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SHANKAR IAS ACADEMY

MAINSTORMING 2021

ENVIRONMENT, AGRICULTURE & GEOGRAPHY

(DECEMBER 2020 to SEPTEMBER 2021)

ENVIRONMENT

1. POLLUTION

1.1 Monitoring the Air Pollution

What is the issue?

India needs context-specific solutions to tackle the problem of monitoring the air pollution.

What are the steps taken until now?

- About 250 continuous & 800 ambient air quality monitoring stations are operating across the country.
- Budget allocation for air pollution was increased significantly in 2020-21 to ensure cleaner air in million plus cities.
- **Commission for Air Quality Management** was established which penalises the polluters in the NCR.
- India has jumped from BSIV to BSVI vehicles & now the focus is shifted towards e-mobility.
- **Pradhan Mantri Ujjwala Yojana** has increased the LPG coverage in rural areas which has reduced indoor air pollution.

What are the innovations under the process to have cleaner air?

- Many institutions are involved in the process of developing solutions to combat the air pollution.
- Indian Agricultural Research Institute has developed **PUSA Bio Decomposer** which converts crop residue into manure in 15-20 days.
- This could be a cost-effective alternative to tackle stubble burning.
- UNDP promotes innovations like filter-less retrofit device to cut down the particulate matter at source.
- Breathing root technology is developed to improve indoor air quality by purifying the air.
- UNDP & the University of Nottingham has developed **GeoAI platform** to identify non-complaint brick kilns.
- The platform has mapped over 37,000 brick manufacturing units across the Indo-Gangetic plains.

What more needs to be done?

- Government needs to support the enterprises to come up with scalable pollution abatement technologies.
- A single window online platform needs to be developed to showcase innovations to mitigate air pollution.
- This can be done by leveraging digital technologies such as geospatial technology and AI.
- More resources need to be allocated to support test, certify & scale innovative solutions & to protect intellectual property rights.
- Private sector needs to innovate their operations, functioning & build emission and pollution controls to reduce carbon footprint.
- They also have the potential to develop commercially viable products to combat air pollution.
- An enabling ecosystem for innovations has to be created to address context-specific air pollution challenges.
- This can be done using the technological, economic, social, legal, educational, political & institutional domains.

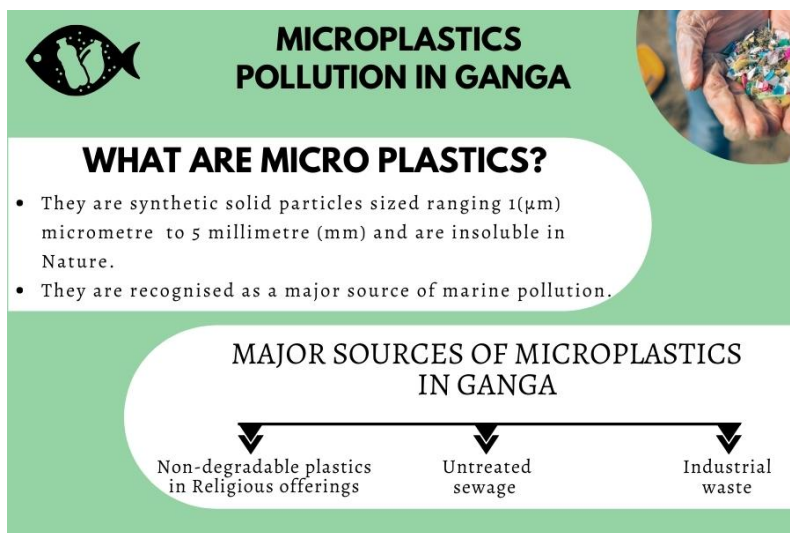
1.2 Microplastics Pollution in the Ganga

Why in news?

An analysis of the stretches of the river Ganga by Delhi-based environment NGO Toxics Link has revealed pollution by microplastics.

What does the study reveal?

- The study is titled 'Quantitative analysis of Microplastics along River Ganga'.
- It was based on an analysis of water samples at Haridwar, Kanpur and Varanasi.
- The highest concentration of microplastics was found at Varanasi.
- It comprised single-use and secondary broken-down plastics from articles of everyday use.
- These include tyres, clothing, food packaging, bags, cosmetics with microbeads, garland covers and other municipal waste.
- The sample test results show the presence of at least 40 different kinds of polymers as microplastics.
- The shapes and nature of the observed resins ranged from fibres to fragments, films and beads.
- Fragments were the predominant shape in all locations, followed by film and fibre.
- Microbeads were observed in Varanasi and Kanpur, while no beads were found in Haridwar.
- The most frequent size range observed in all the samples was $<300\mu\text{m}$.
- Previous studies say that over 663 marine species are affected adversely due to marine debris.
- 11% of them are said to be affected due to microplastic ingestion alone.



What does this signify?

- The study results seriously question the progress of two high-priority, well-funded government missions:
 - i. The Swachh Bharat, to deal with solid waste
 - ii. Namami Gange, to rid the Ganga river of its pollution
- Microplastics are flowing all along into the river system.
- This suggests a direct linkage between the poor state of both solid and liquid waste management.
- Official data indicate that 97 Ganga towns may be discharging about 750 million litres of untreated sewage a day into the river.

What is the larger concern?

- Microplastics is recorded in recent times in the remotest of places.
- These include Mount Everest, Arctic snow, Icelandic glaciers, the French Pyrenees, and the depths of the Mariana Trench, among others.
- It poses a serious hazard as plastics waste production outpaces governments' capacity to collect and manage it, given the limits with recycling.
- The waste management rules issued by successive governments fall short at the implementation level.
- The Centre recently issued a draft to tighten the Plastic Waste Management Rules.
- But cities have failed to implement existing rules as well as the Solid Waste Management rules.


What are the measures needed?

- Swachh Bharat must mean not merely keeping waste out of sight, achieved through costly dumping contracts.
- It instead means sharply reduced waste generation, full segregation and recycling.
- Plastic waste around the world is threatening the food web.
- The crisis thus demands a new global treaty modelled on the Montreal Protocol and the Paris Agreement.
- India needs to demonstrate that it is serious about a clean-up at the domestic level.
- Improving plastic waste management and the subsequent reduction in microplastic pollution should be the priority.
- Various stakeholders, including industry, the government and civil society organisations, need to join hands.


1.3 Plastic Waste Management Rules

Why in news?

The Ministry of Environment, Forest and Climate Change (MoEFCC) has notified the Plastic Waste Management Amendment Rules, 2021, prohibiting identified single use plastic (SUP) items by 2022.



PLASTIC WASTE MANAGEMENT (AMENDMENT) RULES, 2021



PROHIBITION Prohibition of manufacture, import, stocking, distribution, sale and use of Single Use Plastic, including polystyrene and expanded polystyrene, commodities from the 1st July, 2022.

Thickness of plastic carry bags to be increased from 50 microns –

- to 75 microns from 30th September, 2021
- to 120 microns from the 31st December, 2022

EPR Guidelines for Extended Producer Responsibility (as per Plastic Waste Management Rules, 2016) has been given legal force through the 2021 Rules, for effective implementation.

2021 Rules add that the thickness of non-woven plastic carry bags must be at least 60 grams per square meter (GSM).


Non-woven plastic bags are those made by pressing plastic threads together by machine, which form a weave like texture.



What are Single use Plastics?

They are used only once before being recycled or disposed.

These items include:

- ✓ Plastic cutlery (such as spoons),
- ✓ Ear buds with plastic sticks,
- ✓ Plastic sticks for balloons,
- ✓ Plastic flags, candy sticks, and
- ✓ Plastic banners with thickness less than 100 microns.




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What are the impacts of single use plastics?

- **SUP's Impact:**
 1. Low utility but high littering potential.
 2. Large and growing volume adds enormously to the total plastic waste.
 3. Adverse impacts on both terrestrial and aquatic ecosystems.
- **Larger Concerns:**
 1. 22 States have, in the past, announced a ban on SUP, but waste choking wetlands and waterways (and being transported to the oceans to turn into [microplastic](#)) still continue.
 2. Lack of proper waste segregation leading to difficulties in recycling:- 34 lakh tonnes of plastic waste generated in 2019-20 in India; only about 60% is recycled.

3. Nearly 43% of India's plastics are used in packaging and much of it is SUP.

What are the key provisions in the Amendment Rules?

- **Prohibition** of manufacture, import, stocking, distribution, sale and use of SUP, including polystyrene and expanded polystyrene, commodities from the 1st July, 2022. This covers –
 - i. ear buds with plastic sticks, plastic sticks for balloons, plastic flags, candy sticks, ice-cream sticks, polystyrene [Thermocol] for decoration
 - ii. plates, cups, glasses, cutlery, wrapping or packing films around sweet boxes
 - iii. invitation cards, cigarette packets, plastic or PVC banners less than 100 micron, stirrers
- **Thickness** of plastic carry bags to be increased from 50 microns –
 - i. to 75 microns from 30th September, 2021
 - ii. to 120 microns from the 31st December, 2022
- This is to stop littering due to light weight plastic carry bags, and allow their reuse.
- **Guidelines for Extended Producer Responsibility/EPR** (as per Plastic Waste Management Rules, 2016) has been given legal force through the 2021 Rules, for effective implementation.
- EPR - Environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle.
- Accordingly, collection and management of plastic packaging waste, which is not covered under the phase out of identified SUP items, through the EPR of the Producer, Importer and Brand owner (PIBO).
- **Other measures** for elimination of single use plastics and effective implementation of Plastic Waste Management Rules, 2016:
 1. A Special Task Force by States/UTs
 2. National Level Taskforce by the Union MoEFCC for taking coordinated efforts
 3. Strengthening of waste management infrastructure in the States/UTs through the Swachh Bharat Mission.
 4. Comprehensive action plans by State/UT Governments and concerned Central Ministries/Departments
 5. Establishment of institutional mechanism in all States/UTs as per direction issued under Section 5 of Environment (Protection) Act, 1986
 6. Awareness generation
 7. India Plastic Challenge - Hackathon 2021 for Higher Educational Institutions' students and Startups for developing alternatives to identified SUP items and digital solutions to plastic waste management.
- Notably, in the 4th UN Environment Assembly held in 2019, India had piloted a resolution on addressing single-use plastic products pollution.

1.4 Yamuna's Ammonia Levels

What is the issue?

- On at least five instances in 2020, high levels of ammonia in Yamuna have prompted the Delhi Jal Board (DJB) to reduce or stop water production at its plants.
- Increasing pollution in the Yamuna causes frequent disruption to Delhi's water supply. Delhi blames Haryana for this, and here is why.

What happens when ammonia levels increase?

- Ammonia is used as an industrial chemical in the production of fertilisers, plastics, dyes and other products.
- It also occurs naturally in the environment from the breakdown of organic waste matter, including sewage.
- The recommended concentration in Yamuna is 0.9 ppm keeping in line with Delhi Jal Board's (DJB) treatment capacity.



- When it rises beyond this, water production at 3 out of 9 water treatment plants (Wazirabad, Chandrawal and Okhla) have to be stopped or reduced.
- This impacts water supply to parts of Delhi city.

Why is Haryana blamed?

- The Yamuna flows into Delhi from Haryana.
- Haryana has industrial units in Sonipat, which is close to Delhi's northern border.
- A specific area where both Haryana and Delhi agree on is the mixing of two drains carrying drinking water and sewage/ industrial waste/both in Sonipat district.
- Drain number 8 brings potable water to the capital and drain number 6 carries wastewater.
- The two drains often mix due to overflow or damage to the wall that separates them.
- Haryana's irrigation department is expected to start a tendering process to build a conduit pipeline and prevent the mixing of two drains.
- **Delhi's concern** - Delhi blames Haryana for releasing industrial effluents in the river "despite repeated reminders."
- The issue is brought into focus every time the concentration of ammonia increases in the river.
- DJB officials state that the spike in pollution level has been more frequent in 2020.
- Also, Delhi at present receives much less than the share of water they deserve.
- DJB asks the Central Pollution Control Board (CPCB) and the Upper Yamuna River Board (UYRB) to look into the issue.

What is the solution?

- The laying of a conduit pipeline to separate drain number 8 and 6 would reduce pollution of potable water.
- However, it is not clear when this would be completed.
- The National Green Tribunal-appointed Yamuna Monitoring Committee has also said that fast-track approvals should be given to build a conduit.
- Moreover, the Committee had also recommended to the Ministry of Jal Shakti to rework the 1994 water sharing pact.
 - It is a pact among Uttarakhand, Himachal Pradesh, Haryana, Delhi and Uttar Pradesh.
- The recommendation is based on the need to revive the Yamuna by releasing more fresh water into it.
- This would help maintain a certain environmental flow for the river to sustain its functions throughout the year.
- Meanwhile, Delhi Jal Board should increase its capacity to treat ammonia levels in the water.
- Ozone-based units to treat ammonia levels up to 4ppm should be installed at Chandrawal and Wazirabad water treatment plants.

2. GLOBAL WARMING AND CLIMATE CHANGE

2.1 IPCC Sixth Assessment Report (AR6) - 2021

Why in news?

The Intergovernmental Panel on Climate Change (IPCC) recently released the 1st part of its Sixth Assessment Report (AR6) titled 'Climate Change 2021: The Physical Science Basis'.


What are the key factors of climate change based on the report?

Human Activities


- The combined contribution to global warming by natural factors, such as the sun and volcanoes, is now estimated to be close to zero (negligible).
- 1.07°C out of the 1.09°C warming is due to GHG associated with human activities.
- Thus, almost 100% of global warming has been caused by humans.

Emissions

- CO₂ levels were greater in 2019 than they had been in "at least 2 million years."
- Methane and nitrous oxide (2nd and 3rd major contributors of warming respectively) levels are their highest in at least 800,000 years.
- CH₄ stays in the atmosphere only for a fraction of time compared to CO₂, but is far more efficient at trapping heat.
- Human-induced sources of methane
 1. consuming fossil fuels
 2. leaks from natural gas production, coal mining and landfills
 3. livestock and manure handling

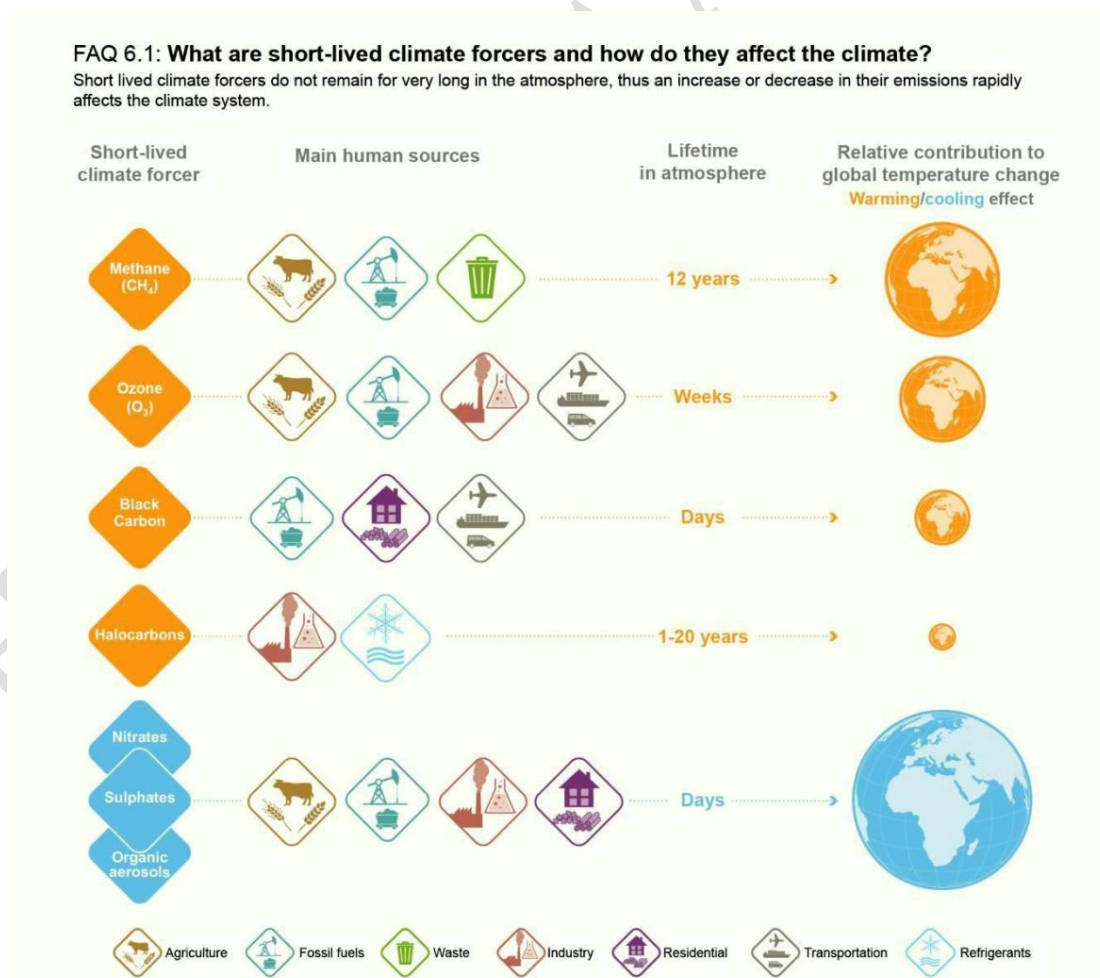


WHAT IS IPCC?



- It is established by the UNEP and the World Meteorological Organization in 1988.
- It is a body of world's leading climate experts.
- It provides reports on the current state of knowledge in climate change and its potential environmental and socio-economic impacts.
- Its first report in 1990 on consequences of rising greenhouse gas (GHG) emissions led to the forming of UNFCCC in 1992.
- Since then, reports have been produced roughly every 7 years.

“
 New IPCC report is
 "A code red for humanity"
 - António Guterres
 UN Secretary General
 ”



- Aerosols contribute to reducing the impact of warming therefore drastic reduction of aerosols actually leads to an increase in warming.

Weakened Natural allies

- The CO₂ emissions notably increased by half since 1960.
- In the same period, forests, soil and oceans have absorbed 56% of all the CO₂ humanity has released into the atmosphere.
- But these carbon sinks which are natural allies in the fight against global heating are showing signs of saturation.
- The percentage of human-induced carbon they soak up is likely to decline as the century unfolds.

Temperature Rise

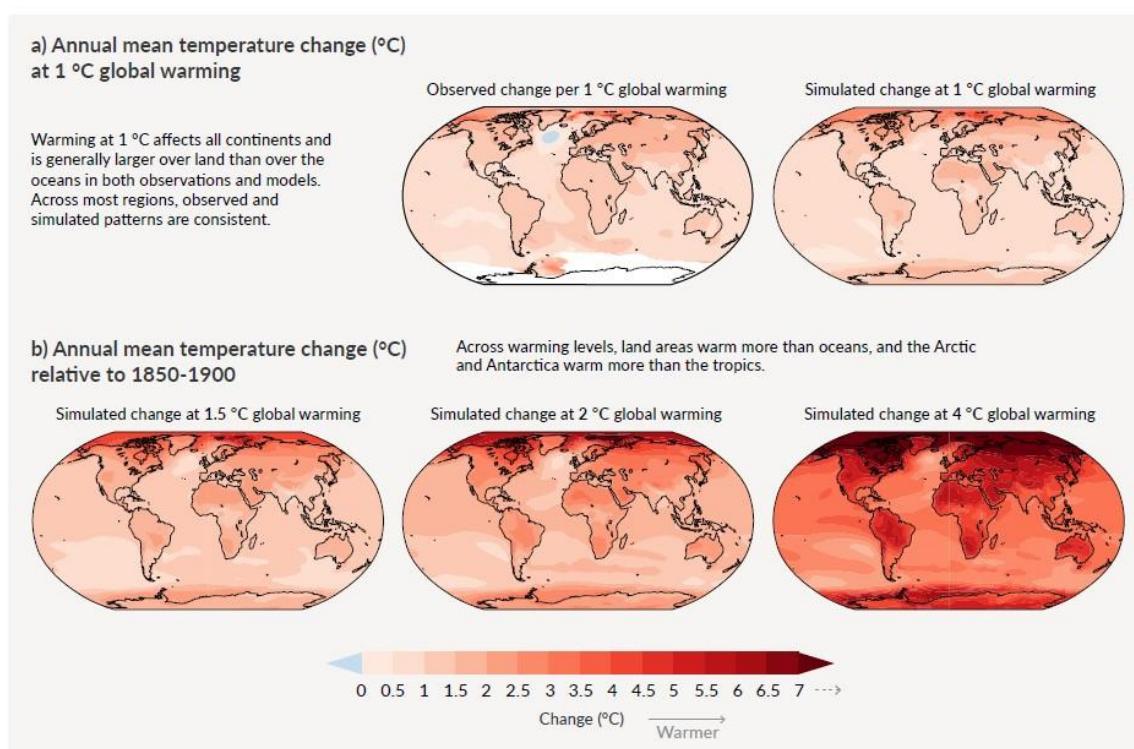
- 2011-20 was hotter than any period of time in the past 1.25 lakh years.
- Global surface temperature was 1.09°C higher in 2011-20 than between 1850-1900.

What are the impending threats?

Global Warming

- Within the next two decades, temperatures are likely to rise by more than 1.5 °C above pre-industrial levels.

With every increment of global warming, changes get larger in regional mean temperature, precipitation and soil moisture



- Additional warming will weaken the Earth's carbon sinks present in plants, soils, and the ocean.
- Air pollution reduction and steep climate change mitigation are not complementary goals but require independent efforts over the short and medium term.
- Human-induced global warming has been more rapid in Africa than the rest of the world.

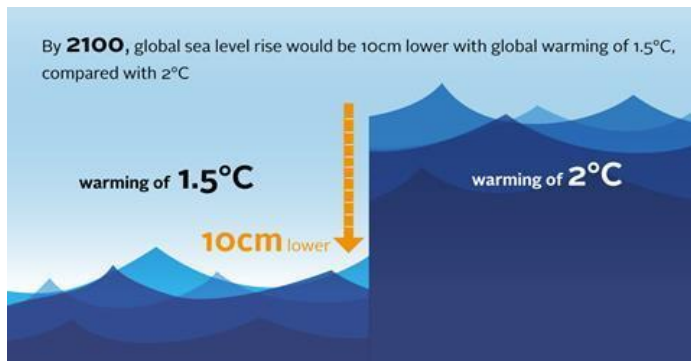
Impact on Cities

- Floods and sea-level rise in coastal areas & Ice sheet collapse or rapid changes in ocean circulations
- **Least developed countries** will increasingly bear the brunt of global warming

- **Other common threats** - increased heatwaves, more intense storms, and more serious droughts and floods etc
- With every 1°C rise in temperature, there will be a 7% increase in the intensification of extreme rain events.

Sea level rise

- Sea-level rise has tripled compared with 1901-1971 in the last decade.
- Global oceans have risen about 20 cm since 1900.
- The Arctic Sea ice is the lowest it has been in 1,000 years.
- Crumbling and melting ice sheets atop Antarctica have replaced glacier melt as the main drivers of sea level rise.
- If global warming is capped at 2°C, the ocean watermark will go up about half a metre over the 21st century.



Impact on India

- With a 7,517 km coastline, India will face significant threats from rising seas
- Across 6 Indian port cities - Chennai, Kochi, Kolkata, Mumbai, Surat and Visakhapatnam - 28.6 million people will be exposed to coastal flooding.

What is the 1.5°C mark that IPCC advocates?

- The 2015 Paris Agreement set the goal to limit global warming to well below 2°C, compared to pre-industrial levels, in this century.
- It also sets 1.5°C as an aspirational target to channelize countries' efforts.
- Temperatures have now risen by about 1.1°C since the period 1850 to 1900.
- Even if we start reducing emissions now, we will still overshoot the 1.5°C mark by 2030. But we will see a drop in temperatures to around 1.4°C.

Will 1.5°C level address all climate risks?

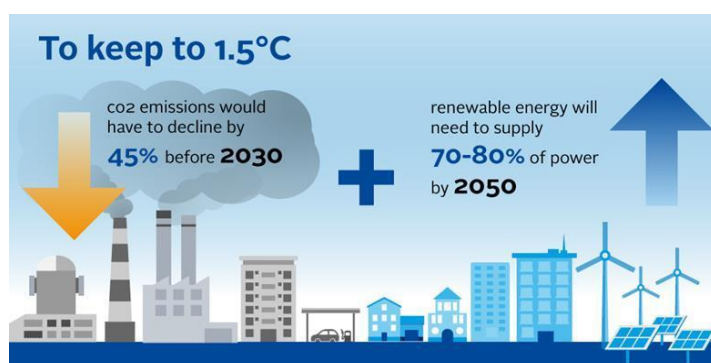
- It will take a lot of time for nature to heal; 20-30 years to see global temperatures stabilise.
- So, some long-term impacts of warming that are already in line are likely to be witnessed - Sea level rises, Melting of Arctic ice, Warming and acidification of the oceans.
- Nevertheless, the 1.5°C level will represent a much smaller risk than 2°C.
- And notably, this report is likely to be the last from the IPCC while there is still time to stay below 1.5°C.

What does IPCC call for?

Emission Control

- IPCC has recommended that countries strive to achieve **net zero emissions** i.e no additional greenhouse gases were emitted by 2050.
- Drastic cuts in GHG emissions are needed this very decade (2021-2030).

EXPRESS explained.



- End to new coal plants and new fossil fuel exploration and development.
- Efforts of governments, investors and businesses towards a low-carbon future.

Cumulative Emissions

- Reaching net zero alone is not enough to reach the 1.5°C target.
- Historical cumulative emission i.e total emission by each country throughout the industrial phase is the cause of the climate crisis that the world faces today.
- They cannot be mitigated by promises of net zero 30 years from now.
- Therefore cumulative emissions should be factored in while calculating net zero.

Negative emissions

- Warming could be brought back down via “negative emissions” i.e., to cool down the planet by -
 1. sucking out or sequestering the carbon from the atmosphere
 2. stopping the use of fossil fuels and stopping deforestation
- But the technology at this end is not yet evolved and perfect, and need attention.

Peak by 2025

- Earth could exceed 1.5°C of global warming as soon as the early 2030s.
- So, staying below 2°C this century will happen only if emissions reach net zero by 2050.
- For this to happen, global emissions must peak sometime in the middle of this decade itself (by 2025).
- **Indigenous and Traditional knowledge** had played an increasing role in historical climatology.
 1. Peruvian fishermen had first thought of the name ‘El Niño’ for the now well-known climate phenomenon in the tropical eastern Pacific Ocean, that scientists link with the Southern Oscillation.
 2. Inuit communities had contributed to community-based monitoring across the Arctic.
 3. Indigenous Australian knowledge of climatic patterns has been offered as a complement to observational records, such as those of sea-level rise.
- Such traditional knowledge must be assessed and integrated with scientific literature.

“It’s suicidal and economically irrational to keep procrastinating”

2.2 Antarctica’s Doomsday Glacier

Why in news?

Recently, the melting of Doomsday Glacier in Antarctica is a cause of concern because of its high potential in speeding up the global sea level rise.

What is the glacier and why is it important?

- Doomsday Glacier also called as thwaites Glacier situated in Antarctica which is 120 km wide at its broadest, fast-moving.
- It is important for Antarctica as it slows the ice behind it from freely flowing into the ocean.
- Due to its large size, it contains enough water to raise the world sea level by more than half a metre.
- It is found that amount of ice flowing out of it has nearly doubled over the past 30 years and now it’s melting at faster rate due to the supply of warm water flowing underneath.
- Now the thwaites’s glacier melting has contributed to 4% of global sea level rise and it is estimated that the glacier would collapse into the sea in 200-900 years.
- Due the risk it faces and poses, thwaites is often called the Doomsday Glacier.



What did the previous studies say about the glacier?

- A 2019 study had discovered a fast-growing cavity in the glacier and deployed an ocean-sensing device called Ice Fin to measure the waters moving below the glacier's surface.
- In 2020, researchers from New York University (NYU) detected warm water at a vital point below the glacier which reported that the water at just two degrees above freezing point at thwaites's grounding line.
- The grounding line is the place below a glacier at which the ice transitions between resting fully on bedrock and floating on the ocean as an ice shelf.
- The location of the line is a pointer to the rate of retreat of a glacier.
- When glaciers melt and lose weight, they float off the land leading to retreating of the grounding line.
- This exposes more of a glacier's underside to seawater thereby accelerating the melting process.
- This results in the glacier stretching out and thinning thereby causing the grounding line to retreat ever further.

