



INSIGHTSIAS

SIMPLIFYING IAS EXAM PREPARATION

INSTA MAINS 2022

EXCLUSIVE

ENVIRONMENT


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Climate Change

- Climate Change is a **periodic modification of Earth's climate** brought about due to the **changes in the atmosphere** as well as the interactions between the atmosphere and various other **geological, chemical, biological and geographical factors** within the Earth's system.
- Climate change can **make weather patterns less predictable**. These unforeseen weather patterns can make it difficult to maintain and grow crops, making agriculture-dependent countries like India vulnerable.
- It is also causing damaging weather events like **more frequent and intense hurricanes, floods, cyclones, flooding etc.**
- The cause of the current rapid climate change is due to **human activities** and **threatening the very survival of humankind**.

1. Impacts of climate change

1. A rise in atmospheric temperature:

- The greenhouse gases released due to human activities are increasing the temperature of the Earth. **The last 6 years topped the list of hottest years ever recorded.**
- This has led to **increase in heat-related deaths** and illnesses, rise in sea levels and an increase in the intensity of natural disasters.
- Research estimates predict that **if the GHGs are not reduced, the average surface temperature could increase to 3-5°F by the end of this century.**

2. Change in landscapes:

- Increasing temperature and changing climate and weather patterns across the globe led to the **shift of trees and plants towards Polar Regions and mountains**. The animals that are dependent on them will be forced to follow them for survival. While some survive, many perish in the attempt.
- Other species like **polar bears dependent on cold terrains will not have any habitat** due to the melting of ice, causing a risk to their survival.
- It is **projected that by 2050, one-fourth of the Earth's species may become extinct if the current trend continues.**

3. Rising sea levels:

- The population living in under-lying areas, islands and coasts are threatened by the rising sea levels.
- It erodes shorelines, damages properties and **destroys ecosystems like mangroves and wetlands** that protect coasts from storms.
- **In the last 100 years, the sea level has risen to 4-8 inches and will continue to rise between 4 and 36 inches in the next 100 years.**

4. Ocean Acidification:

- The increase in the CO₂ concentration in the atmosphere has increased the CO₂ absorption in the ocean. This makes the ocean acidic.
- The increase in the acidification of the ocean can be **harmful to many marine species** like plankton, molluscs, etc. The **corals are especially susceptible** to this.

5. Increase in the risk of natural and manmade disasters:

- The moisture from land and water is rapidly evaporating due to the high atmospheric temperature. **This causes drought**, which may become more frequent and more severe. This may lead to **distressing consequences for agriculture, water security, and health.**
- Countries in Asia and Africa are already facing this phenomenon, with droughts becoming longer and more intense.

- The increased temperature is also increasing the cases of **forest fires** across the globe.
- Climate change is also causing increased and **intensified hurricanes and tropical storms**.

6. Health issues:

- The high temperature across the globe can pose health risks and deaths.
- The **increased heat waves** caused by climate change have led to the deaths of many globally.
- Climate change increases the **spreading of contagious diseases**.
- **The World Health Organisation estimates that between 2030 and 2050, climate change may cause approximately 250,000 additional deaths per year due to malnutrition, malaria, diarrhoea and extreme heat.**

For instance, in 2003, the extreme heat waves led to the death of more than 20,000 people in Europe and caused more than 1,500 deaths in India.

7. Economic impacts:

- It is estimated that if action is not taken to address the carbon emissions, **climate change could cost about 5 to 20% of the annual global GDP.**
- **In contrast, the cost to lessen the most damaging effects of climate change is just 1% of the GDP.**
- Climate change can alter shoreline habitats. This may lead to the need for **relocation of ports and near-shore infrastructures** and habitats, costing about millions of dollars.
- **Declining crop yields** can lead to a risk of starvation of thousands of people.
- Coral reefs generate approximately \$375 billion each year in goods and services. Their very survival is currently under threat.

8. Impact of Climate Change on Financial systems

- Climate change poses significant tail risks with catastrophic system-wide consequences to the stability of entire financial systems.

9. Agriculture productivity and food security:

- Agriculture has always been dependent on climate patterns. The current climate change has affected agricultural productivity, food supply and food security.
- These effects are biophysical, ecological and economic.

10. The burden of climate change on children born today

Key findings from study based on data from the Inter-sectoral Impact Model Intercomparison Project (ISIMIP):

- Children born today will be hit much harder by extreme climate events than today's adults.
- During his or her lifetime, a child born in 2021 is likely to experience on average twice as many wildfires, two to three times more droughts, almost three times more river floods and crop failures and about seven times more heat waves compared to a person who is, say, 60 years old today.

- **Central banks have emerged as important players in the prevention and mitigation of climate change-related impacts on the economy and financial system.**
- **The Network for Greening the Financial System (NGFS)**, an international coalition of central bankers formed in 2017 has emerged as a frontrunner in developing and propagating research on climate-related risks to firms and the financial system.
- In its recently released Financial Stability Report (FSR) 2021, RBI identified climate change as a major risk to financial stability.

Impact of fossil fuel extraction on global warming

According to a new study (published in the journal Nature), global fossil fuel extraction needs to go down to keep global warming to below **1.5 degrees Celsius, which is the target set by the 2015 Paris Climate Agreement.**

Why is there a need to limit the use of fossil fuels?

Global cost of air pollution from fossil fuels is high: It was around \$2.9 trillion per year, or \$8 billion per day, which was 3.3 per cent of the world's GDP at the time.

- India is estimated to bear a cost of \$150 billion from air pollution caused by fossil fuels.

Challenges ahead:

1. As of now, human activities have already caused global temperatures to rise by about 1 degree Celsius above pre-industrial levels (1950-1900).
2. Currently, countries' emissions targets are not in line with limiting global warming to under 1.5 degrees.

What is the goal set out by the Paris Climate Agreement?

The Paris Climate Agreement that was signed by 195 countries in 2015 has set out a goal to limit climate change in the coming decades.

- The agreement aims to slow the process of global warming by making efforts to **“hold the increase in the global average temperature to well below 2 degrees above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 degrees above pre-industrial levels”.**

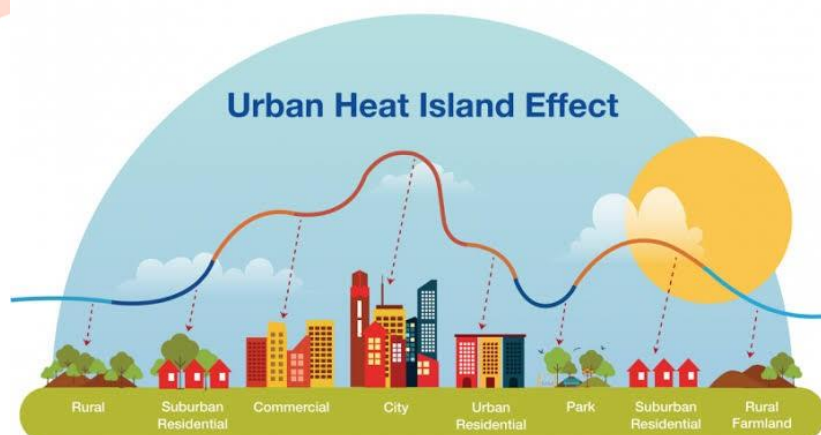
2. Urban Heat Island

Several sections of the country experienced extreme temperatures. Cities, in particular, were significantly hotter than rural places. The reason for this is a phenomenon known as – **“urban heat island effect”.**

What is an urban heat island?

