to EVs is inevitable, the industry should be given a reasonable time.
- With the country facing mounting unemployment, managing the transition fallout will be all-important.
- **Chinese example** - China took the EV route as early as in the 1990s by **classifying** electric two-wheelers that move at 20 km/hour **as bicycles**.
- Beijing **made them attractive** by doing away with registration.



- They are allowed to be **ridden in bicycle lanes**.
- Soon, it **restricted the ownership of gasoline-powered two-wheelers** in some cities.
- It has been **giving tax benefits** and other subsidies to carmakers for almost a decade.
- To spruce up their supply chain, Chinese companies have been aggressively **buying lithium mines**, the critical component for making batteries.

4.7 Maharashtra Civil Disobedience Movement - GM Crops

What it is the issue?

- Over 1,000 farmers recently participated in a 'civil disobedience' movement in Akoli Jahagir village in Akola district of Vidarbha region of Maharashtra.
- The defying of GM crops ban necessitates a quick and well-thought-out decision by the Central government on GM crops.

What was the move on?

- The carrying, storing, selling or sowing of banned GM crops invites a Rs. 1-lakh fine and 5 years' imprisonment.
- But farmers outrightly defied the ban to cultivate HTBT (herbicide tolerant Bt) cotton and Bt brinjal.
- They sowed genetically modified HTBT cotton on a 2-acre plot owned by a local farmer as a form of protest against the ban.
- The police were present on the occasion, but they did not take any action against the farmers.
- Farmers' body Shetkari Sanghatana has decided to take the movement across the State.
- They feel that the ban on GM crops was unfair on farmers who are reeling under poverty.
- They also say that so far, no transgenic crop has been found to do any environmental harm.
- They maintain that vested interests were opposing the use of Bt cotton and Bt brinjal.

HT Bt Cotton

- Herbicide Tolerant Bt cotton is an innovation in the Bt cotton.
- It offers the twin advantage of bollworm resistance and herbicide tolerance.
- In comparison, the approved Bt variety (Bollgard I and Bollgard II) is only bollworm-resistant.
- It takes care of the weeds problem at a much lower cost than the labour farmers engaging for weeding.

What does this imply?

- Farmers' move has confirmed that the variety, which is unaffected by applications of the controversial *weedicide glyphosate*, is being grown in cotton-producing areas.
- In 2001 too, Hyderabad-based Navbharat Seeds distributed illegal Bt cotton seeds in Andhra Pradesh and Gujarat.
- It arguably put the Centre under pressure to legalise Bt cotton, produced by Mahyco-Monsanto.
- It has also come to light that Bt brinjal is being illegally cultivated in Haryana.
- All these indicate that farmers are largely willing to adopt technologies that offer promising and cost-effective solutions to pest attacks.

How has the issue evolved?

- A decision on Bt brinjal has been on hold for nearly a decade.
- The Genetic Engineering Appraisal Committee cleared Bt brinjal in 2009.
- But the Ministry of Environment held back its clearance, citing a lack of scientific consensus.
- In the meantime, Bt brinjal grown in Bangladesh in particular has found its way into the Indian market.
- Meanwhile, slow progress on approval in the government side has led to farmers undertaking illegal cultivation of GM crops.



- On the other hand, activists and academics in the anti-GM camp have pointed 'quasi-official' leaks of GM varieties.

What are the larger concerns?

- **Breach of law** - There is a scientific procedure to be followed for releasing new seeds for cultivation.
- Farmers had not only broken the law but also made the country breach international biosafety conventions such as the Cartagena Protocol.
- On the other hand, farmers resorted to such a drastic step as little is being done to save their crops from pests and pathogens.
- **Slow decision-Making** - The environmental and health debate on GM varieties has been going on without any resolution in sight.
- So, the Centre has avoided a decision on genetically modified varieties of brinjal, mustard and HTBT (herbicide tolerant Bt cotton).
- The slow decision-making process by the government is costing farmers very dearly.
- The prevailing uncertainty has affected both the producers and the consumers.

Glyphosate

- It is an herbicide that is applied to the leaves of plants to kill both broadleaf plants and grasses.
- The sodium salt form of glyphosate is used to regulate plant growth and ripen specific crops.
- It is a non-selective herbicide, as it will kill most plants, preventing them from making certain proteins that are needed for plant growth.
- Humans can be exposed to glyphosate if they get it on skin, in eyes or breathe it in when using it or touching plants that are still wet with spray.
- It is said to be carcinogenic, but this is highly debated.
- It binds tightly to soil; it can persist in soil for up to 6 months depending on the climate and soil type. So it is not likely to get into groundwater.
- It may affect fish and wildlife indirectly because killing the plants alters the animals' habitat.

What is the way forward?

- There can be no dismissing the concerns worldwide over the health effects of glyphosate.
- However, in trying to curtail its use, farmers' issues of rising pest attacks, in the context of drought and climate change, too need to be addressed.
- Apparently, while Bt cotton strains have multiplied the yields, the benefits have declined with pests attack.
- In all, the Centre needs to decide fast.
- The Centre should adopt an open, consultative process so that producers' and consumers' interests are well served.
- The issue of conserving traditional varieties as well as monitoring carcinogenic effects, if any, should be entrusted to public agencies.
- Income support could help subsidise the cost of manual labour in carrying out weeding operations.
- Meanwhile, public-funded R&D should take the lead in producing harmless alternatives.

5. RESOURCE MANAGEMENT

5.1 Rain Deficit and Water Stress

Why in news?

Reportedly, nearly 40% of the country is facing an acute paucity of pre-monsoon rain, causing severe water distress in scorching heat.

How is the rain deficit scenario?

- Though summer droughts are very common, the extent and intensity of aridity witnessed this year are rare.
- The rain deficit has been as high as 48% in the southern peninsula, especially Tamil Nadu and coastal Karnataka.
- It is nearly 30% in western India, notably Gujarat and large parts of Maharashtra, and 17% and 12% in the Central and north-east region respectively.



- Shortfalls of 70 to 80% have also been reported from some places.
- The overall countrywide average rainfall between March and May, 2019 remained 23% below normal.

What do monsoon forecasts suggest?

- The rain deficit conditions across the country are a matter of grave concern.
- But the redeeming factor is that the onset of the monsoon is round the corner.
- The rain during the 4-month monsoon season (June to September) is anticipated to be well spread out.
- It is also expected to be quantitatively normal or somewhat below normal.
- The India Meteorological Department (IMD) forecast has suggested rainfall to be likely around 96% of the long-period average (LPA).
- On the other hand, private weather forecaster Skymet has put it at 91%.

Drought Type	Impact
Meteorological	Below-average rain or snowfall (precipitation)
Hydrological	Lack of precipitation decreases streamflow, lake/reservoir and ground water levels
Agricultural	Lack of soil moisture/ground water that affects crops/livestock
Socioeconomic	Food/water supply does not meet demands due to lack of water
Ecological	Lack of precipitation impacts native plant/animal species

What is the concern though?

- The problem is that both IMD and Skymet have forecast that the monsoon would be sluggish/slow to begin with.
- The reason cited for this is the existence of El Nino (warming up of the Pacific Ocean), which often impairs the monsoon performance.
- Also, IMD and Skymet differ on the progression of El Nino.
- The IMD expects El Nino conditions to turn neutral in the second half of the rainy season.
- But Skymet reckons it to last the whole season, even if in a weaker form.
- So clearly, there is a possible delay in relief from the current water crisis in some areas.

What is a favourable factor yet?

- Of the three main facets of drought (meteorological, hydrological, agricultural), the present conditions conform chiefly to the meteorological drought (rainfall inadequacy).
- Only in some areas, aridity has accentuated to cause hydrological drought, reflected in exhaustion of the surface and groundwater resources.
- The overall hydrological profile of the country is still positive.
- The total water stock in 91 major reservoirs monitored by the Central Water Commission is around 14% above the last year’s corresponding level.
- It is 3% higher than the long-period average (May, 2019 data).
- Agricultural drought has, by and large, been averted as the rabi crops have mostly been harvested and the kharif ones are yet to be planted.

5.2 Addressing India’s Water Crisis

What is the issue?

- India is witnessing depletion of water resources due to several reasons and instances of water shortages across the country.
- In this context, here is a look at India’s water conditions and the possible measures at addressing the water crisis.

What is India’s water resource scenario?

- Today, India conserves only 8% of the rainfall it receives, which is among the lowest in the world.



- Further, only 4% of world's water resources are available to India.
- In contrast, India has to provide for 16% of world's population.
- Moreover, agriculture consumes nearly 80% (65% in China) of fresh water in India.
- The rest 20% is used for drinking and other household activities.
- The latest available World Bank statistics show that India produced \$0.5 of agricultural GDP (in 2010) for a litre of fresh water.
- This figure is \$1.6 for China (in 2012) and \$3.9 for Israel (in 2004), which all stand as success stories of efficient water use for agriculture.
- In contrast, there has been no increase in agricultural output per unit of water usage in India during the last 3 decades.

What is the emerging threat?

- Water crisis is now a worldwide phenomenon.
- Nearly, two-thirds of the global population is living under water-stressed conditions.
- By 2025, about 1.8 billion people are expected to face absolute water scarcity.
- However, it is much worse in India due to mismanagement of water usage in agricultural operations.
- The country is already witnessing water shortage, particularly in Tamil Nadu, Rajasthan, Uttar Pradesh, Telangana and Haryana.
- The huge water shortage is likely to land the country in a critical situation, if urgent steps are not taken.
- NITI Aayog's report of 2018 asserts that groundwater in 21 cities of India is set to plunge to bare minimum levels by 2020.

What are the possible measures?

- **Recycling** sewage and other household waste water by setting up water-treatment plants with innovative technologies, and reusing the extracted water for irrigation
- Singapore, Windhoek (Namibia capital) and Israel are great examples of treating such water for reuse and even for drinking.
- **Increasing awareness** among the masses about scarcity of water and the dire need of conserving it
- **Imposing penalties** suitably for wasting and polluting water
- **Limiting per capita use** of water and imposing fines for exceeding the limit
- **Traditional water conservation/harvesting methods** must be revived. E.g., -
 - i. constructing farm ponds, check dams, gully plugging, dug wells, borewells and artificial glaciers in Ladakh
 - ii. Tamaswada Pattern nallahs treatment in Maharashtra
 - iii. soak pits in Punjab
 - iv. watershed development and management in Maharashtra and Madhya Pradesh
- **Agricultural universities** should take a lead in advising farmers on suitable cropping patterns to save water.
- This should take into account soil and other climatic conditions of a region.
- **Drip irrigation and sprinklers** should be promoted.
- **In urban areas**, there is water theft and also loss of clean water due to slackness on the part of water management bodies.
- This is due to the inferior water service infrastructure and its poor maintenance.
- This needs to be corrected by adopting strict procedures for compliance and monitoring.
- **Stopping providing subsidised power** or free power to farmers



- However, small and marginal farmers may need to be compensated for this loss by increasing the MSP for their produce.
- Free power to farmers leads to excessive withdrawal of groundwater, as well as increases soil salinity, jeopardizing farm sustainability.