What has the new study revealed?

- The new study used an uncrewed submarine to go under the thwaites glacier front to make observations.
- The submersible called Ran was used to measure the strength, temperature, salinity, oxygen content of the ocean currents that go under the glacier.
- Using the results, the researchers mapped the ocean currents that flow below thwaites's floating part.
- They also identified three inflows of warm water among them one has the potential to create severe damage which is underestimated in the past.
- The study also looked at heat transport in one of the three channels which brings warm water towards the glacier from the north.

Why is this a cause of worry?

- The study shows that warm water is approaching the pinning points of the glacier from all sides.
- This will impact the locations where the ice is connected to the seabed and places where the ice sheet finds stability.
- This can also make things worse for thwaites glacier, whose ice shelf is already retreating.
- But with the current data scientist can model the dynamics of thwaite's glacier which can help in calculating the ice melting in the future.
- This will reduce the great uncertainty that now prevails around global sea level variations.

2.3 Fossil Fuel Extraction and Global Warming

Why in news?

A new study highlights that the global fossil fuel production should decline by 3% per year until 2050 to keep global warming to below 1.5°C [Paris Agreement goal].

What are fossil fuels?

- **Coal, crude oil, and natural gas** are all considered fossil fuels.
- They were formed from the fossilized, buried remains of plants and animals that lived millions of years ago.
- Because of their origins, fossil fuels have a **high carbon content**.
- *Fossil fuels produce large quantities of carbon dioxide when burned. Carbon emissions trap heat in the atmosphere, leading to global warming and eventually to climate change.*

What is the Paris climate goal?

- It aims to make efforts to hold the increase in the global average temperature to well below 2°C [an ambitious 1.5°C] above pre-industrial levels (1850-1900).



- As of now (2021), human activities have already caused global temperatures to rise by about 1°C above pre-industrial levels.
- Currently, countries' emissions targets are not in line with limiting global warming to under 1.5°C.

How is the current level of fossil fuel extraction?

- As of now, both planned and operational fossil fuel extraction projects are **not conducive to meeting the Paris Agreement targets**.
- Globally, production of fossil fuels needed to have peaked in 2020 and be on a steady decline of 3% every year until 2050.
- A substantial number of regions in the world have already reached their peak fossil fuel production.
- Any increase hereafter will have to be offset by a decline elsewhere, to stick to the tight carbon budget.
- *To achieve the targets, almost 60% of oil and gas reserves and 90% of coal must remain unextracted by 2050.*
- Specifically, unextractable estimates for coal show less regional variation, although they are lowest in those regions that utilize most coal in the next 30 years.[Notably India, China and other parts of Asia.]

Greenpeace report published in early 2020

- In 2020, global cost of air pollution from fossil fuels was around \$2.9 trillion per year, or \$8 billion per day, which was 3.3% of the world's GDP.
- Of this, India is estimated to bear a cost of \$150 billion from air pollution caused by fossil fuels.
- *IPCC warns that fossil fuel emissions must be halved within 11 years (from 2021) if global warming is to be limited to 1.5°C above pre-industrial levels.*

Why are unextracted reserves important?

- A carbon budget is the cumulative amount of CO₂ that can be released in a time period keeping with the Paris goals.
- But this does not consider uncertainties around, say, climate-system feedbacks.
- So, to ensure more certainty of stabilising at this temperature, even more carbon needs to stay in the ground.
- In other words, there is much less room for fossil fuels to be extracted than previously estimated.

What does this call for?

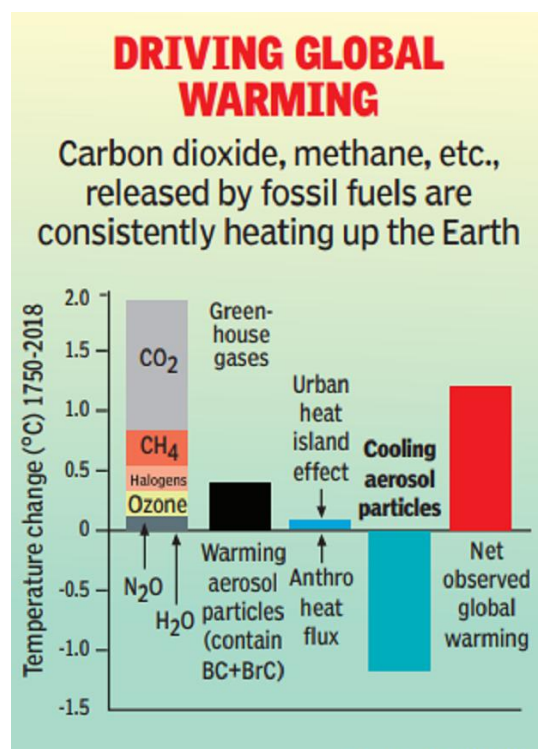
- Bold national policies to entirely phase out fossil-fuel extraction.
- Stopping issuing fossil-fuel exploration permits.
- Move away from reliance on fossil fuels to renewables.

Other harmful effects of fossil fuels

- Land degradation
- Enormous toll on landscapes and ecosystems
- Even after extraction, the nutrient-leached land will never return to its earlier state
- Critical wildlife habitats up fragmented and destroyed

Water pollution

- Acid runoff into water bodies
- Oil spills and leaks during extraction or transport



Courtesy: Mark Jacobson



- Fracking and its toxic fluids contaminate drinking water
- Generate enormous volumes of wastewater in the process

Emission

- Emits harmful air pollutants long before they're burned
- Emits mercury, sulfur dioxide (contribute to acid rain), soot (particulate matter)
- Fossil fuel-powered automobiles - Main contributors of poisonous carbon monoxide and nitrogen oxide, which produces smog (and respiratory illnesses)

Other effects

- Ocean acidification - Since the start of the Industrial Revolution (and coal-burning ways), the ocean has become 30% more acidic.

2.4 Rising Water Scarcity

What is the issue?

- World Water Day is celebrated every year on March 22. This year's theme is aptly titled 'Valuing water.'
- In this context, here is an overview of India's water scenario, the challenges and the ways to deal with it.

What is the extent of water crisis in India?

- The NITI Aayog report on 'Composite Water Management Index (2018)' underlines that over 600 million Indians face high to extreme water stress.
- Also, about 2 lakh people die every year due to inadequate access to safe water.
- According to a World Bank report, the amount of water currently available to an individual will fall below half of the 1,588 cubic meters per year by 2030.
- This will create unimaginable disaster for the majority people in India.
- Another World Bank report warns that the countries facing severe water scarcity are likely to face a 6% fall in their GDP by 2050s.

What are the other indications of water stress?

- **Dams** - The average water levels in dams in June, just before the onset of monsoon, has been declining year after year.
- This is evident from the report of the Central Water Commission on the storage level of 91 major dams.
- There have been shocking reports that perennial rivers like the Ganga, Godavari and Krishna have dried up in many places in recent years.
- There is the problem of accumulation of sediments in the water storage area of major and medium irrigation dams that are currently in use.
- Resultantly, the total storage capacity has fallen significantly.
- Many unprecedented changes are continuously reducing the total water available for future use.
- **Ground water** - The groundwater table in most part of the country has been declining every year because of over-exploitation.
- If the groundwater continues to decline unabated, meeting the country's agricultural and drinking water requirements will be a big challenge.
- 85% of rural water supply, 45% of urban water supply and over 64% of irrigation now rely on groundwater.

What are the challenges ahead and the possible measures?

- According to an estimate released by the Water Resources Ministry, a big demand-supply gap for water is going to happen by 2050.
- There is a compelling need to save water and increase its storage capacity.
- Despite this, farmers are increasingly allocating more area for cultivating water-intensive crops.

- As India's economy relies heavily on agriculture, the country needs to set right the issue of water scarcity before it inflicts irreparable damage.
- Climate change is already causing major changes in rainfall levels
- The quantum received in a day is rising substantially in recent years.
- This is responsible for the unprecedented floods in Mumbai (2005), Chennai (2015) & Hyderabad (2020).
- This being the case, the dams that can store more water needs to be constructed.
- Due to the lack of proper maintenance, the water storage capacity of small water bodies has fallen steeply.
- These waterbodies have been heavily encroached upon and even destroyed in many places.
- Immediate action must be taken to remove such encroachments.
- Also, steps should be taken to remove silt deposited in the water storage areas of the dams.

3. AGREEMENTS AND CONVENTIONS

3.1 Paris Climate Track & Decarbonisation

What is the issue?

- The Ministry of Environment, Forest and Climate Change (MoEFCC) recently constituted a high-level inter-ministerial Apex Committee for Implementation of Paris Agreement (AIPA).
- In this backdrop, here is an assessment of the impact of the Covid-19 pandemic and the issue of climate crisis.

How are Covid-19 impact and climate crisis related?

- With the formation of the AIPA, India is again strengthening its global leadership role in combating climate change.
- At the same time, along with many economies, India is being severely affected by the spread and impact of the Covid-19 pandemic.
- But the good news is that recovering from the economic shocks of the Covid-19 pandemic, and avoiding severe future shocks triggered through the climate crisis, do not represent conflicting interests.
- Instead, a mutually-reinforcing coping strategy is presented with this.

What does this imply?

- India has tremendous potential for a 'green recovery' from the impacts of Covid-19.
- The decarbonisation of India's energy sector has a strong role to play in reviving the economy and the health system by –
 - i. boosting employment
 - ii. fostering rural electrification as foundation of local value creation
 - iii. unburdening national health systems by reducing the prevalence of respiratory diseases
- The various co-benefits that accompany climate action link the missions and mandates of several ministries.
- Notably, the new AIPA committee has members representing 14 ministries.
- It is perfectly suited to generate a coordinated response on climate change matters.
- Importantly it also helps maximise and coordinate the multiple social and economic co-benefits that accompany ambitious climate action.

How does this work in India?

- India can significantly boost employment by increasing the share of renewables in the energy mix.
- Renewables tend to be more labour-intensive than conventional energy technologies.
- By 2050, more than 3.5 million people could be employed in the renewable energy sector.

- This is five times more than the entire Indian fossil-fuel sector (coal, gas, nuclear) employed in 2020.
- India can also markedly improve the livelihoods of its citizens by reducing ambient air pollution.
- In a business-as-usual scenario, during 2020, almost 500,000 people will die prematurely due to exposure to particulate matter (PM₁₀), increasing to 830,000 premature deaths during 2050.
- By moving to a more ambitious decarbonisation pathway (NDC PLUS), more than 200,000 premature deaths can be avoided.

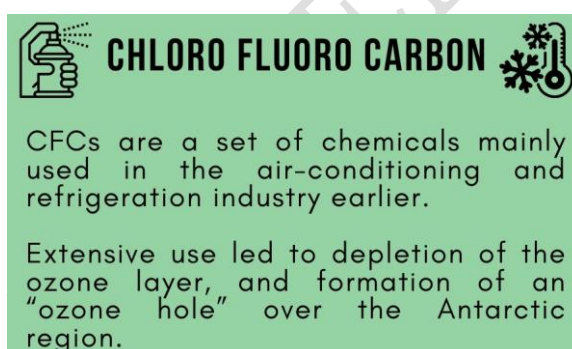
3.2 India's Ratification of Kigali Amendment

Why in news?

India has decided to ratify the Kigali Amendment to the Montreal Protocol.

What is the Montreal Protocol (1989)?

- It is an international treaty that regulates the production and consumption of nearly 100 man-made chemicals referred to as ozone depleting substances (ODS).
- The ODS, when released to the atmosphere, damage the 'stratospheric ozone layer' that protects the earth against the harmful levels of UV radiation from the sun.
- It mandated the complete phase-out of chlorofluorocarbons or CFCs and other ODS.
- CFCs were gradually replaced, first by **hydrochlorofluorocarbons (HCFCs)**.
- Eventually, **hydrofluorocarbons (HFCs)** were introduced as non-ozone depleting alternatives to support the timely phase out of CFCs and HCFCs.



What was the problem with HFCs?

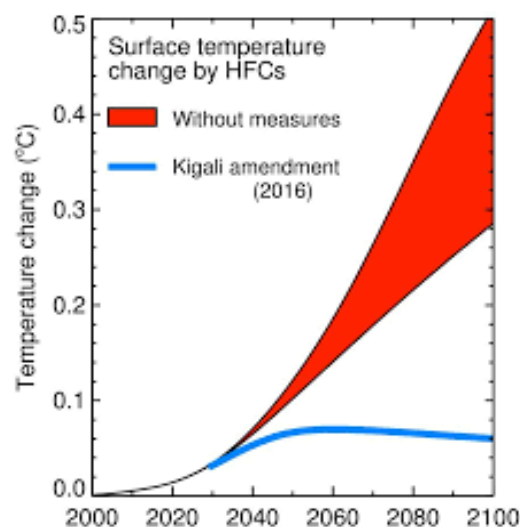
- HFCs do not deplete the ozone but are **powerful greenhouse gases (GHGs)** with high Global Warming Potential (GWP).
- It is essential to phase out HFCs as-
 1. Global warming is emerging as one of the biggest global challenges.
 2. Air-conditioning demand is showing a significant increase, especially in countries like India.
- The average GWP of 22 of the most used HFCs is about 2,500 times that of CO₂. If left unabated, HFCs might contribute to annual GHG emissions up to 19% by 2050.

So, what is the Kigali amendment?

- The Montreal Protocol was amended in 2016 (9th time) after negotiations in Kigali, the capital of Rwanda.
- It essentially enables the **gradual phase-down of hydrofluorocarbons, or HFCs**.
- The terms entered into force in 2019, and have been signed by more than 122 countries so far.

Why HFC is under the Montreal protocol if it is not an ODS?

- Being non-ozone-depleting, HFCs reduction was under the 1997 Kyoto Protocol and 2015 Paris Agreement that addressed GHG emissions and climate change.
- But the Montreal Protocol has –
 1. far more effective and successful than the climate change instruments
 2. already resulted in the phase-out of 98.6% of ODS.



3. to date, the only UN treaty ever that has been ratified by every country - all 198 UN Member States

- So, it was decided to use the Montreal Protocol to phase out HFCs.

How is India's performance?

- According to Climate Action Tracker, India is one of the few countries whose actions are compatible with keeping warming below 2°C.
- The climate actions of different countries are rated as below:
 1. Australia, Brazil, Canada, the UK and all of Europe - 'Insufficient'
 2. China, Japan and South Africa - 'Highly insufficient'
 3. Argentina, Russia, Saudi Arabia and Turkey - 'Critically insufficient'
- India recently crossed the milestone of 100 GW of installed renewable energy capacity.
- India will also draw up a national strategy for phase-down of HFCs by the year 2023 in 'consultation with all industry stakeholders.'
- Amendments to the Ozone Depleting Substances (Regulation and Control) Rules will be done by mid-2024.

GROUPINGS TO PHASE OUT HYDRO FLUORO CARBONS (HFCs)



Group I: Rich & developed economies like USA and EU; Started phase down HFCs by 2019 and reduce it to 15% of 2012 levels by 2036



Group II: Emerging economies like China, Brazil start phase down by 2024 and reduce it to 20% of 2021 levels by 2045.



Group III: Developing economies and some of the hottest climatic countries like India, Pakistan, Iran, Saudi Arabia starts phasing down by 2028 and reduce it to 15% of 2024-2026 levels till 2047.



HFCs reduction as per the countries' commitments is estimated to reduce Earth's average surface warming by 0.5°C over pre-industrial era levels.

What are the concerns?

- Overall energy policy pushes for both renewable and fossil-fuel-based energy production.
- E.g., Draft National Electricity Policy 2021 said India would build more **coal power plants** given its cost-effectiveness.
- Centre's attempts to allow violators to 'pay and pollute' undermines the other efforts.
- Fossil fuel producers, mostly from Russia, US and the Middle East, have begun entering India, seeing it as one of the last big markets for fossil fuels.
- These realities suggest that India's energy transition will see a delay.

3.3 Reworking Climate Agreements

What is the issue?

Setting common targets in climate agreements will undermine the concept of climate justice for developing countries like India.

What is climate justice?

- It reframes global warming as an ethical and political issue rather than being purely environmental or physical in nature.
- When countries such as India were becoming major industrial and middle class nations, they should not pay the price for the pollution caused by the West.

How is climate justice undermined in treaties?

- Firstly, inequity is built in the climate treaties which make India the 4th largest emitter even though India contributes 3% when compared to 26% in U.S. and 13% in China.
- According to UN, richest 1% of the global population emits more than two times the emissions of the bottom 50%.
- Secondly, in the climate negotiations longer term goals are set without any strategy to achieve them.
- The focus is more on physical quantities, emissions of carbon dioxide and increase in global temperature rather than the analysis of drivers, trends and patterns of resource use.
- Moreover the current framework considers symptoms which forces developing countries to keep the discussion away from the causes of the problem.
- Thirdly, global policy recommendations for developing countries are based achieving reasonable not comparable levels of wellbeing.
- This ensures that there is an early capping of energy use thereby not affecting the growth while ignoring the costs on the poor.

How does infrastructure contributes to climate change?

- Firstly, infrastructure has a defining role in human well-being both in its provision of services to the outside market and in shaping the demand- manufacturing, lifestyle.
- Secondly, in the urbanised world, two thirds of emissions arise from the demand of the middle class for infrastructure, mobility, buildings and diet.
- There is no substitute to cement, steel and construction material, which require half the available carbon space.
- Thirdly, because of its young population and late development, much of the future emissions in India will come from infrastructure, buildings and industry.

What are the challenges for India?

- India should highlight its unique national circumstances with respect to food, energy and transportation systems that have to change.
- Consumption of meat contributes to a third of global emissions and Indians eat just 4 kg a year.
- In European Union, a person eats 68 kg and twice that in the U.S. where a third of the food is wasted by households.
- India has abundant coal reserves and per-capita electricity use is tenth when compared to U.S.
- Now it is under pressure to stop using coal though U.S. currently uses more coal.
- India wants to eliminate the use of oil and replace it with renewable energy and hydrogen as a fuel for electrification.
- This acceleration requires international cooperation around technology development and transfer.

What can be done now?

- Global goal-shaping national strategy requires a new understanding.
- Firstly reframe the global concern in terms of sustainable development for countries with per capita emissions below the global average and it should be in line with Paris Agreement.
- Secondly, the verifiable measures should be well-being within ecological limits.
- Thirdly, international cooperation should centre on sharing technology of electric vehicles and hydrogen as a fuel, as they are the most effective response to climate change.



4. CARBON EMISSIONS

4.1 Emission Intensity - India

What is the issue?

- India is largely doing well in reducing emissions-intensity of its GDP as per the international commitments it has made.
- In this context, here is an assessment of India's emission scenario and the gaps to be filled.

How is India's emission scenario?

- As an emerging economy, India's greenhouse gas (GHG) emissions continue to rise.
- But it has also committed to reducing the emissions-intensity of its GDP by 33-35% over 2005 levels by 2030.
- It wants economic growth with lower emission.
- Between 2011 and 2016, while its GDP (current prices) rose at 12% CAGR, emissions increased at 4% CAGR.
 - [CAGR (Compound Annual Growth Rate) is a measure of the average yearly growth of investments over a certain time period.]
- This is revealed in India's latest Biennial Update Report (BUR) submitted to the UN Framework Convention on Climate Change.

What is the BUR and how about India's BUR?

- BURs are the foundation of transparency in the international climate regime.
- It works as a mechanism to check how countries are doing against stated goals.
- Here, India has done better.
- Its measurement, reporting and verification have sound foundations.
- They comprise dashboards/portals, apps, data repositories and initiatives by non-governmental institutions.
- 63 countries have submitted BUR-1 and 31 have submitted BUR-2.
- India is one of the only 13 countries to have published BUR-3 (three countries have submitted BUR-4).
- China and the US, the largest current and historical polluters, respectively, have submitted two reports.

How significant is energy intensity in emission reduction?

- During 2012-16, emissions intensity of GDP reduced by 11% at constant 2011 prices (24% reduction since 2005).
 1. By contrast, energy intensity of GDP decreased 7% at constant prices.
 2. While the share of agriculture emissions fell, energy-use emissions increased to three-fourths of all emissions.
 3. Emissions from residential and commercial energy use grew the fastest (12% CAGR, signalling rapid urbanisation).
 4. This was followed by energy industries, manufacturing and transport (CAGRs of 5%, 3% and 4%, respectively).
- Thus, bulk of India's achievement in reducing emissions intensity after 2016 has been due to energy efficiency.
- The programmes in this regard include -
 1. Ujala scheme for LED light bulbs - 180 million tonnes of CO₂, or mtCO₂, saved between 2014-15 and 2019-20
 2. Perform, Achieve and Trade scheme for industries - 31 mtCO₂ saved during 2012-15 and 61 mtCO₂ during 2016-19
 3. Efficient street lighting - 14.82 mtCO₂ saved between 2015-16 and 2019-20
 4. the Krishi Sinchayee Yojana for agriculture - 11.979 mtCO₂ saved during 2017-19



- 5. supercritical coal power plants (avoiding sub-critical units) - 20.69 mtCO₂ avoided by March 2017
- Smaller savings have come from –
 1. fuel efficiency norms for passenger cars, support for EVs
 2. energy efficiency schemes for small industries
 3. efficient water pumping in cities, and building retrofits
- Together, these resulted in a net reduction of more than 23 million tonnes of oil equivalent in 2018-19.
- This is roughly 6% of total energy consumption that year.
- So, broadly, emissions can be lowered by reducing energy used or the carbon content of the energy mix.

How will it be in the future?

- In future, too, energy-use sectors will determine how quickly India's decarbonisation unfolds.
- Across energy-intensive industries, cement and non-ferrous metals had the highest reduction in energy intensity (21% and 14%, respectively).
- But iron and steel increased energy intensity of output.
- These heavy industries will continue to pose a challenge.

How does India compare with other countries?

- Compared to other countries, India does better.
- Barring China, India outperforms many major emitters (the US, EU-4, Japan, Russia and Brazil) in reducing energy intensity of GDP during 2011-17. This is according to the International Energy Agency data.
- The BUR calculates a carbon budget based on equal per capita allocation.
 1. India's per capita cumulative emissions during 1990-2017 was only 27% of its fair share of emissions.
 2. This contrasts with emissions exceeding the fair share in the US (417%), Germany (242%), Japan (211%), or China (109%).
- Moreover, rich countries have failed to redeem past commitments to cut emissions.
- Under the Kyoto Protocol, they were meant to cut these to 5% below 1990 levels during 2008-12.
- Not all rich countries participated, the US being the most notable case.
- Thereafter, the Doha Amendment to the Protocol set out a second commitment period (2013-20).
- Participating countries were nudged to reduce emission by at least 25-40% below 1990 levels by 2020.
- This time, several more major emitters (Canada, Japan, and Russia) did not participate.
- Net of economies in transition, aggregate emissions of developed countries decreased only by 1.6% during 1990-2018.
- India is going to meet its emissions intensity targets. But that is not the same as emissions reductions.
- Its transformation to a prosperous yet low-carbon economy needs reforms on technology for industry, transport and cities.
- Better performance compared to developed countries positions India as a reliable climate stakeholder.
- International climate discussions must recognise it as such.

What are the shortfalls to be addressed?

- Despite massive deployment, the share of renewables in India's primary energy mix has increased from 0.1% to merely 2% during 2011-19.
- Electricity still accounts for only about 26% of India's final energy consumption and renewables have only a 9% share in power generation.
- So, for faster decarbonisation, there must be a double transition:
 1. faster electrification of sectors

2. rapidly rising share of renewables in power generation

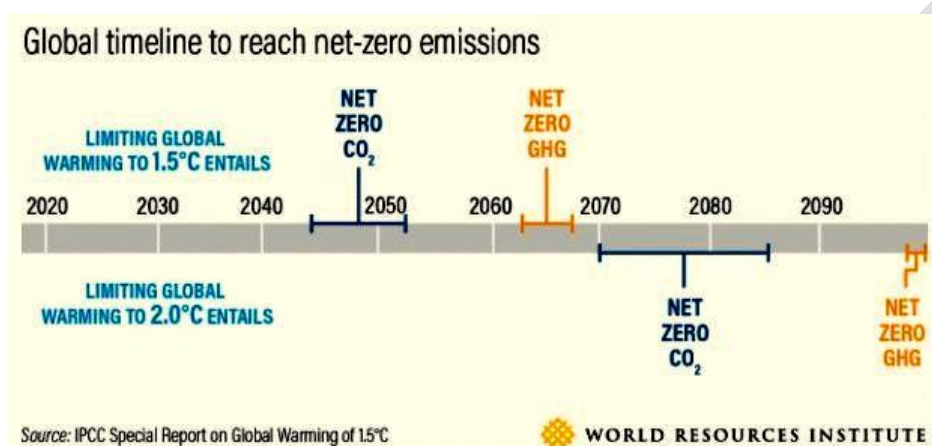
- The Railways, for instance, will become the first major system to be fully electrified and seeks to become a net-zero emitter by 2030.
- For heavy industry, the recently announced National Hydrogen Mission could be fundamental in switching to renewables-derived hydrogen instead of coal.

4.2 India & Net Zero

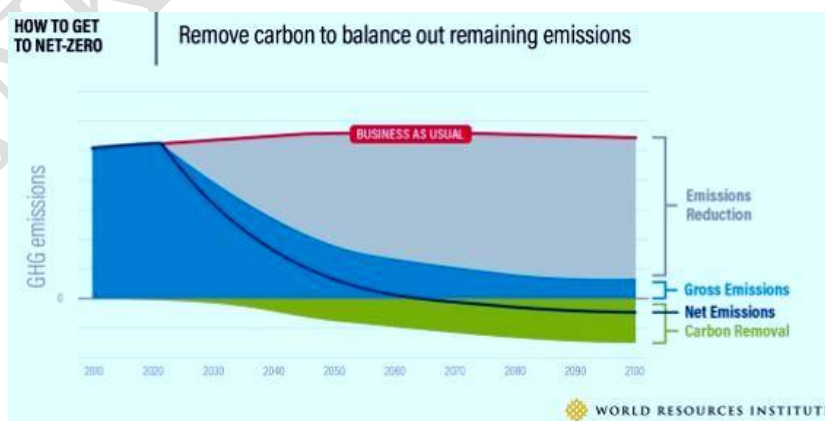
What is the issue?

India is yet to declare its net-zero targets.

What is net-zero?



- It is also referred to as carbon-neutrality.
- It does not mean that a country would bring down its emissions to zero.
- Rather, net-zero is a state in which a country's emissions are compensated by absorption and removal of greenhouse gases from the atmosphere.
- It is achieved by creating more carbon sinks such as forests, while removal of gases from the atmosphere requires futuristic technologies such as carbon capture and storage.
- It is even possible for a country to have negative emissions, if the absorption and removal exceed the actual emissions.
- IPCC report finds that if the world reaches net-zero emissions by 2040, the chance of limiting warming to 1.5°C is considerably higher.



What is the status of the rest of the world?

- 50% of the global economy is already committed to net zero emissions by 2050.
- China is committing to be so before 2060.

- It is not only governments but the businesses are increasing climate action too to take advantage of the new opportunities arising.
- Investors injected over \$500 billion into climate transition in 2020.

Why India has not committed yet?

- **Environmental justice** - India is not committing to net zero on the basis that it needs to see significant support from developed countries.
- India demands long promised environment reparation (\$100 billion) from developed nations for adaptation strategies of emerging economies to achieve their net zero target by 2030.
- **CoP targets** - It states that the net-zero goal does not figure in the 2015 Paris Agreement, which only requires every signatory to take the best climate action it can.
- It argues that instead of opening up a parallel discussion on net-zero targets outside of the Paris Agreement framework, countries must focus on delivering on what they have already promised.
- India is set to significantly exceed its Paris Agreement commitment of reducing the emissions intensity of its GDP by 33-35% below 2005 levels by 2030.

Why is net-zero by 2050 unfeasible for India?