It's a **localised and temporary phenomenon** that occurs when particular parts of a city receive more heat than the rest of the city on the same day.

- The differences are primarily due to heat being trapped within environments that resemble **concrete jungles.**
- The **temperature variation can range between 3 to 5 degrees Celsius.**



What are the Causes of Urban Heat Island?

- **Carbon-absorbing materials such as asphalt and concrete** are required for the constructing buildings in cities. They trap a lot of heat, which raises the average surface temperature of cities.
- **Many structures in urban areas have dark surfaces,** which reduce albedo and increase heat absorption.

- **Tall buildings, as well as the small streets that commonly accompany them**, obstruct air circulation, diminish wind speed, and hence reduce any natural cooling effects. The effect is known as **the Urban Canyon Effect**.
- **Use of fossil fuels** adds up to the heat effect.
- Reduced **tree cover and green areas**.

How can Urban Heat Islands be Reduced?

- Increase Area Under Green Cover.
- To reflect heat and prevent absorption, roofs and terraces should be painted white or with light colours.
- Kitchen gardening and terrace vegetation should be encouraged.

3. Impact of Sea Level Rise on India

- Sea level rise (SLR) is an increase in the level of the world's oceans due to the effects of global warming and other factors.
- According to IPCC report, destructive changes have already been set in motion.

IPCC report

- The report says that even with most optimistic emission reduction scenario, by the year 2050 many low-lying megacities and small island nations will experience extreme sea level events every year.
- The big four – **United States of America, China, India and European Union** will face most devastating fall out.

Alarming rate of sea level rise

- Sea levels have risen by between **180 to 200 mm since 1900**.
- Nearly **5-0.7%** of the world's land area is at a risk of episodic coastal flooding by 2100.
- By 2100, the global population potentially exposed to episodic coastal flooding will increase from 128-171 million to 176-287 million.

Consequences of sea-level rise

- **Loss of habitat**
 - Almost 3 billion people are living within 200 km of the coasts and islands all over the world.
 - A sea level rise will lead to **loss of habitation** and hence leads to **de-urbanization**.
 - **Indonesia** is shifting its capital from **Jakarta to a new city called 'Nusantara'**.
- **Agriculture**
 - SLR will affect agriculture mainly through **land submergence**, soil and fresh groundwater **resources salinisation**, and land loss.
 - It will impact production and food security.
- **Coastal fisheries and aquaculture**
 - Adverse impacts on habitats (e.g., coral reef degradation, reduced water quality in deltas and estuarine environments, soil salinisation, etc.
- **Impact on Small Island Nations**
 - Because of small islands' high coastline to land area ratio, most of their human settlements, agricultural lands, and critical infrastructure are at or near the coasts.

Impact on India

- As per study, Sea levels along the Indian coast are projected to rise between 3.5 inches to 34 inch (2.8 feet) by the end of century.
- India's coastal regions are **experiencing sea-level rise, erosion, and natural disasters such as tropical storms and cyclones**.

- In May 2020, the strongest storm recorded in decades in the Bay of Bengal—**Cyclone Amphan**—hit, forcing several million people to evacuate.
- **India lost 235 square kilometres of land to coastal erosion** between 1990 and 2016, placing people's livelihoods and homes in jeopardy.
- Sea level around **Asia in the North Indian Ocean has increased faster than global average**, with coastal area loss and **shoreline retreat**.
- Mega cities such as **Mumbai, Chennai, and Kolkata** are at high risk of **flooding and sea-level rise**.
- In such circumstances, forced migration and displacement would be inevitable.

Adaptation measures

- **Integrated coastal management**
 - It will help in resource management and addressing the complex management issues in the coastal area.
 - **Coastal Regulation Zone** notifications issued under Environmental Protection Act, 1986 will help in this integrated management.
- **Community ownership**
 - Policy makers should engage stakeholders in the early stages of decision-making to enhance overall resilience in coastal areas, while supporting community ownership.
- **Barriers to urban areas**
 - Rotterdam has offered a model to other cities seeking to combat flooding and land loss.
 - **Rotterdam has built barriers, drainage, and innovative architectural features such as a "water square" with temporary ponds.**
- **Adaptation to Sea Level Rise**
 - **Relocating utility infrastructure**, such as treatment plants to higher elevations would reduce risks from coastal flooding.
- **Limiting global warming**
 - More use of renewable energy can help reduce carbon emissions.
 - Nations must act fast to attain their NDC's and work on carbon sequestration.

Conclusion

- **The Paris Agreement** provides a clear vision on limiting climate change and thus, Sea level rise.
- Sea level rise is a slow disaster that will become magnanimous and all steps must be taken to ensure that such disasters are mitigated.

4. Infrastructure for Resilient Island States

This initiative has been launched by India for developing the infrastructure of small island nations vulnerable to climate change.

- The new initiative is the result of cooperation between India, the U.K. and Australia and included the participation of leaders of small island nations such as Fiji, Jamaica and Mauritius.

Need for:

- The last few decades have proved that no one is untouched by the wrath of climate change. Whether they are developed countries or countries rich in natural resources, this is a big threat to everyone. But, **Small Island Developing States (SIDS)** face the biggest threat from climate change.
- One-third of the entire population of SIDS lives on lands that are less than five metres below the sea level. This makes them highly vulnerable to sea-level rise, storm surge and coastal destruction.

- These countries contribute to only 1 per cent of global greenhouse gas emissions, and yet are among the first to experience the worst impacts of climate change.
- Agricultural production, fisheries, and related sectors are declining as the climate changes, threatening livelihoods and economic growth. In addition, extreme weather spawned by climate change is destroying SIDS land, real estate and infrastructure, with economically catastrophic effects.

5. Climate vulnerability index

Environmental think tank **Council on Energy, Environment and Water** has carried a **first-of-its-kind district-level climate vulnerability assessment, or Climate Vulnerability Index (CVI)**.

Findings of the climate vulnerability index:

- **Assam, Andhra Pradesh, Maharashtra, Karnataka and Bihar** are most vulnerable to extreme climate events such as floods, droughts and cyclones in India.
- More than 80 per cent Indians live in districts vulnerable to climate risks – that is 17 of 20 people in India are vulnerable to climate risks, out of which every five Indians live in areas that are extremely vulnerable.
- North-eastern states are more vulnerable to floods.