What lies ahead?

- Water crisis in urban areas normally attracts governments' attention.
- However, it is the inefficient water use in agricultural sector in rural areas that is largely contributing to this situation in India.
- Keeping in mind the India's water scenario, the government rightly launched the Jal Shakti Abhiyan (JSA) recently.
- The objective is to take measures for rainwater harvesting, water conservation and replenishing water bodies for meeting acute water shortage.
- While launching JSA, the government announced reorientation of MGNREGA towards water conservation and harvesting.
- Accordingly, it reserved 75% (instead of 67% in 2018-19) of 2.58 billion person-days expected to be generated during 2019-20.
- Going further, it would be necessary to provide adequate funds to complete all pending water storage projects in states.
- The Centre and states will have to reflect on the much-needed water conservation measures, for JSA to achieve its objectives.

5.3 Towards Water Security

What is the issue?

- The World Water Day is being observed on March 22.
- In this backdrop, here is an assessment of water situation in the world and in India, and necessary measures to deal with it.

How is the share of water bodies declining?

- Most of the world's water systems that keep the ecosystems thriving and feed a growing human population are under severe stress.
- Ramsar Convention on Wetlands brought out the Global Wetland Outlook: State of World's Wetlands and their Services to People (2018) report.
- It makes an alarming observation that up to 87% of the global wetland resource has been lost since 1700.
- The analysis of satellite data of NASA underlines that half of the earth's 37 largest aquifers are declining too fast to be replenished.

How does it compare with water demand?

- The UN in its World Water Development Report 2018 notes that the global water use has increased by a factor of 6 over the past 100 years.
- It continues to grow at a rate of 1% per year.
- Competitive demand for water from various sectors has resulted in water scarcity that is affecting almost every part of the world.
- A latest report of World Bank has underlined that the Ganga River Basin could see drinking water shortage go up by as much as 39% in some States by 2040.
- Another WB report highlights that countries that lack a sufficient amount of water could see their GDPs decline by as much as 6% by 2050.
- Over two-third of the global population lives with severe water scarcity for at least one month every year, nearly half of whom live in India and China.



What is the case with India?

- In India, the annual per capita availability of water continues to decline sharply from about 5000 cubic metres in 1951 to about 1,700 cubic metres in 2019.
- The NITI Aayog in its report on Composite Water Management Index (2018) notes that -
 - i. currently 600 million people face high to extreme water stress
 - ii. about 2 lakh die every year due to inadequate access to safe water
 - iii. about three-fourths of the household do not get drinking water at their premise
 - iv. about 70% of water is contaminated
- Moreover, the rate of groundwater extraction is so severe in India.
- NASA's findings suggest that India's water table is declining alarmingly at a rate of about 0.3 metres per year.
- At this rate of depletion, India will have only 22% of the present daily per capita water available in 2050.
- This could possibly force the country to import water for meeting the demands.

Why are large irrigation structures unfeasible any more?

- Dams do serve the purpose of supplying water for irrigation and drinking.
- However, the potential available for construction of new big dams is fast declining.
- The total irrigation potential has increased from 22.6 million hectares during the pre-Plan period to about 113 million hectares now.
- About 81% of India's ultimate irrigation potential, estimated at 140 million hectares, has already been created.
- So the scope for further expansion of irrigation infrastructure on a large scale is limited.
- Besides, dams in India have the capacity to store only about 30 days of rainfall, compared with 900 days in major river basins in arid areas of developed countries.
- Also, constructing major irrigation projects will require huge cost in future than in the past.

How significant are small water bodies?

- Small water bodies (mainly tanks) are less capital-intensive, user-friendly with fewer environmental problems.
- They significantly augment groundwater resources through sub-surface recharge.
- Most small water bodies have been encroached and subject to centuries of neglect and mismanagement.
- The Standing Committee on Water Resources highlighted that out of 5.56 lakh tanks in the country, only 4.71 lakh tanks are in use.
- The state of Tamil Nadu alone has a total of about 41,127 tanks, most of which are in bad shape today because of poor maintenance.

What is the way forward?

- **Small water bodies** - Predictably, there will be fewer rainy days in the future but it would rain heavily in those days.
- Therefore, it is essential to renovate and restore the capacity of small water bodies to have decentralised water distribution system.
- Corrective measures are crucial not only in the areas of storage, but also in efficiency in managing supply, demand and use.
- **Agriculture** - The agricultural sector consumes over 85% of the available water today in India, and improved efficiency can save much water.
- Shifting cropping pattern from water-intensive to less water consuming crops can save significant amount of water.
- Micro-irrigation method (drip and sprinkler) of rice cultivation will enhance water use efficiency with increased crop productivity.



- **Rainwater harvesting** is one of the cheapest and easiest ways of augmenting water stock.
- Investing and promoting water-recycling technologies and storm water capturing schemes should also be given utmost emphasis.
- The proposed water conservation fee on groundwater extraction is a right step in the direction of regulating water use.

5.4 Mission Kakatiya - A Model to Address Water Scarcity

What is the issue?

With growing environmental distress, policymakers must adopt best eco-management practices to address water crisis.

What are the existing water scarcity issues in India?

- **Chennai** -In Chennai, more than 30 waterbodies of significance have disappeared in the past century.
- Concretization or the increase in paved surfaces has affected the percolation of rainwater into the soil, thereby depleting groundwater levels to a point of no return.
- In a report last year, the Comptroller and Auditor General of India (CAG) called the Chennai floods of 2015 a “man-made disaster”, a pointer to how the encroachment of lakes and river floodplains has driven India’s sixth largest city to this ineluctable situation.
- The Chennai floods are a symbol of consistent human failings and poor urban design which are common to most urban centers in India if not urban centers across the world.
- **Bengaluru** - In Bengaluru, 15 lakes have lost their ecological character in less than five years according to a High Court notice to the Bruhat Bengaluru MahanagaraPalike, the city’s administrative body responsible for civic amenities and some infrastructural assets.
- The lakes, which are now encroached areas, find use as a bus stand, a stadium and, quite ironically, as an office of the Pollution Control Board.
- **Telangana** -In Telangana, the byzantine network of tanks and lakes built by the Kakatiya dynasty has disappeared over the years.

How Telangana’s Mission Kakatiya address water crisis?

- In Telangana, “tanks have been the lifeline of the State because of its geographical positioning”.
- The State’s “topography and rainfall pattern have made tank irrigation an ideal type of irrigation by storing and regulating water flow for agricultural use”.
- In 2015 Telangana Government had launched a massive rejuvenation movement in form of “Mission Kakatiya” which involves the restoration of irrigation tanks and lakes/minor irrigation sources built by the Kakatiya dynasty.
- From the perspective of inter-generational justice, this is a move towards giving future generations in the State their rightful share of water and, therefore, a life of dignity.
- The city of Hyderabad is now moving towards a sustainable hydraulic model with some of the best minds in the country working on it.
- This model integrates six sources of water in a way that even the most underdeveloped areas of the city can have equitable access to water resources and the groundwater levels restored in order to avoid a calamity of the kind that has gripped Chennai now.

What other cities can learn from the model?

- Hyderabad and the larger state of Telangana rebuild its resilience through a combination of political will and well-designed policies such as the Kaleshwaram Lift Irrigation Scheme and Mission.
- Following Telangana’s footsteps Bengaluru can reclaim Kundalahallilake (once a landfill) through corporate social responsibility funds in a Public Private Partnership model.
- Policymakers must give up the tendency to discount the future and of their obsession of focusing on the here and now, and start adopting sustainable policies for the future.

5.5 Water Governance - Chennai's Water Crisis

What is the issue?

- Chennai is reeling under its worst water crisis in decades.
- The crisis calls not for reactive measures but much more systematized solutions to address the water problem in the long run.

What is Chennai's current water scenario?

- Chennai's four main reservoirs (Cholavaram, Chembarambakkam, Poondi and Red Hills) are nearly empty.
- The city has not had rain in nearly 200 days; only over the past few days there has been light rainfall.
- Groundwater too has been over extracted.
- This year, a tanker (private) of approximately 12,000 litres of water cost Rs. 6,000 in several places (last year, it was Rs. 2,000).
- This is almost 7 times the cost of water supplied by Chennai Metro Water.
- The Tamil Nadu Chief Minister has announced that 10 MLD (million litres a day) of water will be transported to the city for the next 6 months from Jolarpettai, Vellore district.
- The Tamil Nadu government has also accepted Kerala's offer to provide water.

How effective had rainwater harvesting been?

- At the political level, rainwater harvesting (RWH) was initiated in 2000. From 2003 onwards, the government mandated RWH.
- This meant that the building plan for new apartments and dwellings included a RWH component, to get Chennai City Corporation's approval.
- The order also mandated that all existing buildings in Tamil Nadu install RWH structures.
- 16 years from then, it is now found that even most of the government buildings in Chennai do not have a functioning RWH structure.
- The Greater Corporation of Chennai has now ordered the inspection of RWH structures, much after the crisis.

What are the shortfalls in the approach?

- The scarcity of essential resources such as water not only leads to economic losses but also social unrest.
- But the issue with any crisis in India is the fire-fighting strategy that is adopted in response, as opposed to systematized solutions.
- These timely arrangements are soon forgotten when things temporarily go back to normal.
- In effect, efforts are not taken to deeply ingrain such practices in the system to have a sustainable remedy.
- This level of action, especially during the floods, is usually undertaken at the level of the National Disaster Management Authority and the National Disaster Response Force.
- Local follow-up measures that are necessary to sustain the results are largely ignored.
- E.g. during the floods in Chennai in December 2015, the encroachment of wetlands was the key issue, as the catchment areas got vanished
- But even now, three-and-a-half years later, no formal mechanism has been put in place to check whether wetlands are being desilted.
- According to a recent NITI Aayog report, 21 Indian cities will run out of groundwater by 2020 if usage continues at the current rate.
- But water governance in cities across India has only been ad hoc.





How can water governance be made better?