- India has a national interest in global and national climate action as it is among the most vulnerable countries to climate change
- Therefore it should be among the more active against the threats.
- As a rising power, India must involve in climate action to seek stronger influence globally.
- India is already the 3rd largest emitter in the world
- With US, China, and the EU being signed up to net zero, it will become a significant drag on India's international diplomacy not to sign up.
- There is no longer a trade-off between reducing emissions and economic growth.
- e.g U.K. has reduced emissions over 40% and grown its economy over 70% since 1990.
- Solar energy costs have fallen 90% in recent years, providing the cheapest electricity in India.
- Given the negative impacts, addressing climate is now central to economic development, not an added luxury to consider.
- E.g Agricultural policy that does not consider adaptive approaches in the face of increased flooding & drought is irresponsible.

“India's climate burden is four times its climate guilt”
- David Wallace Wells,
Climate Journalist

What alternatives does India have?

- India is already among the very few countries which are well on their path to achieving their voluntary Nationally Determined Contributions (NDCs).
- This is part of the Paris Accord (Conference of Parties 21, or COP 21, Paris, 2015).
- This includes decreasing the carbon intensity of its GDP by 33-35% compared to 2005 levels by 2030.
- Also, the non-fossil fuel capacity of the total electricity capacity of the country would have to go up to 40% by 2030.
- Also, the country has accordingly planned for renewable capacity of 450 MW by that year.
- There is progress in solar power sector such as grid parity and favourable auction prices.
- So, the renewable energy (RE) transition is already helping achieve India's voluntary obligations aimed at preventing disastrous climate change.

Is net zero the one-stop solution?

- Global warming is just one input in the carrying capacity of the Earth.
- So Net Zero should not treat as a form of 'cognitive bargain' to reverse climate change.

- There is a lengthy road beyond Net Zero to achieve a carbon negative environment.

4.3 Low-Carbon Future

Why in news?

In the recently organised Leaders' Climate Summit, there is a debate whether India should announce net-zero emissions target.

What should be India's approach?

- IPCC 1.5°C report called for global carbon emissions to reach net-zero by 2050.
- India being a climate-vulnerable country, it must contribute to limit the global temperature rise ideally below 1.5°C.
- While doing so, it should not lose sight of the history of global climate negotiations and its own developmental needs.
- By announcing net-zero commitment, India risks taking a heavier burden of decarbonisation than many wealthier countries.
- Hence focused near-term sectoral transformations through aggressive adoption of technologies can be adopted.

How can we de-carbonise the power sector?

- Electricity sector is the single largest source (about 40%) of India's greenhouse gas emissions.
- De-carbonising the electricity sector would require transformational changes in urbanisation and industrial development.
- For example, electricity should be used for transport and integrating electric systems into urban planning.
- Till now electricity sector is focussing on expanding renewable electricity capacity-175GW of renewable capacity by 2022.
- It now needs a comprehensive shift going beyond expanding the renewable energy targets.
- This can be done by limiting the expansion of coal-based electricity capacity.

How can this be done?

- First India can pledge that it will not grow its coal-fired power capacity beyond what is already announced and reach peak coal electricity capacity by 2030.
- It should also strive to make existing coal-based generation cleaner and more efficient.
- Second, multi-stakeholder Just Transition Commission can be created to represent all levels of government and affected communities to ensure decent livelihood opportunities to people in the India's coal belt.
- This is necessary because the transition costs of a brighter low-carbon future should not fall on the backs of India's poor.
- Third, existing problems of the sector such as the poor finances and management of distribution companies needs to be addressed.
- Finally, India will need to work hard to become a leader in technologies of the future such as electricity storage, smart grids and technologies that enable the electrification of other sectors such as transportation.

How can we improve energy services?

- Growing urbanisation and uptake of electricity services offer a good opportunity to shape energy consumption within buildings through proactive measures.
- Air conditioners, fans and refrigerators together consume about 60% of the electricity in households.
- India could set aggressive targets- 80% of air conditioner sales and 50% of fan and refrigerator sales in 2030- should be most efficient.
- This will reduce green house gas emissions and benefit the consumer by lowering their electricity bills.

- India can leverage this transition too as an opportunity to become a global leader in production of clean appliances.
- Such a sector-by-sector approach can be developed for other sectors which can set a path towards net zero emissions and achieve the Paris Agreement targets.
- India can also come out with timelines for achieving climate targets.

How can timelines be formed?

- India can also consider committing to submit plausible pathways and timelines to achieving net-zero emissions as part of its future pledges.
- It can undertake detailed assessments of its development needs and low-carbon opportunities, the possible pace of technological developments.
- It can also assess the potential geo-political and geo-economic risks of over-dependence on certain countries for technologies or materials.
- It can use interim period to develop a strategic road map to enhance its own technology and manufacturing competence as part of the global clean energy supply chain.

4.4 Deconstructing Carbon-Neutrality

Why in news?

Recently, 32 countries declared their proposed intention to achieve carbon neutral status by mid-century.

What is the temperature goal?

- UN Secretary General has urged all countries, especially India, to make explicit declarations in the climate targets.
- Article 4.1 of the Paris Agreement asks countries to reach global peaking of greenhouse gas emissions as soon as possible.
- It also requires countries to undertake rapid reductions in carbon emissions to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases.
- The temperature goal referred in the Paris Agreement is to limit temperature rise to well below 2°C and further pursuing efforts to restrict it to 1.5°C above pre-industrial levels.

What is the problem with this target?

- The balance between emissions and removal of greenhouse gases is sought not on a country-wise basis but for the world as a whole.
- The carbon neutrality goals of the countries do not reflect the principle of equity and the principle of common but differentiated responsibility.
- It is also incompatible with achieving the goal of 1.5°C or 2°C.
- Moreover the three-way compatibility between temperature goals, carbon neutrality and equity is not guaranteed.
- According to IPCC report, for a 50% probability of restricting temperature rise to less than 1.5°C, there should be carbon budget of 480 Giga-tonnes of carbon dioxide equivalent (GtCO₂eq).
- At the current rate of emissions of about 42 GtCO₂eq per year, this budget would be consumed in 12 years.
- To keep within the 480 Gt budget, global carbon neutrality must be reached by 2039 which is infeasible.

How are the emissions in the west?

- In U.S., emissions have peaked in 2005 and have declined at an average rate of 1.1% from then till 2017, with a maximum annual reduction of 6.3% in 2009.
- If it reaches net-zero by 2050, the cumulative emissions between 2018 and 2050 would be 106 GtCO₂ which is 22% of the total remaining carbon budget- very high share.
- If U.S. stays within its fair share of the remaining carbon budget, it would have to reach net zero emissions by 2025.

- But it would still owe a carbon debt of 470 GtCO₂ to the rest of the world for having used more than its fair share of carbon space in the past.
- Similarly, European Union, to keep to its fair share of the remaining carbon budget would have to reach net zero by 2033, with a constant annual reduction in emissions.
- So this climate policy modelling has promoted the illusion that three-way compatibility is feasible through negative emissions by expanding the carbon capture.
- They also promote the other illusion that not resorting to any serious emissions increase is the means to guarantee the successful development of the third world.

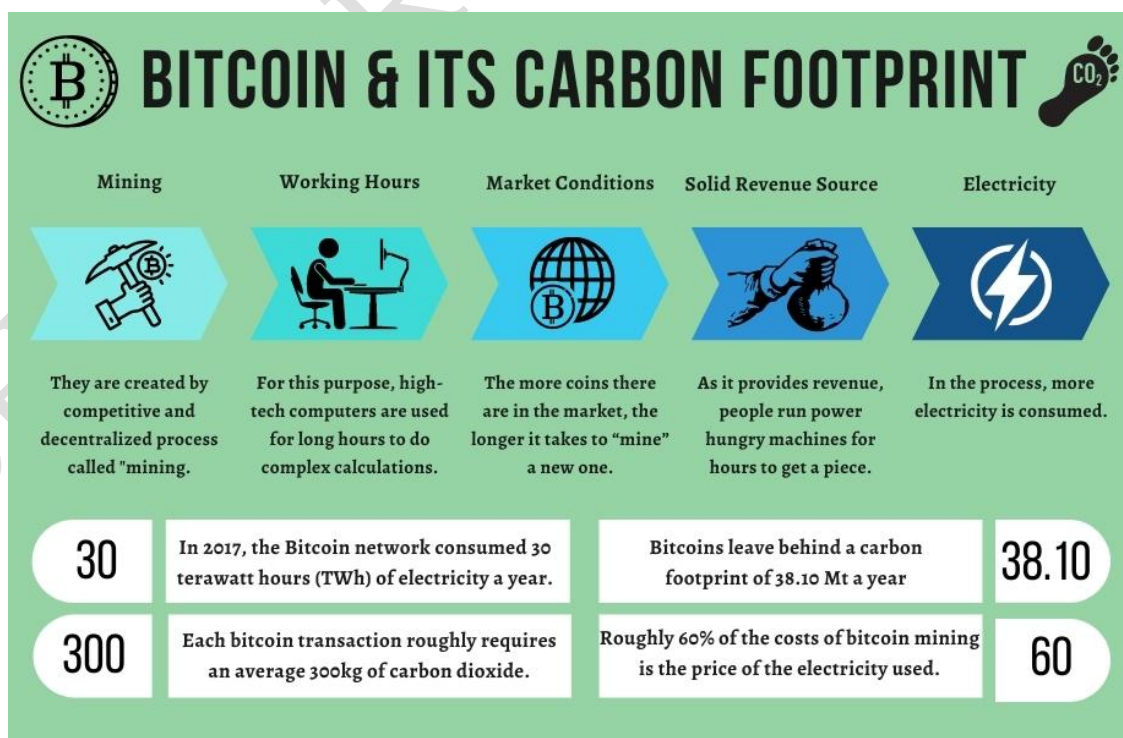
Why India should not join the carbon neutrality declarations?

- India's twin burden of low-carbon development and adaptation to climate impacts requires serious, concerted action.
- One, India has to stay focused on development — both as its immediate need as well as its aspirational goal.
- India's current low carbon footprint is a consequence of the utter poverty and deprivation.
- Second, India does not owe a carbon debt to the world as the country's emissions is not more than 3.5% of global cumulative emissions prior to 1990 and about 5% since till 2018.
- India's mitigation efforts are quite compatible with a 2°C target.
- So any self-sacrificial declaration of carbon neutrality will only reduce the burden of the developed world and transfer it to the backs of the Indian people.
- India's approach to eventual net-zero emissions should be contingent on deep first world emissions reductions.
- Meanwhile, India must reject any attempt to restrict its options and being led into a low-development trap.

4.5 Bitcoin's Electricity Consumption

What is the issue?

- Investors around the world are rushing to follow the newest financial trend of Bitcoin which is currently worth around \$1 trillion.
- But the carbon footprint that the cryptocurrency is leaving behind has raised concerns.



What is the level of electricity consumption?

- Bitcoin uses more electricity per transaction than any other method known to mankind.
- In 2017, the Bitcoin network consumed 30 terawatt hours (TWh) of electricity a year.
- However, the network currently uses more than twice as much energy: between 78TWh and 101TWh.
- **Carbon footprint**- Each bitcoin transaction roughly requires an average 300kg of carbon dioxide.
- This is equivalent to the carbon footprint produced by 750,000 credit cards swiped.
- A recent study has shown that Bitcoins leave behind a carbon footprint of 38.10 Mt a year.
- The annual carbon footprint of Bitcoins is thus almost equivalent to that of Mumbai.
- To put it in a global perspective, it is as high as the carbon footprint of Slovakia.
- Roughly 60% of the costs of bitcoin mining is the price of the electricity used.

What are the other impacts of Bitcoin mining?

- As miners use high-tech computers for hours to formulate new blockchains, these machines do not last long.
- Manufacturers of Bitcoin mining devices need a substantial number of chips to produce these machines.
- Recently, during the Covid-19 crisis, the world had witnessed a shortage of these chips.
- This shortage, now, in turn started affecting the production of electric vehicles around the world.
- To produce 1 million such computers, the largest provider, Bitmain, would have to use a month's capacity of one of only two chip fabricators in the world capable of producing such high-power silicon.
- This potentially crowds out demand from other sectors such as Artificial Intelligence, transportation and home electronics.
- Besides this, countries like Iran are using cryptocurrency to circumvent economic sanctions (imposed to prevent developing nuclear capabilities).
- Cheap energy has lured in many cryptocurrency miners.
- The mining activity in Iran now represents 8% of the total computational power in Bitcoin's network.
- The country is thus using Bitcoin to boost revenues while its oil exports suffer from international sanctions.
- The effects of cryptocurrency mining thus often spill over to other parts of the economy too.

What can possibly be done to control the carbon footprint?

- The major problem with mining Bitcoin is not its massive energy-consumption nature.
- It is rather the fact that most of the mining facilities are located in regions that rely heavily on coal-based power.
- Given the growing implications of the cryptocurrency mining industry, policymakers should follow the path shown by Québec in Canada.
- There, a moratorium on new mining operations has been imposed.
- Although Bitcoin might be a decentralised currency, many aspects of the ecosystem surrounding it are not.
- So, large-scale miners can easily be targeted with higher electricity rates, moratoria, or, in the most extreme case, confiscation of the equipment used.
- Governments can also ban cryptocurrencies from digital asset marketplaces as it will affect the prices of a digital currency.

What is the case with India?

- The country, at present, has around 75 lakh cryptocurrency investors.
- They have together pooled in over Rs 10,000 crore into Bitcoins and other such digital currencies.
- The prices have surged by over 900%, given the worldwide boom.
- A single bitcoin that used to cost around Rs 4 lakh in 2020 now costs somewhere around Rs 41 lakh.



- However, reportedly, the government seems to plan to pass the pending cryptocurrency Bill that puts a complete ban on and criminalises possession of Bitcoins.
- Finance minister has however said that the Centre will take a “calibrated approach” and leave a window open for experiments with blockchain technology.

5. MITIGATION

5.1 Mumbai Climate Action Plan

Why in news?

The Brihanmumbai Municipal Corporation (BMC) is drafting a Mumbai Climate Action Plan (MCAP) to tackle climate challenges.

What is the MCAP?

- It is a comprehensive roadmap outlining specific activities to reduce emissions and meet the goals of the Paris Agreement.
- It was drafted with the technical support from World Resources Institute India (WRI India).

What is the need for a climate plan?

Weather events

- WRI study on Mumbai’s vulnerability assessment says Mumbai will face **rise in temperature & extreme rain leading to floods**.
- Recent IPCC report predicts that Mumbai will face sea rise of 0.1m to 0.3m in next three decades.
- By 2050, Mumbai will see a 25% increase in the intensity of flash floods.
- This will affect 2-3 million people living within 1 km from the coastline.
- The plan also comes as part of the C40 compliance process, as Mumbai joined C40 Cities group in December 2020.
- *C40 is a network of the world’s megacities committed to addressing climate change. There are 97 cities across the world connected in C40 Cities to collaborate and take measures on climate change.*

GHG emissions

- Mumbai’s greenhouse gas (GHG) emission was 34.3 million tonnes in 2019.
- Of this, 71% came from the energy sector which is mainly based on coal.
- 24% is from transport, and the 5% is from solid waste management.
- *95% of Mumbai’s electricity is coal-based and needs to be shifted to renewable energy to bring down emissions.*

What are the signs of climate change impact in Mumbai so far?

- Steady rise in air temperature over the past 50 years.
- Uneven increase in night time temperatures.
- Faster warming of the winter months compared to the summer.
- The number of extreme caution days is increasing. e.g Mumbai sees 174 caution days and 187 extreme caution days per year.
- *Caution days - Temperature is 26-32°C.*
- *Extreme caution day - Temperature is 32-42°C.*
- *Temperatures above 35°C can impact human health and productivity.*

- Since 2007, a constant rise in temperature mainly due to concretization, lack of green cover and housing density in Mumbai.
- A substantial increase in intense rainfall and storm events in the last 5 years, resulting in frequent water logging and flooding.

What will the MCAP address?

PLAN TO BE **READY BY NOVEMBER**

The Mumbai Climate Action Plan will focus on six action areas:

- 1** Sustainable waste mgmt
- 2** Urban greening, biodiversity
- 3** Flooding, water resource mgmt
- 4** Bldg energy efficiency
- 5** Air quality
- 6** Sustainable mobility



➤ Expected to be ready by November 2021, said Lubaina Rangwala, associate director, WRI Ross Center for Sustainable Cities

➤ Citizens can send suggestions to the website (<https://mcap.mcg.gov.in/about/>)

- Reduction of GHG emission by sectors.
- Consumption patterns, for the near term (2030), medium term (2040) and long-term (2050).
- Vulnerability assessment.
- Increasing community resilience capacities in vulnerable neighborhoods.
- Building climate resilient infrastructure.
- Nurturing robust natural systems to better adapt to climate risks.

5.2 Climate Finance

Why in news?

Climate finance will be a central theme in recently held Leaders Summit on Climate.

How is the existing performance on climate finance?

- In 2009, developed countries promised developing countries \$100 billion by 2020 in climate finance.
- OECD estimated that \$78.9 billion of climate finance was provided in 2018.
- But India called this as **green washing of finance** as the committed aid had been diverted from other purposes to climate activities.
- The new and additional finance was only \$2.2 billion which is far lower than the committed one.
- Oxfam reports that in 2017-18, only \$19-22.5 billion were paid, after discounting for loan repayments, interest and administration costs.
- This stand in sharp contrast to other estimates that pegged global climate finance at more than \$530 billion in 2017.
- Thus, developing countries claim they are not receiving what was promised to them and the claims of developed countries are a fraction of total global climate investment.

What can be done to address this issue?

- In dealing with climate finance four shifts are necessary- Scale, balance, risk and regulation.



- First, capital commitment should be in far greater scale than what has been negotiated.
- Developing countries need \$3.5 trillion to implement climate pledges up to 2030 and according to RBI India alone needs \$2.5 trillion.
- The capital requirement could be two-three times this value for deep decarbonisation of the energy sector.
- Secondly, there must be balance between public and private sources and public funds cannot sufficiently pay for a low-carbon transition.
- OECD estimates showed public climate finance at \$64.3 billion against only \$14.6 billion of private capital mobilised.
- The world's largest sovereign wealth funds, pension funds shy away from developing countries considering them risky destinations and there is still very limited insurance against climate shocks.
- According reinsurance giant Swiss Re, of \$146 billion in damages from natural disasters in 2019, only \$60 billion was insured.
- So a rebalancing of climate finance is required- more blended capital, more insurance for climate-resilient infrastructure.
- Thirdly, without de-risking instruments, capital requirements for transitions in clean energy, sustainable mobility would be impossible to meet.
- Developing countries need three categories of blended finance:
 1. De-risking utility-scale renewables in emerging markets by targeting non-project risks (exchange rate fluctuations, policy);
 2. Reduce the finance cost for distributed energy solutions for small businesses to clean their energy mix ;
 3. Risk capital for R&D investment in disruptive technologies is required;
- Fourthly, regulation in developing countries must create an ecosystem for green finance.
- RBI has only taken tentative steps, giving priority sector lending status to small renewables in 2015 and a call for deep green bond markets.
- SEBI has issued green bond guidelines in 2017 and ministry of finance's Climate Change Finance Unit has mostly focused on representations in international forums.

What more can be done?

- First, regulation must report on climate risk exposures and planned infrastructure must prioritise resilient projects and write down stranded assets.
- Secondly, a green taxonomy would help in identifying genuine investments from green washed investments.
- Green tagging increases visibility of assets and their climate impacts for potential investors.
- Thirdly, tax incentives could encourage green bond issuances.
- Fourthly, reducing information asymmetries (investment opportunities, risks, market developments) can create larger portfolios of investment for emerging markets.
- Fifthly, public funds should create pipelines of securitised, low-risk green projects so that developed countries could reduce cost of capital in developing and emerging markets.
- Finally, there must be greater coordination in regulatory forums-the Basel Committee on Banking Supervision, Network for Greening the Financial System-to set standards & for capacity building.
- Also developing countries must hold rich countries accountable for not honouring climate finance commitments.

6. RENEWABLE ENERGY

6.1 Hydrogen Fuel Economy - Green Hydrogen

Why in news?

Indian Prime Minister recently announced the National Hydrogen Mission.

What is the National Hydrogen Mission?

- Budget 2021 found mention of Hydrogen Energy Mission in 2021-22 for generating Hydrogen from green power sources.
- Accordingly, the Ministry of New and Renewable Energy (MNRE) has drafted a National Hydrogen Energy Mission.
- It aims to scale up Green Hydrogen production and utilization across multiple sectors.

Hydrogen colour palette

Colour code	Brown	Grey	Blue	Turquoise	Green
Energy source	Coal or lignite	Natural gas	Any non-renewable energy source	Methane	Any renewable energy source
Process of getting hydrogen	Gasification	Steam methane reformation	Steam methane reformation and carbon capture & storage	Pyrolysis	Electrolysis of water
Highest to lowest greenhouse gas emissions	←————→				
Lowest to highest acceptance level	←————→				

How is the current hydrogen production?

- Hydrogen is emerging as an important source of energy since it has zero carbon content and is a non-polluting source of energy.
- But the current global production of hydrogen of about 80 million metric tonnes, is almost wholly produced **through fossil fuels**.
- It uses 6% of global natural gas and 2% of coal, and contributes 830 million tonnes of CO₂.

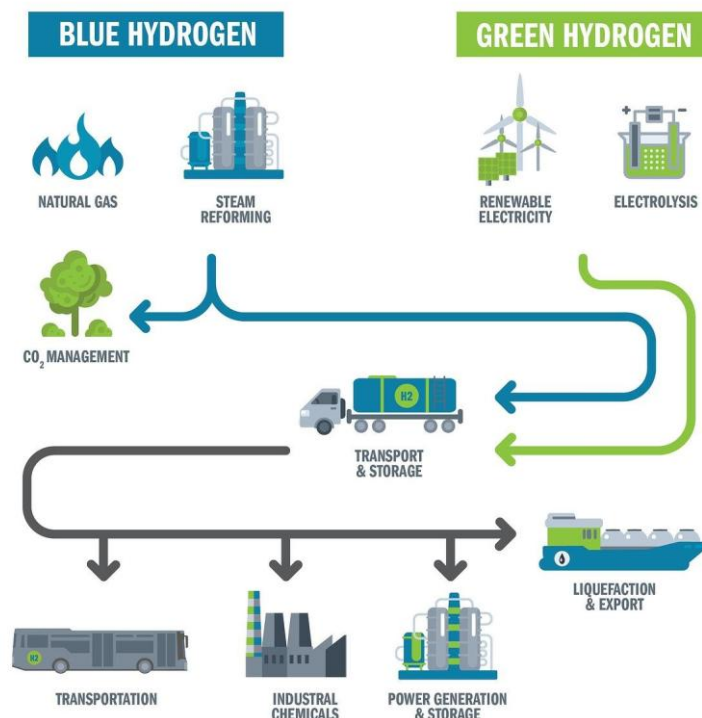
What is green hydrogen?

- Green hydrogen is produced by splitting water into hydrogen and oxygen using an electrolyzer powered by electricity from green energy sources such as wind and solar.
- When burnt, it gives out water vapour, with no residue or climate-harming impact.
- Green hydrogen is aided by:
 - Global energy transition toward renewables
 - Declining costs
 - Breakthroughs in technology - electrolyzer capacity projects
 - High carbon taxes

What are the challenges?

- A lot of energy for the electrolysis of water is needed.

- Unless this electricity is produced with a zero-carbon footprint, it defeats the key aspect of 'green' hydrogen.



What are the advantages?

- Transform India from an energy-deficient to an energy-rich country.
- Make India a net exporter of energy.
- Play a key role in decarbonization efforts.
- Significantly reduce import dependence– India spends \$160 billion on imports of crude oil, liquified natural gas, coal and fertilizer.
- Solar-to-hydrogen also solves an intermittence problem, as hydrogen substitutes the need for battery storage.

Favourable factor

- All-year sunshine - Most parts of India receive 4-7 kilowatt-hour of solar energy/sq. m/day.

What are the possible applications?

- Transportation, including trucks, buses, cars and rail.
- Feedstock for fertilizers, chemicals and refineries.
- Decarbonizing buildings and decarbonizing high-heat industries such as steel-making.
- Hydrogen fuel cells – A key complement to batteries.
- Grid-scale storage solutions and feedstock for ammonia production (thus eliminating the need for natural gas).
- Blending hydrogen with natural gas in city gas pipelines reduces the import of natural gas.

What are the interventions so far?

- The cost of green hydrogen made by electrolysis is estimated to be around Rs.350 per kg. The Centre plans to bring it down to Rs.160 per kg by 2029-30.
- Plans for green hydrogen consumption obligation (GHCO) in fertilizer production and petroleum refining; similar to renewable purchase obligations (RPO).
- The draft Electricity Rules, 2021 have allowed green hydrogen purchase to help meet RPOs.
- Plans to call bids for 4 GW electrolyzer capacity.

- Extending the PLI (Production Linked Incentive) scheme for manufacturing electrolyzers.
- NTPC Renewable Energy is setting up India's largest solar park of 4.75 GW in Gujarat, with plans to make green hydrogen on a commercial scale.
- NTPC has also called bids for setting up a pilot project for mixing green hydrogen with natural gas for the city gas distribution network.
- Besides, Reliance Industries Ltd has recently announced plans to build large-scale, low-cost and high-efficiency electrolyzers as part of its \$10 billion renewables push.

What lies ahead?

- An enabling policy framework.
- A nudge to increase demand for green hydrogen.
- Infrastructure development, such as of pipeline networks and last-mile connectivity.
- Facilitating private capital to participate in the scaling-up effort.

7. GOVERNMENT INTERVENTIONS

7.1 Electric Mobility

Why in news?

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

Why there is a need to shift to electric vehicles?

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

What are the steps taken to introduce electric mobility?

- Government has drafted policies that act as catalysts in propelling the acceptance of electric vehicles.
- Under the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME), government has allocated \$1.3 billion as incentives for buying electric buses, 3-wheelers and 4-wheelers.
- They will be used for commercial purposes till 2022 & another \$135 million is earmarked for charging stations.
- NITI Aayog has given a proposal that a \$4.6 billion subsidy will be given for battery makers.
- In September 2019, a consortium was formed by Japanese automobile Suzuki Motor to set a manufacturing unit in Gujarat for producing lithium-ion batteries & electrodes.
- These policies are embedded with the vision to have 30% electric vehicles plying the roads by 2030.

Where are Lithium reserves available?

- Latin America has the famous lithium triangle region.
- These regions comprise of lithium deposits under the





salt flats of northwest Argentina, northern Chile, and southwest Bolivia.

- They hold about 80% of the explored lithium of the world & most of the production comes from these countries.

How India does meet its Lithium demands?

- At present, India's lithium-ion battery demand is fulfilled by imports from China, Vietnam, and Hong Kong.
- But India has a growing thirst for lithium-ion batteries in the last 2 years & its lithium imports have tripled from \$384 mn to \$1.2 bn.
- In 2019, India's National Aluminium Company (NALCO), Hindustan Copper Limited (HCL) and Mineral Exploration Corporation Ltd (MECL) signed a joint venture agreement.
- They formed KhanijBidesh India Limited (KABIL) to search strategic mineral -lithium and cobalt- abroad for commercial use & to meet domestic requirement.
- India plans to buy lithium from the resource-rich Latin American countries.

How will lithium imports change India's trading relations with Latin America?

- Today Lithium is used as a drug to treat bipolar disorder & soon it will become the metal to treat a world polluted by excessive carbon emissions.
- India's biggest trading partners in Latin America are Brazil, Mexico, and Venezuela & we import 14%-20% of total crude oil from these countries.
- With the progression to electric vehicles, India will start importing lithium and cobalt rather than crude oil.
- This will support battery manufacturers & India's goal in switching to electric mobility.
- This will also influence India's foreign policy as our energy security dependence will shift from West Asia to Latin America.
- India also sent a high-level delegation to have a clear understanding about the availability of lithium and the possibilities of joint ventures.
- This will supply lithium to domestic markets and drive international markets.
- Moreover it provides long-term solution to clean our cities, build new markets, and skill people for new jobs towards an 'Atmanirbhar Bharat'.