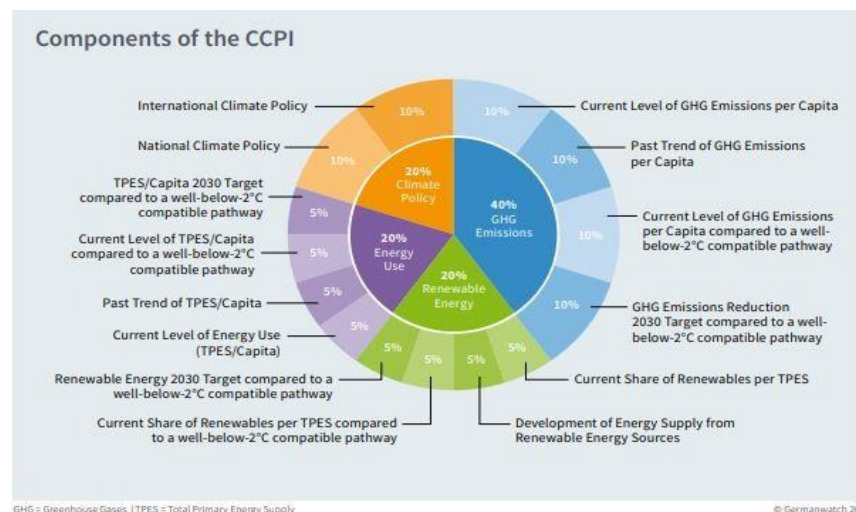
What are the recommendations that have been made?

1. Develop a high-resolution **Climate Risk Atlas (CRA)** to map critical vulnerabilities at the district level and better identify, assess, and project chronic and acute risks such as extreme climate events, heat and water stress, crop loss, vector-borne diseases and biodiversity collapse.
2. Establish a **centralised climate-risk commission** to coordinate the environmental de-risking mission.
3. Undertake **climate-sensitivity-led landscape restoration** focused on rehabilitating, restoring, and reintegrating natural ecosystems as part of the developmental process.
4. **Integrate climate risk profiling with infrastructure planning** to increase adaptive capacity.
5. Provide for **climate risk-interlinked adaptation financing** by creating innovative CVI-based financing instruments that integrate climate risks for an effective risk transfer mechanism.

6. Climate Change Performance Index

The **17th edition of the Climate Change Performance Index** was released.

- It is compiled by Germanwatch, the New Climate Institute, and the Climate Action Network.
- It monitors climate mitigation progress of 60 countries and the European Union.
- It aims to enhance transparency in international climate politics and enables the comparability of climate protection efforts and progress made by individual countries.



Performance of various countries in the latest index:

- **The first three ranks of the overall rankings were kept empty** because no country had performed well enough in all index categories to achieve an overall very high rating.
- **The first three ranks in the greenhouse gas emissions category, too, were kept empty.**
- In the overall rankings, India is at number 10 with a score of 69.22. It is a high performer except in the renewable energy category, in which it is ranked “medium”.
- The report says that **India is benefiting from its relatively low per-capita emissions.**

7. Groundswell report on climate change

The Report was recently released by the World Bank. It examined how the impacts of slow-onset climate change, such as water scarcity, decreasing crop productivity and rising sea levels, could lead to millions of what it describes as “**climate migrants**” by 2050.

The report provides a series of policy recommendations that can help slow the factors driving climate migration and prepare for expected migration flows, including:

1. Reducing global emissions and making every effort to meet the temperature goals of the Paris Agreement.
2. Embedding internal climate migration in far-sighted green, resilient, and inclusive development planning.
3. Preparing for each phase of migration, so that internal climate migration as an adaptation strategy can result in positive development outcomes.
4. Investing in better understanding of the drivers of internal climate migration to inform well-targeted policies.

Hotspots of internal climate migration will intensify in rural, urban, and coastal systems

People will migrate due to slow-onset climate change impacts—those included in the model are:



Water scarcity



Lower crop productivity



Sea level rise and storm surge

Some places may become less livable—factors examined include:



Heat stress



Extreme events



Land loss

People in the Middle East and Small Island Developing States (SIDS) will also be affected by climate-driven migration

8. India unveils its Arctic policy

Centre unveiled India’s Arctic Policy, with the aim of enhancing the country’s cooperation with the resource-rich and rapidly transforming region.

India’s Arctic Policy

The six pillars of the Policy are as follows:

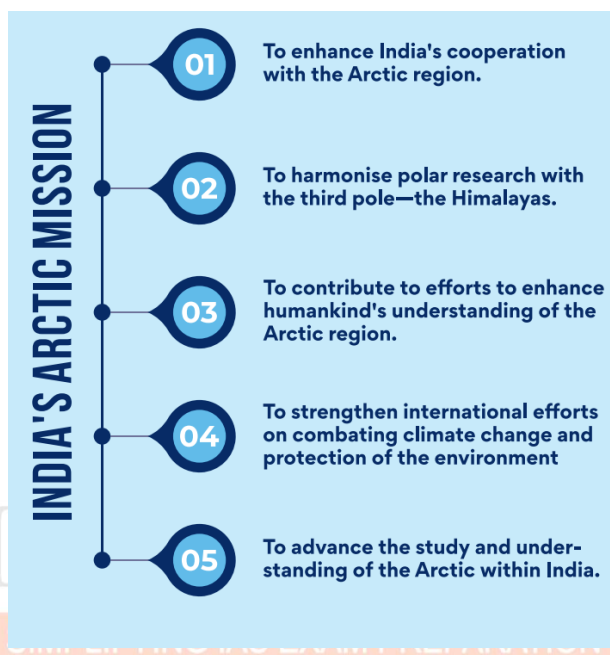
- Science and Research
- Economic and Human Development Cooperation
- Climate and Environmental Protection
- Transportation and Connectivity
- Governance and International Cooperation
- National Capacity Building

History of India's Arctic Research



On the whole, India's Arctic Policy is timely and is likely to provide a direction to India's policy-makers on contours of India's engagement with the region. **It is the first step towards developing a whole-of-government approach on India's engagement with the region.**

- The Policy is likely to have a **multiplier effect** towards a more synergised and focused scientific research including an enhanced understanding of linkages between monsoons and climate change in the Arctic, and between polar studies and the Himalayas.
- Thus, India's Arctic Policy is deftly dovetailed, enmeshed and in synergy with the broader policy framework of the Government of India



9. India's Stand at COP-26

The Government of India has articulated and put across the concerns of developing countries at the **26th session of the Conference of the Parties (COP26)** to the United Nations Framework Convention on Climate Change (UNFCCC).

Five Nectar Elements (Panchamrit):

India has presented the following five nectar elements (Panchamrit) of India's climate action:

1. Reach **500 GW Non-fossil energy capacity** by 2030.
2. **50 per cent of its energy requirements** from renewable energy by 2030.
3. **Reduction of total projected carbon emissions** by one billion tonnes from now to 2030.
4. **Reduction of the carbon intensity** of the economy by 45 per cent by 2030, over 2005 levels.
5. Achieving the **target of net zero emissions** by 2070.

Mantra of LIFE- Lifestyle:

The **mantra of LIFE- Lifestyle for Environment to combat climate change** was also shared in COP 26.

- It was stated that Lifestyle for Environment has to be taken forward as a campaign to make it a **mass movement of Environment Conscious Lifestyles.**
- The message conveyed by India was that the world needs mindful and deliberate utilization, instead of mindless and destructive consumption.