- The Chennai water crisis brings to the fore the need for **urban water planning and management boards** in metropolitan cities.
- This should work as a permanent body similar to urban development authorities.
- The objective should be to regulate the supply, demand and maintenance of water services and structures.
- This authority should monitor and regulate groundwater in the city.
- With exorbitant levels of pricing for water supply by private tankers, this must be regulated too.
- The urban water management board should also oversee the desilting of lakes in the city on a regular basis.
- The management of lakes comes under the Public Works Department, which works in isolation from Chennai Metro Water.
- There has to be proper coordination among these institutional mechanisms for a better integrated water policy.
- Deepening of beds of existing lakes is essential for greater water storage and better water percolation.
- Additional desalination plants should also be commissioned; this water might help bring down water prices to below 6 paise a litre.
- Metro Water and groundwater use should be measured and priced progressively.
- Similar to the electricity tariff, the quantity of use should determine the price.
- The board can practise differential pricing and cross-subsidise those households with a lower per capita income use of water.
- Water meters are a must for this to be implemented effectively.
- In existing RWH structures, pipes are either broken or clogged, filtration equipment is not cleaned, bore pits have too much silt, and drains are poorly maintained.
- The board must also have regulatory powers to monitor the maintenance of RWH structures at homes and in offices.
- Water scarcity has resulted in the IT corridor in Chennai suffering, with most companies even asking employees to work from home.
- In contrast, the large manufacturing units around the Sriperumbudur-Oragadam belt have been able to maintain production due to efficient water management practices.
- The water boards thus need to work in coordination with governments on granting approvals to new mass working spaces.
- IT corridors should be regulated for their water-use necessities.
- Besides these, Chennai must also learn from the experiences of other cities across the world such as Cape Town, South Africa.
- Here, water saving is being driven through the concepts such as Day Zero, prompting better and more efficient use of water.
- [Day zero is when active water rationing will happen; most of the city's taps will be closed, with strict regulations for use.]
- In all, a sustainable governance solution to water crisis along with public participation is the need of the hour

6. BIODIVERSITY

6.1 IPBES Report

Why in news?

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) recently released a report.

What is IPBES?

- IPBES is an independent intergovernmental body, established by member States in 2012.
- It is a global scientific body, similar in composition and functioning to the Intergovernmental Panel on Climate Change (IPCC).
- IPCC's assessment reports form the scientific basis on which the international negotiations on climate change have been happening.
- IPBES is often described as the "IPCC for biodiversity", as it is mandated to do a similar job for natural ecosystems and biodiversity.
- The objective is to strengthen the science-policy interface for biodiversity and ecosystem services.

How does it differ from IPCC?

- Like IPCC, IPBES does not produce any new science. It only evaluates existing scientific knowledge to make assessments and projections.
- However, unlike IPCC, the IPBES assessment reports are likely to feed into and inform several multilateral processes.
- Two UN Conventions are likely to be guided by this report in future, -
 1. Convention on Biological Diversity that addresses biodiversity issues
 2. Convention on Combating Desertification that deals with sustainable land management
- Besides, the Ramsar Convention, Convention on International Trade in Endangered Species, and Cartagena Protocol may also find some inputs.

What is the present report on?

- The present one is the first global assessment report by the IPBES. [IPCC, set up in 1988, has produced 5 reports so far.]
- It includes a systematic review of 15,000 scientific and government sources and resources collected from indigenous and local knowledge.
- The IPBES report makes a comprehensive scientific evaluation of the state of Earth's natural ecosystems.
- It gives a detailed account of health of the species that inhabit earth and the condition of habitats that they live in and depend upon.
- It ranks "five direct drivers" that cause changes in nature that have the largest relative global impact.

In descending order, these include:

1. changes in land and sea use
2. direct exploitation of organisms
3. climate change
4. pollution
5. invasive alien species

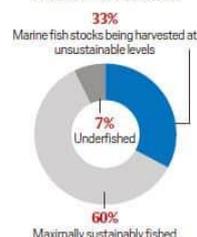
FORESTS



Tree stumps in Madagascar; result of deforestation and slash & burn farming. DudarevMikhail/Shutterstock.com

- 50%:** agricultural expansion that occurred at the expense of forests
- 68%:** global forest area today compared with pre-industrial level
- 7%:** reduction of intact forests (>500 sq km with no human pressure) from 2000-13 in developed and developing countries
- URBANISATION**
- >100%:** growth of urban areas since 1992
- 105%:** increase in human population (from 3.7 to 7.6 billion) since 1970 unevenly across countries, regions
- >2,500:** conflicts over fossil fuels, water, food and land currently occurring worldwide

OCEANS & FISHING



- 3-10%:** projected decrease in ocean net primary production due to climate change alone by the end of the century
- 3-25%:** projected decrease in fish biomass by end of century in low and high warming scenarios, respectively
- +/-50%:** live coral cover of reefs lost since 1870s
- 100-300 MILLION:** people in coastal areas at increased risk due to loss of coastal habitat protection
- >107:** highly threatened birds, mammals and reptiles estimated to have benefited from the eradication of invasive mammals on islands

HEALTH



Kuta beach, Bali. Plastic pollution has multiplied 10 times since 1980. Maxim Blinskoy/Shutterstock.com

- 40%:** proportion of global population lacking access to clean and safe drinking water
- >80%:** global wastewater discharged untreated into the environment
- 300-400 mn TONNES:** Industrial wastes dumped annually into the world's waters
- CLIMATE CHANGE**
- 1°C:** average global temperature difference in 2017 compared to pre-industrial levels
- >3 mm:** annual average global sea level rise over the past two decades
- 5%:** estimated fraction of species at risk of extinction from 2°C warming alone, rising to 16% at 4.3°C warming

What humans have done to nature

8 million

estimated number of animal and plant species on Earth

1 million* (*approx)

of these species are threatened with extinction, many within decades

- 40%:** amphibian species threatened with extinction
- 33%:** reef forming corals, sharks and shark relatives, and 33% marine mammals threatened with extinction
- 680:** vertebrate species driven to extinction by human actions since the 16th century

- +/-10%:** tentative estimate of proportion of insect species threatened with extinction. Total insect species are 5.5 million.
- 3.5%:** domesticated breed of birds extinct by 2016
- 70%:** increase since 1970 in numbers of invasive alien species across 21 countries with detailed records

- 47%:** proportion of terrestrial flightless mammals (besides 23% of threatened birds) whose distributions may have been impacted by climate change already
- >6:** species of ungulate (hoofed mammals) would likely be extinct or surviving only in captivity today without conservation measures

What are the key findings?

- The health of ecosystems that humans and other species depend on is "deteriorating more rapidly than ever".

- As many as 1 million different species are facing the threat of extinction, more than at any previous time.
- This is out of a total of an estimated 8 million plant and animal species.
- The threat is because of changes brought about in natural environments by human activities.
- The current rate of global species extinction is “tens to hundreds of times” higher compared to the average over the last 10 million years.
- Even for global warming of 1.5 to 2 degree Celsius, the majority of terrestrial species ranges are projected to shrink profoundly.
- Natural habitats are being destroyed at an accelerating pace.
- 75% of earth’s land surface and 66% marine environments have been “significantly altered”.
- Over 85% of wetland area had been lost.
- But, on an average, these trends were less severe on areas controlled or managed by indigenous people and local communities like the tribes.
- The negative trends in nature are expected to continue to 2050 and beyond in all of the policy scenarios explored in the assessment.

What is the relevance for India?

- The report does not have country-specific information.
- However, India can identify with most of the trends pointed out in the report.
- The major biodiversity hotspot, vast areas, especially the coastline, of which are under tremendous stress due to large population, makes some findings very relevant to India.
- E.g. 23% of global land area had shown a reduction in productivity due to degradation
- Also, 100 to 300 million people are said to be at an increased risk of floods and hurricanes due to loss of coastal habitats and protection.
- The other findings in connection with India include the following:
 - i. plastic pollution had increased 10 times from 1980
 - ii. the number of large dams (those with a height of 15 m or more) had reached almost 50,000
 - iii. human population had more than doubled since 1970s
 - iv. the number of urban areas had doubled since 1992
- All these trends have been clearly visible in the case of India and thus bring with them the associated risks to natural ecosystems.

What is the way forward?

- The report says there is still an opportunity for human beings to live in harmony with nature.
- But there has to be a change in the way how natural resources are governed, and things are produced and consumed.
- This is inevitable in terms of economies, livelihoods, food security, health and quality of life worldwide.

6.2 Status of Tigers in India, 2018 Report

Why in News?

The 4-year tiger census report, Status of Tigers in India of 2018, released recently shows numbers of the big cat have increased across all landscapes.

What is it all about?

- The total number of tigers has risen by 33% since 2014.
- This is by far the biggest increase in terms of both numbers and percentage since the census using camera traps and the capture-mark-recapture method began in 2006.



- The 2018 figure has a great degree of credibility because 83% of the total tigers have been photographed by trap cameras.

Why is a tiger census needed?

- As tiger sits at the peak of the food chain, its conservation is important to ensure the well-being of the forest ecosystem.
- The tiger estimation exercise includes habitat assessment and prey estimation.
- The numbers reflect the success or failure of conservation efforts.
- The Global Tiger Forum, an international collaboration of tiger-bearing countries, has set a goal of doubling the count of wild tigers by 2022.
- More than 80% of the world's wild tigers are in India, and it's crucial to keep track of their numbers.

Where has the tiger population increased the most?

- The biggest increase has been in Madhya Pradesh, 71% as compared to the numbers in 2014.
- In Maharashtra, Karnataka and Uttarkhand, the number has gone up by 64%, 29% and 30% respectively.
- However, since tigers keep moving between states, conservationists prefer to talk about tiger numbers in terms of landscapes.
- **India's five tiger landscapes:** Shivalik Hills and Gangetic Plains, Central Indian Landscape and Eastern Ghats, Western Ghats, North-East Hills and Brahmaputra Plains, and the Sundarbans.

Which states/regions have done badly?

- Only one of the 20 tiger-bearing states has seen a fall in numbers — Chhattisgarh, where the number reduced to 19 from 46 of 2014.
- The report has cited law and order as the reason, as large parts of the state are hit by the Maoist insurgency.
- No tiger has been found in the Buxa, Palamau and Dampa reserves.

How the census were was carried out?

- **Phases 1 and 2 –**
 1. Forest beats (15 sq km each) covered by Forest Departments,
 2. Collection of the signs of tiger presence like scat and pugmarks.
- **Phase 3 -**
 1. Sample areas are of 2 sq.km. parcels and trap cameras were laid in these grids.
 2. The information was plotted on the forest map prepared with remote-sensing and GIS application.
- **Phase 4 –** The data were extrapolated to areas where cameras could not be deployed.

Why have the numbers gone up?

- The success owes a lot to **increased vigilance and conservation efforts** by the Forest Department.
- The number of tiger reserves went up in 2018, extending protection to larger numbers of tigers over the years.
- The fact that organized poaching rackets have been crushed.
- The increased protection has encouraged the tiger to breed.
- The rehabilitation of villages outside core areas in many parts of the country has led to the availability of more inviolate space for tigers.
- Since state boundaries do not apply to the movement of tigers, conservationists prefer to talk about tiger numbers in terms of landscapes rather than of states.