7.2 Supreme Court on National Environmental Regulator

Why in news?

The Supreme Court has asked the government to explain why it had not set up an "independent environment regulator" under the Environment (Protection) Act, 1986 to oversee green clearances.

Why is the delay?

- The official policy prioritises ease of doing business.
- There is thus no consensus on what a new regulator can achieve.
- The draft Environmental Impact Assessment (EIA) Notification 2020 too seeks to advance that goal.
- It is much in line with virtually eliminating the civil society's role in environmental clearance.
- It does not encourage the public to voice its views and report violations, while independent scrutiny of proposals is weakened.

What are the shortfalls in EIA process?

- A key issue raised by the PIL is the lack of credibility of the EIA process.
- This is leaving way for reports that are often produced with the help of dubious expertise and manipulated data.
- The EIA process, especially after the notification in 2006, has been heavily critiqued for conflicts of interest.
- Under it, the proponent of a project herself/himself is responsible for producing the EIA report.

- In most cases, the proponents ignore the views of communities that would be displaced.
- They are ill-equipped to assess the loss of biodiversity and ecosystem services such as clean air, water and farm productivity.
- Clearances under forest, wildlife, air and water quality laws are heavily weighted in favour of promoters.
- The Centre has not taken any substantial move to set an independent regulator despite court's interventions in 2011 and 2014.
- The current PIL is forcing the government to come up with a fresh explanation on the delay year after year.

What are the implications?

- Polluting projects make way for conflict arising from pressure on scarce land and ecosystems.
- Such projects have already created clusters of industrial locations that are doing badly on the CPCB's Comprehensive Environmental Pollution Index.
- But this did not stop approvals for further polluting activity in some of these places.
- Other issues are the slow pace at which multiple departments process project proposals.
- This raises the transaction costs and results in the clamour to dispense with regulation.

7.3 Ethanol Blending

Why in news?

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

What is the current status of blending?

- In 2017, ethanol blending was less than 2% and has never exceeded 5% blending thus far.
- In the first four months of the current supply year (December 2020 to November 2021), about 80 crore litres of ethanol was supplied to the fuel pumps.
- This can translate to a blending ratio of 7% and if supplies continue at this pace, the blending ratio could reach 8.5% for the full year.

What are the benefits of this programme?

- This programme can reduce India's fossil fuel dependence and trim the large crude oil import bill.
- This can help in achieving the targets set in the National Bio fuels Policy - 10% ethanol blending by 2022 and 20% by 2025.
- But India's EBP programme has often come under some issues.

What is the problem with the programme now?

- The sugar industries and oil marketing companies (OMCs) are taking an opportunistic approach to the EBP which has proved to be undoing.
- Though sugar mills make strident demands for higher blending to get rid of excess cane, they are reluctant to stick to the fixed annual supplies.
- In deficit years, they prefer to divert more cane to sugar and alcohol to industrial or potable uses in the hunt for better margins.
- On the other hand OMCs have failed to take their contracted quantities of ethanol when imported crude oil becomes cheaper.

What are the steps taken to address this?

- The Centre has established some ground rules in the last three years —
 1. Setting annual supply obligations for sugar millers;
 2. Fixing the selling prices for ethanol produced through different routes;
 3. Requiring OMCs to pay these prices with reasonable transportation costs;

- This has helped in rising the ethanol supplies from 38 crore litres in 2013-14 to a targeted 262 crore litres in 2020-21.
- In the above targets, sugar industry alone owns the capacity for 300-350 crore litres.
- The 20% blending ratio target will roughly require 1,000 crore litres of ethanol.
- For this OMCs have to invest in distillery capacity and storage and blending infrastructure.

7.4 Biofuel - Lessons from Brazil

What is the issue?

- The government recently announced an ambitious plan to roll out vehicles running on 20% ethanol blended petrol by 2025, against the current level of blending of 5-6%.
- Achieving this target needs a paradigm shift in production and distribution of ethanol, the lessons for which could be taken from Brazil.

Why is Brazil notable in this regard?

- Brazil is one country that has successfully integrated biofuels into its fuel economy.
- It has efficiently leveraged its traditions and dominance in sugarcane production into a biofuel economy without compromising food security.
- Biofuels are also central to Brazil's low carbon emission strategy.

How did it achieve this?

- To mitigate high dependence on oil imports, Brazil turned to its traditional sugarcane to revolutionise its fuel economy.
- Brazil aimed for a higher productivity and sugar-ethanol balance.
- This led Brazil to revolutionise its biomass production for ethanol and develop a new variety of sugarcane.
- This is popularly known as '**energy cane**', which is low on sucrose but high on biomass.
- With productivity up to 350 tonnes of biomass per ha, against 80 tonnes per ha of traditional sugarcane, it offered a perfect balance.
- Brazil thus took up ethanol production without compromising sugar production.
- This enabled it to gradually augment its production and blend.
- With a mandatory blending of 27% ethanol with gasoline, in 2019 alone Brazil saved about 0.5 million barrels per day of gasoline with a savings of \$13 billion in imports.
- 78% of Brazilian automobiles today run on 27% of ethanol blend.
- High biomass productivity of energy-cane is the biological factor that contributes to the high positive lifecycle energy balance of ethanol produced from it.
- It thus comes with a resultant positive balance of greenhouse gases emission.
- The residual cane-waste (Bagasse) also become commercially valuable for power generation and other commercial uses.
- So, it has been possible to transform energy-cane production into a multiproduct enterprise in Brazil.

What is the significance?

- Energy cane is promising on drier and lower fertility soils, not suitable for conventional cultivation.
- Initially, economic, and strategic security reasons drove Brazil's ethanol production from sugarcane.
- But later it was realised that Brazil's was the most successful renewable energy programme from biomass.
- This especially came with the opening of the debate on the planet's environmental sustainability.
- Use of fossil fuels is one of the major sources of CO₂ and other GHG emission globally.



- Brazilian sugarcane ethanol is designated as an 'advanced biofuel' due to its 61% reduction of total life cycle GHG emissions.

How will it help with emission reduction?

- Fossil fuels consumed world-over produce an estimated 4.5 billion tonnes of Co₂ every year.
- But only a fraction of it is replenished to the earth in fossil-carbon cycle.
- However, Co₂ is a non-toxic gaseous fertiliser.
- If its production and consumption can be rebalanced, it can be beneficially used in the carbon cycle to produce non-toxic biofuel.
- Plant based biofuel seems to have an edge over all other sources of biofuels.
- This is because plants consume Co₂ from the atmosphere and give back oxygen to the atmosphere.
- Plant based biofuel thus works as a Co₂-O₂ pump or a Co₂ battery in liquid form through carbon fixation.
- Specific crops grown in large areas consume Co₂ from the atmosphere and the crop can be used to produce low Co₂ emitting biofuels.
- This is even better than the electric vehicles which do not reduce GHG but only geographically displaces the emission, unless using renewable energy.
- Experience from Brazil shows that GHG emission is the lowest from hybrid ethanol.
- With this, Brazil has proved that harmonious coexistence between biofuels and traditional fuels is possible to mitigate the factors that harm the environment.

What steps has India taken?

- Apart from the environmental issues, India's import dependence for fuel economy is alarming.
- To note, 85% of India's crude oil requirement is imported.
- To address these twin problems, some serious attempts have been made in the last few years to scale up biofuel production and blending.
- The National Biofuel Policy, 2018 has brought in certain revolutionary changes in the biofuel production philosophy of the country.
- It envisages augmentation of ethanol production through the traditional sugarcane route.
- Also, it has allowed production of alcohol from certain other sugary feedstock.
- These include sugar beet, sweet sorghum, and starchy feedstock like corn, cassava, damaged food grains, rotten potatoes, etc.
- It has also opened the production of second-generation ethanol from cellulosic agri-residues.
- E.g. rice and wheat straw, corncobs, cotton stalk, bagasse and municipal solid waste, etc
- These are welcome steps, but it may not be enough to achieve the twin objectives.

7.5 Need for Environmental Tax Reforms

What is the issue?

- The increased need for spending on health and the mounting fiscal deficit makes sustained health financing in India a huge challenge.
- In this context, here is a look at the what and why of environmental tax as alternative sources of revenue.

How is household spending on health?

- As per WHO data, in India in 2011, 17.33% of the population made more than 10% of their income as out-of-pocket payments on health.
- The percentage was higher in rural areas compared to urban areas.
- Globally, the average was 12.67%.



- Similarly, 3.9% of the population in India made more than 25% of out-of-pocket payments on health, with 4.34% in the rural areas.

What is the policy suggestion?

- The National Health Policy of 2017 suggested increasing the public spending on health from 1% to 2.5-3% of GDP.
- The Economic Survey 2019-20 noted that doing so could decrease out-of-pocket expenditure from 65% to 30% of overall healthcare expenses.
- The COVID-19 pandemic necessitated countries to rethink climate change and the need for preservation of the environment.
- Considering these two, the need for alternate sources of health financing through 'fiscal reforms for managing the environment' is increasingly felt.

What are the available options?

- Environment regulation may take several forms:
 - i. command and control
 - ii. economic planning/urban planning
 - iii. environmental tax (eco tax)/subsidies
 - iv. cap and trade
- India currently focuses majorly on the command-and-control approach in tackling pollution.
- So, environmental tax reforms could now be considered as an option.
- This generally involves three complementary activities:
 1. eliminating existing subsidies and taxes that have a harmful impact on the environment
 2. restructuring existing taxes in an environmentally supportive manner
 3. initiating new environmental taxes / eco tax

How about the eco tax?

- An eco tax involves evaluation of the damage to the environment based on scientific assessments.
- This would include the adverse impacts on the health of people, climate change, etc.
- Ideally, the eco tax rate should be equal to the marginal social cost arising from the negative externalities of a project.
- This applies to externalities associated with the production, consumption or disposal of goods and services.

How should eco tax be in India's case?

- The success of an eco tax in India would depend on its architecture i.e. how well it is planned and designed.
- In India, eco taxes can target three main areas:
 1. differential taxation on vehicles in the transport sector purely oriented towards fuel efficiency and GPS-based congestion charges
 2. in the energy sector, taxing fuels which feed into energy generation
 3. waste generation and use of natural resources
- There is also a need to integrate environmental taxes in the GST framework.
- It is also essential that the eco tax regime remains credible, transparent and predictable.

What is the likely effect?

- The implementation of an environmental tax in India will have three broad benefits: fiscal, environmental and poverty reduction.
- It can mobilise revenues to finance basic public services.
- It can also be used to reduce other distorting taxes such as fiscal dividend.

- In developing countries like India, it can be used for the provision of environmental public goods and addressing environmental health issues.
- It helps internalise the externalities, and the said revenue can finance research and the development of new technologies.
- But, environmental regulations may also have significant costs on the private sector in the form of slow productivity growth and high cost of compliance, possibly resulting in price increase.
- However, global experiences suggest negligible impact on the GDP, though such revenues have not necessarily been used for environmental considerations.
- Considering all these, this is the right time for India to adopt environmental fiscal reforms.

7.6 EU's Carbon Border Tax - India's Concerns

Why in news?

Indian Environment Minister expressed concerns at the European Union's (EU) plan to levy an additional 'carbon border tax' to discourage import of carbon-intensive goods.

What is the EU's proposal?

- Earlier, the EU Parliament had adopted a resolution to implement a 'Carbon Border Adjusted Mechanism' (CBAM).
- To begin with, by 2023, the CBAM would cover energy-intensive sectors.
- These may include cement, steel, aluminium, oil refinery, paper, glass, chemicals as well as the power sector.
- A recent draft regulation pertaining to the CBAM proposed that goods entering the EU would be taxed at the borders.
- Such a tax would promote "low-carbon, resource-efficient manufacturing."
- The UK and the US are also considering such proposals.

What is the rationale?

- Two key reasons for the carbon tax proposal are EU's environmental goals and its industries' global competitiveness.
- Recently, the EU declared it would cut its carbon emissions by at least 55% by 2030 compared to 1990 levels.
- EU's greenhouse gas emissions have fallen by 24% compared to 1990 levels.
- But emissions associated with imports are increasing.
- These contribute 20% of the EU's carbon dioxide emissions.
- So, a carbon tax would incentivise other countries to reduce GHG emissions.
- This can further shrink the EU's carbon footprint.
- Secondly, the 27 EU member states have much stricter laws to control GHG emissions.
- It has an 'Emissions Trading System' that caps how much GHG individual industrial units can emit.
- This makes operating within the EU expensive for certain businesses.
- So, the EU authorities fear that these firms might prefer to relocate to countries that have more relaxed or no emission limits.
- This is known as 'carbon leakage' and it increases the total emissions in the world.

Who all have opposed it?

- The BASIC (Brazil, South Africa, India, and China) countries' grouping had opposed the EU's proposal, terming it "discriminatory."
- It is said to be against the principles of equity and 'common but differentiated responsibilities and respective capabilities' (CBDR-RC).

- These principles acknowledge that richer countries have a responsibility of providing financial and technological assistance to developing and vulnerable countries to fight climate change.
- Developing nations feel that the developed nations have failed to fulfil the Green Climate Fund commitments.
- Under this, developing nations were to receive \$100 billion for green development by 2020. This has now been delayed to 2025.

How does this impact India?

- A carbon tax would increase the prices of Indian-made goods in the EU.
- That would make Indian goods less attractive for buyers and shrink the demand.
- This would create serious near-term challenges for companies with a large greenhouse gas footprint.
- It would get to be a new source of disruption to a global trading system.
- Notably, EU is India's third largest trading partner.
- It accounted for \$74.5 billion worth of trade in goods in 2020, or 11.1% of India's total global trade.
- India's exports to the EU were worth \$41.36 billion in 2020-21.

What are the larger implications?

- The carbon tax mechanism may spur adoption of cleaner technologies.
- But without adequate assistance for newer technologies and finance, it would amount to levying taxes on developing countries.
- It is currently unclear how the EU would assess emissions of an imported product.
- There are many small businesses that will face difficulty in quantifying their emissions.
- And the additional costs will be passed on to the consumers, eventually.
- Also, possibly, the tax could discourage sectors and industries that are already adopting cleaner technologies.
- In that case, it becomes another procedural and compliance hassle, and prove to be counterproductive.

7.7 Forest Rights & Forest Conservation

What is the issue?

- Recently, at the UN High-Level Dialogue on Desertification, Land Degradation and Drought, Indian PM reiterated India's target of land degradation neutrality by 2030, citing the Banni grassland in Gujarat.
- In this context, here is a look at the various aspects of land restoration in India.

Why is the Banni grassland notable?

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



What is the significance?

- Local communities applying their deep knowledge of the local ecology to become “decision-makers” in restoring their commons is indeed novel in India.
- However, the mandate for them to do so is not new. The Forest Rights Act (FRA), 2006 provides for this.
- Adivasis and other traditional forest-dwelling communities, including pastoralists, are legally empowered.
- They can decide on the management and restoration of their community forest resources (CFR).
- They can stop any activity that adversely impacts biodiversity or the local ecology.

What is the larger picture?

- Similar to the Banni grasslands, India’s forests are grappling with degradation, an important contributor to GHG emissions.
- More than 40% of the forest cover is open, often degraded.
- India has committed to restore 26 million hectares of degraded forests and lands by 2030 under the Bonn pledge.
- It has also targeted creating an additional carbon sink of 2.5 to 3 billion tonnes by 2030 through additional forest and tree cover.
- This is committed as part of its Nationally Determined Contribution under the Paris Agreement.

What are the forest restoration efforts so far?

- Initiatives to restore degraded landscapes include:
 - i. social forestry in the 1970s
 - ii. tree growers’ cooperative societies in the 1980s
 - iii. Joint Forest Management in the 1990s
 - iv. National Afforestation Programme and Green India Mission in the last two decades
- Studies have found these to have limited restoration benefits.
- These initiatives have drawn criticism for paying little attention to the land and forest tenure of local communities.
- They fail to incorporate traditional ecological knowledge.
- The CFR rights under FRA tackle these issues.
- It assigns rights to protect, manage and restore around 40 million hectare of forests to village-level democratic institutions.
- The recognition of these rights, however, has happened at an extremely slow pace.
- Less than 5 % of the total potential area has been brought under CFR.
- In Banni too, title deeds formally recognising the CFR rights of the pastoralists are yet to be issued.
- Institutional support for CFR remains minimal.

7.8 India’s Effort Towards a Greener World

What is the issue?

Despite challenges, India is setting a global example in meeting its Intended Nationally Determined Contributions (INDC)

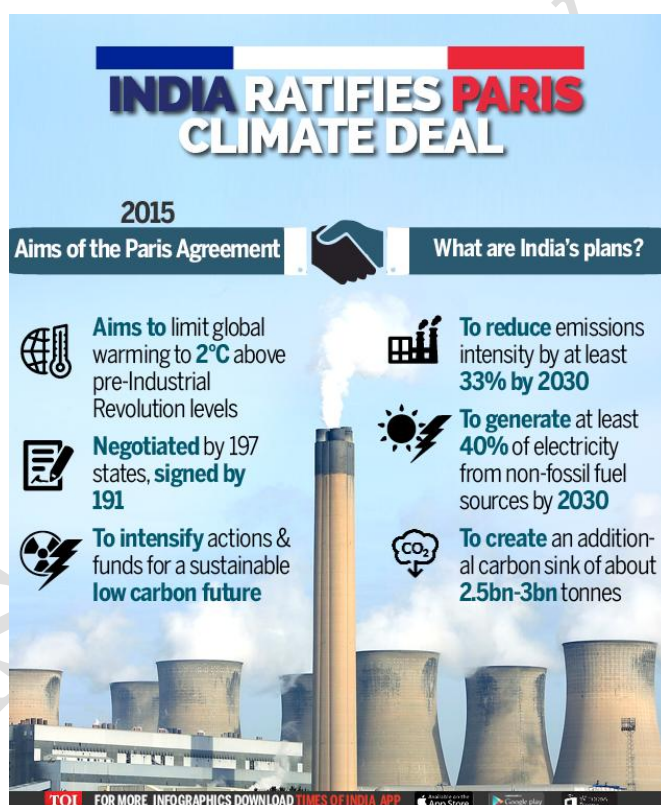
What is INDC?

- An INDC is a public pledge from a country on how it plans to play its part in post-2020 collective action on climate change.
- These contributions are to be achieved before 2030.
- It was adopted at UNFCCC COP21 in Paris in December 2015

- India committed to achieve the following three targets (INDC)
 1. India's greenhouse gas emission intensity of its GDP will be reduced by 33-35 % below 2005 levels by 2030.
 2. 40 % of India's power capacity would be based on non-fossil fuel sources.
 3. India will create an additional 'carbon sink' of 2.5 to 3 billion tons of CO₂ equivalent through additional forest and tree cover by 2030.

What is India's progress with respect to the targets?

- Reduced the emission intensity of GDP by 24% between 2005-2016
- Produced 38.18% of electricity from non-fossil fuel-based sources by November 2020.
- These targets were achieved with only 2% out of the U.S.\$100 billion committed to developing nations in Copenhagen (2009)
- India's per capita CO₂ emissions is 1.6 tonnes/person in 2012 which is less than the world average.
- By December 2020, India was the only G20 nation compliant with the agreement
- India has been ranked within the top 10 for two years consecutively in the Climate Change Performance Index



What is the progress of other countries?

- China, the world's largest GHG emitter targets carbon neutrality by 2060
- U.S. rejoined the Paris Agreement and committed to reach net-zero emissions economy-wide by 2050
- But at the current rate, both China and the U.S. could emit 5 times more than India in 2030

What efforts have been taken by India?

- India is implementing an extensive renewable energy expansion programmes to achieve 175 GW of renewable energy capacity by 2022 and 450 GW by 2030.
- Government announced several green measures, including
 - \$26.5-billion investment in biogas and cleaner fuels
 - \$3.5 billion in incentives for producing efficient solar photovoltaic (PV) and advanced chemistry cell battery
 - \$780 million towards an afforestation programme
- Unnat Jyoti by Affordable LEDs for All (UJALA) scheme, the world's largest zero-subsidy LED bulb programme for domestic consumers has been implemented
- India provided leadership for setting up the International Solar Alliance, a coalition of solar-resource-rich countries

Emissions by Countries (2012)

Country	CO ₂ Emissions per year (billion tons)	%age Share in Global Annual Emissions	CO ₂ Emissions per capita (tons/person)
World	34.5	100%	4.9
China	9.86	28.6%	7.1
United States	5.19	15.1%	16.4
European Union	3.74	10.9%	7.4
India	1.97	5.7%	1.6
Russia	1.77	5.1%	12.4
Japan	1.32	3.8%	10.4

- India initiated the Coalition for Disaster Resilient Infrastructure (CDRI), a multi-stakeholder global partnership to promote the resilience of infrastructure systems to climate and disaster risks.
- *Coalition for Disaster Resilient Infrastructure is a partnership of governments, United Nations agencies, multilateral development banks, the private sector, and knowledge institutions*

7.9 Beginning of Green Era

Why in news?

Recently, Saudi Arabia has launched the Saudi Green Initiative and Middle East Green Initiative to combat climate change.

Why it was announced now?

- In the G20 summit presided by Saudi Arabia, one of the main pillars of the agenda was safeguarding the planet.
- The summit highlighted how climate change had negatively impacted the planet, people's lives and their well-being.
- Initiatives like establishing a Global Coral Reef Research and Development Accelerator Platform was announced in the summit.
- G20 leaders also acknowledged the Circular Carbon Economy (CCE) Platform as a tool towards affordable, reliable, and secure energy and economic growth.
- Saudi Arabia committed to lead regional efforts to address climate change and is making steady progress in this direction.

What is the initiative all about?

- **Saudi Green Initiative** aims to raise the vegetation cover, reduce carbon emissions, combat pollution, land degradation and preserve marine life.
- As part of the initiative, 10 billion trees will be planted which reduces carbon emissions by more than 4% of global contributions.
- This will be made through a renewable energy programme that will generate 50% of Saudi's energy from renewables by 2030.
- It is also working towards raising the percentage of its protected areas to more than 30% of its total land area, exceeding the global target of 17%.
- As part of the **Middle East Green initiative**, it will work with the Gulf Cooperation Council countries and regional partners to plant an additional 40 billion trees in the West Asian region.
- It represents 5% of the global target of planting one trillion trees and can reduce 2.5% of global carbon levels.
- Saudi Arabia will share its expertise and know-how with its neighbouring countries to reduce carbon emissions resulting from hydrocarbon production in the region by 60% and globally by 10%.

What are the benefits of this initiative?

- Saudi Arabia currently operates the largest carbon capture and utilisation plant in the world, turning half a million tonnes of CO₂ annually into products such as fertilizers and methanol.
- It also operates one of the region's most advanced CO₂-enhanced oil recovery plants that captures and stores 8,00,000 tonnes of CO₂ annually.
- It believes that nature-based solutions will play an important role in removing carbon as part of the CCE.
- Earlier it joined International Solar Alliance to promote cooperation in the renewable energy sector.
- To ensure momentum and continuity, it proposes to convene an annual summit called the Middle East Green Initiative.
- The aim is start implementing the plan in the fourth quarter of this year and continue for the next two decades.
- It also recognised the scarcity of financial resources to irrigate the terrain.



- Therefore, in partnership with participating countries, it aims to research innovative methods.
- This includes irrigation from treated water, cloud seeding and other purpose-driven solutions such as planting native trees.

How it will help Vision 2030 plan?

- In 2016, Saudi Arabia unveiled Vision 2030, a comprehensive road map to improve the quality of life of the citizens of the country.
- As part of this, Saudi Arabia carried out a comprehensive restructuring of the environmental sector and established the Environmental Special Forces in 2019.
- With NEOM and The Line, Saudi Arabia has already redefined the idea of sustainable habitats.
- Recently Public Investment Fund pumped in \$15 billion in the NEOM project and another \$10 billion in renewable and solar energy projects.
- This will realise the Saudi Arabia's goal of Vision 2030 and become one of the major producers of renewable energy with a capacity to generate 9.5 GW by 2023.

7.10 Goa's draft CZMP

Why in news?

Recently, the draft Coastal Zone Management Plan of Goa has met with criticism from the wider sections of the society.

What is Coastal Zone Management Plan (CZMP)?

- In 2011, Union Ministry for Environment aimed to secure the livelihood of fishing and other local communities living in the coastal areas.
- It also wanted to conserve and protect coastal stretches, their unique environment and marine area and promote development in a sustainable manner.
- Hence the CRZ notification was formulated in 2011.
- It declared the coastal stretches of India and its territorial waters, excluding Andaman and Nicobar and Lakshadweep islands, as Coastal Regulation Zone (CRZ).
- It restricted the setting up and expansion of any industry, operations or processes and manufacture or handling or storage or disposal of hazardous substances there.
- Then the respective state governments and UT's were directed to prepare CZMP by identifying and classifying the CRZ areas.

What action did Goa take?

- Goa is India's smallest state with 105 km coastline.
- The state environment department directed the National Centre for Sustainable Coastal Management to prepare the CZMP.
- National Centre for Sustainable Coastal Management (NCSCM) is an agency approved by the Centre located in Chennai.
- The NCSCM's draft report stated that the proposed actions present in the CZMP will be implemented by administrative or other public authorities and by the private sector.
- The plan aimed to address the priority management issues in the coastal zone over a defined implementation period.

Why has the draft CZMP met with criticism?

- The draft plan provided only 30-day limit for inviting suggestions and objections to the draft from the public.
- This is contrary to the 60-day limit provided by the Environment Protection Rules, 1986.
- Environmental activists question the state government's intention of fixing only one day to decide the plan for the entire coastline of Goa.
- It is also alleged that several errors are reported in the draft CZMP and they are:



1. Re-zoning of beach areas are carried out without any legal basis.
2. The maps are put for public hearing without examining the errors pointed out by village communities earlier.
3. Several illegal constructions are allowed in the draft which indicates there is an indirect influence on its preparation.
4. Locals and fishermen claim that some homes, villages, municipal areas and churches are left out in the CZMP.

8. BIODIVERSITY

8.1 Sariska Relocation

What is the issue?

- Tiger happens to be at the pinnacle of the eco-system triangle. Saving tigers is much like saving the forests.
- Here is a look at the tiger conservation efforts in India, with particular reference to relocations made in Rajasthan.

Why are tigers, and conserving them, so significant?

- As top predators, wild tigers play an important role in maintaining the harmony of the planet's ecosystems.
- The tiger moves in a big territory and requires a sizeable forest area.
- So, tiger conservation efforts with landscape connectivity and conservation involve measures in such a large range.
- Consequently, it leads to the betterment and strengthening of the entire biosphere.

What were the results of Project Tiger?

- At the beginning of the 20th century, the number of Indian tigers was around 40,000.
- After Independence, tigers were killed mercilessly and the 1972 tiger census put their numbers at less than 1500.
- [The tigers were killed and their parts were sold to South-East Asian countries, for medicinal purposes.]
- To preserve the tiger, the Indian government banned their hunting and launched 'Project Tiger' in 1973.
- It created tiger reserves in the country.
- The viable tiger population in their natural habitat was also maintained.
- Starting with nine tiger reserves in 1973, there are now around 50 tiger reserves in India.
- The project totally covers an area of nearly 40000 sq. km.

What led to the constitution of the NTCA?

- At the beginning of the 21st century, the tiger population again started declining.
- The main Protected Area which was left without tigers due to hunting and poaching activities was the Sariska Tiger Reserve (Rajasthan) in 2004-2005.
- Subsequently, the Panna Tiger Reserve (M.P) faced the same in 2007-2008.
- This led to several inquiry commissions, at national and state levels to find out the reason behind it.
- Subsequently, the government reconstituted 'Project Tiger' and converted it into the National Tiger Conservation Authority (NTCA).
- The NTCA had more power to check poaching and preserve the tiger population.
- Its mandate included setting up Tiger Protection Force and funding the relocation of villages from the protected areas.



What were the corrective measures taken in Sariska?

- The Rajasthan government took up the challenge to reintroduce tigers in Sariska and set up a task force in June 2008.
- The Wildlife Institute of India and World Wide Fund were approached.
- This was to plan and organize a population estimation exercise in Ranthambhore & Sariska.
- The genetic studies were undertaken to identify tigers suitable for translocation.
- For the first time in the history of tiger conservation, the wild cats were translocated from Ranthambhore to Sariska.
- The tiger population increased at a rapid speed from 1,411, as per the tiger census in 2006, to 2,226 in 2015 and 2,967 in 2018.