Net Zero:

India has also pledged to become a **'net zero' carbon emitter by 2070**, and announced enhanced targets for renewable energy deployment and reduction in carbon emissions.

India's concerns:

Over the next two to three decades, India's emissions are likely to grow at the fastest pace in the world, as it presses for higher growth to pull hundreds of millions of people out of poverty. No amount of afforestation or reforestation would be able to compensate for the increased emissions. Most of the carbon removal technologies right now are either unreliable or very expensive.

India's approach:

- As a part of its overall approach, India emphasized the foundational **principles of equity, and common but differentiated responsibilities and respective capabilities**.
- It also highlighted that **all countries should have equitable access to the global carbon budget**, a finite global resource, for keeping temperature increase within the limits set by the Paris Agreement.
- And, all countries must stay **within their fair share of this global carbon budget**, while using it responsibly.
- **Responsibility of the developed nations:** India also called on the developed countries for climate justice, and for undertaking rapid reductions in emissions during the current decade so as to reach net zero much earlier than their announced dates, as they have used more than their fair share of the depleting global carbon budget.

Challenges for India:

1. Achieving 'net zero' means deep and significant **cuts to fossil fuel use** that could affect the development trajectory of India and other developing countries.
2. For India to achieve a net-zero target by 2070, usage of coal especially for power generation would need to peak by 2040 and drop by 99% between 2040 and 2060.
3. And, the consumption of crude oil across sectors would also need to peak by 2050 and fall substantially by 90% between 2050 and 2070.

Measures required to address the existing challenges:

- Platforms must adopt a **'renewable first' approach**.
- **Creating synergies amongst the various institutions and other countries.** Ex: One Sun, One World, One Grid (OSOWOG), launched by India at CoP26, this would provide a lot of learning to connect energy grids across borders for renewable energy adoption under OSOWOG.
- **Decarbonize emission-intensive sectors.** Ex: Heavy industries like Iron and Steel.
- **An 'ecosystem-based' approach** in implementing policies. Ex: FAME India scheme.
- We need more **'carbon sinks'** – areas that store carbon, like forests, oceans and wetlands.
- **Inclusion of local people** in safeguarding environment.

Road to net zero | In 2015, over 190 countries committed to limiting global warming to 1.5°C above pre-industrial levels. Countries such as the U.K. and France have already enacted laws to achieve net zero target by 2050. This has put pressure on India, the third-largest emitter, which has not been in favour of committing to a deadline

- Net zero means committing to a year beyond which emissions will be balanced by taking an equivalent amount of greenhouse gases from the air
- India has maintained that committing to a target will require retiring coal plants and fossil fuel use overnight and even then, it will not guarantee that temperature rise stays below 1.5°C
- India says that future net zero promises are hollow as countries responsible for the climate crisis have not delivered on previous promises
- India argues that countries clamouring for net zero will continue to pollute on a per capita basis way beyond their fair share



The **European Union** has unveiled some of the world's most ambitious proposals, titled **"Fit for 55"**, to reduce carbon emissions and wean its 27 members off fossil fuels.

- These measures are a **EU's roadmap to achieve its target to reduce emissions by 55% by 2030, compared with 1990 levels.**

- **Ramping up sufficient resources towards climate adaptation.** Ex: The Climate Finance Leadership Initiative launched by India and the United Kingdom in September to generate more resources for climate and green energy projects is a positive step in this direction.

10. Sixth Assessment Report (AR6) of IPCC

The **Sixth Assessment Report (AR6)** of the United Nations Intergovernmental Panel on Climate Change (IPCC) is intended to assess scientific, technical, and socio-economic information concerning climate change.

- This report evaluates the physical science of climate change – looking at the past, present, and future climate.
- It reveals how human-caused emissions are altering our planet and what that means for our collective future.

The report identifies **India as one of the vulnerable hotspots, with several regions and important cities facing very high risk of climate disasters such as flooding, sea-level rise and heat-waves.**

Highlights of the report:

1. The report has, **for the first time, made an assessment of regional and sectoral impacts of climate change.**
2. **It has included risks to, and vulnerabilities of, mega-cities around the world.** For example, it has said Mumbai is at high risk of sea-level rise and flooding, while Ahmedabad faces serious danger of heat-waves.
3. The report found **that over the past decade, emissions have continued to rise.** Average annual global greenhouse gas emissions in the decade of 2010-19 were at their highest levels in human history.
4. Limiting global warming to around 1.5 degrees Celsius requires global GHG emissions to peak before 2025 at the latest, and be reduced by 43% by 2030.
5. **Pledges to Paris Agreement are Insufficient:** Current pledges made by countries who have signed the Paris Agreement are known as Nationally Determined Contributions (NDCs).
6. **Abysmal climate finance flows from developed countries** have affected energy transition in developing countries.

Impact on health:

For the first time, the IPCC report has looked at the health impacts of climate change.

- It has found that **climate change is increasing vector-borne and water-borne diseases** such as malaria or dengue, particularly in sub-tropical regions of Asia.
- It has also said **deaths** related to circulatory, respiratory, diabetic and infectious diseases, as well as infant mortality, are **likely to increase with a rise in temperature.**
- **Increasing frequency of extreme weather events** like heat waves, flooding and drought, and even air pollution was contributing to under-nutrition, allergic diseases and even mental disorders.

Need of the hour:

- **It is essential that all countries** – in particular the major economies – do their part during this critical decade of the 2020s to put the world on a trajectory to keep a 1.5 degrees Celsius limit on warming within reach.
- This is why the United States has committed to a **50-52 percent reduction in emissions from 2005 levels in 2030** and is marshaling the entire federal government to tackle the climate crisis.
- This report is a stark reminder that we must let science drive us to action.

- This moment requires world leaders, the private sector, and individuals to act together with urgency and do everything it takes to protect our planet and our future in this decade and beyond.

11. Carbon Pricing

Carbon pricing is an instrument that captures **the external costs of greenhouse gas (GHG) emissions and ties them to their sources** through a price usually in the form of a price on the carbon dioxide (CO₂) emitted.

- A price on carbon helps shift the burden for the damage from GHG emissions back to those who are responsible for it and who can avoid it.

Significance of Carbon Pricing:

1. Putting a price on carbon helps to **incorporate climate risks into the cost of doing business.**
2. **Emitting carbon becomes more expensive**, and consumers and producers seek ways to use technologies and products that generate less of it.
3. The market then operates as an **efficient means to cut emissions**, fostering a shift to a clean energy economy and driving innovation in low-carbon technologies.
4. Complementary renewable energy and energy efficiency policies are also critical to cost-effectively drive down emissions.

Issues related to Carbon Pricing:

- Big carbon polluters like fossil fuel companies, electric utilities, automakers, petrochemical companies, and other heavy industries, have used their structural power to receive policy exemptions.
- According to the World Bank, countries need policies between \$40 to \$80 per tonne to meet the Paris Agreement targets. Yet half of the world's carbon prices are less than \$10 per tonne.
- Some researchers suggested that it limits innovations. But there is no strong evidence that carbon pricing has rapidly induced the innovation we need in new, cleaner technologies.