6.3 Deforestation in Amazon Forests

What is the issue?

- Deforestation in the Amazon rainforest in Brazil is increasing rapidly since January, 2019.

- It is a matter of global concern, and Brazil must recognise that the Amazon rainforest is a universal treasure.

How significant are the Amazon forests?

- The Amazon basin, spread across millions of hectares in multiple countries, hosts massive sinks of sequestered carbon.
- Significantly, the Amazon forests are a key factor in regulating monsoon systems.
- The rainforests harbour rich biodiversity.
- Moreover, about 400 known indigenous groups present there have prevented commercial interests from overrunning the lands.
- Much of the Amazon has survived, despite relentless pressure to convert forests into farmlands, pastures and gold mines, and to build roads.
- The legacy of the ecosystem and the indigenous groups are now under great threat.

What are the recent changes?

- **Deforestation** - The new Brazilian President Mr. Bolsonaro has spoken in favour of “reasonable” exploitation of Amazon forestlands.
- Although the forest code has not been changed, his comments have emboldened illegal expansion into forests.
- Armed gold-hunting gangs have reached tribal areas and the leader of a tribe has been murdered in an incursion.
- Satellite images show that about 4,200 sq km of forests have been destroyed up to July 24, 2019 under the new government (since January).
- **Brazil’s stance** - Brazil is the custodian of forests in about 5 million sq km of Amazon land.
- Given this, it has everything to gain by engaging with the international community on meeting the opportunity cost of leaving the Amazon undisturbed.
- But Mr. Bolsonaro refused to host the annual convention of the UN Framework Convention on Climate Change in 2019 (but did not exit the Paris Agreement).
- By doing so, he lost a valuable opportunity to seek higher funding for forest protection.

What should be done?

- Most nations tend to view their land and forests through the narrow prism of short-term economic gain.
- However, climate science data show that they play a larger environmental role.
- Globally, there is tremendous momentum to save the Amazon forests.
- So, Brazil must welcome initiatives such as the billion-dollar *Amazon Fund* backed by Norway and Germany, instead of trying to shut them down.
- Remedial funding, accounting for the value of environmental services, is the most productive approach.
- This is because forest removal has not helped agriculture everywhere due to soil and other factors.
- In all, Brazil’s President must recognise that rainforests are universal treasures, and the rights of indigenous communities to their lands are inalienable.
- The international community must use diplomacy in convincing Mr. Bolsonaro at this front.

Amazon Fund

- The Amazon Fund was created in 2008 to receive donations for non-reimbursable investments.
- The objective was to prevent, monitor, and combat deforestation, as well as to promote the preservation and sustainable use in the Brazilian Amazon.
- It consists of money donated by Norway, the main donor, and Germany.
- The fund holds US\$850 million, and is managed by the National Bank for Economic and Social Development (BNDES) of Brazil.



6.4 Biodiversity Challenges - Role of Indigenous People

What is the issue?

- The UN-backed panel's first global assessment of biodiversity held humans squarely responsible for the looming mass extinction of species.
- In this context, forest dwellers and farmers are the best hope to preserve biodiversity and ensure food security.

What is the emerging threat?

- Nature now faces the threat of another mass extinction of species.
- Pressure from industrialisation does not care too much about conservation and biodiversity.
- The same holds true for the overexploitation of our rivers and seas.
- Without radical efforts towards conservation, the rate of species extinction will only gather momentum.
- A loss in biodiversity simply means that plants and animals are more vulnerable to pests and diseases.
- This, in effect, puts food security and nutrition at risk.

What do tribes hold for the ecosystem?

- The Dongria Kondh tribe of Niyamgiri Hills, Odisha are among the best conservationists in the world.
- They are known for the spirited defence of their forested habitat against short-sighted industrialisation.
- Through millennia, they have evolved a lifestyle that is in perfect harmony with nature.
- Across India, there are many indigenous people who have managed to lead safe lives without any needless destruction of natural ecosystems.
- These tribes, along with marginalised communities living on the fringes of forests and millions of smallholder farmers, have a crucial role now.
- They offer the much-needed solutions to the bio-diversity challenges of the present era.

What should the approach be?

- Although biodiversity loss is a global problem, it can be countered only with local solutions, as there is no one-size-fits-all approach in this.
- India's tropical homeland is rich in biodiversity.
- But, the imperatives of relentless economic growth, urbanisation, deforestation and overpopulation place it at a higher risk.
- Certainly, a solution that has succeeded in a temperate, wealthy nation may not be suitable for a country like India.
- It is now obvious that intensive agriculture, exploitative forestry and overfishing are the main threats to biodiversity in India and the world.
- Given these, the approach now should be to ensure the active participation of communities that live close to nature - farmers and forest dwellers.
- The UN agencies too have emphasized on the significance of the accumulated wisdom of indigenous peoples, fishers and farmers.

What lies ahead?

- The situation with India's forests now is less encouraging.
- Instead of evicting forest dwellers from their homes, the country should be encouraging them to conserve and nurture their habitats.
- For solutions, the policies has to take lead from the -
 - i. growing movement of zero-budget natural farming in Andhra Pradesh and Telangana
 - ii. the community-driven forest conservation initiatives in Odisha and the Northeast
- There is no single national-level answer to the problem of crop and biodiversity loss.

- The natural farming movement in Andhra Pradesh may not be suitable for, say, Punjab.
- Fortunately, India's farmers and tribes are innovative and have local solutions.
- In all, people should be at the centre of all the actions taken at dealing with the challenges of nature.

6.5 Protecting Seed Sovereignty - PepsiCo Case

What is the issue?

- PepsiCo India Holdings (PIH) had sued 11 farmers for "illegally growing and selling" a potato variety registered in its' name, and later withdrew the case.
- This is a wake-up call to the policymakers on securing sustainable rural societies, protecting soil health and promoting seed sovereignty.

What is the central problem?

- So many small farmers are, like the ones targeted by PepsiCo, reliant, directly or indirectly, on proprietary seeds.
- Typically these seeds are grown in high input (fertilizer-pesticide-irrigation) environments that, over time, erode local biodiversity.
- There is large expense in buying these seeds and inputs.
- On the other hand, there is loss of the skills and social relationships which rely on saving and exchange of seeds of indigenous varieties.
- In effect, small-scale farming continues to decline and face the persistent problems of lower income, status and dignity.

What do the law provide for?

- In India, the Protection of Plant Varieties and Farmers' Rights (PPV&FR) Act, 2001 deals with intellectual property rights in seeds.
- The law permits farmers to save and resow (multiply) seeds.
- Importantly, it also allows them to sell seeds to other farmers, irrespective of the seeds' original source.
- This broad permission (called farmers' privilege) is considered indispensable for 'seed sovereignty'.
- It also includes proprietary vegetative propagation materials such as what are used for the cultivation of potatoes.
- Clearly, there is a shift away from seed replacement to the right to save seeds.

Why are proprietary seeds still dominating?

- The farmers cannot be blamed for thinking that proprietary seeds are better.
- Since the days of the Green Revolution, agricultural extension officers have taught farmers to buy these higher-yielding seeds.
- So despite the legal protection offered to farmers' seeds, the emphasis remains on proprietary seeds.

What are the risks involved?

- Proprietary seeds have narrow, uniform and non-variable genetic builds.
- Farmers could be using genetically distinctive seeds adapted to local conditions and farming traditions.
- But instead, they are adapting local conditions and traditions in order to use genetically standardised seeds, to ruinous effect.
- Alongside, there exists a science-and-industry-know-best stance when it comes to seed quality.
- Resultantly, efforts have been ongoing to pass a new seed law in India permitting the sale of certified seeds only.

What do regulatory efforts in Europe teach?

- The EU Regulation on Organic Production and Labelling of Organic Products was adopted in 2018.

- For the first time, it permits and encourages, among other things, the use and marketing of organic agriculture.
- This refers to “plant reproductive material of organic heterogenous material.”
- It allows this without most of the arduous registration and certification requirements under various EU laws.
- Heterogenous materials, unlike current proprietary seeds, need not be uniform or stable.
- The regulation acknowledges the benefits of using such diverse material, including-
 - i. reducing the spread of diseases
 - ii. improving resilience
 - iii. increasing biodiversity
- Accordingly, the regulation makes way for expansive use of indigenous varieties.
- It would support the creation of markets and marketplaces facilitating trade of heterogenous seeds, including by small farmers.
- There are also multimillion-Euro research and innovation projects being invited and funded by the EU, to make this diversity an integral part of farming in Europe.

What is the need now in India?

- A biodiversity-rich nation like India must shift its agriculture from a high-yield ideal to a high-value one.
- Here, ‘values’ include striving to minimise environmental harm while maximising nutritional gains and farmer welfare.
- **Heterogenous seeds** - Agriculture that conserves and improves traditional/desi (heterogenous) seeds in situ should be promoted.
- Small farmers must be educated and encouraged with proper incentive structures in this line.
- Currently, in the garb of protecting this diversity against biopiracy, India is preventing its effective use.
- **Record** - A permanent record-keeping system, perhaps blockchain, is needed.
- It helps farmers keep track of where and how the seeds/propagation materials and the genetic resources are being transferred and traded.
- **Payments** - Smart-contract facilitated micropayments could ensure that monetary returns come in from users and buyers of these seeds, from around the globe.
- The monetary returns would effectively incentivise continuous cultivation and improvement of indigenous seeds.
- It will also ensure sustainable growth of agriculture and of rural communities.
- **Traditional knowledge** - India’s invaluable traditional ecological knowledge systems need to be revived.
- It should be made a part of mainstream agricultural research, education and extension services.
- E.g. the know-how contained in ancient Indian treatises like the Vrikshayurveda and the Krishi Parashar
- These fall within the scope of what international conventions such as the Convention on Biological Diversity refer to as ‘indigenous and traditional technologies’.
- The revival of these technologies is central to promoting sustainable ‘high value’ agriculture.

7. DISASTER MANAGEMENT

7.1 Oil Spill Disaster in the Solomon Islands

Why in news?

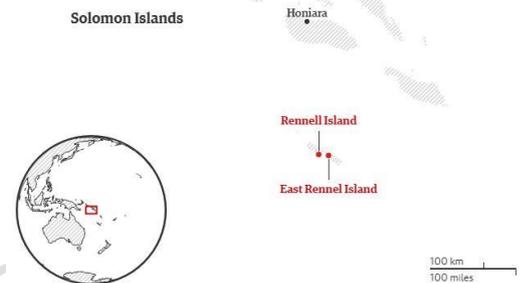
A major oil spill from a 700-ton cargo ship in the Solomon Islands is threatening the environment and biodiversity of the region.

What is the significance of Solomon Islands?