Why was relocation essential?

- Due to the loss of the forest corridors, tigers were surviving only in pockets like Sariska, Panna and Ranthambhore Tiger Projects.
- As these pockets were not connected, there was inbreeding of tigers.
- This, in the long run, would have affected their biological fitness, among other issues.
- Another factor important for tiger reserves is to have the right male and female ratio.
- These issues could only be corrected/addressed by relocation.

What are the other issues to be addressed?

- Every year, more than 100 tigers die due to several reasons (like health factors or poaching).
- Although protected areas are fundamental for their survival, a connecting landscape is also essential as they move between different habitats.
- These areas often have limited protection as many development, mining, and extraction projects diminish the forest areas.
- It also gives additional opportunities to poachers to kill and hunt tigers and leopards.

What should be done?

Engaging local communities should be a key component of conservation efforts.

8.2 Inter-State Tiger Relocation Project

Why in news?

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

What was the Tiger Relocation Project?

- The tiger relocation project was initiated in 2018.
- As part of this, two big cats were relocated to Satkosia Tiger Reserve in Odisha, to shore up the tiger population in the state.
 - a male (Mahavir) from Kanha Tiger Reserve and a female (Sundari) from Bandhavgarh from Madhya Pradesh
- Both were selected for the translocation project as per the NTCA (National Tiger Conservation Authority) guidelines and in collaboration with the Wildlife Institute of India and the Government of India.
- The relocation was meant to serve two purposes:
 - i. reducing tiger population in areas with excess tigers to majorly reduce territorial disputes
 - ii. reintroduce tigers in areas where the population has considerably reduced due to various reasons
- The project was estimated with a budget of Rs 19 crore.
- It was started under the project of "augmentation and recovery of tiger population in Satkosia tiger reserve".

- Six tigers (three pairs) from different reserves of Madhya Pradesh were to be sent to Odisha under the project.

Why was Satkosia Tiger Reserve chosen?

- Encompassing an area of around 960 sq km, the Satkosia Tiger Reserve spreads across four districts and has as its core area 523 sq km.
- According to NTCA, Satkosia falls under reserves where “there is a potential for increasing tiger populations”.
- Declared as a Tiger Reserve in 2007, Satkosia had a population of 12 tigers then.
- The numbers reduced to two in 2018.
- The purpose of the relocation was thus to repopulate tigers in the reserve areas.

What was the outcome of the project?

- The project ran into trouble within weeks of initiation.
- The arrival of the tigers was followed by severe protests by villagers living on the fringes of the reserve.
- Forest department officials were attacked and their offices burnt down by the villagers.
- This reaction was the outcome of displacing tribals from Raigoda in the core area to Saruali on the outskirts of the reserve.
- The villagers feared the big cats would endanger their livelihoods, lives and livestock.
- They also alleged that they were not consulted or informed prior to the translocation.
- Within months of the translocation, Mahavir was found dead.
- A field inspection report by the NTCA stated that Mahavir’s death took place due to poaching.
- Earlier, a woman was allegedly mauled to death by Sundari and another person was also killed.
- Soon, Sundari was tranquilised and shifted to an enclosure at Raigoda.
- Subsequently, the project was suspended by NTCA.

What led to the likely failure of the project?

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

8.3 Declining Vulture Population

What is the issue?

With India losing more than 95% of its vulture population between 1990s and mid-2000s, the country requires urgent conservation efforts to save vultures from becoming extinct

What about the population of vultures in India?

- There are nine recorded species of vultures in India
- 4 critically endangered and 1 endangered

Why is vulture population so significant?

- Vultures clear the carcasses of dead animals (nature's cleanup crew) playing crucial role in maintaining health of the ecosystem
- Vultures have a highly acidic stomach that helps them kill disease-causing bacteria
- Reduces the health hazards associated with feral dogs that consume carcasses

What is the reason for the decline in vulture population?

- Use of the drug "**Diclofenac**" as a pain reliever in cattle results in kidney failure and death of vultures
- Myths about its medicinal healing powers results in poaching
- Quarrying and blasting of stones where vultures nest results in decline
- Power lines are killing vultures in some areas

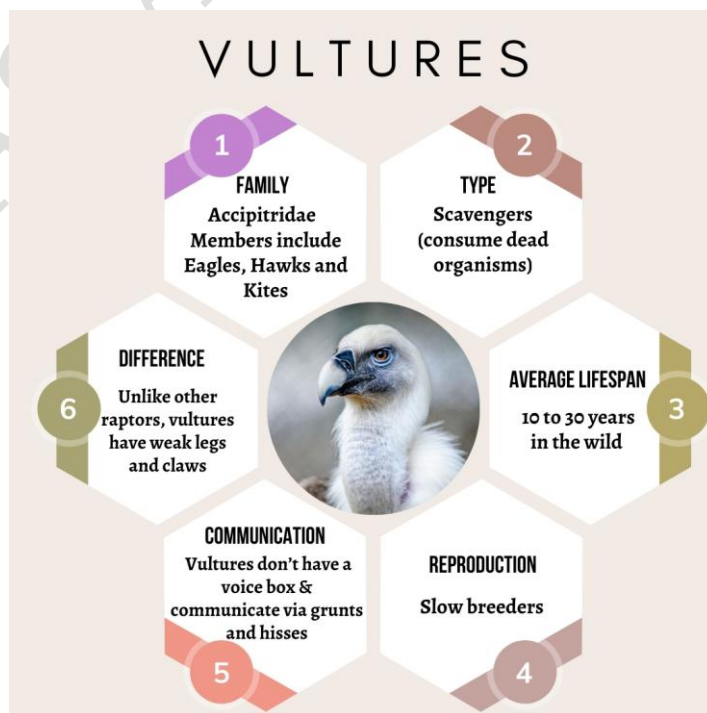
What efforts have been taken for their conservation?

National Efforts

- India banned diclofenac for veterinary use in 2006
- Action Plan for Vulture Conservation 2020-25 was released by MoEFCC
- Vulture Conservation Breeding Programme (VCBP) was established by Central Zoo Authority and Bombay Natural History Society (BNHS) for captive breeding
- Vulture Safe Zones are declared when no toxic drugs are found in undercover pharmacy and cattle carcass surveys for two consecutive years
- The Ministry also plans on carrying out safety testing of available Non-steroidal anti-inflammatory drugs (NSAIDs) on vulture
- Vulture restaurant has been established at Phansad wildlife sanctuary near Murud in Maharashtra
- *Nationwide vulture survey is held once in four years*

International Efforts

Saving Asia's Vultures from Extinction (SAVE) – A consortium of like-minded, regional and international organizations for conservation of south Asia's vultures



9. DISASTER MANAGEMENT

9.1 Uttarakhand Disaster

Why in news?

Various studies and reports on the flash floods in Uttarakhand are being published in identifying the cause.

Why did the flash floods occur?

- The area has seen two days of heavy snowfall & suddenly the weather became clear & little warmer.
- This has led to melting of snow & since glaciers in the area contain large amounts of debris when snow melts they carry large amounts of debris.
- This eroded everything that comes in the way thereby triggering an avalanche leading to the flash floods.

How big is the threat of such incidents continuing?

- When glaciers retreat due to rising temperatures, the snow melts but the debris remains which aids in the formation of lakes.
- Uttarakhand has 1,000 glaciers & over the years frequency of formation of such lakes has increased.
- But many glacial lake outburst flood events are not happening as in Sikkim because Uttarakhand has very steep slopes and the water manages to find a way out.
- But since the state has 1,200 big and small lakes in the high mountains, which are increasing in size, they do pose a threat of similar kinds of incidents.
- Hence it is extremely important to regularly monitor these lakes, measure the rates at which they are increasing or shrinking which needs to be incorporated into the planning process.

Why such preventive measures are not taken?

- Large numbers of glaciologists are working in the area and generating data but they lack of coordination and focus.
- Multiple scientific groups and institutions are involved, lots of data are generated but there is no coherent output.
- All these groups collect data, write reports and publish their findings but it will be forgotten until the next disaster strikes.
- Hence a nodal national agency needs to be created which can coordinate all the research and also the operational things happening in this region.

What can be done to minimise such risks?

- It is not possible to completely prevent these kinds of incidents but their potential to cause destruction can be certainly minimised.
- The Lonar lake in Sikkim is one of the largest glacial lakes & scientists have found a way to slowly drain the water in a nearby river at a regulated rate so that there is no flooding.
- Such solutions can be applied in Uttarakhand but this cannot be applied to each of the 1,000-plus lakes.
- So a detailed study needs to be conducted to identify which lakes pose maximum risk, monitor them and look for possible solutions that are suitable to local environments.
- This exercise needs to be done not just in Uttarakhand but in the entire Himalayan region.

Does large hydroelectric dams contribute to disaster?

- The hydropower projects in this area are run-of-the-river type & it is not prudent to construct dams at such heights.
- When DPR (detailed project report) for any project is done, study on glaciology is not carried out which is a major flaw.
- Hence overall environmental assessment must take into account the frequency of landslides and snow avalanches, the possibility of lake formation upstream, the ice volume in the glaciers.

- They should also find whether the glaciers are retreating or advancing and the rate at which these changes are happening.

How vulnerable is India?

- The stakes are laid out in alarming reports, which show that India is particularly vulnerable.
 1. HSBC ranks India at the top among 67 nations in climate vulnerability (2018).
 2. Germanwatch ranks India fifth among 181 nations in terms of climate risks (2020).
- But public spending does not reflect these perils.
- Worryingly, the Uttarakhand government and the Centre have been diluting, instead of strengthening, climate safeguards for hydroelectric and road projects.
- Studies had flagged ice loss across the Himalayas, and the dangers to densely populated catchments, but policy response has been lacking.
- Similarly, Kerala ignored a landmark study calling for regulation of mining, quarrying and dam construction in ecologically sensitive places.
- These notably contributed to the massive floods and landslides in 2018 and 2019.

9.2 Forest Fires in India

What is the issue?

- Uttarakhand has witnessed over 1,000 incidents of forest fire over a six months period.
- With increasing frequency of forest fires in India, here is a look at the various aspects of it.

What is the recent flare?

- Since the start of 2021, there has been a series of forest fires in HP, Nagaland-Manipur border, Odisha, MP, and Gujarat.
- These include the forest fires in wildlife sanctuaries.
- January 2021 saw prolonged fires in Uttarakhand, Himachal Pradesh (Kullu Valley) and Nagaland-Manipur border (Dzukou Valley).
- The recent one in Nainital began in March-end.
- The Simlipal National Park in Odisha saw a major fire between February-end and early March.
- Recent fires also include those in Bandhavgarh Forest Reserve in Madhya Pradesh, and in sanctuaries for the Asiatic lion and the great Indian bustard in Gujarat.

Why is this unusual?

- April-May is the season when forest fires take place in various parts of the country.
- But forest fires have been more frequent than usual in Uttarakhand and have also taken place during winter.
- Dry soil caused by a weak monsoon is being seen as one of the causes.

How fire prone are India's forests?

- As of 2019, about 21.67% (7,12,249 sq km) of the country's geographical area is identified as forest.
- This is according to the India State of Forest Report 2019 (ISFR) released by the Forest Survey of India (FSI), Dehradun.
- Tree cover makes up another 2.89% (95, 027 sq km).
- Based on previous fire incidents and recorded events, the 2020-2021 annual report of the MoEFCC makes the following categorisations:
 - Forests of the Northeast and central India regions - most vulnerable areas to forest fires
 - Forests in Assam, Mizoram and Tripura - 'extremely prone' to forest fire



- States with large forest areas including Andhra Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Maharashtra, Bihar and UP - 'very highly prone' category
- Western Maharashtra, Southern Chhattisgarh and areas of Telangana and Andhra Pradesh, along with central Odisha are also turning into 'extremely prone' forest fire hotspots.
- Areas under the 'highly prone' and 'moderately prone' categories make up about 26.2% of the total forest cover.
- **Uttarakhand and Himachal Pradesh** are the two states that witness the most frequent forest fires annually.
- In Uttarakhand, over 45% of the geographical area (24,303 sq km) is under forest cover.
- The FSI has identified forests along the south, west and southwest regions of Uttarakhand as being prone to varying intensities of forest fires.
- These comprise Dehradun, Haridwar, Garhwal, Almora, Nainital, Udham Singh Nagar, and Champawat districts.

What are the key causes of forest fires?

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

What are the challenges to control measures?

- The locality of the forest and access to it pose hurdles in initiating fire-fighting efforts.
- During peak season, shortage of staff is another challenge in dispatching fire-fighting teams.
- Timely mobilisation of forest staff, fuel and equipment, depending on the type of fire, through the thick forests remains challenging.
- This is because it is impossible to transport heavy vehicles loaded with water into the thick forests.
- So, a majority of fire dousing is initiated manually, using blowers and similar devices.
- But there have been incidents when forest fires were brought under control using helicopter services too.
- Wind speed and direction also play a critical role in bringing forest fire under control.
- The fire often spreads in the direction of the winds and towards higher elevations.

What are the associated concerns?

- Forests play an important role in mitigation and adaptation to climate change.
- They act as a sink, reservoir and source of carbon. A healthy forest stores and sequesters more carbon than any other terrestrial ecosystem.
- In India, notably, 1.70 lakh villages are in close proximity to forests (Census 2011).
- So, the livelihood of several crores of people is dependent on fuelwood, bamboo, fodder, and small timber.
- Forest fires can have multiple adverse effects on the forest cover, soil, tree growth, vegetation, and the overall flora and fauna.
- Fires render several hectares of forest useless and leave behind ash, making it unfit for any vegetation growth.
- Heat generated during the fire destroys animal habitats.
- Soil quality also decreases with the alteration in their compositions. Soil moisture and fertility, too, is affected.
- Thus, forests can shrink in size.
- The trees that survive fire often remain stunted and growth is severely affected.

What are the measures taken in this regard?

- Since 2004, the FSI developed the Forest Fire Alert System to monitor forest fires in real time.
- In its advanced version launched in January 2019, the system now uses satellite information gathered from NASA and ISRO.
- Real-time fire information from identified fire hotspots is gathered using MODIS (Moderate Resolution Imaging Spectroradiometer) sensors (1km by 1km grid) and electronically transmitted to FSI.
- This information is then relayed via email at state, district, circle, division, range, beat levels.
- Users of this system in the locality are issued SMS alerts. Notably, the FSI system in January 2019 had over 66,000 users.

9.3 Similipal Forest Fire

Why in news?

- The Similipal forest reserve area frequently witnesses forest fires during dry weather conditions.
- The recent one took weeks to come to control and the massive fire has threatened to cause colossal damage to the Similipal Biosphere.

What is the Similipal Biosphere reserve?

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



How fire prone is Similipal forest?

- Generally, with the onset of summers and towards the end of autumn, the forest area remains vulnerable to forest fires.
- They are a recurrent annual phenomenon, but are also brought under control due to short span of precipitation.
 - The months of January and February witness rainfall of 10.8 and 21 mm, respectively.
- This duration coincides with the shedding of deciduous forests in the forest areas.
- The fallen leaves are more vulnerable to catching fire.
- They facilitate the spreading of forest fires quickly over the entire forest area.
- The last incident of a major forest fire was reported in 2015.

What are the main causes?

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

How are these forest fires controlled and prevented?

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

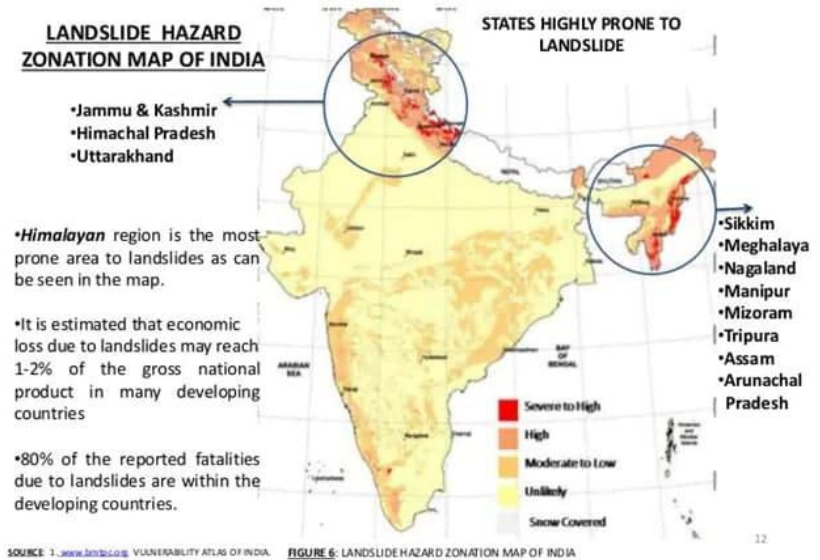
9.4 Landslips in Himachal Pradesh

What is the issue?

- Himachal Pradesh faces rising instability from environmental factors such as climate change, heavy rainfall and landslides.
- The rising threat calls for a renewed approach to the developmental designs in the State.

What is the recent happening?

- Landslip/Lanslide in the Kinnaur district of Himachal Pradesh killed at least 14 people and buried several others.
- Severe catastrophe as mud, rocks and debris rained down on vehicles.
- A fortnight back, a similar disaster killed a group of tourists.



What are the recurring threats and the causes?

- Landslips** - They have become more common.
- Seismic events threaten to increase their frequency and aggravate the impact.
- The Landslide Hazard Zonation Map of India marks over 70% of Himachal Pradesh as 'high risk' and 14% as 'severe' to 'very high risk'.
- Earthquakes** - Mountains here are geologically young and therefore active (unstable).
- 32% of the State is categorised as a high damage risk zone for seismicity.
- Causes** -
 - Himachal's mountain slopes experience seismicity and rain-induced stresses.
 - Heavily engineered structures such as dams and hydropower (involve rock blasting, tree felling and inundating large spaces), building roads.
 - With greater rainfall and cloudburst activity, Himachal Pradesh is bound to face greater uncertainty.

What does this call for?

- A new and redesigned development paradigm.
- Greater caution in pursuing disruptive projects, particularly hydropower.
- An updated action plan on climate change that goes beyond disaster management.
- Long-term remedial measures for the key hazards.
- Harnessing the available support among local communities for sustainable tourism and expansion of the farm-based economy, particularly apple growing.

9.5 Earthquakes in Haiti

Why in news?

A powerful earthquake (magnitude 7.2) killed hundreds and injured thousands more in Haiti (which faces frequent earthquakes).

Where is Haiti?

- An island country located in the Caribbean Sea, on the island of Hispaniola in the Greater Antilles archipelago.
- Bordered in land by the Dominican Republic in east.



- Maritime borders with the Bahamas, Colombia, Cuba, and Jamaica.

What causes frequent quakes in Haiti?

- Haiti's **unique geology** makes it **seismically active** and prone to devastating earthquakes.
- Located near the intersection of two tectonic plates—the North American plate and the Caribbean plate.
- Multiple fault lines between those plates cut through or near the island of Hispaniola.
- The recent earthquake likely occurred along the **Enriquillo-Plantain Garden fault zone**:
 1. cuts across Haiti's south-western Tiburon Peninsula
 2. the source of many earlier big earthquakes in Haiti
- **Other reasons**
 1. High population density of 11 million people.
 2. Typical concrete and cinder block buildings designed to withstand hurricanes but are vulnerable to collapse when the ground shakes.
 3. Given the factors, it is much a natural hazard that overlaps with a vulnerable design and system, and not really a natural disaster.

AGRICULTURE

10. AGRICULTURAL PRACTICES

10.1 Significance of Millet Farming

Why in news?

The United Nations General Assembly recently adopted a resolution declaring **2023 the International Year of Millets**, as proposed by India to the Food and Agriculture Organization (FAO).

What are millets?

- Millets - Sorghum, pearl millet, finger millet and several small millets (kodo, little, foxtail, proso and barnyard).
- All millets, maize, and barley together are called **coarse cereals**.
- Millets were one of the oldest foods known to humans. But they were discarded in favour of wheat and rice with urbanization and industrialization.
- *India is the largest global producer of millets, with a 41% market share.*
- *A compound annual growth rate of 4.5% is projected for the global millet market in the coming decade.*

How significant are millets?

- Provide food, nutrition, fodder and livelihood security.
- Help mitigate the effects of climate change with low carbon footprint of 3,218-Kg equivalent of CO₂ per hectare. [Wheat - 3,968 kg; Rice - 3,401kg]

What are the favourable factors?

- Drought resistant
- Suitable for harsh, hot and dry environments.
- Can grow in arid regions, requiring only 350-400 mm of annual rainfall.
- Some varieties of pearl millet survive at temperatures up to 46°C.
- Require minimal inputs for growth.



- Being hardy crops, they can withstand extreme temperatures, floods and droughts.

What are the concerns with millets farming?

- Market and economic barriers.
- Low demand, especially in urban markets.
- Unjust pricing and value wringing by intermediaries.
- Low remuneration leading to farmer distress.
- Lack of input subsidies and price incentives.
- Subsidised supply of fine cereals through the PDS and change in consumer preferences leading led to a shift from the production of millets (jowar in particular) to soybean, maize, cotton, sugarcane and sunflower.

What are the government's initiatives so far?

- **Millet Mission in 2018** as part of the National Food Security Mission - Promotion of technological interventions, improvement in seed quality and MSP for bajra and jowar.
- Millet Network of India and the M.S. Swaminathan Research Foundation - Collective formation efforts to boost the domestic growth of millets.
- Setting up farmer organizations to help small and marginal farmers overcome hindrances in millet production and marketing.
- Odisha Millet Mission:
 - i. 7.2 million women emerged as 'agri-preneurs'
 - ii. about 70,000 farmers in the state took up millet farming

What are the other measures needed?

Market dynamics

- Incentivizing the adoption of inter-cropping involving millets.
- Providing crop insurance and support for storage facilities.
- Broadening the millet marketing policies.
- Generation of demand for millets-based products.
 1. 2018 '#LetsMilletCampaign' in Bengaluru promoted the use of millets in dishes such as risotto and pizza by restaurateurs.
 2. Food delivery startups such as FreshMenu rolled out millet-intensive menus

Cultural connection

- Harnessing the knowledge of the value of little millets among traditional communities.
- Re-introduction of cultural associations and festivals that help promote the growth of millets. E.g.,
 1. North-East Network in Nagaland organized in 2020
 2. Mandukiya in Vishakhapatnam celebrated annually in June/July
 3. Women's collectives in Telanganapromoting millets through a culture-centric approach

Ecosystems and sustainability

- The value of millets is evident in their relevance to the sustainable development goals of food security, nutrition and poverty eradication.
- In line with goals of the UN Decade of Ecosystem Restoration (2021-30), local practices can support rural economies.
 1. Drought-tolerant crops like millets with low dependence on chemical inputs.
 2. Inter-cropping of millets with other crops. [Fibrous roots of millet plants help in improving soil quality, keep water run-off in check and aid soil conservation.]

Biofuel and climate resilience

- Creating bio-ethanol using sorghum (jowar) and pearl millet (bajra), thus bringing down carbon emissions by about half.
- Millets can deliver greater returns than maize, while using 40% less energy in processing, and are cost advantageous as a feedstock for bio-ethanol production.
- All the above priorities need to be backed by government policies that promote millets production, incentivize farmers and strengthen market linkages.
- *In India, 2025 is set as the deadline for achieving 20% ethanol blending with petrol. Most bio-ethanol in India is produced using sugar molasses and maize.*

10.2 Paddy-Wheat Monoculture in Punjab

What is the issue?

Questions are being raised on the sustainability of paddy-wheat cultivation, especially in Punjab.

What is the extent of paddy-wheat monoculture in Punjab?

Monoculture refers to the practice of cultivation of a single crop at a given area

- Paddy-wheat cultivation adds up to 84.6% of the total area planted to all crops in Punjab in 2018-19.
- The real acreage share increase has taken place in paddy from below 7% in 1970-71 to almost 40% in 2018-19.
- The above gains have been at the expense of other crops such as pulses, maize, bajra, oilseeds, cotton, groundnut, sugarcane, etc.
- The only crops that have registered some acreage expansions are vegetables (especially potato and pea) and fruits (kinnow).

What are the problems of monoculture?

- Increase in vulnerability to pest and disease attacks
- No nitrogen fixation unlike pulses and legumes
- Absence of crop rotation leads to depletion of soil nutrients
- Growing dependence on chemical fertilizers and pesticides
- Decline in water table since paddy is a water-guzzling crop where more than 30 irrigations are needed (5 irrigations for wheat)
- Punjab's groundwater table has been declining by 0.5 meters per annum on an average
- Soil salinity and waterlogging due to excess surface irrigation
- Nutrition insecurity because of lack of crop diversification
- Decrease in biodiversity
- Economically riskier for farmers

TABLE 1: CROP-WISE PERCENTAGE SHARE OF TOTAL PLANTED AREA IN PUNJAB

	1960-61	1970-71	1980-81	1990-91	2000-01	2018-19
Wheat	27.3	40.5	41.6	43.6	43.1	44.9
Paddy	4.8	6.9	17.5	26.9	31.3	39.6
Pulses	19.1	7.3	5.0	1.9	0.7	0.4
Cotton	9.4	7.0	9.6	9.3	7.6	5.1
Maize	6.9	9.8	5.6	2.5	2.1	1.4
Oilseeds	3.9	5.2	3.7	1.5	1.1	0.5
Bajra	2.7	3.7	1.0	0.2	0.1	0
Sugarcane	2.8	2.3	1.0	1.3	1.8	1.2
Barley	1.4	1.0	0.9	0.5	0.3	0.1
Vegetables	1.2	0.9	1.1	0.7	1.3	3.3
Fruits	0.6	0.6	0.4	0.8	0.5	1.1
Other crops	17.7	14.8	12.6	10.8	10.1	2.4

Source: Punjab Economic Survey 2019-20

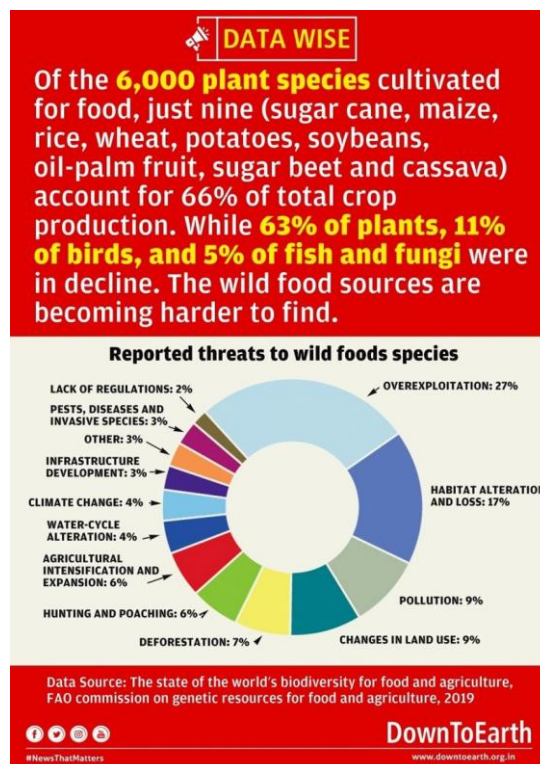
What measures have been taken so far?

- **Punjab Preservation of Subsoil Water Act in 2009**- bars any nursery-sowing and transplanting of paddy before May 15 and June 15, respectively
- But it pushes harvesting to October-end leaving little time for farmers contributing to stubble burning

- Minimum Support Prices (MSP) given to various crops incentivises crop diversification

How can the issues of monoculture be addressed?

- Limit Punjab's a non-basmati paddy area and ensure planting of only shorter-duration varieties
- Direct seeding of paddy can reduce the usage of inputs
- Water savings can be induced through metering of electricity
- Assured government price/per-acre incentive support must be provided for crops other than paddy and wheat
- Crop diversification, including rotation and intercropping and the use of diverse forage plants in pastureland must be promoted
- Prospective private buyers should be part of the extension effort
- But change is possible only if the State works closely with the Union Government



10.3 Achieving Crop diversification in Punjab

Why in news?