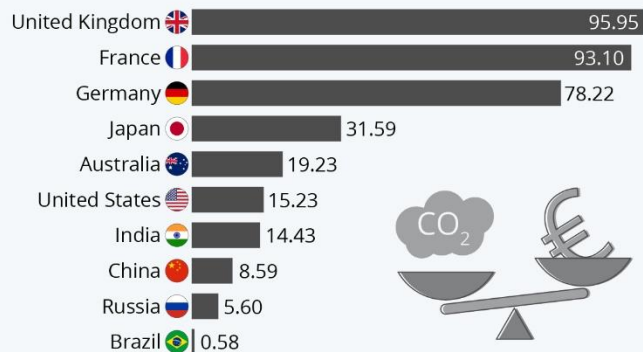
Pennsylvania has become the first major fossil fuel-producing state in the US to adopt a carbon pricing policy to address climate change.

The **International Air Transport Association (IATA)** 77th Annual General Meeting approved a resolution for the global air transport industry to achieve net-zero carbon emissions by 2050.

- This commitment will align with the Paris Agreement goal for global warming not to exceed 1.5°C.

How the World Puts a Price on Carbon

Average carbon prices in selected countries in 2021 (EUR per tonne of CO₂)



Based on taxes applicable on 1 April 2021. Source: OECD



12. Marine heatwaves

A marine heat wave is defined as a **coherent area of extreme warm sea surface temperature** that persists for days to months. Marine heatwaves **happen when sea temperatures are warmer than normal for an extended period**. MHWs have been observed in all major ocean basins over the recent decade.

Causes:

- The most common cause of marine heat waves are **ocean currents** which can build up areas of warm water and air-sea heat flux, or warming through the ocean surface from the atmosphere.

- **Weak winds:** Normally, sunlight passes through the atmosphere and heats the surface of the ocean. If there are weak winds this warm water doesn't mix with the cooler waters below. It sits on top and continues to heat leading to marine heat waves.

Impacts of rising marine heatwaves:

- **Affect ecosystem** structure, by supporting certain species and suppressing others.
- Can **change the habitat ranges of certain species**, such as the spiny sea urchin off southeastern Australia which has been expanding southward into Tasmania at the expense of kelp forests which it feeds upon.
- Can cause economic losses through impacts on fisheries and aquaculture.
- There is a link between marine heat waves and **harmful algal blooms**.

Marine heatwaves in Indian ocean:

According to a study, the **Western Indian Ocean region** experienced **the largest increase in marine heatwaves at a rate of about 1.5 events per decade**, followed by the north Bay of Bengal at a rate of 0.5 events per decade.

From 1982 to 2018, the Western Indian Ocean had a total of 66 events, while the Bay of Bengal had 94 events.

Factors affecting:

- The marine heatwaves in the Western Indian Ocean and the Bay of Bengal increased drying conditions over the central Indian subcontinent.
- Correspondingly, there is a significant increase in the rainfall over south peninsular India in response to the heatwaves in the north Bay of Bengal.

13. India, Russia blocked move to take climate change to UNSC

India and Russia have blocked a proposal that would have allowed **the UN Security Council to deliberate on climate-related issues**.

What's the issue?

The draft resolution, piloted by Ireland and Niger, sought to create a formal space in the Security Council for discussions on climate change and its implications on international security.

- It also asked that the UN Secretary-General provide periodic reports on how risks from climate change can be addressed to prevent conflicts.

What has India said?

India is second to none when it comes to climate action and climate justice. But UNSC is not the place to discuss either issue. In fact, an attempt to do so appears to be motivated by a desire to evade responsibility in the appropriate forum and divert the world's attention from an unwillingness to deliver where it counts.

Concerns over the proposal:

- Billing climate change as a threat to international security **diverts the council's attention from genuine, deep-rooted reasons of conflict** in the countries on the Council's agenda.
- Securitising climate change would be **largely convenient to countries that were actively helping engender conflicts or waged military activities in diversion from the Security Council's mandate** or simply don't want to provide the necessary help to developing countries.
- Action taken as part of the resolution can potentially range from sanctions on fossil-rich countries to UN military intervention in domestic conflicts perceived to have been caused by climate change.

What next?

The UN already has a specialized agency, the UNFCCC, for discussing all matters related to climate change.

- The parties to the UNFCCC — over 190 countries — meet several times every year, including at a two-week year-ending conference like the one at Glasgow, to work on a global approach to combat climate change.
- It is this process that has given rise to the Paris Agreement, and its predecessor the Kyoto Protocol, the international instrument that is designed to respond to the climate change crisis.

14. Clean, healthy and sustainable environment, a universal right

The United Nations Human Rights Council has unanimously voted for **recognising a clean, healthy and sustainable environment as a universal right** in Geneva, Switzerland.

Significance:

If recognised by all, the right would be the first of its kind in more than 70 years since **the Universal Declaration of Human Rights** was adopted by **the UN General Assembly in 1948**.

Need for recognition:

The resolution emphasises “the rights to life, liberty and security of human rights defenders working in environmental matters, referred to as **environmental human rights defenders**.”

- Environmental defenders across the globe are subject to constant physical attacks, detentions, arrests, legal action and smear campaigns.
- Some 200 environmental defenders have been murdered in 2020 alone.

Challenges ahead:

A human right to a safe, clean, healthy and sustainable environment has not been agreed in any human rights treaty and it is yet to emerge as a customary right.

- Recognising rights without due consideration and a common understanding at an international level of what they comprise creates ambiguity.
- Individuals cannot know what they can legitimately claim from the State, and the State has no clear understanding of the protection it is obliged to afford to the individual.
- Besides, **human rights resolutions are not legally binding instruments**, and as such the recognition of the right in this resolution does not bind States to its terms.

Expected outcomes of this recognition:

1. Stronger environmental laws and policies.
2. Improved implementation and enforcement.
3. Greater public participation in environmental decision-making.
4. Reduced environmental injustices.
5. A level playing field with social and economic rights.
6. And better environmental performance.

15. Nature-based solutions to Tackle Climate Change

- Nature-based solutions refer to a collection of actions and policies that harness the power of nature to protect and restore ecosystems.
- It involves **conserving, restoring or better managing ecosystems to remove carbon dioxide from the atmosphere**.
- **Forests** are probably the most well-known nature-based solution for climate change, but there are many more - including **peatlands, mangroves, wetlands, savannahs, coral reefs and other landscapes**.
- They were a key theme at COP26 summit.

Why is it important?

- Our planet is facing a **dual climate and biodiversity crisis**.
- Around a million animal and plant species are now threatened with extinction - more than ever before in human history.
- At the same time, the **climate emergency** threatens to expose millions of people to extreme heat waves and could leave a billion people affected by sea-level rise within decades.
- Nature-based solutions can **transform our energy, land, urban and industrial systems**.
- It is required to **protect and enhance biodiversity**.

Regenerative farming

- An essential example for nature-based solution is regenerative farming, which **works to harness the power of nature rather than depleting it**.
- **Regenerative farming improves soil health** – and healthy soil is the biggest carbon pool on the planet.
- A regenerative practice called **agroforestry** – not only increases carbon storage, but it also creates a protective canopy that helps to regulate temperature and humidity, boost biodiversity and improve productivity.