- The Solomon Islands is a sovereign state consisting of six major islands and over 900 smaller islands in Oceania lying to the east of Papua New Guinea.
- The country takes its name from the Solomon Islands archipelago, which is a collection of Melanesian islands that also includes the North Solomon Islands (part of Papua New Guinea), but excludes outlying islands, such as Rennell and Bellona, and the Santa Cruz Islands.
- The Island is environmentally sensitive and culturally important geography which is home to a protected UNESCO World Heritage Site.
- The East Rennell Island which is the largest raised coral atoll in the world, according to UNESCO.

How the recent accident impacts the region?

- A bulk carrier with 700 tons of oil meet with Cyclone Oma and spilt the oil in a part of Solomon Island.
- The ship was carrying bauxite meant for producing aluminium when it met with the accident on Solomon Islands' Rennell Island, gradually coughing out oil into the waters.
- Environmentalists fear whether the spill would endanger the coral atoll, the calamity has also affected human activity in the region.
- The spill from the ship is now threatening life, work and environment of the island.



What are the concerns in addressing oil spills?

- In regard to the recent accident the oil carrier has a Hong Kong registration and is owned by an Indonesian mining company.
- Bintan Solomon Islands, the mining company that owned the oil, says it is not supposed to bear any responsibility for the spill.
- It is just a charter and has no liability for the shipping running aground, thus no one is ready to take the blame for a disaster
- In this case, international agencies and even governments that volunteered to help clean up the mess said they were disappointed by the response from those directly responsible for the spill.
- Earlier experiences with the world's worst oil spills, also show that those who were directly responsible have managed to dilute their responsibilities.

What is the way forward?

- Environmentalists and legal experts want a global watchdog to deal with spills.
- There are also demands for a contingency fund to compensate the victims and help in clean-up missions.
- Strict guidelines to shipping companies to share (with their clients) the blame and swift international legal processes irrespective of the geography of the accidents need to be formulated.
- Oil companies and their logistics partners must understand the world cannot afford oils leaks whose impacts on precious marine life and other organisms are very difficult to be ascertained.

7.2 Lessons from Fani Cyclone

What is the issue?

- A horrific tropical cyclone Fani made landfall in Odisha recently.
- It is imperative at this juncture to understand the increasingly climate-risked world that Fani indicated.

What was Fani's impact?

- Cyclone Fani left behind a trail of broken homes, powerlines and infrastructure.
- Odisha has lost years of its development dividend in one shock.



- Nevertheless, the fact that there were far fewer fatalities in this cyclone than before is to be acknowledged.
- Even when wind speeds crossed 170 km/hour and reached 204 km/hour, the loss of human life was contained at 41 (reportedly increased to 70).
- In contrast, the state had lost 10,000 people in the super cyclone of 1999.

What is the climate change factor here?

- The 2018 climate assessment by the World Meteorological Organization (WMO) gives some inputs in this regard.
- Tropical storms in the Northern Hemisphere were up, from 63 in the previous year to 74 in 2018.
- They were roughly the same, 22, in the Southern Hemisphere.
- The fact is that there is a big difference in these storms, as the India Meteorological Department (IMD) is finding.
- The recent storms are being increasingly and crazily unpredictable.
- In recent years, the IMD has nearly perfected the science of cyclone forecast.
- But now it is learning, in real time, to change its methods and to advance its technology.

What is the recent evidence to this?

- Ockhi which hit the Kerala coast in late 2017 took many lives and caught fishermen at sea unawares.
- Ockhi went from a deep depression in the ocean to a cyclonic storm in a matter of just 6 hours.
- The failure to predict and warn was not just human, but because of the unnatural characteristics of such a tropical storm.
- It changed direction; it gathered steam when least expected and became more intense and more virulent at speeds never seen before.
- One reason was the intense heat pockets in the ocean, which changed the direction and speed of the cyclone.

What was the case with Fani?

- As the IMD was prepared for such changes, it used even more sophisticated equipment and improved the prediction models in Fani.
- But the speed of change was so rapid that the learning of 2017 from Ockhi became outdated.
- **Intensity** - Fani intensified from severe to very severe in no time.
- **Landfall** - Fani also made landfall ahead of its schedule.
- It was to hit Odisha by the afternoon; in real time, this meant evacuations should have been completed by then.
- But Fani landed with ferocity by the morning itself.
- The fact that the state administration had planned and managed to move people ahead of schedule speaks volumes for the preparedness.
- **Inland** - Fani moved inland and reached Bhubaneswar.
- But notably, it did not weaken in its wind speed there, as should have been the usual case.
- This was strange because storms need moisture on land to gather intensity and to lash the land with rain.
- But it was peak summer, a time when ocean storms never hit in any case.
- It is still unclear why it moved inland and how should this be predicted in the future.
- In all, Fani demands that India invest in the science of weather and in the governance capacity to move rapidly to avert disasters.
- The future is even more risky and even more unpredictable than imagined.



7.3 Surat Fire Tragedy

What is the issue?

- More than 20 students died in a massive fire in a Surat coaching centre.
- Besides fixing accountability, the tragedy calls for updating the fire safety protocol countrywide.

What are the shortfalls in this regard?

- The Surat fire cannot be completely called an accident.
- As, there are reports of notices having been served to the builder on the risks, but not pursued.
- Two deaths had occurred in another coaching centre in the city the previous year too.
- The earlier tragedies, at least, should have led to a comprehensive review of public buildings.
- But civic officials were largely indifferent to these.

What are the larger concerns?

- India's abysmal record on fire safety is reflected in the death of 17,700 people countrywide in fires (public and residential buildings) during 2015.
- Notable ones are the Uphaar cinema blaze in Delhi that killed 59 people in 1997, and Kumbakonam school fire in Tamil Nadu in 2004 that killed 94 children.
- The latest tragedy highlights the gap between India's dreamy smart cities visions and the worrisome reality of urbanisation and lawlessness.
- None of these had been a strong case for governments to make fire safety the priority it should be.
- The courts too have allowed this to continue without severe penalties.
- The prolonged, aggressive litigation by the affected families in the Uphaar case made no difference.
- The role of administrative machinery and officials who sanctioned unsafe buildings, often in return for bribes, remains largely unaddressed.

What is to be done?

- The present inquiry should go into any deviations from the sanctioned plan for the commercial building housing the coaching centre.
- The role of urban planning officials in allowing it to come up should also be inquired into.
- It is essential now that the judiciary stresses on 'no tolerance' to corruption and evasion in the enforcement of building rules and fire safety.
- Beyond suspending a few officials and filing cases against the building owners, the role of sanctioning and enforcement authorities should also be looked into.
- Mandating compulsory insurance for all public buildings against fire risk and public liability can help.
- With this, the insurer would require a reduction of risk and compliance with building plans.
- It would thus bring about a change to the way architects and builders approach the question of safety.

7.4 European heat wave

What is the issue?

Last week, Europe went through a heat wave that lasted for six days. It has smashed temperature records, left many people dead and caused huge fires to break out.

Why is it happening?

- The heat wave in Europe is a **result of warm air masses** from Africa, the World Meteorological Organization (WMO) said.
- It follows extreme heat episodes in India, Pakistan, parts of the Middle East and Australia.
- More events are expected to follow during this northern hemisphere summer.



What is a heat wave?

- Heat wave is a **weather** phenomenon which is a period of **prolonged abnormally high surface temperatures** relative to those normally expected.
- **No standardized definition** of a heat wave exists.
- **WMO definition:** If five or more consecutive days during which the daily maximum temperature surpasses the average maximum temperature by 5 °C or more, it is called heat wave.
- It may be characterized by low humidity (which may exacerbate drought) or high humidity.

How heat waves are classified?

- **Classifying** a heat wave **varies from country to country**.
- That is because what is seen as extremely hot in one place may seem within normal range in another.
- In 2016 – The WMO listed several factors to be considered while analysing an extreme weather event such as a heat wave.
- This includes **defining a specific threshold for variables** such as temperature to be considered extreme as well as a human perspective of extremes.

How heat waves are classified in India?

- The India Meteorological Department (**IMD**) classifies heat waves.
- It does not consider a heat wave unless the maximum temperature crosses **40°C** and **30°C** in the plains and hills respectively.
- Where the normal maximum is **40°C or less**,
 1. Heat wave departure from normal – 5°C to 6°C
 2. Severe heat wave departure – 7°C or more.
- Where the normal maximum is **more than 40°C**,
 1. Heat wave departure from normal – 4°C to 5°C
 2. Severe heat wave departure – 6°C or more.
- In places where the maximum temperature reaches **45°C or more**, the IMD declares a heat wave irrespective of the normal.

What is the controversy?

- **Some scientists** – Blamed climate change for these trends.
- **WMO** – It is too early for such an attribution.
- However, the WMO **agreed that the heat wave is consistent with climate scenarios** which predict more frequent.
- The WMO says that the drawn out and intense heat events as greenhouse gas concentrations lead to a rise in global temperatures.

What are its health hazards?

- It poses a risk to people's health, agriculture and the environment.
- **Babies and older people** are particularly **vulnerable** as their bodies are not as well able to regulate their own temperatures.
- It can cause **exhaustion** and **heat stroke**.
- It can cause **organfailure** and **breathingproblems**.
- The people living in **urban** areas are **trapped in heat islands** as steel, concrete, and asphalt structures absorb heat.
- In regions like Europe where people are not used to extremely high temperatures, many buildings don't have air-conditioning.

7.5 Understanding Assam Floods

What is the issue?

- Assam is in the grip of yet another flood, with lakhs of people displaced and some killed, besides hundreds of animals.
- In this context, here is a look at why Assam has traditionally been flood-prone and an assessment of the measures taken.

Why are floods so destructive in Assam?

- Apart from heavy and constant rainfall during the monsoon, there are many contributory factors, both natural and man-made that make floods so destructive in Assam.
- **Brahmaputra** - The very nature of the river Brahmaputra is dynamic and unstable.
- Its 580,000 sq km basin spreads over four countries (China, India, Bangladesh and Bhutan) with diverse environments.
- The Brahmaputra features among the world's top five rivers in terms of discharge as well as the sediment it brings.
- The vast amount of sediment comes from Tibet, where the river originates.
- Tibet is a cold and arid region, and lacks plantation. Glaciers melt, soil erodes and all of it results in a highly sedimented river.
- On the other hand, Assam primarily comprises floodplains surrounded by hills on all sides.

- So, by the time the Brahmaputra enters Assam, i.e. from a high slope to a flat plain, its velocity decreases suddenly.
- This results in the river unloading the sediment.
- Also, following the devastating earthquake of 1950, the level of the Brahmaputra rose by two metres in Dibrugarh area in eastern Assam.
- Because of the earthquake-prone nature of the region, the river has not been able to acquire a stable character.
- So the river's channels prove inadequate amid the siltation, in turn, leading to erosion and floods.