Recent farmer protests raised questions about the sustainability of Paddy-Wheat cultivation especially in Punjab.

What is the extent of paddy-wheat cultivation in Punjab?

- In 2018-19, of the total gross cropped area paddy & wheat cultivation constituted to 84.6%.
- This ratio was just 32% in 1960-61 & 47.4% in 1970-71.
- This increase is at the expense of other crops.
- Wheat replaced chana, masur, mustard and sunflower & cotton, maize, groundnut and sugarcane area got diverted to paddy.
- Only vegetables (potato, pea) & fruits (kinnow) registered some acreage expansions which is very meagre.

Why is monoculture a problem?

- It increases vulnerability to pest and disease attacks.
- Crop and genetic diversity makes crops less sensitive to insects and attacks.
- Unlike pulses and legumes, wheat and paddy cannot fix nitrogen from the atmosphere.
- Their continuous cultivation leads to depletion of soil nutrients & increases the use of chemical fertilisers & pesticides.

Is Paddy cultivation creating problem in the state?

- Wheat is naturally adapted to its soil and agro-climatic conditions.
- It is a cool season crop & can only be grown where day temperatures are in the range of 30°C.
- Hence it is desirable to cultivate wheat in Punjab.
- However paddy (Pusa-44) is not very sensitive to high temperature & but needs higher irrigation.
- So the state's groundwater table depleted to 0.5 meters per annum on an average & is aggravated by state's policy of supplying free power for irrigation.
- Hence paddy can be grown in eastern central & southern India where water is sufficiently available.

What are the steps taken by Punjab to address this problem?

- It enacted **Punjab Preservation of Subsoil Water Act in 2009**, which barred any nursery-sowing and transplanting of paddy before May 15 and June 15.



- But this has created another problem.
- It has pushed paddy harvesting to October-end leaving a small time to sow wheat (before the November 15 deadline).
- So farmers have to burn the stubble after harvesting leading to air pollution in Delhi.

How can this be avoided?

- Scientists at the Punjab Agriculture University have done a breed that shortened the duration of paddy varieties.
- PR-126 has a mere 123 days duration to mature (13 to 37 days less) and its yields 30 quintals per acre.
- In 2012, 39% of Punjab's non-basmati paddy area was under Pusa-44 & it was 20% this year.
- This is mainly because of PR-121 and PR-126 which crossed 71% of total area.
- Moreover PR-126 & PR-121 require only 23 & 26 irrigations respectively whereas Pusa-44 requires around 31 irrigations.
- This will save 3-4 irrigation if farmers adopt direct seeding of paddy when compared to transplanting.

What is the way forward?

- Only 10 lakh hectares (lh) area should be allocated to non-basmati paddy which are of shorter-duration varieties.
- These should be transplanted after June 20 and harvested well before mid-October.
- This gives farmers ample time to handle stubble without burning them.
- Water savings can be achieved through metering of electricity and direct seeding of paddy.
- The 10 lh less non-basmati area can be diverted to basmati varieties as they consume less water because of transplantation occurs only in July.
- Government can provide price incentive support to cotton, maize, groundnut, kharif pulses, chana, mustard & sunflower for crop diversification.

11. MARKETING

11.1 APMC Markets

What is the issue?

In the light of the ongoing farmer protests, here is a look at how APMC (Agriculture Produce Market Committee) markets went from being a solution to a problem.

How did the APMC act help?

- From the 1960s, there have been concerted efforts to bring all wholesale markets for agricultural produce in various states under the Agriculture Produce Market Regulation (APMR) acts.
- All states, except Kerala, Jammu and Kashmir and Manipur, enacted such laws.
- The APMC Acts mandated that the sale/purchase of agricultural commodities is carried out in a specified market area.
- Producer-sellers or traders pay the requisite market fee, user charges, levies and commissions for the commission agents (arhatias).
- These charges were levied irrespective of whether the sale took place inside APMC premises or outside it.
- Also, the charges varied widely across states and commodities.
- In the initial years, APMC acts helped remove malpractices.
- It freed the farmers from the exploitative power of middlemen and mercantile capital.
- The golden period for APMC markets lasted till around 1991.

How did APMCs become a problem then?

- With time, there was a considerable loss in growth in market facilities.
- By 2006, it had declined to less than one-fourth of the growth in crop output after which there was no further growth.
- This increased the woes of Indian farmers.
- Market facilities did not keep pace with the increase in output.
- But regulation did not allow farmers to sell outside APMC markets.
- So, the farmers were left with no choice but to seek the help of middlemen.
- Due to poor market infrastructure, more produce is sold outside markets than in APMC mandis.
- The net result was a system of interlocked transactions that robs farmers of their choice to decide to whom and where to sell.
- This, ultimately, subjected farmers to exploitation by middlemen.
- Over time, APMC markets have been turned from infrastructure services to a source of revenue generation.
- In several states, commission charges were increased without any improvement in the services.
- And to avoid any protests from farmers against these high charges, most of these were required to be paid by buyers like the FCI (Food Corporation of India).
- This resulted in a heavy burden on the Centre.
- It also increased the logistics cost for domestic produce and reduced trade competitiveness.
- Given the above drawbacks, successive governments at the Centre made attempts to persuade the states to make appropriate changes in their APMC acts.
- But for 18 long years, the progress in reforms remained slow.

What is the latest move?

- It is in the above backdrop that the Farmers' Produce Trading and Commerce Act 2020 (FPTC Act) was brought in.
- The FPTC Act gives farmers the freedom to sell and buy farm produce at any place in the country.
- They can sell and buy in APMC markets or outside the mandated area, to any trader, like sale of milk.
- The Act also allows transactions on electronic platforms to promote e-commerce in agriculture trade.

11.2 Mirroring the Dairy's Cooperative Model

What is the issue?

Realising the remunerative price of agricultural produce remains a key challenge in Indian agriculture.

What is the current status?

- Even today consumers in metros pay Rs 50-60 for a kg of tomato or onion whereas farmer in the remote part of India receives only Rs 6-8/kg for that.
- But Dairy farmers in India receive up to 80% of the consumer price.
- The gains of the price rise to the consumer are hardly transferred to the farmers for their agricultural products.

What are strides of Dairy sector?

- India, from being a net importer of dairy products has become the world's largest milk producing country.
- In the last 60 years, CAGR of India's milk production grew to 4.5 % when compared to 1.8 % in US & 1.3% in the EU and Australia.
- In India, milk remains the key source of liquidity and supplementary income for over 100 million marginal and even landless farmers.

- It is also the sole source of their daily income to meet their daily household expenses.
- Despite with no MSP for milk, dairy farmers in India receive 70-80 % of the consumer price.

How is this possible in India?

- This has been achieved by setting a large number of innovative organisations of small milk producers across the rural areas.
- Milk producers are well organised and institutionalised which has been a grudge to the traditionally well-established dairy producing countries- European nations, the US, Australia and New Zealand.
- Dairy processing plants are owned by farmers in massive capacities surpassing dairy processors in most parts of the developed world.

How this model can be replicated to agriculture?

- Although this co-operative model is adopted in other sectors of agriculture, it could hardly achieve the professionalism, efficiency & agricultural marketing remains at the mercy of numerous middlemen.
- In order to achieve higher price realisation for farmers, markets can be opened up making them more competitive & to provide alternate avenues to sell their farm produce.
- Improving productivity, efficient management of logistics, removing marketing anomalies and setting institutional mechanisms ensure farmers get remunerative prices & farm production remain sustainable.
- The new farm reforms is a landmark step in this direction but government needs to be very prudent in balancing the conflicting interests of various stakeholders while implementing it.

11.3 Farmer Producer Organization

What is the news about?

The government's 10,000 Farmer Producer Organisation scheme has given a major thrust to the FPO movement from corporates to public service organisations.

What is an FPO?

- Farmers' Producer Organisation (FPO), also known as farmers' producer company (FPC), is an entity formed by primary producers including farmers, milk producers, fishermen, weavers, rural artisans, and craftsmen.
- An FPO can be a Producer Company, a Cooperative Society or any other legal form.
- FPOs are basically the hybrids of cooperatives and private companies.
- The participation, organisation and membership pattern of these companies are more or less similar to the cooperatives.
- But their day-to-day functioning and business models resemble those of the professionally-run private companies.
- The **Companies Act** was amended by incorporating Section-IX A in it to allow creation and registration of FPOs under it.

Why are FPOs significant?

- Better income for producers
- Producers enjoy better bargaining power
- Better equipped to facilitate value-addition of the farm produce
- Doubling of export by 2022
- Facilitate small and marginal farmers with access to improved technology, credit, better input and more markets

What are the challenges faced by FPOs?

- **Liability of newness** – New ventures have high probability to fail since they have to battle multiple problems at a time.
- Lack of distinctiveness - With no novelty to offer, it is often challenging for FPOs to compete in the market.

- Audience diversity - FPOs need to derive support from different group of stakeholders (farmer, government, buyers, NGOs etc) which is crucial to understand their expectations.
- Lack of clarity on the market category - FPOs may fail to meet the demand of buyers in terms of quantity requirement leading to a weak inter-organisational relationship.
- FPOs, often in a hurry, would make unrealistic promises to members to increase their membership which could lead to mismatch in expectations.
- Multiple thresholds for success – Measuring the success of FPOs varies according to the stakeholder
- Farmer may be look at receiving timely credit from the FPO as the vital indicator for success while corporate buyer may look upon the quality of the product.

How can the issues be addressed?

- Collectives must do the requisite homework on issues such as modalities of the conduct of boards meetings, technical expertise for better procurement, identifying potential buyers, etc.
- Focus on multiple stakeholders including farmers , buyers and regulators can accommodate audience diversity.
- Need informational clarity regarding the process and market conditions.
- Collective effort of all stakeholders is crucial for the success of an FPO.

Formation and Promotion of 10,000 new FPOs Scheme

- Launched by Ministry of Agriculture & Farmers Welfare
- Central Sector Scheme with an outlay of Rs. 6865 crore
- Implementing Agencies – Nine agencies including NABARD, SFAC, NAFED, etc.
- Support will be provided to each FPO for a period of 5 years
- FPOs will be provided financial assistance upto Rs 18 lakh per FPO for a period of 3 years
- A credit guarantee facility upto Rs. 2 crore of project loan per FPO can be availed
- Training & skill development modules have been developed to further strengthen the FPOs
- At district level, a District Level Monitoring Committee (D-MC) is constituted for overall coordination & monitoring
- At National level, National Project Management Agency (NPMA) has been engaged for providing overall project guidance and coordination

11.4 Small and Marginal Farmers

What is the issue?

- One of the reasons for agrarian distress is the declining average size of farm holdings.
- In this context, here is how farmer producer organisations (FPOs) could help deal with it.

How have farm holdings nature changed?

- The average farm size declined from 2.3 hectares (ha) in 1970-71 to 1.08 ha in 2015-16.
- The share of small and marginal farmers increased from 70% in 1980-81 to 86% in 2015-16.
- At the state level, the average size of farm holdings in 2015-16 ranged from 3.62 ha in Punjab, 2.73 in Rajasthan to 0.75 in Tamil Nadu, 0.73 in Uttar Pradesh, 0.39 in Bihar and 0.18 in Kerala.

What are the government measures in this regard?

- Since 2011, it has intensively promoted FPOs under the Small Farmers' Agri-Business Consortium (SFAC), NABARD, state governments and NGOs.
- The ongoing support for FPOs is mainly in the form of –
 1. a grant of matching equity (cash infusion of up to Rs 10 lakh) to registered FPOs



2. a credit guarantee cover to lending institutions (maximum guarantee cover 85% of loans not exceeding Rs 100 lakh)

- India has 5,000 to 7,500 such entities as per different estimates.
- A majority of them are farmer producer companies.
- The budget for 2018-19 announced supporting measures for FPOs including a five-year tax exemption.
- The budget for 2019-20 talked of setting up 10,000 more FPOs in the next 5 years.

How have FPOs performed so far?

- Experience shows a mixed performance of FPOs in the last decade.
- Some estimates show that 30% of these are operating viably while 20% are struggling to survive.
- The remaining 50% are still in the initial phase of mobilisation and business planning.
- FPOs in Gujarat, Maharashtra, Madhya Pradesh, Rajasthan and some other states have shown encouraging results.
- They have been able to realise higher returns for their produce.

What are the concerns to be addressed?

- Studies of NABARD show that there are some important challenges for building sustainable FPOs.
- Some of these are -
 - i. lack of technical skills
 - ii. inadequate professional management
 - iii. weak financials, inadequate access to credit
 - iv. lack of risk mitigation mechanism
 - v. inadequate access to market and infrastructure
- Some studies highlight the need for more than one lakh FPOs for a large country like India while currently there are less than 10,000.
- FPO seems to be an important institutional mechanism to organise small and marginal farmers.
- However, the fundamental problem of the small size of holdings giving only a limited income is not resolved.
- Incomes will rise because of the benefits flowing from FPOs.
- But they may not still be adequate to give a reasonable income to small and marginal farmers. That issue has to be handled separately.

What are the possible measures?

- The above issues such as working capital, marketing, infrastructure have to be addressed while scaling up FPOs.
- Getting credit is the biggest problem. Banks must thus have structured products for lending to FPOs.
- These organisations lack professional management and, therefore, need capacity building.
- Also, they have to be linked with input companies, technical service providers, marketing/processing companies, retailers etc.
- They need a lot of data on markets and prices and other information and competency in information technology.
- FPOs can be used to augment the size of the land by focusing on grouping contiguous tracts of land as far as possible; they should not be a mere grouping of individuals.
- Women farmers can also be encouraged to group cultivate for getting better returns.
- FPOs can also encourage consolidation of holdings.



11.5 Viable Value Chain for Pulses

Why in news?

Pulses production has reached a high of 231.5 lakh tonne (lt) in 2019-20 against 146.4 lt in 2009-10 making India a largely self-sufficient nation in pulses.

How is this achievement possible?

- Pulses are relatively easier to grow from the perspective of small and marginal farmers, with smaller duration, lesser requirement of water and land use.
- They are regularly procured at Minimum Support Price and there was more focus on increasing its production and productivity.
- This has played a critical role in providing remunerative prices & assured market to the cultivators thereby increasing the production.
- However the challenge is its availability at affordable rates to consumers across all income groups.

What is the issue in affordability of pulses?

- In the post COVID scenario, pulse-specific production levels and retail prices have been fluctuating.
- Inflation targeting is essential to ensure that pulse price does not emerge as a pressure point as far as inflation is concerned.
- The need of the hour is to ensure stability in prices of pulses enabled by a steady availability.
- Hence appropriate policy instruments needs to be adopted taking into consideration of the interests of both farmers and consumers.
- For this a strong value chain for pulses is crucial which can help in consuming healthier & pulses-based diets.

How to ensure well established value chain for pulses?

- One, Small scale/household level processing units needs to be set up in pulse growing areas especially at the cultivator's location.
- This will reduce price difference between raw/unprocessed pulses and processed dal/pulse products.
- Two, convergence with various components of National Rural Livelihoods Mission must be ensured by States/UTs to improve nutrition status.
- For this processing facilities can be set up & community Investment Fund can act as Seed Capital to SHG's at Cluster level & Vulnerability Reduction Fund to SHG's at Village level.
- These small-scale mills can provide better conversion ratio of raw to milled pulses with better nutrition content.
- Three, existing schemes must be leveraged for creating infrastructure.
- Creation/Expansion of Food Processing/Preservation capacities scheme and Agro Processing Clusters can be joined under the PM Kisan SAMPADA Yojana for funding purposes.
- Four, the funding facility under the Agriculture Infrastructure Fund can be used for providing debt financing facility.
- This can be invested in viable projects for post-harvest management infrastructure and community farming assets through interest subvention and financial support.
- Five, participation and strengthening of FPOs needs to be encouraged to improve farmer's bargaining power which can ensure that consumer's extra expenditure goes to the grower.
- This will also reduce intermediary costs & PM FPO Kisan Yojana which promotes 10,000 new FPOs is an encouraging step.
- Six, tax incentive can be given to agri-business start-ups.
- Innovation and Agri-entrepreneurship Development programme promotes innovation and agri-entrepreneurship by providing financial support.
- Implementing the above suggestions can be a game changer for both consumers and farmers thereby improving the nutrition of people.



12. ISSUES RELATED TO MSP, FARM SUBSIDIES

12.1 Demand for Legal Guarantee MSP

Why in news?

Farmer unions are demanding the legal guarantee of minimum support prices (MSP) announced for various crops which is not available now.

How can MSP be made legally binding?

- There are two ways it can be done.
- One forcing the private buyers to buy crops not below the MSP which can also act as the floor price for bidding in mandi auctions.
- This practise is already prevalent in case of sugarcane crop where mills are required by law to pay growers within 14 days of supply.
- Second way can be buying the entire crop that farmers offer by the government at the MSP.
- In 2019-20, government agencies —FCI,NAFED— procured 77.34 million tonnes (mt) of paddy and 38.99 mt of wheat, at Rs 140,834 crore and Rs 75,060 crore at their respective MSPs.

How much of farmers' produce can the government buy at MSP?

- MSP is now applicable for 23 farm commodities- 7 cereals, 5 pulses, 7 oilseeds & 4 commercial crops and MSP value for these crops amounts to Rs 10.78 lakh crore in 2019-20.
- However all this produce is not marketed as farmers retain part of it for self-consumption, seed for the next season's sowing and to feed their animals.
- The average marketed surplus ratio for different crops is estimated to be 75% costing over Rs 8 lakh crore.
- This is the MSP value of production that is the marketable surplus — which farmers actually sell.

What is the exact amount that government spends to ensure farmers get their MSP?

- The following statements clearly explain the reality.
- Firstly sugarcane must be excluded from the calculations as they are paid by the sugar mills and not the government.
- Secondly, the government is already procuring many crops —paddy, wheat, cotton, pulses and oilseeds & their combined MSP value exceeds Rs 2.7 lakh crore in 2019-20.
- Thirdly, government agencies need not buy every single grain that comes to the market & procuring even a quarter or third of the market arrivals is enough to lift prices.
- For instance, CCI procured 87.85 lakh bundles out of the current year's projections of 358.50 lakh bundles which has led to open market prices crossing the MSP in most of the mandis.
- Fourthly, crops (wheat & paddy) bought on government account are distributed at super-subsidised rates under the National Food Security Act.
- The revenues realised from sales would partly offset the expenditures from MSP procurement.
- Hence the government undertaking the maximum required procurement for guaranteeing MSP to farmers may not be more than Rs 1-1.5 lakh crore per year.

What can we infer from this?

- The government undertaking to buy at MSP is definitely better than forcing private players because sugar mills are unable to pay farmers on time despite having Sugarcane (Control) Order, 1966.
- However, even assured government MSP-based procurement is fraught with problems.
- MSPs today does not extend to fruits, vegetables and livestock products that together constitute 45% in the gross value of output of India's agriculture, forestry and fishing sector.
- But extending MSP to all farm produce and guaranteeing it through law is fiscally challenging.

- That is why economists increasingly are in favour of guaranteeing minimum incomes rather than prices to farmers.
- This can be achieved via DBT either on a flat per-acre (as in the Telangana government's RythuBandhu scheme) or per-farm household (Pradhan Mantri Kisan Samman Nidhi) basis.

12.2 India's Agricultural Support

Why in news?

- Organisation for Economic Co-operation & Development (OECD) claimed that agricultural support provided to Indian agriculture is extremely low or negative.

What does OECD report says?

- It estimated that Indian farmers received negative support to the extent of minus Rs 2.36-lakh crore & minus Rs 1.62-lakh crore in 2010 and 2019 respectively.
- This support to farmers was consistently negative during 2000-2019 except in 2000.
- This negative support of minus Rs 1.62-lakh crore is higher than the total budgetary allocation of the Ministry of Agriculture at Rs 1.09-lakh crore in 2019.
- This data considered only market price support and budgetary payments.

How did OECD arrive at this data?

- Data was calculated based on the expenditure on PM-KISAN, National Food Security Mission, crop insurance, input subsidies are covered under its estimates.
- It did not cover expenditure related to the operation of minimum support price and general services.
- Hence massive negative market price support resulted into total negative producer support overshadowing the increase in the budgetary support registering 85% growth between 2015-19.
- As per OECD methods, market price support of a commodity is calculated by multiplying its total production with the gap between domestic price and international prices in a relevant year.

What are the consequences of adopting this methodology?

- This methodology assumes that if no government intervention in the market exists, then domestic & international price of a product will converge resulting in no gap in prices.
- However this gap can still arise due to domestic and international factors- COVID-19 pandemic, weather conditions etc.
- Firstly, if the domestic price for a product is less than its international price then also support for that product would be negative.
- Secondly, a negative market price support for a product in one year can turn into huge positive support in another year due to relative movement of domestic and international prices.
- For instance, in 2018, the domestic price of cotton was lower than the international price, resulting in negative support of minus Rs 5,102 crore.
- However, in the subsequent year, the domestic price exceeded the international price, and the support turned positive to the extent of Rs 4,414 crore.
- Thirdly, even if in a particular year if government did not provide any additional support compared to previous year then level of support calculated by the OECD can change.
- This will arise if there is a change in either the gap between the domestic price and international price for a commodity, or its production, in the two years.

What can we infer from this?

- The amount of subsidy depends on the methodology adopted in calculating it.
- Given the unpredictability in the inherent data, the total support can move from huge negative to huge positive.

- For India, the negative support as a percentage of the total value of agriculture production has substantially reduced in recent years.
- Rather than being swayed by the OECD numbers suggesting negative support, policymakers & others need to understand the limitations in the underlying methods.
- This will provide a correct perception on the level of support given to agriculture in India.

12.3 Increase of Subsidy on DAP

Why in news?

Recently, the government has announced a 140% increase in the subsidy on di-ammonium phosphate (DAP).

What is DAP and why is it important for farmers?

- DAP is the second most commonly used fertiliser in India after urea and farmers normally apply this fertiliser just before or at the beginning of sowing.
- It is high in phosphorus which stimulates root development.
- Though there are other phosphatic (P) fertiliser such as single super phosphate that contains 16% P and 11% sulphur (S)-DAP is the preferred source of P for farmers.
- This is similar to urea, which is the farmers preferred nitrogenous fertiliser that contains 46% N.

How is subsidy scheme in DAP different from other fertilisers?

- The maximum retail price (MRP) of urea is currently fixed at Rs 5,378 per tonne or Rs 242 for a 45-kg bag.
- Since companies are required to sell at this rate, the subsidy (the difference between the cost of manufacturing or import and the fixed MRP) is variable.
- But the MRPs of all other fertilisers are decontrolled and companies sell these at the rates that they decide and the government only gives a fixed per-tonne subsidy.

Do non-urea fertilisers attract same subsidy?

- Non-Urea fertilisers are governed by nutrient-based subsidy or NBS i.e. depending on the nutrient content for different fertilisers, the per-tonne subsidy is fixed.
- Since one tonne of DAP contains 460 kg (46%) of P and 180 kg (18%) of N, the subsidy comes to Rs 10,231 or Rs 511.50 for a 50-kg bag.
- Likewise, the subsidy on muriate of potash (60% K) is Rs 6,070 per tonne, while it is Rs 2,643/tonne for SSP and Rs 8,380/tonne for the popular '10:26:26' NPK fertiliser.
- Most of the companies sell DAP to farmers at around Rs 24,000 per tonne or Rs 1,200/bag.
- They could do this when international prices were at reasonable levels.
- But the global prices of fertilisers and inputs have surged in the past 6-7 months which has made it unviable for companies to sell at the old rates.

What do the companies do now?

- Now all the companies have raised their MRPs including the country's biggest seller, Indian Farmers Fertiliser Cooperative (Iffco).
- Since non-urea fertilisers are decontrolled, so these companies went for such steep price hikes.
- But Iffco declared that the higher MRPs will be only for newly produced/imported fertilisers and old stocks would continue to be sold at the earlier rates.

What happened now?

- As the old stocks started running out, the companies started selling the new material at the higher rates.
- Since April was a lean month for fertiliser sales, the extent of price increase was not drastic.
- The prices started increasing only when the purchases started picking up from around the second week of April-ahead of the kharif planting season.



What has the government now done?

- Earlier Department of Fertilisers had notified the NBS rates for 2021-22 which was kept unchanged from last year's levels thereby leaving companies little choice but to go ahead with the MRP hikes.
- But recently a historic decision was taken by the centre to increase the subsidy on DAP from the existing Rs 10,231 per tonne (Rs 511.55/bag) to Rs 24,231 per tonne (1,211.55/bag).
- The Department of Fertilisers too has notified a higher NBS rate for P (from Rs 14.888 to Rs 45.323/kg), while keeping those for the other three nutrients (N, K and S) unchanged.
- This will enable companies to sell DAP at the earlier MRP, though not MOP and other complex fertilisers.
- This will help farmers to start their sowing operations from next month with the arrival of the southwest monsoon rains.

13. ACTS & POLICIES

13.1 Farm Reform Laws

Why in news?

Thousands of farmers from Punjab, Haryana, Rajasthan and Uttar Pradesh have been marching toward Delhi in protest against the three central farm legislations.

What are the three recent farm reforms Acts?

- The three recent Acts on agriculture reforms are:
 1. The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act, 2020
 2. The Farmers (Empowerment and Protection) Agreement of Price Assurance and Farm Services Act, 2020
 3. The Essential Commodities (Amendment) Act, 2020
- The Bills were introduced in the Parliament in September 2020 to replace the ordinances issued during the lockdown.

What are the key provisions of and rationale for the legislations?

Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act, 2020:

- **Need:**
 - Farmers in India suffered from various restrictions in marketing their produce.
 - There were restrictions for farmers in selling agri-produce outside the notified APMC (Agricultural Produce Market Committee) market yards.
 - The farmers were also restricted to sell the produce only to registered licensees of the State Governments.
 - Further, barriers existed in free flow of agriculture produce between various States owing to the prevalence of various APMC legislations enacted by the State Governments.
- **Provisions:**
 - It seeks to provide for the creation of an ecosystem where the farmers and traders have the choice relating to sale and purchase of farmers' produce.
 - This facilitates remunerative prices through competitive alternative trading channels.
 - It thus promotes efficient, transparent and barrier-free inter-State and intra-State trade and commerce of farmers' produce.
 - The produce will have a reach outside the physical premises of markets or deemed markets notified under various State agricultural produce market legislations.
 - It will also provide a facilitative framework for electronic trading.
 - It will also help farmers of regions with surplus produce to get better prices and consumers of regions with shortages, lower prices.

The Farmers (Empowerment and Protection) Agreement of Price Assurance and Farm Services Act, 2020

Need:

- Indian agriculture is characterized by fragmentation due to small holding sizes.
- It has certain weaknesses such as weather dependence, production uncertainties and market unpredictability.
- This makes agriculture risky and inefficient in respect of both input and output management.
- In this context, this legislation will transfer the risk of market unpredictability from the farmer to the sponsor.

Provisions:

- This seeks to provide for a national framework on farming agreements.
- It thus seeks to protect and empower farmers to engage with agri-business firms, processors, wholesalers, exporters or large retailers.
- They can take up farm services and sale of future farming produce at a mutually agreed remunerative price framework.
- It will also enable the farmer to access modern technology and better inputs.
- It will reduce the cost of marketing and improve income of farmers.
- Farmers will engage in direct marketing thereby eliminating intermediaries resulting in full realization of price.
- Effective dispute resolution mechanism has been provided for with clear time lines for redressal.

The Essential Commodities (Amendment) Act, 2020

- The Act seeks to remove commodities like cereals, pulses, oilseeds, edible oils, onion and potatoes from the list of essential commodities.
- This will remove fears of private investors of excessive regulatory interference in their business operations.
- The freedom to produce, hold, move, distribute and supply will lead to harnessing of economies of scale and attract private sector/foreign direct investment into agriculture sector.

Rationale

- India has become surplus in most agri-commodities.
- But farmers have been unable to get better prices due to lack of investment in cold storage, warehouses, processing and export.
- This is because the entrepreneurial spirit gets dampened due to Essential Commodities Act.
- Farmers suffer huge losses when there are bumper harvests, especially of perishable commodities.
- In this context, the legislation will help drive up investment in cold storages and modernization of food supply chain.
- It will help both farmers and consumers while bringing in price stability.
- It will create competitive market environment and also prevent wastage of agri-produce that happens due to lack of storage facilities.