Progress of NbS in some countries

- **Argentina** launched the **Forest AR2030**. The initiative aimed to restore two million hectares of forested land.
- **China** has been aggressively pursuing the NbS since the 1998 mass flooding. They have **planted trees on a massive scale** to reduce the flood runoff and established the **sponge cities project** to develop better urban centres.
- **Italy** has developed an instrument through which local enterprises and firms can decrease their carbon footprint by paying for local afforestation and contributing to the community's environmental and social benefits.
- **The United States** is pursuing the agenda of NbS, which has also been included in **hazard mitigation plans**.

How Nature based Solutions can benefit India

- **India can potentially leverage these global practices and harness multiple benefits** by implementing NbS.
- Planting mangroves can play a crucial role in **climate-proofing India's coastal cities**.
- NbS can be an effective tool in **mitigating urban heat island problems**, urban flooding and poor air quality to develop resilient cities.
- Programmes such as GrowGreen, funded by the European Union or the Sponge City programme in China, have been exemplary examples of managing urban floods and addressing urban heat stress.

Concerns / Challenges

- **Finance** around nature-based solutions is still not adequate. Much more investment is needed to unlock the full potential of it.
- Much of the world still seems to favour **destruction for short term gains** over the longer-term benefits of sustainable management.
- There is **limited technical expertise** within governments to identify nature-based solutions targets in order to integrate them into development strategies.

Way Forward

- Promoting nature-based solutions and prioritizing actions that could have climate benefits.
- Need to **increase investment in high-quality nature-based solutions**.
- Advocating for **policy changes** and the increased inclusion of nature-based solutions for climate in national climate targets.

- **Global standards for nature-based solutions** like those developed by the IUCN are key to advancing a rigorous, consistent and accountable framework for implementation.
- **To ensure long-term resilience, projects involving nature-based solutions should adhere to four high-level principles.**
 - Nature-based solutions are not an alternative to decarbonization;
 - They need to involve a wide range of ecosystems;
 - They should be designed in partnership with local communities while respecting Indigenous and other rights; and
 - They must support biodiversity, from the level of the gene to the ecosystem.
- The world must invest now in nature-based solutions that are ecologically sound, socially equitable and designed to pay dividends over a century or more.

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Biodiversity

1. Changes to Biological Diversity Act, 2002

Government had, in December 2021, introduced the **Biological Diversity (Amendment) Bill, 2021** in Lok Sabha. The bill is in the final stages of consultations in **the Joint Parliamentary Committee**.

Concerns expressed over contentious provisions of the bill:

- **Exemption given to AYUSH practitioners** from the provisions of the law. This exemption could open the law for abuse.
- **Distinction** has been made in the law **between cultivated biodiversity and forest-based biodiversity**.
- The appointment of sixteen ex-officio officers of the Government of India dilutes the authority of **the National Biodiversity Authority (NBA)**.
- **NBA approval is required only at the time of commercialisation of a patent** and not at the time of application for a patent.

Highlights of the Bill:

- It seeks to **reduce the pressure on wild medicinal plants** by encouraging the cultivation of medicinal plants.
- The Bill also facilitates **fast-tracking of research, simplify the patent application process, decriminalises certain offences**.
- It brings more **foreign investments** in biological resources, research, patent and commercial utilisation, without compromising the national interest.
- It focuses on **regulating who can access biological resources and knowledge and how access will be monitored**.

Why is the Biodiversity Act 2002 being amended?

- People from AYUSH medicine urged the government to simplify, streamline and reduce the compliance burden to provide for a conducive environment for collaborative research and investments.
- They also sought to simplify the patent application process, widen the scope of access and **benefit-sharing** with local communities.

Why are environmentalists opposed to this bill?

- The main focus of the bill is **to facilitate trade in biodiversity** as opposed to conservation, protection of biodiversity and knowledge of the local communities.
- The bill has been introduced **without seeking public comments** as required under **the pre-legislative consultative policy**.
- The bill has **excluded the term Bio-utilization** which is an important element in the Act. Leaving out bio utilization would leave out an array of activities like characterization, incentivisation and bioassay which are undertaken with commercial motive.
- The bill also **exempts cultivated medicinal plants from the purview of the Act** but it is practically impossible to detect which plants are cultivated and which are from the wild.

What is the Biological Diversity Act, 2002?

- Enacted for the conservation of biological diversity and **fair, equitable sharing of the monetary benefits** from the commercial use of biological resources and **traditional knowledge**.
- The main intent of this legislation is to protect India's rich biodiversity and associated knowledge against their use by foreign individuals.

- It seeks to check **biopiracy**, protect biological diversity and local growers through a three-tier structure of central and state boards and local committees.
- The Act provides for setting up of a **National Biodiversity Authority (NBA), State Biodiversity Boards (SBBs) and Biodiversity Management Committees (BMCs) in local bodies.**
- The NBA will enjoy the power of a civil court.

2. Wild Life (Protection) Amendment Bill, 2021

The **Wild Life (Protection) Amendment Bill, 2021** referred to the Standing Committee on Science and Tech-nology, Environment, Forests and Climate Change.

Need for:

Section 43 of the Wildlife (Protection) Act, 1972 states that no person having in his possession captive animal, animal article, trophy or uncured trophy in respect of which he has a certificate of ownership shall transfer by way of sale or offer for sale or by any other mode of consideration of commercial nature, such animal or article or trophy or uncured trophy.

- The amended Bill introduces an exemption clause for elephants.

Other issues wrt Bill highlighted by the standing committee:

- The Standing Committee pointed out that a number of species is missing in all the three Schedules.
- The committee also finds species that should be in Schedule I but have been placed in Schedule II.
- There are species missing altogether both in Schedules I and II as well as in Schedule III.
- The Bill also fails to address “human-animal conflict”, the committee noted.

Highlights of the Wild Life (Protection) Amendment Bill, 2021:

The proposed amendment is likely the most expansive so far in scope: it **covers more areas of legislation, from trade in wild species to permitting filmmaking in protected areas and controlling the spread of invasive species.**

Positives:

- The Bill increases **penalties for wildlife crimes.** For example, offences that attracted a fine of Rs 25,000 now attract Rs 1 lakh.
- There’s a **new and separate chapter on regulating species** involved in international trade according to **the CITES treaty.**
- The Bill **prohibits possessing, trading and breeding species without prior permissions from CITES authorities.**
- The Bill also **recognises threats that invasive alien species pose.**

What's missing in the bill? What are the concerns?

The Bill doesn’t include regional invasive species – some of which may be native to the country but invasive in some parts.

The amendment Bill has **no separate Schedule for species the Act classifies as ‘vermin’**, so the Centre can directly notify such species and open them up to be hunted – including some of the species currently in Schedule II.

The Bill also proposes changes to the Schedules. Foremost, it reduces the number of Schedules from six to four, to “rationalise” the lists. But the two main substitute Schedules that will specify the protected species are incomplete.