- **Man-made factors** - Besides the natural factors are the man-made ones which lead to higher sedimentation.
- These include habitation, deforestation, population growth in catchment areas (including in China), etc.
- For instance, the sediment deposition itself creates temporary sandbars or river islands.
- It is common for people to settle in such places, which further restricts the river flowing space.
- When rainfall is heavy, it combines with all these factors and leads to destructive floods.

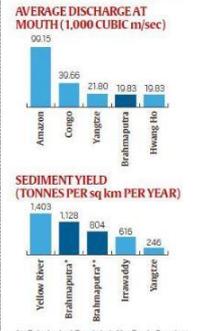
How effective are the flood control measures?

- **Dams** - In its master plan on the river in 1982, the Brahmaputra Board had suggested that dams and reservoirs be built to mitigate floods.
- However, the idea of dams has traditionally been a double-edged sword.
- One of objectives of dams is to regulate the release of flood waters.
- But, the release, when it comes, can sometimes be beyond the capacity of the channels downstream, further leading to floods there.
- In the Brahmaputra basin, there were protests against dam-building plans on grounds of displacement and destruction of ecology.
- All these prevent the plans from moving forward.

AREA OF INFLUENCE



STRONGEST & SILTIEST



- **Embankments** - Given the above, the government has been using only one approach towards floods, which is building embankments on the river.
- Embankments were proposed only as an interim and ad hoc measure for short-term mitigation and thus, they lack durability.
- Since they were temporary measures, the government did not spend on high-specification embankments, and so, are weak and are regularly breached.
- **Dredging** - The government also considered dredging (digging up the riverbed and making the river deeper).
- However, this is not a wise idea given the fact that Brahmaputra sediment yield is among the highest in the world.
- Even if the silt is taken out this year, more silt will be deposited the following year, making the very expensive effort futile.
- Overall, most of the government's measures have been piecemeal and short-term, and the problem is not addressed at the source.

What could a sustainable solution be?

- Addressing the issues only in Assam, when the flood strikes, could not be long-term solution.
- There has to be a "basin-wide approach" to the flood problem of Assam.
- An "integrated basin management" system should ideally bring in all the basin-sharing countries on board.
- The countries should come to an understanding about taking measures in the catchment areas.
- For this, the inter-state relationships, political cooperation and the role of the government are important.
- Flood-plain zoning is another measure in which depending on the vulnerability of the area it is divided into different categories.
- Accordingly, certain activities such as farming, building a house, etc are banned.

GEOGRAPHY

8.1 Development of a Weak El Nino

Why in news?

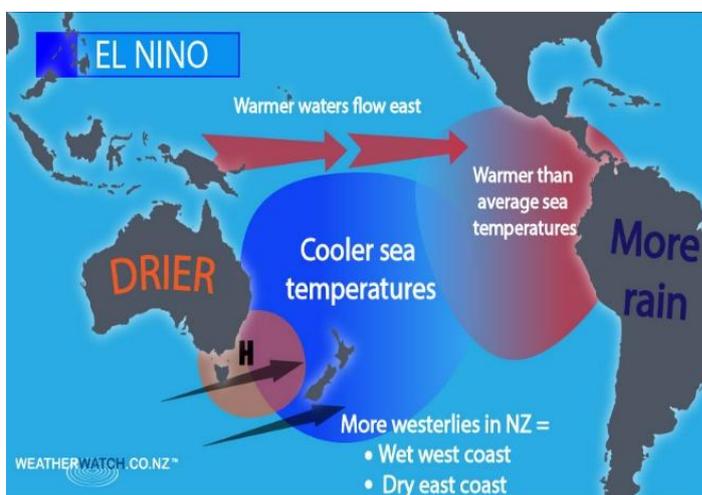
The National Oceanic and Atmospheric Administration (NOAA) of the U.S. recently announced the development of a weak El Nino in the equatorial Pacific Ocean.

What is an El Nino?

- El Nino is a phenomenon of unusual warming of waters in the equatorial Pacific Ocean off the coast of Chile and Peru.
- It largely impacts weather events across the world, with excessive rainfall in some areas and dry spells in regions like India, Indonesia and Australia.
- In India, over the years, El Nino has been found to have strong links in suppressing the monsoon rainfall.
- On the other hand, the opposite phenomenon of La Nina (unusual cooling) has been found to be helpful in bringing good rainfall.

What is the NOAA outlook?

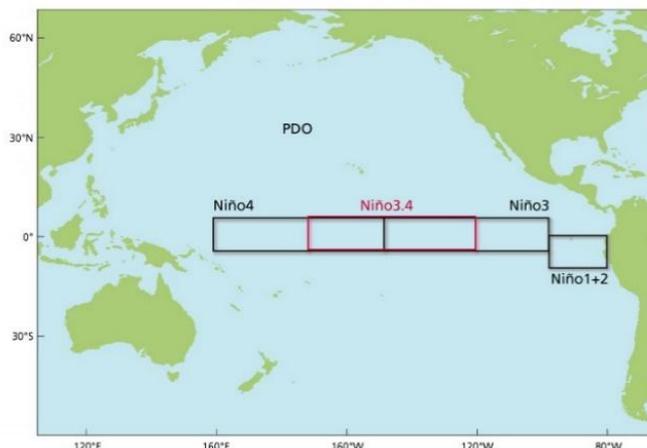
- Status of El Nino at this time of the year usually indicates the kind of rainfall to be expected during the monsoon season later in the year.



- Weak El Nino conditions had already built up in January 2019.
- It is likely to continue (with 55% probability) until the spring season in the northern hemisphere (mid-March to mid-June).
- NOAA said that the probability of El Nino persisting into the summer (beyond June) was 50% or less.
- Significantly, the warming in the Nino 3.4 region of the Pacific Ocean has been forecast to remain in excess of 0.5°C above normal.
- This is the region whose sea surface temperature (SST) has more connection to the impact on India's rainfall.

What is the likely impact for India?

- The data for the last 100 years shows that if the SST in Nino 3.4 is over 0.5°C above normal in the monsoon season, rainfall over India gets affected.
- However, prediction through the northern spring season (instead of summer) has higher degree of uncertainty.
- So there is a need for better prediction, for clearer understanding of the impact on Indian monsoons.
- Moreover, past records show that the impact of El Nino in the monsoon months is relatively high when it is preceded by a La Nina in the winter.
- Notably, in this winter, sea surface temperatures were above normal, almost close to El Nino; in other words, absence of La Nina.
- So, even if it occurs, the impact of an El Nino event might not be very large this monsoon.
- Nevertheless, if El Nino strengthens beyond spring and grows into the summer, India may witness a drought.
- Some weather events like winds over the western tropical Pacific will finally determine whether El Nino will grow beyond spring.



Is El Nino frequency changing?

- El Nino events repeat themselves in a 2-to-7-year cycle, with a strong El Nino expected every 10-15 years.
- However, since 2000, 5 El Nino events have already happened, and this year could witness a sixth one.
- New scientific research is pointing to increased frequency of extreme El Ninos due to climate change.
- Such extreme events could happen twice as often as today if the average annual global temperatures reach 1.5°C above pre-industrial times.
- However, the increasing frequency could be because of other reasons as well.
- They are related with the fact that trade winds got stronger and the eastern equatorial Pacific Ocean has remained colder since 1998, which makes El Nino more active.
- The stronger trade winds are not easily explained by global warming, hinting at more complicated reasons.

8.2 Stalagmites of Meghalaya Cave - Predicting Northeast Monsoons

Why in news?

A new study reveals the connection between Northeast monsoon and El Nino, with the help of rock formations in Meghalaya.

What is the study on?

- The rock formations in a cave near Cherrapunji in Meghalaya were studied by researchers from a US university.

- New evidence was found suggesting the possible influence of the state of the ocean waters in the faraway Pacific on India's winter rainfall.
- It records the connection between winter rainfall amounts in northeast India and climatic conditions in the Pacific Ocean.

How is summer monsoon and El Nino connected?

- India's summer monsoon (June to September) brings in about 70% of annual rainfall in the country.
- It is known to be heavily influenced by the variability in sea-surface temperatures of Pacific Ocean.
- This is a condition referred to as El Nino Southern Oscillation (ENSO).
- A warmer than usual Pacific Ocean, off the coast of South America, is known to suppress the summer monsoon rainfall in India.

What is the case with winter monsoons?

- ENSO is known to have an impact on the winter monsoon (October to December) i.e. the northeastern monsoon as well.
- E.g. the warming of sea-surface waters is seen to help winter rainfall rather than suppressing it
- But the relationship is not so strongly established in this case as the impact varies in time and space.
- The influence is weaker in October and stronger in November and December.
- Similarly, the rainfall over southeastern peninsular India and Sri Lanka is strengthened with warming ocean.
- But again this is diminished over Thailand, Vietnam and the Philippines.

What is the recent revelation?

- The findings are based on more than 3 years of research on stalagmites of the Mawmluh Cave, near Cherrapunji, in the East Khasi Hills district.
- Stalagmites are the mineral deposits, mainly limestone, in caves.
- These solid stalagmite structures, or mineral deposits, are the result of slow but steady water dripping in the caves.
- They contain several thin layers of different kinds of minerals that get picked up while the water is flowing.
- On studying the composition of these stalagmites, scientists deduced the amount of rainfall that could have happened over the caves in the past.
- They also studied if the water was a result of local rainfall, or had flown in from a different place.
- With this, the local variations in rainfall in the past were estimated and this was correlated with old ocean records of the Pacific Ocean.
- The stalagmites indicate the recurrence of intense, multi-year droughts in India over the last several thousand years.
- They reflect the changes in the amount of monsoon rainfall and changes in monsoonal circulation in the atmosphere.
- This distant link between land and ocean records could aid in predicting dry season rainfall amounts in northeast India.



What is the significance?

- North-eastern monsoon is vital for several regions in the Northeast and India's eastern coast.
- It gives more than 50% of the annual rains in coastal Andhra Pradesh, Rayalaseema, TN, south interior Karnataka, and Kerala.
- Winter rainfall following weak monsoon years in India can alleviate water stress for farmers.

- The study gains significance, in this context, as it could help in predicting the winter rainfall and prepare for rainfall variations.
- Stalagmite records from monsoon regions, including India, are also vital to understanding past variability in the global climate system.

8.3 IMD Monsoon Forecast, April 2019

Why in news?

The India Meteorological Department (IMD) recently released the monsoon forecast for 2019, and expects a "normal" monsoon rains.

What are the highlights?

- Monsoon rains in India is forecast to be 96% of the Long Period Average (LPA) and thus likely to be "normal" this year.
- This is a more optimistic assessment from the one by private weather forecasting agency, Skymet, that warned of 'below normal' rains in June-September.
- However, uncertainty prevails as last year the IMD's April forecast indicated normal monsoon rains but India saw below normal rainfall (91% of LPA).
- The IMD issues its first monsoon forecast in April and then updates it in June.