Why are only some states protesting?

- The protests are perhaps the loudest in northern states, traditionally India's wheat basket and rice bowl.
- The MSP system, in place since the mid-1960s, was part of the country's drive to reduce dependence on food imports.
- The MSP was meant to protect farmers against price crashes that could (and do) occur with large harvests.
- It is in its role as a floor price that a credible MSP matters to farmers.
- In principle, in deficit states (where demand exceeds local supply), market prices should be higher than the MSP, obviating the need for supporting the market at the level of MSP.



- However, this differential could be dampened or even eliminated by the distribution of grains under the National Food Security Act (NFSA).
- Seen in this light, the MSP matters more in historically surplus states of Punjab and Haryana.
 - Here, the government purchases over 80% of wheat and rice output for NFSA supply.
 - In comparison, in Bihar, the government procures at most a quarter of rice output of the state and no wheat.
- Also, in practice there is wide variation in the implementation of the MSP, across crops, states and categories of farmers.
 - A 2016 Niti Aayog report notes that all surveyed Punjab farmers reported selling at the MSP.
 - While other states often saw only one-third of farmers reporting sales at the MSP, and some, none at all (with sales at the lower open market prices).
 - The report also finds that large farmers are able to sell a greater share of their produce at the MSP as compared to smaller farmers.
 - Small farmers often rely on aggregators to sell their output.

What are the concerns?

- **Cooperative federalism** - Agriculture and markets are State subjects – entry 14 and 28 respectively in List II.
- So the farm legislations are being seen as a direct encroachment upon the functions of the States.
- It is seen as being against the spirit of cooperative federalism enshrined in the Constitution.
- The Centre, however, argued that trade and commerce in food items is part of the concurrent list.
- **End to MSP?** - APMCs were set up with the objective of ensuring fair trade between buyers and sellers for effective price discovery.
- APMCs can -
 - regulate the trade of farmers' produce by providing licences to buyers, commission agents, and private markets
 - levy market fees or any other charges on such trade
 - provide necessary infrastructure within their markets to facilitate the trade
- The Farmers' Produce Trade and Commerce Act aims at opening up agricultural sale and marketing outside the notified APMC mandis for farmers.
- Given this, dismantling of the monopoly of the APMCs is seen as a sign of ending the assured procurement of food grains at MSP.
- To the Centre's 'one nation, one market' call, farmers have sought 'one nation, one MSP'.
- Farmers call for addressing the gaps in the APMCs, instead of making these State mechanisms redundant altogether.
- **No mechanism for price fixation** - The Price Assurance Act offers protection to farmers against price exploitation.
- However, it does not prescribe the mechanism for price fixation.
- There is apprehension that the free hand given to private corporate houses could lead to farmer exploitation.
- Farmers are apprehensive about formal contractual obligations owing to the unorganised nature of the farm sector.
- There is also the lack of resources for a legal battle with private corporate entities.
- **Food security** – Easing of regulation of food commodities in the essential commodities list would lead to hoarding of farm produce during the harvest season when prices are generally lower.
- This could undermine food security since the States would have no information about the availability of stocks within the State.



What does the Government say?

- It says that these acts will only increase options for farmers in the output markets & MSP-procurement system will continue.
- It also says that there is no mention of either MSP or procurement in the acts.

Will Government stop public procurement of grains?

- The National Food Security Act (NFSA) has 80 crore beneficiaries and an additional eight crore migrants who need to be supported under the PDS.
- Due to the onset of the novel coronavirus pandemic and the migrant crisis, the government has earmarked about 58 million tons of rice and 37 million tons of wheat.
- If the government intends to procure such huge quantities of grains, then it needs to depend on these two States in supplying grains to procurement agencies.
- As these states account for 35% of the rice and 62% of the wheat public procurement in the last three years.
- Thus, the government has little option but to continue its procurement from these States in the foreseeable future.
- Therefore, it is imperative that the government reaches out to the farmer groups and assures them of the indispensability of MSP-procurement system.

14. GOVERNMENT INTERVENTIONS

14.1 New Paradigm in Animal husbandry

What is the issue?

Infrastructure investments in animal husbandry and dairy sector can boost productivity levels in farming.

What is Animal Husbandry Infrastructure Development Fund (AHIDF)?

- The fund was set up with an outlay of Rs 15,000 crore and eligible entities will get an interest subvention of 3% for a loan amount which covers up to 90% of the estimated project cost.
- Through the Udyami Mitra Portal, applicants need to submit the proposal with the complete Detailed Project Report.
- This fund was announced when the country was reeling under COVID-19 and subsequent lockdowns in order to give cushion to economy.
- This is the first major fund launched by the government that includes diverse stakeholders- FPOs, private dairy players, individual entrepreneurs and non-profits in its ambit.

How can AHIDF boost dairy sector?

- Currently there is an infrastructure gap of about 120-130 MMT and there is a need to enhance chilling infrastructure in order to prevent wastage of milk.
- If this infrastructure gap is addressed, then the overall potential investment opportunity in the dairy value chain will be Rs 1, 40,000 crore.
- AHIDF can establish animal feed plants of varying capacities – including setting up of mineral mixture plants, silage making units, and animal feed testing laboratory.
- In order to spur innovations, Ministry has collaborated with Invest India to get ideas from domestic start-ups for developing new varieties of green fodder and enriched animal feed.
- This can increase the productivity of cattle by enhancing the quality of animal feed and can translate into an investment potential of around Rs 5,000 crore.

How can AHIDF boost the poultry sector?

- India is the fourth largest chicken meat producer and the second largest egg producer in the world.

- In the anganwadis, eggs are given as part of the mid-day meal and upgrading the poultry infrastructure can mitigate rampant malnutrition.
- Chicken meat also provides cheap source of protein per unit.
- Moreover enhanced infrastructure can make processing units more energy-efficient and mitigate carbon footprint.

What are the takeaways from this?

- Animal husbandry and dairy sector collectively employs more than 100 million people and bulk of the establishments in this sector are concentrated in rural India.
- AHIDF has the potential to create 30 lakh jobs, overhaul domestic infrastructure & make India to attain greater prominence in the global value chain of dairy and livestock products.
- If such investments are made in a timely manner, it can bring immense benefits for the entire economy.

14.2 Agriculture Infrastructure Fund

What is the issue?

The Agriculture Infrastructure Fund scheme that aims to boost agri marketing facilities needs to be recast as the scheme remains ambiguous.

What is AIF scheme?

- It is a Central Sector Scheme approved by the Union Cabinet in 2020.
- It aims to provide a medium - long term debt financing facility for investment in viable projects for post-harvest management Infrastructure and community farming assets.
- The duration of the Scheme shall be from FY2020 to FY2032.
- Eligible beneficiaries include farmers, FPOs, PACS, Marketing Cooperative Societies, SHGs, Joint Liability Groups, Agri-entrepreneurs, Start-ups, and Central/State agency or Local Body sponsored Public-Private Partnership Projects.
- Under the scheme, Rs. 1 Lakh Crore will be provided by banks and financial institutions as loans.
- The loans are provided with interest subvention of 3% per annum and credit guarantee coverage under CGTMSE for loans up to Rs. 2 crores.

What is the significance of the scheme?

- It provides support facilities to farmers and value chain actors for risk-sharing and market access.
- Improved marketing infrastructure will help farmers sell their produce directly.
- With investments in logistics infrastructure, post-harvest losses can be reduced.
- It also provides targeting State-specific APMCs and maintenance of sanitary and phytosanitary standards for organic produce marketing and exports.
- District, state or national level monitoring committees will reduce the turnaround time for file processing to less than 60 days.
- The scheme tries to mitigate spatial and temporal risks in the agribusiness ecosystem through adequate post-harvest infrastructure facilities.

Why the scheme appears ambiguous?

- FPOs are the potential beneficiary of the scheme but their viability is a question.
- There is no reliable data about flow of funds from institutions such as NABARD, SFAC, and State agencies to FPOs in public domain.
- Lack of clarity on how the AIF will act as a market intervention scheme for market infrastructure institutions.
- There is no mechanism of convergence with existing schemes such as PEG scheme that has infused private or corporate capital into agribusiness.



- Expanding the scope of APMCs by integrating them into eNAM structure may not prevent farmers from distress sales or market failures until a monitoring and evaluation cell is put in place.
- There is a need for modification of AIF funds linked to agricultural commodity derivative markets for improved market integration and reliable price discovery as like China's '**futures plus**' scheme.

14.3 Digital Ecosystem for Agriculture

Why in news?

Government has launched an initiative called **India Digital Ecosystem for Agriculture (IDEA)** that would place the farmer in the centre of the agriculture ecosystem leveraging open digital technologies

What is the scheme about?

- The scheme aims to develop "evidence based" policy for the agriculture sector, driven by big data and analytics and powered by information technology
- It will incorporate the National Farmers Database which is being built by **Microsoft** under the aegis of Department of Agriculture & Farmers' Welfare (DoAFW)
- It will include farmers' digitised land records and information from running schemes like PM Kisan, soil health cards, PM Fasal Bima Yojna, etc.
- Land records database is to be crosslinked with Aadhaar to create an unique FID or a **farmers' ID** where an user can access virtually the entire universe of a farmer's activities
- It also aims to create **AgriStack** that would serve as a foundation to build innovative agri-focused solutions using emerging technologies
- The government is hoping that agriStack will help eventually to achieve the goal of doubling farmers' income by 2022

What are the challenges in the implementation of this scheme?

- Complicated land records
- Leaves out the tenant farmers who comprise about 12 per cent of agricultural households
- No legal recognition of land tenancy agreements in India
- Doesn't solve the problem of women farmers where substantial portion of landholdings are managed by women but land titles continue to be held by men
- Suspicions on whether agriStack is the precursor to a complete privatisation of agriculture since government has signed MOUs with Amazon, Patanjali, ESRI, StarBazaar, etc.
- Formation of 'AgriStack' also implies commercialisation of agriculture extension activities as they will shift into a private sphere.
- Concerns over data privacy in the absence of a data protection law

14.4 Fuel Prices & Farmers

Why in news?

The rising prices of petrol and diesel are set to increase the input cost of farming sector by 28 % compared to last year.

How will fuel price rise affect the input cost of agriculture?

- In Punjab, 11 lakh farm households own 5.20 lakh tractors, 17,000 combine harvesters which includes 6,000 Straw Management System (SMS).
- Apart from this, the state owns 75,000 stubble management machines, over one lakh other farm implements.
- They machines harvest around 36-37 million tonnes wheat and paddy in the state annually & they are diesel operated.
- Apart from this there are 1.50 lakh diesel operated tube wells too in the state.



How much diesel is consumed in Punjab in the agriculture?

- The consumption of diesel in the state is 2.5 times higher than the petrol.
- Out of total 3,400 pumps used in agriculture, 40% consume diesel and nearly 20 % consume petrol.
- The retail oil price has never got decreased when the rate of crude oil in international market fell down.
- This affects the farming sector even during Covid-19 lockdown.

What is the current fuel price in Punjab?

- In February 18, 2020, the petrol and diesel were Rs. 71.83 per litre and Rs. 63.62 per litre, respectively.
- Currently, the price of petrol and diesel is Rs.90.51 per litre and Rs. 81.64 per litre respectively.
- So there is 28 % and 26 % rise in diesel and Petrol prices respectively in the state in one year.
- After the announced of double the farming income by 2022 in 2017, diesel price was around Rs 56 per litre including 28 % VAT + 10 % additional tax on VAT.
- Now it has gone up to Rs 81.64 per litre, an increase of Rs 25.64 per litre, which is an increase of 45.8 % in the past four years.

What will be the cost of running farm implements now?

- If one operation is taken for wheat harvesting, from coming April farmer has to spend Rs 816 per acre on diesel cost because a harvester consumes around 10 litre diesel on one acre.
- Last year, the cost was Rs 636 per acre and there is an increase of Rs 180 per acre in just one year.
- Now the field requires around 8-10 operations for sowing, harvesting, post harvesting and every operation will see an increase of 28.3 per % in diesel consumption.
- That is if the total cost of field preparation for one crop after normal combine-harvesting was Rs 3,000 per acre, now it will go up to Rs 3,800 to 3,900.
- This will add extra burden to farmers as there are 41 lakh hectares of area under cultivation for various crops in Punjab.

14.5 Food Corporation of India Directive

Why in news?

Food Corporation of India's (FCI) Punjab office recently wrote to the director of food, civil supplies and consumer affairs seeking land records of farmers.

What is the FCI directive and why?

- The FCI has requested to share the data of land records.
- It was also asked to convey to the FCI office where to find them so that FCI shall verify land records of farmers during Rabi marketing season (RMS) 2021-22 with regard to FCI's own purchase.
- The purpose is to make direct online payment of Minimum Support Price (MSP) to the land owners' bank accounts from the upcoming RMS.
- The issue of direct payment to farmers' accounts is something the Centre has been mulling for the past couple of years.
- The aim is to remove middlemen from the process.

How many land owners are there in Punjab?

- There are around 10.93 lakh operational land holdings in Punjab as per the agricultural census 2015-16.
- But this does not mean that the number of agricultural land owners is also the same.
- The number of owners are more because in several cases, a single piece of land has many shareholders.
- According to records, there are around 16 lakh farmer land owners in Punjab and around 9.50 lakh cultivators.

What is the problem with providing land records?

- There is no hindrance in providing land records.
- The main problem is that all the 16 lakh farm land owners are not cultivating their respective lands.
- According to the Punjab Land Revenue Act, the owner of the land is mentioned as khud kashtkar (self-cultivator) whether the person is cultivating that land or not.
- In that case, providing the owners' bank accounts would not serve the purpose of making MSP payment.
- The MSP should technically go to the real cultivators of the land.
- Around 45-50% owners have given their lands on lease and are charging annual rent for that.
- The actual cultivators do not own that land while doing farming on it for decades.

What is the current practice?

- Currently, arhtiyas (commission agents) get the payments in their accounts, which they in turn pay to farmers through cheques.
- The Centre has to pay 2.5% commission to arhtiyas who facilitate procurement of the crop from farmers to government agencies.
- In this system, farmers get payment through their landlord who may not be residing in the local area.
- There is hardly anything in written in majority of land leasing cases.
- The name of the cultivator is hardly mentioned anywhere as everything goes on in good faith.
- Both landless farmers, and small and marginal farmers also take land on rent for cultivation.

What will the implication of the new proposal be?

- Earlier too, this category (cultivators or landless) of farmers was deprived of benefits of several government schemes such as subsidies and direct benefit transfers.
- The cultivators do not receive these benefits or it is delayed by a year, as farmer owners do not pass it on to the cultivators.
- The same is likely to happen now for MSPs too.
- The actual cultivators may not get the MSP against sold crop as the money will go into the land owner account.
- There are no mechanisms in place to ensure that the cultivator would get his/her money on time from the land owner.
- Sometimes a cultivator takes land on lease from multiple landlords.
- This would further complicate the matter and he/she will be dependent on the owner of the land for payment of the MSP.
- Going by the land owners record will thus create inefficiency in the marketing process and will hit the income of the actual cultivators.
- Such measures of the government are only seen as attempts to run away from procurement in a phased manner.

14.6 Becoming 'Atmanirbhar' in Edible Oils

What is the issue?

- The prices of imported edible oil are at an all-time high, causing inflation and high dependence on imports.
- In this context, here is a look at the government's programmes and the measures needed to increase palm oil production.

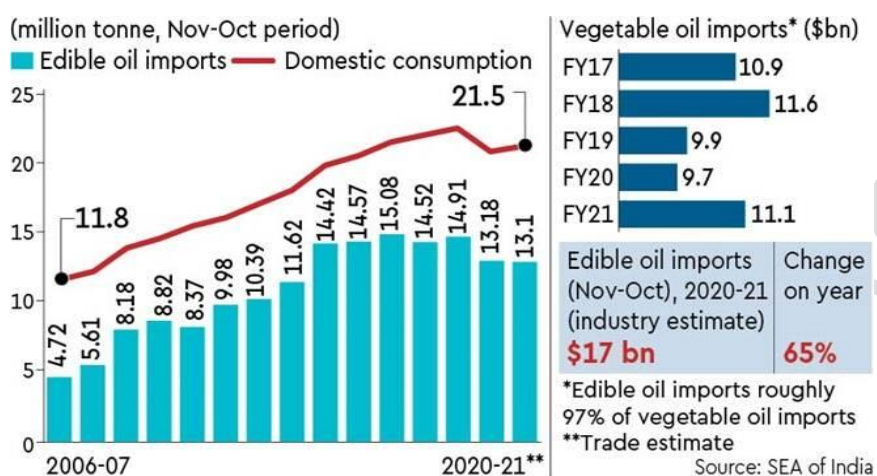
What are the domestic requirements?

- India needs about 25 million tonnes of edible oil a year to meet its domestic requirements.
- India cultivated oilseeds on 25 million hectare of land, producing 32 million tons of oilseeds in 2018-19.

- Soybean, rapeseed, mustard and groundnut accounts for almost 90% share in the area.
- 1. Primary sources - soybean, rapeseed and mustard, groundnut, sunflower, safflower and Niger (Niger nut)
- 2. Secondary sources - palm, coconut, rice bran, cotton seeds and tree borne oilseeds

How import-dependent is India?

- Domestic production can only meet a little over 30% of the total demand for edible oils. The remaining requirement is met through imports.
- India is the world's largest importer of edible oil with a share of 20.7%, [EU (13.5%) & China (12.8%)]
- Edible oils imports account for 40% of the agricultural imports bill and 3% of the overall import bill of the country.
 1. Palm oil - 62 % of total oil imports (from Indonesia & Malaysia)
 2. Soya oil - 21% (from Argentina & Brazil)
 3. Sunflower oil - 21% (from Ukraine & Argentina)



Labour shortage in palm oil plantations of Indonesia and Malaysia, drought in Argentina affecting soyabean production, lower production of sunflower crops in Ukraine impacted price of edible oils. Subsequently, the government has to reduce import tariff of palm oil by 10 per cent in November to ease the domestic price.

What are the negatives of imports?

- Burden on the government's exchequer
- Dependence on the international market
- Price volatility

What is the government's recent palm oil mission?

- Diversifying more areas for palm oil plantations is the need of the hour.
- Palm cultivation has high potential - 1 hectare can give about 4,000 kg of oil (only 500 kg of oil in the case of sunflower, coconut, and rice bran).
- **National Edible Oil Mission-Oil Palm (NEMO-OP)** - The government recently launched this Rs.11,000-crore program to increase palm oil production by 3 times (11 lakh tonnes of Palm oil by 2025-26.)
- The government plans to boost cultivation of oil palm to 10 lakh hectares and 16.7 lakh hectares by 2025-26 and 2029-30 respectively across 19 Southern and the North-Eastern States.
- Forex savings from reduced imports can be spent on encouraging farmers to take up palm and oilseeds cultivation.
- **Others Initiatives**
 1. Oil Palm Area Expansion under Rastriya Krishi Vikas Yojana
 2. Increasing MSP of oilseed crops,
 3. Creation of buffer stock for oilseeds
 4. Cluster demonstration of oilseed crops

Why is the recent oil palm mission so significant?

- **Productivity** - Oil palm is the only crop that can give up to four tonnes of oil productivity per hectare under good farm practices
- **Area Expansion** - The National Re-assessment Committee (2020) has identified 28 lakh hectares suitable for oil palm cultivation but actual area under oil palm cultivation, as of 2020, is only 3.5 lakh hectares
- Thus a huge potential of area expansion is waiting to be tapped especially in North East, Andhra Pradesh and Telangana
- The government plans to boost cultivation of oil palm to 10 lakh hectares by 2025-26
- **Reduction in imports** - Comprehensive assistance package is offered to attract farmers and industries to boost edible oil production in a globally competitive manner thereby reducing the import bill.
- **Pricing formula** - There will be no MSP, but the price for farmers would be fixed at 14.3 % of average landed CPO price of the past five years, adjusted with the wholesale price index

What is the issue with the current MSP?

- MSP system for oilseeds has failed due to low procurement by government agencies.
- As the procurement of pulses on MSP has been increased, the government should also ensure the oilseeds procurement.
- [Against a domestic demand of 30 million tonnes of pulses/year, India now imports just 4 million tonnes.
- India's success story of achieving self-sufficiency in pulses, must be replicated in the oilseeds & palm oil.]

What are the measures to be taken?

- Attracting corporate bodies towards palm oil production.
- Effectively using 100% FDI in palm oil plantation to attract corporate bodies.
- Leasing, renting or selling of wasteland, degraded land, and other lands to private entrepreneurs, cooperative bodies or joint ventures for oil palm plantation.
- Combining individual farming, contract farming and captive plantation.
- Incentivising farmers to cultivate oil palm and oilseeds.
- Compensating farmers for at least 6 years for their land under oil palm against the potential loss; providing a one-time irrigation subsidy to farmers.

What is needed beyond the mission?

- Import duty needs to be in sync with rational domestic price policy as recommended by Commission for Agricultural Costs and Prices (CACP)
- Revisit the existing incentive structure that unduly favours rice, wheat and sugarcane through heavy subsidisation of power, fertilisers and MSP
- Devise a crop-neutral incentive structure where cropping patterns are aligned with demand patterns

India's edible oil economy

- India is the world's largest importer of edible oil with a share of 20.7 per cent, followed by EU and China.
- 60% of edible oil requirement is met through imports and the share of palm oil is about 60% of the import bill.
- India is the second-largest edible oil consuming country.

Palm oil

- Palm oil is currently the world's most consumed vegetable oil
- Top consumers are India, China, and the European Union (EU)
- It is used extensively in the production of detergents, plastics, cosmetics, and biofuels



14.7 Agriculture Sector Reforms

What is the issue?

- The initiative of the Union government to bring about far-reaching reform in agriculture has run into severe weather.
- These reforms have alarmed the States and they are opposing it.

What are the responses?

- **Protests** - An allied party's Minister, Harsimrat Kaur Badal (Akali Dal) has resigned in protest.
- There is a strong pushback from farmers against three Bills that seek to replace ordinances issued in June, on key aspects of the farm economy,
 1. Trade in agricultural commodities,
 2. Price assurance,
 3. Farm services including contracts, and
 4. Stock limits for essential commodities.
- **Alarming** - The Farmers' Produce Trade and Commerce Bill, 2020, provide for unfettered commerce in designated trade areas outside APMC jurisdictions without levy of any fee.
- It empowers the Centre to issue orders to States in furtherance of the law's objectives, which has alarmed States.

Why are the States opposing?

- The opposition is due to the fear that the free market philosophy could spell the end of MSPs for produce that has so far been procured by the government.
- The opposition to the Bills flows from the position articulated by Punjab that **agriculture and markets are State subjects**.
- As they are State subjects, there should be no tinkering with the MSP and Agricultural Produce Market Committees (APMC).
- MSP and APMC form the backbone of existing trading arrangements.

What did the States do?

- Several States have already liberalised agricultural marketing by amending their APMC Acts.
- Some States have allowed regulated private commerce including direct marketing.

What did the Centre say?

- The Centre has characterised the arguments as misleading, promising that the MSP system will continue, which is welcome.
- But the new dispensation cannot bring cheer to small farmers, who form the majority.
- Their access levels to markets under the APMC system are at the rate of one market for an area of 434.48 sq. km on average.
- This is well below the recommendation of the National Commission on Farmers (NCF), at one market for 80 sq. km.
- There is evidence that mere liberalisation does not lead to private investment in new markets.

What could be done?

- If the Centre's intent is to strengthen competition, it should massively fund the expansion of the APMC market system.
- It should remove trade cartels, and provide farmers good roads, logistics of scale and real time information.
- It should empower the farmers through State Farmers Commissions recommended by the NCF.
- This will bring about a speedy government response to issues.



- Without strong institutional arrangements, laissez-faire policy may harm unorganised small farmers, who have shored up the economy during a pandemic.

14.8 Revitalising PM-KUSUM

What is the issue?

The pandemic-induced disruptions, limited buy-in from States and implementation challenges have affected the roll-out of Kisan Urja Suraksha evam Utthaan Mahabhiyan (KUSUM).

What is KUSUM about?

- KUSUM was launched by **Ministry of New and Renewable Energy** in 2019 to provide energy sufficiency and sustainable irrigation access to farmers.
- **Objective** - Providing financial and water security to farmers.
- The components of the proposed scheme are
 1. **Component-A:** 10,000 MW of Decentralized Ground Mounted Grid Connected Renewable Power Plants.
 2. **Component-B:** Installation of 17.50 lakh standalone Solar Powered Agriculture Pumps.
 3. **Component-C:** Solarisation of 10 Lakh Grid-connected Solar Powered Agriculture Pumps.

What are the barriers in effective implementation of the scheme?

- Limited awareness about solar pumps among farmers.
- Farmers' inability to pay their upfront contribution.
- Regulatory, financial, operational and technical challenges.
- Non-initiation of tenders or commissioned projects for solar feeders or grid-connected pumps by some states.
- Covid induced disruptions.

How can the challenges be tackled?

- Extending the scheme's timeline beyond 2022 would allow discoms to align the scheme with their power purchase planning.
- Create a level playing field for distributed solar plants in par with utility-scale solar which is cheaper and most preferred by discoms.
- Grid-unavailability risks needs to be addressed and tariff determination should be standardised with the removal of waiver of ISTS charges for solar plants.
- Land regulations must be streamlined through inter-departmental coordination reduce delays in converting agricultural lands for solar power generation.
- Innovative solutions like Karnataka's pilot of a farmer-developer special-purpose vehicle are needed for financing farmers' contributions.
- Piloting grid-connected solar pumps along with smart meters and smart transformers will be useful for scaling up the scheme.
- The scheme, if implemented successfully, can generate thousands of jobs, reduce the carbon footprint of agriculture, and result in oil import savings.

15. OTHER ISSUES

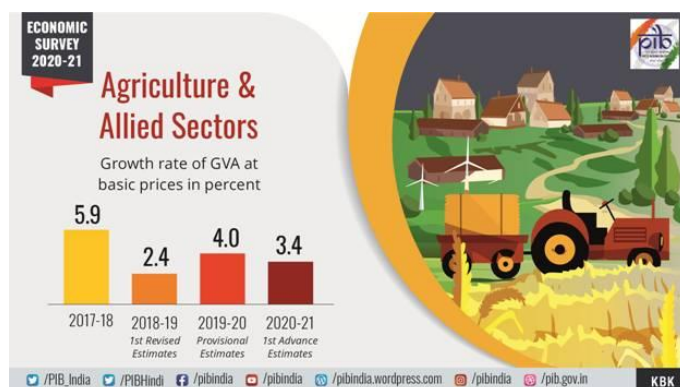
15.1 The State of Agriculture in India

What is the issue?

National Statistical Office's Situation Assessment Survey (SAS) of agricultural households for the 2018-19 agricultural year holds importance given the unprecedented crisis in India's agricultural economy.

What are the causes for crisis in agriculture?

- Sharp slowdown in the economy
- Rise in input costs driven by rising wages
- Faulty implementation of India's fertilizer-subsidy reforms
- Higher fuel prices
- Back-to-back drought in 2014 and 2015
- Demonetization caused disruptions
- Covid pandemic



What does the SAS 2018-19 say?

- The average income of an agricultural household from farm and non-farm incomes increased in real terms from Rs.6,436 in 2012-13 to Rs.7,683 in 2018-19.
- This was mainly due to higher wage incomes which rose 6.7% per annum.
- For a majority of the farmers engaged in crop cultivation, real incomes from it declined 1.3% per annum which led to fall in investment in productive assets.
- Net investment in productive assets in 2018-19 was less than half the level in 2012-13, even in nominal terms.

Why is the estimate of the SAS worrisome?