The Bill will render the existing **‘State Boards for Wildlife’** defunct by replacing it them with set up a **‘Standing Committee’ of the State Board of Wildlife** – headed by the respective state forest minister and 10 members nominated by the minister.

- The State Boards of Wildlife currently manage the conservation and protection of wildlife at the state level. The state chief minister sits atop the board and is supported by 20+ members,

including of the state legislature, NGOs, conservationists and representatives of the state forest departments and tribal welfare.

Under the proposed amendments, **the commercial sale and purchase of elephants will no longer be prohibited under the Act.** This clause is prone to abuse and can severely impact elephant populations by legitimising live trade of elephants.

In 1972, Parliament enacted the Wild Life Act (Protection) Act:

The Wild Life Act provides for:

- state wildlife advisory boards,
- regulations for hunting wild animals and birds
- establishment of sanctuaries and national parks
- regulations for trade in wild animals, animal products and trophies
- judicially imposed penalties for violating the Act
- Harming endangered species listed in Schedule I of the Act is prohibited throughout India.
- Hunting species, like those requiring special protection (Schedule II), big game (Schedule III), and small game (Schedule IV), is regulated through licensing.
- A few species classified as vermin (Schedule V), may be hunted without restrictions.
- Wildlife wardens and their staff administer the act.
- An amendment to the Act in 1982, introduced a provision permitting the capture and transportation of wild animals for the scientific management of the animal population.

Constitution of Various Bodies:

The WPA act provides for the constitution of bodies to be established under this act such as **the National and State Board for Wildlife, Central Zoo Authority and National Tiger Conservation Authority.**

Constitutional Provisions for Wildlife:

- **The 42nd Amendment Act, 1976,** Forests and Protection of Wild Animals and Birds was transferred from State to Concurrent List.
- **Article 51 A (g) of the Constitution** states that it shall be the fundamental duty of every citizen to protect and improve the natural environment including forests and Wildlife.
- **Article 48 A in the Directive Principles of State policy,** mandates that the State shall endeavor to protect and improve the environment and to safeguard the forests and wildlife of the country.

3. Invasive species

Senna spectabilis is an invasive species found mostly in the forest areas of **the Nilgiri Biosphere Reserve (NBR).**

- The dearth of effective steps to arrest the rampant growth of these invasive plants is a matter of serious concern to the conservation of wildlife habitats of the Western Ghats.

Concerns:

1. The invasive species has now **spread through the most iconic wildlife habitats of the Western Ghats,** destroying habitats of elephants, deer, gaur and tigers by pushing out native flora.
2. **The allelopathic traits** of the species prevent other plants from growing under it. Allelopathy is a biological phenomenon by which an organism produces one or more biochemicals that influence the germination, growth, survival, and reproduction of other organisms.
3. **This drastically affects primary productivity at the ground level.** The forest floor is almost bare under the invasive species. Grasses and herbs get completely wiped out and herbivores are deprived of their forage.
4. **The carrying capacity of forests** to feed wildlife is drastically declining under the invasion, which accelerates man-animal conflict further.

Efforts to remove them:

The Kerala Forest Department attempted to remove the trees by uprooting, girdling, cutting, chopping the tree branches, and even testing the application of chemicals. However, all the efforts were in vain. Instead, multiple coppice shoots started growing from each cut tree stump. The situation is similar in the Karnataka and Tamil Nadu.

What are invasive species?

Invasive alien species are plants, animals, pathogens and other organisms that are non-native to an ecosystem, and which may cause economic or environmental harm or adversely affect human health.

- In particular, they impact adversely upon biodiversity, including decline or elimination of native species – through competition, predation, or transmission of pathogens – and the disruption of local ecosystems and ecosystem functions.

The impacts of invasive species include:

1. Reduced biodiversity.
2. Decreased availability and quality of key natural resources.
3. Water shortages.
4. Increased frequency of wildfires and flooding.
5. Pollution caused by overuse of chemicals to control infestations.

Efforts in this regard:

1. **Convention on Biological Diversity (CBD)** recognize that there is an urgent need to address the impact of invasive species.
2. **Aichi Biodiversity Target 9** and one clause of **UN Sustainable Development Goal 15 – Life on Land** specifically address the issue.
3. **The IUCN SSC Invasive Species Specialist Group (ISSG)** aim to reduce threats to ecosystems and their native species by increasing awareness of ways to prevent, control or eradicate IAS.
4. **IUCN has developed knowledge platforms:**
5. The Global Invasive Species Database (GISD) and the Global Register of Introduced and Invasive Species (GRIIS).

4. Sundarbans threatened by human activities

As per the latest findings, continuous loss of biodiversity is observed across the shorelines of settlement zones in Indian **Sundarbans**.

Issues and challenges:

1. Small patches of mangroves are being lost gradually and quietly due to their indiscriminate destruction for either coastal development or short-term gains.
2. These patches are observed to be enriched habitats of several rare and threatened flora and fauna.
3. The continued loss of shoreline mangrove ecosystems has created fragmented and fragile mangrove habitats for rare taxa and framed barriers to their movement and dispersal.
4. This irreversible loss of biodiversity is often neglected, which could never be compensated with any 'cut the established and plant the new' theory.

What can be done?

The Sunderbans are affected due to the polluted discharges from shrimp ponds. So, instead of popularising shrimp farming, if more indigenous fishing activities were encouraged, coastal threatened biodiversity could be protected and at the same time livelihood options may be provided to the coastal dwellers.

5. Central Asian flyway

Every winter, the birds make their way to India through the **central Asian flyway**, which covers a large continental area of Europe–Asia between the Arctic and the Indian Oceans.

What is migration? Why is it significant?

Migration is an adaptation mechanism to help birds overcome weather adversities and unavailability of food in colder regions.

- The importance of bird migrations on the health of the ecosystems is well-established.
- Saving migratory birds means saving **the wetlands, terrestrial habitats and saving of an ecosystem**, benefiting communities dependent on wetlands.

A HOST TO 370 AVIAN VARIETIES

370 species of migratory birds visit Indian sub-continent

310 species of them use wetlands as habitats

Remaining species are landbirds, inhabiting dispersed terrestrial areas

There are nine flyways in the world
(A flyway is a geographical region within which a single or a group of migratory species completes its annual cycle - breeding, moulting, staging and non-breeding)

Northernmost grounds - **Russia (Siberia)**

INDIA FALLS WITHIN CENTRAL ASIAN FLYWAY (CAF)

CAF encompasses overlapping migration route over 30 countries

Southernmost grounds - **South Asia and the Maldives**

Challenges faced by migratory birds:

1. Accelerated habitat loss globally during the last decade.
2. Decreased area under water bodies, wetlands, natural grasslands and forests.

Increased weather variability, and climate change have resulted in loss of biodiversity for the migratory birds.