What is the rationale?

- The IMD's optimism is based on global climate models projecting a 'weakening El Nino.'
- The El Nino, a cyclic warming of the Central and Eastern Pacific region, has historically been linked to a weakening of monsoon rain.
- A temperature rise greater than 1°C for 3 months is considered a 'strong' El Nino and a threat to the monsoon.
- A 0.5°C-1°C rise is called weak El Nino conditions; currently the El Nino is 0.9 C.
- The IMD's models in March, expect the El Nino to peak around May and then recede for the rest of the monsoon months.
- Globally too, other models expect El Nino to recede after June or July.
- All these suggest the possibilities of a normal as opposed to below normal monsoon rains in India this year.
- Another factor, called a positive Indian Ocean Dipole (IOD) (warming in the western Arabian ocean) could neutralise the potential negative impact from the El Nino.

How does IMD calculate monsoon level?

- The India Meteorological Department (IMD) expresses the projected rainfall in terms of Long Period Average (LPA).
- The LPA is the average rainfall recorded during the months from June to September, calculated during the 50-year period from 1951 to 2000.
- LPA is kept as a benchmark while forecasting the quantitative rainfall for the monsoon season every year.
- The LPA of the monsoon season over the entire country is 89 cm.
- Like the countrywide figure, IMD maintains an independent LPA for every homogeneous region of the country.
- E.g. 143.83 cm, 97.55 cm, 71.61 cm, and 61.5 cm for East and Northeast India, Central India, South Peninsular India, and Northwest India respectively.
- Going by this, IMD maintains five rainfall distribution categories on an all-India scale. These are:
 1. **Normal or Near Normal** - when there is +/-10% departure of actual rainfall i.e. between 96-104% of LPA
 2. **Below normal** - when departure of actual rainfall is less than 10% of LPA i.e. 90-96% of LPA
 3. **Above normal** - when actual rainfall is 104-110% of LPA
 4. **Deficient** - when departure of actual rainfall is less than 90% of LPA

- Excess** - when departure of actual rainfall is more than 110% of LPA

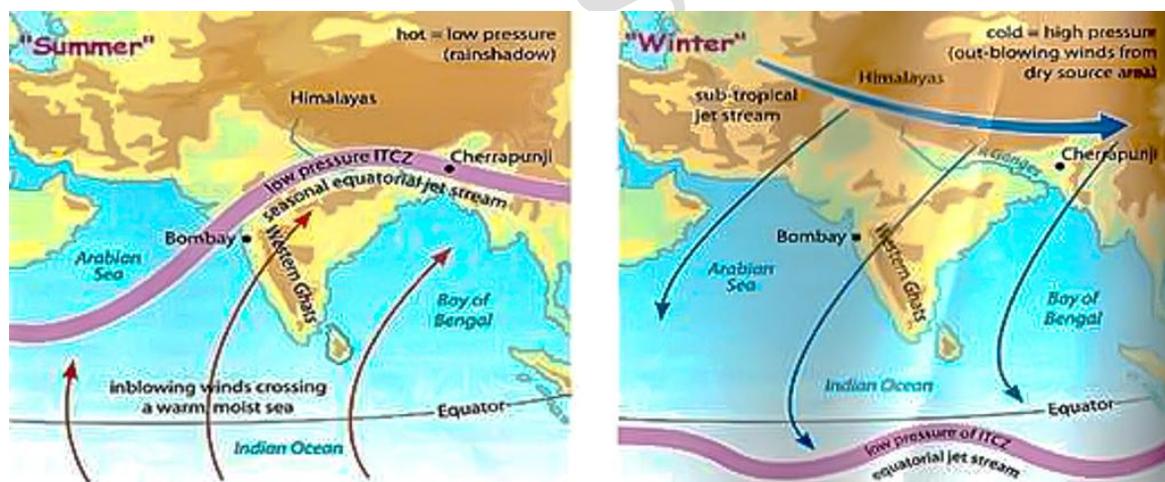
8.4 Cyclone Fani - An Unusual Storm

What is the issue?

- A powerful cyclonic storm named Fani is headed towards the Odisha coast.
- As a cyclone in Bay of Bengal in April-May season, of this nature, is unusual, it is essential to understand the causes.

How do tropical cyclones form?

- Cyclones are formed over slightly warm ocean waters.
- It depends on the temperature of the top layer of the sea, up to a depth of about 60 metres.
- This has to be at least 28°C to support the formation of a cyclone.
- This explains why the April-May and October-December periods are conducive for cyclones.
- Secondly, the low level of air above the waters needs to have an ‘anticlockwise’ rotation in the northern hemisphere and vice versa.
- During these periods, there lies the Inter-Tropical Convergence Zone (ITCZ) (a low pressure zone) in the Bay of Bengal region, which shifts with seasons.
- The southern boundary of the zone experiences winds from west to east and the northern boundary from east to west.
- The ITCZ and the resultant wind pattern induce the anticlockwise rotation of air.
- Once formed, cyclones in this area usually move northwest.
- As it travels over the sea, the cyclone gathers more moist air from the warm sea, and adds to its strength.



How prevalent are tropical cyclones in India?

- Cyclones are a normal event in the eastern coast of India.
- On an average, five to six significant cyclonic storms emerge in the Bay of Bengal region every year.
- The prime seasons for tropical cyclones are
 - the months of April and May, just before the start of the summer monsoon
 - October to December, immediately after the end of the summer monsoon
- Cyclones emerging in April-May are usually much weaker than those during October-December.
- Most of the cyclones in April-May move northeast to hit Bangladesh, Myanmar or other countries in the Southeast Asian region.
- There have been only 14 instances of a “severe cyclone” forming in the Bay of Bengal region in April since 1891.

Why are Oct-Dec cyclones more strong?

- A thumb rule for cyclones is that the more time they spend over the seas, the stronger they become.
- [E.g. Hurricanes around the US, which originate in the vast open Pacific Ocean
- They are usually much stronger than the tropical cyclones in the Bay of Bengal, a relatively narrow and enclosed region.]
- In India, cyclones in October-December are usually remnants of cyclonic systems that emerge in the Pacific Ocean.
- They manage to come to the Bay of Bengal, considerably weakened after crossing the Southeast Asian landmass near the South China Sea.
- However, these systems already have some energy, and gather momentum as they traverse over the Bay of Bengal.
- Notably, April-May is not the season for typhoons in the west Pacific Ocean.
- Most of the typhoons, in northern hemisphere, form between June and November.
- So cyclones in April-May originate in situ in the Bay of Bengal itself.
- This is barely a few hundred kilometres from the Indian landmass, and hence the cyclones are relatively weaker.

How and why is Fani different?

- Tropical cyclones in the Bay of Bengal are graded according to maximum wind speeds at their centre as follows:

1. depressions - 30 to 60 km per hour (kph)
2. cyclonic storms - 61 to 88 kph
3. severe cyclonic storms - 89 to 117 kph
4. very severe cyclonic storms - 118 to 166 kph
5. extremely severe cyclonic storms - 167 to 221 kph
6. super cyclones - 222 kph or higher



- Fani is now categorised as an “extremely severe cyclone”.
- It is expected to generate storms with wind speeds as high as 200 km per hour.
- It has the potential to cause widespread damage in Odisha and neighbouring states.
- Given the above discussed reasons, a cyclone of this nature is unusual for April-May cyclones in India.
- Fani is different mainly on account of its place of origin, and the route it has taken.
- **Origin** - The in situ cyclonic systems in the Bay of Bengal usually originate around latitude 10° N (in line with Chennai).
- But Fani originated quite close to the Equator, around latitude 2° N, well below the Sri Lankan landmass.
- The forecast landfall on the Odisha coast is at a latitude of almost 20°N.
- As it has originated very close to the Equator, it has taken a long route to reach the landmass.
- Resultantly, it has traversed a long way on the sea, and thus gained more strength.
- **Route** - Fani was initially headed north-westwards, towards the Tamil Nadu coast.
- But it changed its course midway and moved northeast away from the coastline to reach Odisha.
- The recurve it has taken gave it more time over the sea and has ensured that it has gathered unusual strength.

8.5 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.

What could be done?

- Build-up of clouds is known to be a factor which can help predicting.
- However, much more improved weather modelling is required to give accurate warnings.
- State- and district-level disaster management agencies routinely issue advisories.
- It includes asking people to refrain from using mobile phones or handling electrical equipment plugged to sockets.

8.6 Overcoming Obstacles in river Interlinking

What is the issue?

Disagreement between States, absence of a legal framework for Central intervention and environmental issues are obstacles in river interlinking.

What is the importance of rivers in India?

- A river is the lifeline of the masses and supports wild life.
- The river system is a major source of irrigation, provides potable water and cheap transportation, helps in electricity generation, and is a source of livelihood for the people.
- Out of total utilisable surface water resources of 690 billion cubic meter (BCM), only 65% is currently utilised in India, the rest falls into the sea.
- This maintains the ecological balance of land and oceans and freshwater and sea.
- However, there is spatial and temporal variation of water availability.
- Due to this, droughts and floods often coexist in India.

What are the measures taken so far?

- In 1980, the Central government prepared a National Perspective on Water Development.
- It envisaged inter-basin water transfer comprising 30 water-link projects and about 3,000 storages connecting 37 Himalayan and Peninsular rivers.
- Though the scheme is likely to cost \$123 billion, it will help create 35 gigawatt of hydropower, irrigate 35 million hectares, and usher in navigation and fishery benefits.
- Of the 30 water-link projects, Ken-Betwa Link project involving Madhya Pradesh and Uttar Pradesh, is at an advanced stage of preparation.
- This project aims to transfer surplus water from the Ken river to Betwa basin through canals to irrigate land, supply drinking water to drought-prone Bundelkhand region, and generate hydro power.
- Though this project been accorded all statutory clearances, a water-sharing arrangement between the two States is pending.
- However, in the case of Renuka dam project in the Upper Yamuna basin, five States recently entered into a water-sharing pact.
- Thus, there are clearly many challenges in implementation of inter-basin water transfer projects.

What should be done?

- **Evolving consensus** - The States with surplus water resources do not generally agree that there is such surplus.
- It is difficult for donor and donee States to come to an agreement as the latter often demand more water.
- The States are also apprehensive about disturbing the existing allocation of water as per awards.