- A large proportion of rural households in India are engaged in agriculture and within agriculture, an overwhelmingly large proportion is dependent on crop production.
- The fall in real cultivation incomes has been partly responsible for hurting demand and in turn economic growth.
- While the increase in wage labour may have protected agricultural households from a decline in real incomes, it doesn't warrant that the non-farm sector will protect farmers' incomes in the future.
- These estimates pertain to two years before the pandemic and now the situation would have worsened on account of a rise in input costs driven by energy and fertilizer prices.
- Also data from the wholesale price index suggests that farm-gate prices for a majority of crops have either declined or remained stagnant.
- Periodic Labour Force Survey showed an actual increase in workers dependent on agriculture which would cause sharp reduction in real incomes per agricultural worker.
- The agrarian issues are taking centre-stage with the intensification of the farmer agitation against three farm laws.
- The survey raises a serious concern not only on the implications of working conditions of Indian farmers but also on the sustainability of growth itself.

15.2 Ignoring Women Farmers

What is the issue?

- According to the agricultural census, 73.2% of rural women are engaged in farming activities but only 12.8% own landholdings.
- The gender gap in the agriculture sector will only widen more with the current farm laws.

What are the concerns for women in agriculture?

- In India, agriculture is mostly related as a field for men who are alone seen as farmers. However, this is far from the truth.
- As mentioned, 73.2% of rural women are engaged in farming activities but only 12.8% own landholdings.
- Due to cultural, social and religious forces, women have been denied ownership of land.

- Notably, 83% of agricultural land in the country is inherited by male members of the family and less than 2% by their female counterparts.
- Thus, women are mostly left without any title of land in their names and are excluded from the definition of farmers.
- The government only labels them as 'cultivators' or 'agricultural labourers' but not 'farmers'.

What impact does this create?

- Without any recognition, women are systematically excluded from all the benefits of government schemes.
- Moreover, they are not guaranteed the rights which they would otherwise be given if they were recognised as farmers.
- These include loans for cultivation, loan waivers, crop insurance, subsidies or even compensation to their families in cases where they commit suicide.

What are the other problems?

- Non-recognition as farmers is only one of their problems.
- Women have unequal access to rights over land, water and forests.
- There is gendered access to support systems such as storage facilities, transportation costs, and cash for new investments or for paying off old dues and such services related to agricultural credit.
- There is also gendered access to inputs and markets.
- Thus, despite their large contribution to the sector, women farmers have been reduced to a marginal section, vulnerable to exploitation.

How do the recent farm laws affect them?

- The policies fall short of reducing disparity or alleviating their distress.
- Given this, women farmers fear that the farm laws will further deepen gender inequality in the sector.
- In this context, the first concern is the lack of any mention of MSP (minimum support price) that protects farmers from exploitation.
- Also, farmers will have no bargaining power in the corporatisation of agriculture.
- Corporates get to decide the price, with less safety net or adequate redressal mechanism for the farmers.
- Consequently, the small, marginal and medium farmers will be forced to sell their land to big agro-businesses and become wage labourers.
- In this, women are barely in a position as empowered agents who can either understand or negotiate (written) agreements with traders and corporate entities.
- Perhaps, this is why women are notable part of the ongoing farmers struggle to remind that they are farmers too and have an equal stake in this fight.

15.3 Role of Agriculture

What is the issue?

- The National Statistical Office's first advance estimates released recently show a 7.2% fall in gross value added (GVA) for 2020-21.
- While this would be the sharpest fall ever recorded in India, a more significant aspect is to do with the driving factor (economic sector).

What do earlier economic slumps show?

- There have been four earlier occasions when the country's GVA has suffered contraction.
- GVA is GDP net of all taxes and subsidies on products. It is thus a more accurate measure of economic activity.
- The extent of negative growth in those four years was lower than the 7.2% being projected for the current fiscal.



- 1979-80 (minus 5.2%), 1972-73 (minus 0.3%), 1965-66 (minus 3.7%) and 1957-58 (minus 1.2%)
- In each of those four previous years, the primary cause was agriculture.
- All four were drought years and the farm sector (agriculture, forestry and fishing) registered minus growth.
 - minus 12.8% in 1979-80, minus 5% in 1972-73, minus 11% in 1965-66 and minus 4.5% in 1957-58

What is different this time?

- The low growth in agriculture in the previous years, in turn affected the rest of the economy.
- However, this is not the case in 2020-21.
- So, beyond the bigger decline in GVA/GDP this time, it is the sector that is behind the decline that is more significant.
- While overall GVA is expected to shrink 7.2%, agriculture and allied activities are set to post 3.4% growth.
- During the worst phase of Covid-19 and the nationwide lockdown, it is the farm sector that kept the rest of the economy going.
- If the farm sector had not grown at all, the GVA decline would have worked out to 7.7%, not 7.2%.
- Incidentally, in 2019-20 as well, agricultural growth at 4% surpassed the 3.9% for the economy as a whole.
- Reasons:
 1. Agriculture's relatively better performance in the last 2 years is largely a result of consecutive years of good monsoon (and also post-monsoon) rains.
 2. Recharged groundwater tables and reservoirs getting filled to near capacity led to increase in crop acreages and higher production.
 3. Besides these, farming operations being exempted from lockdown restrictions also helped.

Why has this not prevented the economic slump?

- The farm sector doing well has not however prevented the current worst economic slump.
- This is because in 1979-80, agriculture's share in India's GDP at constant prices was 33.9%; in 1957-58, it was 48.2%.
- In effect, a drought year in those times invariably translated into low/negative growth rates and vice versa.
- However, the condition is different today. The share of agriculture in real GVA was only 14.6% in 2019-20.
- This is estimated to go up to 16.3% this fiscal, but not enough to make a big difference in the economy even in a bountiful monsoon year.

GEOGRAPHY

Dip in Delhi's Temperature - Causes

Why in news?

The minimum or night time temperature in New Delhi dropped to 4.1 degrees Celsius on 15 December 2020, the lowest during the season this year.

Why is it significant?

- A rapid decline in minimum temperature in Delhi was noted from 14.4 degrees Celsius on December 12 to 4.1 degrees on the 15th.
- The dip was five degrees below the normal temperature for this time of the year, according to the India Meteorological Department (IMD).
- IMD has also forecasted that the temperature would fall further over the next three days, both during night and day.



What is causing the dip in Delhi's temperature?

- There has been a significant amount of snowfall over the past few days in states falling in the western Himalayan range under the influence of a **Western Disturbance**.
- These include Jammu & Kashmir, Himachal Pradesh and Uttarakhand.
- In winters, whenever an active Western Disturbance passes through the western Himalayan region, it leads to a dip in temperatures across northwest India.
 1. A Western Disturbance is as an extra-tropical storm originating in the Mediterranean.
 2. It is an area of low pressure that brings sudden showers, snow and fog in northwest India.
- Snowfall in the western Himalayan range means cold, north-westerly winds blowing over Delhi from the direction of this high altitude area.
- It also leads to clearing of cloud cover with the passing of Western Disturbance, and leads to a fall in temperatures.
- The lack of cloud cover also leads to higher radiation from the Earth's surface into the atmosphere at night time, which also cools the ground.
- Moreover, under the influence of an **active La Niña climate pattern**, temperatures across the globe have been dipping.
- The maximum or day time temperature has also dipped in Delhi from 29 degrees Celsius on December 10 to 19.4 on the 14th.

What does IMD forecast show?

- The IMD has forecast cold day and cold wave conditions in some parts of the city for the next three days.
 1. A **cold day** is when the maximum temperature dips 4.5 degrees Celsius below normal temperature.
 2. The 'normal' has been set based on climatological data of 30 years between 1981 and 2010.
 3. **Cold wave** is when the minimum temperature dips to 10 degrees Celsius or less and the departure from normal temperature is 4.5 degrees Celsius or lower.
- Until December 19, the maximum temperature is forecast to be between 18 and 19 degrees Celsius.
- The minimum temperature is forecast to be between 4 and 5 degrees Celsius.

Rising Temperatures before Winter End

What is the issue?

- The plains over North India reported a sharp shift in temperatures (rising) in mid-February.
- This has triggered apprehensions that the cold season is ending soon and the summers are going to start early. Here is a look at the geographical factors.

How has the weather over North India been in 2021?

- The region experienced continuous cold conditions all through January and the beginning of February 2021.
- Cold conditions dominated both the plains and hilly regions in North and Northwest India this season.
- The average monthly minimum temperature recorded over the country in January remained the warmest in 62 years.
- However, Delhi, Punjab, Haryana, Himachal Pradesh, Chandigarh and Jammu and Kashmir experienced prolonged severe cold conditions.
- The national capital and neighbouring areas also reported sporadic rainfall in the first week of January.
- However unlike the winter of 2020, not many cold day conditions were recorded during this season.
- In January, there were fewer and feeble western disturbances across lower latitudes.
- The effects of western disturbances were mostly limited to hilly regions in January.



Why is the sudden rise in temperatures?

- In the absence of cold wave and cold day conditions over the plains of north India, temperatures began to soar.
- Delhi, Dehradun and many locations in both the plains and the hills recorded significantly above normal day temperatures for this time of the year.
- On February 11, New Delhi recorded 30.4 degrees Celsius, which was 7.7 degrees above normal.
- The cold waves are prevented from reaching the northern parts of India by -
 - i. the dominance of the prevailing easterly waves
 - ii. presence of multiple weather systems over Central India
- It is because of these that temperatures have seen a sharp rise.
- The temperature departures notably ranged between 5 to 7 degrees from normal.

How will these weather systems affect the cold conditions?

- There is the presence of multiple weather systems in Central India.
- Their confluence with moist easterly winds is expected over Central India for few days.
- With this, thunderstorm is forecast over this region for some days.
- Madhya Pradesh, Chhattisgarh along with parts of Vidarbha, Marathwada, South Interior Karnataka, Jharkhand and Odisha will experience light intensity rainfall accompanied by lightning.
- Some parts of Maharashtra could see hailstorm for two to three days.
- As a result, no significant cold conditions would prevail over the country, except Jammu and Kashmir during this period.

Is the winter season over then?

- India Meteorological Department (IMD) identifies January and February as winter months over India.
- The temperatures would remain on the higher side till February 20, 2021. But, the winter season is not over yet.
- A fresh western disturbance is expected to cross extreme north India on February 20.
- This system will bring rainfall or snowfall over Jammu and Kashmir.
- Once it passes, there is likely to be a marginal drop of around 2 to 3 degrees over Delhi, Punjab, Haryana, Chandigarh areas starting February 22 onwards.
- It would not be a very cold spell, but would be a respite from the present warm conditions.

What is the forecast for the coming months?

- With the winter season nearing its end for this year, the seasonal transition is expected to commence soon.
- With that, a gradual rise in minimum temperatures by 2 to 4 degree Celsius over North and Northwest India is expected after February 25.
- The day temperatures, too, shall soar in the coming days and remain between 22 to 30 degrees, except over Jammu and Kashmir, Shimla and places of higher altitudes.

IMD's First-Stage Forecast for 2021

Why in news?

India Meteorological Department (IMD) released its first-stage forecast for the south-west monsoon for 2021.

How is 2021 likely to be?

- IMD's forecast suggests that monsoon in 2021 may not be as bountiful as in last year; it does however offers some hope.



- The forecast for the south-west monsoon indicates that the quantum of rainfall is likely to be at 98% of the long period average.
- It estimates a 61% probability of the country ending up with normal or excess rains.
 - It actually expected rainfall at 100% of the long period average with a 70% probability of normal to excess rains.

What is the need for caution though?

- A normal monsoon this year is obviously welcome as it could help agriculture GDP expand for the third consecutive year.
- Nevertheless, these preliminary forecasts cannot be taken for the good prospects for the farm economy.
- IMD's first-stage long-range forecast is generally too early to capture the evolving impact of phenomena such as the El Nino Southern Oscillation (ENSO) and Indian Ocean Dipole (IOD).
- Notably, these have proved to be critical swing factors influencing south-west monsoon performances in the past.
- IMD expects the current year's monsoon to be less generous than last year's.
- While neutral conditions now prevail on both the ENSO and IOD, IMD is watchful on negative IOD conditions developing as the season progresses.
- Last year, it was an unfolding La Nina that led to rainfall eventually exceeding IMD's estimates at 109% of the long-term average.
- Also, IMD has been improving its record at foreseeing normal and excess monsoon years.
- But, it has tended to over-estimate rainfall in drought years such as 2002, 2009, 2014 and 2015.
- On this score, its second-stage forecast in June, factoring in evolving weather conditions, is somewhat more reliable.
- There is also the fact that three consecutive normal monsoon years have been quite rare for India.

Cyclone Tauktae

What is the issue?

- The recent Cyclone Tauktae has left a trail of death and destruction before making landfall in Gujarat.
- This reminds again that accurate forecasts and resilience-building hold the key to handling severe cyclones.

How severe was Cyclone Tauktae?

- Cyclone Tauktae swelled into an extremely severe cyclonic storm.
- It led to dumping enormous volumes of water all along the west coast.
- The cyclone caused loss of life in Kerala, Karnataka, Goa, Maharashtra and Gujarat, before weakening overland.
- The twin crises of the cyclone and COVID-19 have strained the capacities of multiple States, especially the coastal ones.

What are IMD's recent measures?

- In 2020, the India Meteorological Department (IMD) launched an impact-based cyclone warning system.
- This was designed to reduce economic losses by focusing on districts and specific locations.
- It incorporates such factors as population, infrastructure, land use and settlements.
- The IMD also claimed that its accuracy of forecasts, for instance, in plotting landfall location, is now better.
- Together with ground mapping of vulnerabilities, this is a promising approach to avoid loss of life and destruction of property.

What are the priorities now?

- Developing greater expertise in forecasting and disaster mitigation is essential.



- Crafting policies to increase resilience among communities is another priority.
- Arabian Sea has emerged as a major source of severe cyclones.
- Their intensity is aggravated by long-term rise in sea surface temperatures linked to pollution over South Asia and its neighbourhood.
- So importance of precise early warnings is high now than before.
- Climate-proofing lives and dwellings is also a high priority now.
- This calls for a multi-sectoral approach:
 - i. to build sturdy homes of suitable design
 - ii. create adequate storm shelters
 - iii. provide accurate early warnings
 - iv. ensure financial protection against calamities through insurance for property and assets

Punjab's case of Desertification

What is the issue?

Series of reports on water table depletion predicted that Punjab will turn into a desert in 25 years.

What were the reports?

- The Punjab Vidhan Sabha committee has said that the state will turn into a desert in the next 25 years if the present trend of drawing water from underground aquifers continues.
- The State of the World Report, 1998 published by Washington-based World Watch Institute (WWI) said that Punjab's aquifers could be depleted by 2025.

What were the reasons cited for desertification?

- Drawing more water than is being replenished
- Use of tubewell or submersible pumps for extraction of groundwater
- faulty cropping pattern such as predominant cultivation of water guzzling paddy especially with the advent of Green Revolution
- The rate of water extraction in Punjab is 1.66 times against the rate of replenishment.
- Puddling (tillage of paddy field in a flooded condition) has created a thick hard layer on the agricultural fields, disturbing the recharging system and creating flash floods.

How to explain the two 25-year predictions?

- Out of 138 blocks in Punjab, 109 have already gone into the 'dark' or over-exploited zone, which means groundwater extraction is more than 100 per cent here.
- Paddy takes at least 4,000 liters water to grow one kg of rice, estimating that the remaining half of Punjab will also slip into the dark zone in the coming 25 to 27 years.
- Already upper aquifers have been dried and this could happen to deep aquifers too, and then Punjab will be like another Rajasthan.
- Farmers must be incentivised to choose cropping patterns that require less water, and go for drip irrigation or other water management mechanisms.

Godavari - Cauvery Link Project

What is the issue?

- Tamil Nadu recently launched its intra-State river linking project by building a canal from the Cauvery to the Vaigai and the Gundar, a part of the larger Godavari-Cauvery Link Project.
- The rationale for the plan causes concerns given the environmental and geographical features of the region developed over the years.

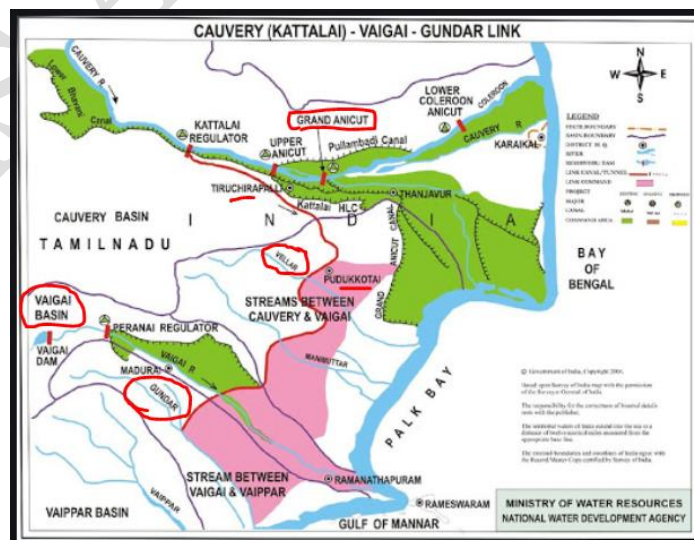
What does the project aim at?

- The Cauvery - Gundar link project forms part of the peninsular rivers' development component of the National Perspective Plan.
- The latter envisages diversion of surplus flows of the Mahanadi basin and the Godavari basin to the water-short Krishna, Pennar, Cauvery, Vaigai and Gundar basins in the South.
- The Cauvery - Gundar link project seeks to divert surplus flows from the Cauvery to the water scarce southern parts of the State.
- This component will be carried out in three phases:
 1. First phase – linking Cauvery to the South Vellar river (118.45 km)
 2. Second phase - linking the South Vellar and Vaigai rivers (110 km)
 3. Third phase - linking the Vaigai with the Gundar river (34.04 km)
- The first significant step towards the linking was made with the commissioning of the barrage across Cauvery at Mayanur in Karur district in 2014.
- The barrage will form the head of the new link canal.
- The link canal will carry the surplus waters from the Cauvery to the South Vellar, the Vaigai river and finally the Gundar.
- The canal will have a capacity to carry about 6,000 cusecs of water.



What is the government's rationale?

- The Cauvery is perceived to carry surplus water.
- This is mixing into the Sea unused, when the water demand for agricultural use is evident year after year.
- So, the idea is to divert the surplus water through a canal, so as to irrigate farm lands.
- The canal, of nearly 250 km, travelling North-South, will carry 6,000 cusecs of water from Kattalai barrage in the north end, to the Gundar river in the South.



What are the concerns with this approach?

- The idea of surplus or deficit in terms of a river seems essentially flawed.
- It all depends on the amount of water being used and for what.
- The excess water flowing across the banks ought to be identified as flood; it is not surplus indeed.
- In that case, floods are to be seen neither as wastage of water nor as surplus and so to be commercialised.
- This is because floods do play a key role in a riverine ecosystem and the associated geographical features.

Why are floods significant?

- The present day Cauvery delta region is largely a result of the deposits and sedimentation formed with floods in Cauvery river over generations.
- All these resulted from the free flow of water along the entire course of the river from its various tributaries, canals and up to the streams and rivulets.
- Excavations in the Cauvery banks and the region around, if done, would reveal this fact.



- Floods thus play a key role in delta formation.
- Moreover, the flooding at intervals and free flow of water along the river channel help preserve the biodiversity of the region, especially fishes.

What impact will the plan have over the deltas?

- The Cauvery River has already in place an old delta and a new delta.
- The former one was formed naturally by Cauvery and its tributary Vennar.
- The latter took shape as a result of constructing the Kallanai Dam (Grand Anicut) in the 1930s.
- Now, the inter-state river link project is expected to make way for a new, third delta for the Cauvery.
- The link river would notably pass in the north-south direction.
- So, a possible delta formation over the course of time could interrupt the natural course of Cauvery and the natural geo-features in the region around.
- This may not happen any soon but the idea of viewing floods as surplus water and commercialising it are disturbing trends to environment protection and conservation.

Hazardous Ideas for the Himalayas

What is the issue?

- Over the past 20 years, China and India have been competing with each other to build hydroelectric dams in the Himalayas.
- Planning hydropower projects in the ecologically fragile and seismically vulnerable area is placing the region at great risk.

What is China's recent proposal?

- In an article published on the website of the Central Committee of the Communist Youth League, China made a proposal.
- It announced that it was planning to build a major hydropower project as a part of its 14th Five-Year Plan (2021-25).
- This will be built on the Yarlung Zangbo River, in Mêdog County in Tibet.
- The hydropower generation station is expected to provide 300 billion kWh of electricity annually.
- China says that the project would help the country realise its goal of reaching a carbon emission peak before 2030 and carbon neutrality before 2060.

What is India's response?

- Mêdog County is not far from Arunachal Pradesh.
- So, soon after speculations about China's plan, Indian counterparts were quick to reiterate their plans to dam the Himalayas on this side of the border.
- India is reportedly considering a 10-GW hydropower project in an eastern State.

What are the other key ongoing projects?

- There are two hydropower projects in the works in Arunachal Pradesh on the tributaries of the Brahmaputra:
 1. the 600 MW Kameng project on the Bichom and Tenga Rivers
 2. the 2,000 MW Subansiri Lower Hydroelectricity Project
- On the other side of the border, China has already completed 11 out of 55 projects that are planned for the Tibetan region.

Why is it unfavourable?

- Both countries ignore how unviable such 'super' dam projects are.
- They are being planned in an area that is geologically unstable and where massive earthquakes are bound to take place.

- In executing the hydroelectric projects, the two countries overestimate their economic potential.
- On the other hand, they grossly underestimate the earthquake vulnerability of the region.

How intense is the earthquake vulnerability of the region?

- High seismic zones coincide with areas of high population concentration in the Himalayan region.
- Notably, landslides and glacial lake outburst floods are common here.
- About 15% of the great earthquakes of the 20th century (with a magnitude of more than 8) occurred in the Himalayan region.
- The northeast Himalayan bend has experienced several large earthquakes of magnitude 7 and above in the last 100 years.
 - This is more than the share from other parts of the Himalayas.
- **1950 earthquake** - The 1950 earthquake just south of the McMahon Line was of magnitude 8.6.
- It was the largest continental event ever recorded, and devastated Tibet and Assam.
- The earthquake killed thousands, and caused extensive landslides, widespread land level changes and gaping fissures.
- It resulted in water and mud oozing in the Himalayan ranges and the upper Assam valley.
- This ultimately dammed the rivers.
- Later the dams were breached generating flash floods in the downstream sides, seriously silting the drainage systems.
- **2015 Gorkha earthquake** - This is a more recent example with magnitude 7.8 in central Nepal.
- This resulted in huge losses in the hydropower sector.
- Nepal lost about 20% of its hydropower capacity consequent to the earthquake.
- About 30 projects with a capacity of 270 MW, mostly located along the steep river valleys, were damaged.
- The cost of physical damage is calculated to be about \$200 million.
- All these reflect what could be expected in the north-eastern bend of the Himalayas if a similar event was to take place in the background of the fast-developing hydro projects.

How do hydropower projects endanger the region?

- A study published in 2018 reveals the earthquake-borne damage sustained by hydropower projects in Nepal.
- The main mechanisms that contributed to the vulnerability of hydropower projects were found to be landslides.
 - This depends on the intensity of seismic ground shaking and slope gradients.
- Heavy siltation from giant landslides is expected in the project sites and headwater region from future earthquakes.
- This will severely reduce the water-holding capacity and life expectancy of such dams.
 - Desilting of dams is not an economically viable proposition and is technologically challenging.
- Even without earthquakes, the steep slopes made of soft rocks are bound to slide due to deforestation and road-building.
- These activities will get intensified as part of the dam-building initiatives.

What do these imply?

- The northeast Himalayan bend with its deep gorges is the most unsuitable locale within the Himalayas for giant dams.
- Also, it is not known how reservoirs with their water load would alter the existing stresses and strains on the earth's crust in the long term.
- This, in turn, could impact the frequency of earthquakes and their mechanisms.



How significant is the Himalayas and what is the imminent threat?

- The Himalayan range is a transnational mountain chain and is the chief driver of the Asian climate.
- It is a source for numerous Asian river systems and glaciers which are now under the threat of degradation and retreat due to global warming.
- These river systems provide water for billions of people.
- In recent years, the Himalayas (the legacy of humanity) have seen the highest rate of deforestation and land use changes.
- Besides, it has now become highly contentious with territorial disputes between two nuclear powers - India and China.
- The military confrontations have also led to demands for further infrastructural development including all-weather roads.
- But this would impact regional biodiversity and the livelihoods of the indigenous population.

Ageing Indian Dams

What is the issue?

India's ageing dams can threaten water security, affect farmers' income, and increase flooding.

How old are Indian dams?

- India is ranked 3rd in the world in terms of building large dams.
- Of the over 5,200 large dams built so far, about 1,100 large dams have already reached 50 years of age and some are older than 120 years.
- The number of such dams will increase to 4,400 by 2050 which means that 80% of the nation's large dams face the prospect of becoming outdated as they will be 50 years to over 150 years old.
- Krishna Raja Sagar dam was built in 1931 and is now 90 years old and Mettur dam was constructed in 1934 and is now 87 years old.
- Moreover hundreds of thousands of medium and minor dams are even more hazardous as their shelf life is even lower than that of large dams.

What are the other worrying facts about the dams?

- As the dams get older, soil replaces the water in the reservoirs and the storage capacity cannot be claimed to be the same as it was in the 1900s and 1950s.
- In a paper, 'Supply-side Hydrology: Last gasp', published in 2003, reveals that the observed siltation rate in India's iconic Bhakra dam is 139.86% higher than originally assumed.
- At this rate, the Bhakra dam is now expected to function for merely 47 years, virtually halved from the original estimate of 88 years.
- Similarly, the actual siltation rate observed for the Hirakud, Maithan and Ghod dams are way higher at 141.67%, 808.64% and 426.59%, respectively.
- Studies in later years showed the similar findings which establish the fact that Indian reservoirs are designed with a poor understanding of sedimentation science.
- The designs underestimate the rate of siltation and overestimate live storage capacity created.
- Therefore, the storage spaces in Indian reservoirs are receding at a rate faster than anticipated and reservoirs are expected to become extinct in less than a few decades.

What are the consequences of the siltation?

- Siltation disrupts the supply of water flow & cropped area begins to receive less and less water as time progress.
- The net sown water area either shrinks in size or depends on rains or groundwater, which is over-exploited.
- Crop yield gets affected severely and disrupts farmer's income & farmer's income may get reduced.

- The flawed siltation rates demonstrate that the designed flood cushion within several reservoirs across many river basins may have already depleted substantially.
- Hence floods are becoming more frequent in downstream of dams.

What does Chopra Committee say about in 2013 floods?

- The committee was formed in October 2013 after the Supreme Court ordered the Union Environment Ministry to constitute an expert body to assess whether dams exacerbated the 2013 floods
- The report mentions that dams aggravated the 2013 floods as riverbeds were already raised from the disposed muck at the dam construction sites.
- Hence it could not contain the sudden increased flow from floodwaters.
- It proves that dams are not only damaged in floods but also cause immense damage in downstream areas due to increase in the destructive capacity of the water.
- It suggested that 23 of the 24 proposed dam projects which it reviewed needs to be cancelled due to the potential damage they could cause.
- In an affidavit submitted on December 5, 2014 in the Supreme Court, Ministry of Environment acknowledged the adverse impact of dams in the 2013 floods.
- However, even after all these years, the matter remains pending in the Supreme Court and environmental norms for dam construction continue to be flouted in Uttarakhand.

How does climate change impact the ecosystem?

- Himalayan glaciers are receding and disintegrating due to climate change and the snow cover in the Himalayas is thinning.
- Research shows that there will be increasing number and volume of glacial lakes due to increase in temperatures.
- This means there will be rapid increase or decrease in the reservoir water level in the dams & the projections on the life of a dam reservoir may not stand due to erratic events such as floods.
- This could rapidly fill a reservoir with muck and boulders brought along with the floods.
- And there is also the threat of earthquakes as Uttarakhand lies in Seismic Zone-IV (severe intensity) and Seismic Zone-V (very severe intensity).

What can we infer from this?

- Ignoring these threats many dams are constructed as a source of revenue in zones that are under high risk of witnessing severe earthquakes.
- Now the State plans to construct up to 450 hydropower projects of 27,039 MW installed capacity ignoring the disastrous impacts of rampant dam-building.
- It is clear that dams worsen disasters which is ignored by the State authorities is unfortunate one.