- There is thus a need to evolve consensus among the States concerned.
- Further, to mitigate the likely adverse impact of climate change, long- and short-term measures, including inter-basin water transfer, is the need of the hour.
- **Need for Legislation** - At present, there is no legislative framework through which the Central government can intervene in this regard.
- Most of the river basins are inter-State.
- The Constitution allows the Centre to regulate and develop inter-State rivers and river valleys as per Entry 56 of the Union List.
- Thus, one or more Central legislation should be passed using this Entry for facilitating inter-basin transfer.
- **Environmental concerns** - The inter-basin water transfer (IBWT) projects are like other water resources projects and hence the environmental concerns of IBWT projects are similar.
- Thus, all environmental issues and concerns such as submergence of forest areas and biodiversity loss need to be addressed in a holistic manner if benefits are to outweigh costs.
- **Rehabilitation and resettlement**- The IBWT projects require construction of reservoirs and link canals and these involve substantial submergence.
- Further, canal construction also requires land acquisitions.
- Thus rehabilitation and resettlement (R&R) is an important issue.
- There is a need to have diverse innovative and attractive R&R packages for project-affected persons so that they support the project on their own.
- **International co-operation**- Many of the link rivers flow through the neighbouring countries and hence require international co-operation.
- For example, main components of six Himalayan link projects fall in Nepal and Bhutan.
- There is a need of hydro diplomacy with these two neighbours to evolve a consensus.
- Similarly, the Sankosh project (Manas-Sankosh-Teesta-Ganga Link) also requires interaction with Bangladesh, Nepal and Bhutan, calling for consensus among these countries with India.
- On the whole, India needs to constitute a National Water Mission on river linking to address various issues, that are macro as well as project-specific in a time-bound manner.

8.7 Cyclones in the East Coast - Cyclone Titli

What is the issue?

- Cyclone Titli recently hit the Odisha-Andhra coastal zone.
- Given the cyclone frequency in the Eastern Coast, it is essential to understand about cyclone formation and evacuation process.

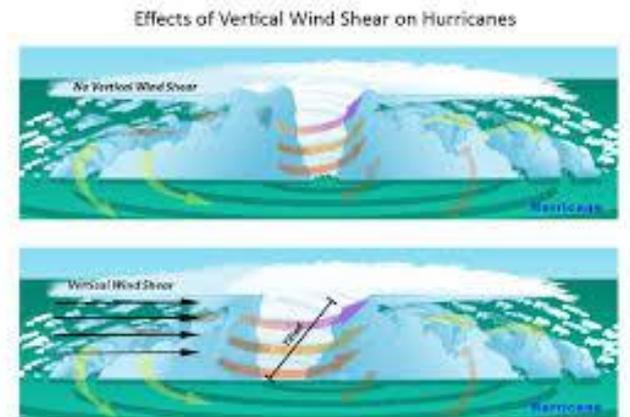
How has the cyclone trend been?

- Titli is the third major cyclone to hit the Odisha-Andhra coastal zone in the last five years, all in October.
- The other two are the Phailin (2013) and Hudhud (2014) cyclones.
- Cyclones have always been frequent in the Odisha-Andhra coastal region.
- But notably, the frequency of intense cyclones in the area has increased over the years.

How do they form?

- Pacific is one of the world's most active basins for typhoons, and adjacent to the northwest of this is the Bay of Bengal.
- Notably, Bay of Bengal receives the remnants of major landfalls in the Philippines, China and South Asia.
- From these places come low-pressure systems that develop into a monsoon depression or a cyclone.
- This is the reason why most of the cyclones such as Titli, Phailin and Hudhud typically struck in October.

- The reason is that wind shear i.e. the difference within wind speeds and direction at two different levels is low during this time.
- The low wind shear, when combined with surface sea temperatures greater than 26°C, raises the likelihood of cyclones.
- This is because, if there's too much wind, these weather systems have trouble organizing and developing into a tropical cyclone.
- But with little to no wind shear, the turning within the tropical system is uniform.
- So the storm becomes vertically aligned, helping to keep it intact and, likely, strengthening.



Why is it hard to predict?

- India acquires storm prediction models from the US and Europe but lacks the resources to upgrade the models regularly.
- The Odisha government was criticised for being unable to anticipate the landfall of Cyclone Titli or the very heavy rainfall.
- But prediction is difficult here because of budgetary and meteorological factors.
- In the Atlantic basin, the US has dedicated aircraft that fly directly into the clouds.
- It studies moisture levels and gather various data on cyclone profile.
- But for Indian cyclones developing over the ocean, the reliance is largely on satellite images (a top view).
- This only reveals little data on moisture content and intensity.
- So getting a more detailed picture is possible only when a cyclone is 300-400 km from the coast.
- But this reduces the prediction and preparation time.
- Specifically, Cyclone Titli was hard to read because it turned into a recurving cyclone.

How is evacuation done?

- Evacuation exercises are classified as preventive, vertical, and shelter-in-place.
- In preventive (or horizontal) evacuation, the impact area is meant to be completely evacuated.
- But this is a measure rarely taken in India because of poor roads and inadequate public transportation.
- Also, poor people rarely have the resources to find alternative accommodation.
- In vertical evacuation, people are directed to specially designed buildings within the impact area, which was largely followed during Cyclone Titli.
- Shelter-in-place evacuation involves fortification of existing houses and community buildings, which again required financial resources.
- **Concerns** - Reportedly, the government does not have adequate multipurpose cyclone shelters.
- The government claimed around 3 lakh people were successfully evacuated during Cyclone Titli.
- But widely held parameters of success in disaster management, such as number of evacuees, are “misleading”.
- Notably, the fewer casualties during Phailin and Hudhud were because of the limited severity of these cyclones than effective disaster planning.

8.8 Having Two Time Zones for India

Why in news?

A proposal for two time zones has come from the Council of Scientific & Industrial Research's National Physical Laboratory (CSIR-NPL).

How is time defined and maintained?

- If lines of longitude are drawn exactly a degree apart, they will divide the Earth into 360 zones.
- As the Earth spins 360° in 24 hours, a longitudinal distance of 15° represents 1 hour.
- In other words, 1° represents a time separation of 4 minutes.
- So theoretically, the time zone followed by any place should relate to its longitudinal distance from any other place.
- Political boundaries mean that time zones are often demarcated by bent lines rather than straight lines of longitude.
- This is the “legal time”, as defined by a country’s law.
- The geographic “zero line” runs through Greenwich, London.
- It identifies the GMT (Greenwich Mean Time), now known as Universal Coordinated Time (UTC).
- It is maintained by the Bureau of Weights and Measures (BIPM) in France.
- The United States follows several time zones across its breadth.

What is the case with India?

- The Indian Standard Time (IST) is maintained by CSIR-NPL.

- The Indian Standard Time (IST) is based on a line of longitude that runs through Mirzapur in UP.

- At 82°33'E, the line is 82.5° east of Greenwich, or 5 hours 30 minutes ahead of UTC.

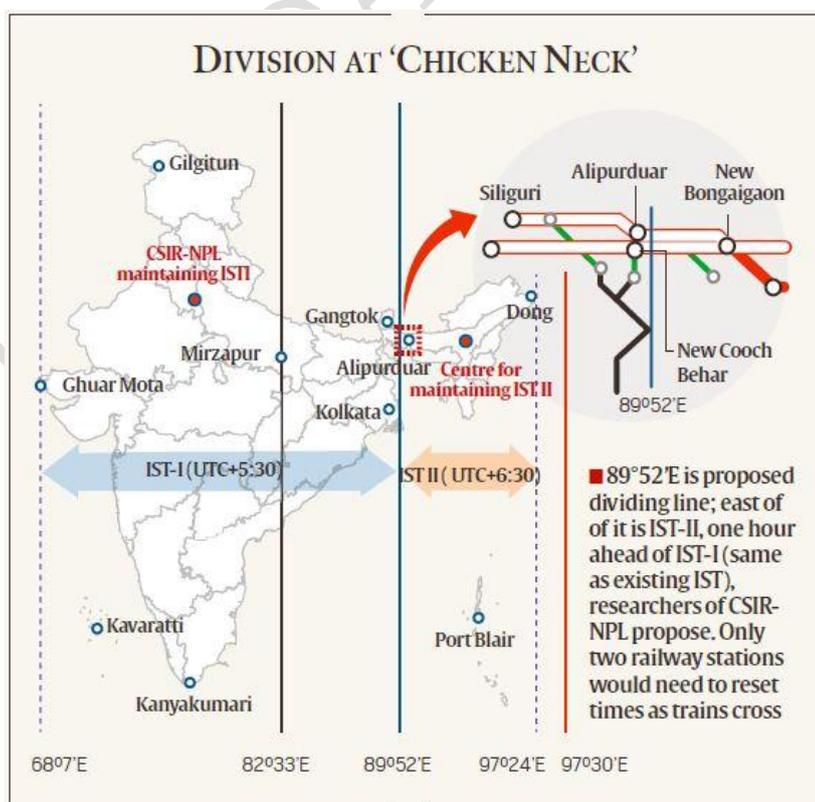
- But notably, India extends from 68°7'E to 97°25'E (spread of 29°), representing almost two hours from the geographic perspective.

- Evidently, there is huge difference in daylight times between the country’s longitudinal extremes.

- So the early sunrise in the easternmost parts causes the loss of many daylight hours by the time offices or educational institutions open.

- Also, the early sunset in the region, leads to higher consumption of electricity and concerns over the costs associated it.

- Thus, over the years, there have been demands and debates over India having two separate time zones.



- **Concern** - Those against the idea cite the impracticability of having different time zones.
- Particularly the risk of railway accidents is cited, given the need to reset times at every crossing from one time zone into another.
- The government has also, in the past, not favoured two time zones citing the complexities involved.

What is the recent proposal?

- The CSIR-NPL has published a research article describing the necessity of two time zones.
- It has proposed a new time zone with an hour ahead of the existing time zone.
- It proposes to call the two time zones IST-I (UTC + 5.30 h) and IST-II (UTC + 6.30 h).



- The proposed line of demarcation is at 89°52'E, the narrow border between Assam and West Bengal.
- States west of the line would follow IST-I, and states east of the line would follow IST-II.
- The latter include Assam, Meghalaya, Nagaland, Arunachal Pradesh, Manipur, Mizoram, Tripura, and Andaman & Nicobar Islands.
- To make the idea possible, CSIR-NPL would need a second laboratory in the new time zone.
- CSIR-NPL already has the technical expertise to duplicate its existing facility, but the move would require legislative sanction.

What is the rationale?

- The “chicken neck”, connecting Northeast to the rest of India, is where the two time zones will be demarcated from each other.
- **Railways** - The railway signals have not yet been fully automated in the country.
- In this line, the border between the two time zones has a very narrow spatial-width with minimum number of train stations.
- So the train timings, while crossing the border, can be managed manually without any untoward incidents.
- **Energy** - The country could potentially save 20 million kWh energy a year if it follows two time zones.
- Besides, the importance of synchronising office hours as well as biological activities to sunrise and sunset timings was analysed.