Central Asian Flyway

One of 9 key flight paths (flyways) taken by migratory water birds

30 countries
From breeding grounds in Siberia to wintering places across West and South Asia, waterbodies offer stopovers for lakhs of birds

622 water bodies in Karnataka
Lack of comprehensive surveys to monitor species and their populations have left gaps in data

Regional importance
Experts say conservation of water bodies should be prioritised not just for international migratory birds but for local bird populations as well

— Central Asian Flyway • Community Reserve • Conservation Reserve • Non-Protected Area
• National Park • Reserve Forest • Tiger Reserve • Wild Sanctuary

Air Pollution

1. WHO Air Pollution Guidelines

- The latest air-quality guidelines released by the World Health Organization (WHO) show **air pollutants are harmful at much lower levels than believed so far.**
- The new guidelines reflect an overwhelming scientific consensus that **countries need to more aggressively limit air pollution** and protect everyone's health.

New air quality guidelines

- The new air quality guidelines are the WHO's first update since 2005.
- The WHO has recommended minimum air-quality standards for six kinds of hazards. These include particulate matter (PM), ozone, nitrogen dioxide, sulphur dioxide and carbon monoxide.
- **The exposure levels considered safe for all pollutants have been lowered.**
- For PM2.5, for example, we should risk no more than 15 micrograms per cubic metre within a 24-hour period, on average, down from 25 earlier.
- For PM10, no more than 45 micrograms, down from 50.

Air Pollution and its effects

- **Air pollution is the world's fourth leading cause of death**, contributing to about 13 premature deaths every minute.
- The gases and tiny particles can travel deep into the lungs, enter bloodstream and damage the cells.
- Air pollution levels that seem low are now linked to dangerous health outcomes such as low birth weight, respiratory problems, heart disease and Alzheimer's disease.
- **Exposure to even very low levels of air pollution** is associated with premature death, and that there does not seem to be a safe exposure level.
- Over 90% of people worldwide are exposed to levels of PM2.5 that exceed even the old WHO guidelines.
- In some places, like India, the yearly average PM2.5 concentration is nearly 12 times higher than the new WHO levels.

Concerns / Challenges

- **No country has legal air quality standards that meet the new WHO recommendations.**
- Not everyone is equally protected by the existing air quality laws.
- Globally and locally, the people who bear the greatest burden of exposure to air pollution are generally those producing the least amount of air pollution.
- In the United States, the people and places most exposed to air pollution in the 1980s are still the most exposed today.

Way Forward

- Reducing the drivers of air pollution can help fight another global crisis – climate change.
- Countries can improve their air quality by moving to cleaner sources of energy and cutting out fossil fuels.
- Electric vehicles can help reduce traffic-related air pollution.
- **Investing in more equitable air pollution monitoring networks that capture real-time air quality levels can help recognize risks.**
- Policymakers worldwide can use the new **evidence-based recommendations** to develop and enforce air quality policies.
- The new WHO air quality guidelines could help governments set limits on average air pollution exposure that better protect everyone's health.

2. World Air Quality Report 2021

The **2021 World Air Quality Report** was released, the report presented an overview of the state of global air quality in 2021.

Performance of India:

- New Delhi continues to be the world's most polluted capital city for the fourth consecutive year.
- As per the report, in 2021, India was home to 11 of the 15 most polluted cities in Central and also in South Asia.

Concerns associated with air pollution:

- Air pollution is now considered to be the world's largest environmental health threat, accounting for seven million deaths around the world every year.
- Air pollution causes and aggravates many diseases, ranging from asthma to cancer, lung illnesses and heart disease.
- The estimated daily economic cost of air pollution has been figured at \$8 billion (USD), or 3 to 4 per cent of the gross world product.

What can governments do?

- Decrease air pollution emissions.
- Pass legislation to incentivize the use of clean air vehicles for personal and industrial use.
- Invest in renewable energy sources.
- Provide financial incentives, such as trade-in programs, to limit the use of internal combustion engines.
- Provide subsidies to encourage the use of battery and human-powered transportation methods.
- Expand public transportation and power with clean and renewable energy sources.

3. Ethanol blend in petrol

The Union Cabinet has approved amendments to the National Policy on Biofuels, 2018.

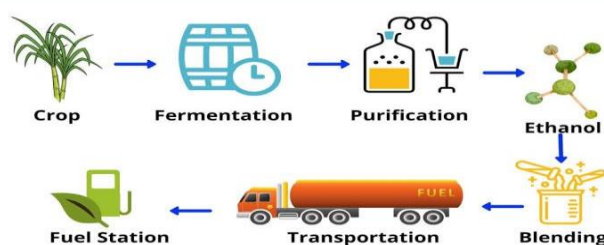
As per the amendments:

- The deadline for fuel firms to raise the ratio of ethanol in gasoline to 20% will be 2025.
- From April 1, 2023, the policy of introducing 20% ethanol will take effect.

Benefits of 20% ethanol

blending (According to NITI Aayog report):

- Saving ₹30,000 crore of foreign exchange per year.
- Increased energy security.
- Lowered carbon emissions.
- Better air quality.
- Self-reliance.
- Better use of damaged foodgrains.
- Increased farmers' incomes and greater investment opportunities.



Aiming for an eco boost

Oil industry experts have allayed fears over mixing ethanol with petrol and say it cannot damage engines

- Ethanol is a bio-fuel obtained primarily from sugarcane. Blending of ethanol with petrol reduces dependence on fossil fuel and helps the environment

- The government had set a target of 10% of ethanol per litre of petrol

- Ethanol is blended through a separate pumping and metering mechanism

- Once blended, ethanol cannot be separated from petrol

Since ethanol can absorb moisture from the atmosphere, dealers say it can cause issues with vehicle engines



Ethanol blending - India's journey so far:

- As of March 13, 2022, India had attained a **9.45 percent ethanol blend**. By the conclusion of the fiscal year 2022, this is expected to touch 10%.

Challenges:

- **A 10% blend** does not necessitate major engine changes, but a 20% blend may necessitate certain changes and may even raise vehicle prices.
- **More blending might imply** more land being diverted for water-intensive crops like sugarcane, which the government presently subsidises.
- **An ethanol demand of 10.16 billion litres by 2025:** This will require six million tonnes of sugar and 16.5 million tonnes of grains per annum by 2025.
- **The increased allocation of land** also puts into question the actual reduction in emissions that blending ethanol with petrol brings about.

What is ethanol?

- It is the **organic compound Ethyl Alcohol** which is produced from biomass. It is also an ingredient in alcoholic beverages.
- It has a **higher-octane number** than gasoline, hence improves the petrol octane number.
- **Since ethanol contains oxygen**, it is supposed to help in complete combustion of fuel, resulting in lower emissions.

4. NHRC flags pollution effect on human rights

- A **latest Lancet Commission report on Pollution and Health** has highlighted the impact of increasing pollution on human health in India.
- Following this, **the National Human Rights Commission (NHRC)** has issued **an advisory to the Centre and State Governments** on preventing, minimising and mitigating the impacts of environmental pollution and degradation on **human rights**.

India specific findings:

- Air pollution was responsible for 16.7 lakh deaths in India in 2019, or 17.8% of all deaths in the country that year.
- This is **the largest number of air-pollution-related deaths of any country**.
- **Pollution sources associated with extreme poverty (such as indoor air pollution and water pollution):** This number has reduced; but, this reduction is offset by **increased deaths attributable to industrial pollution** (such as ambient air pollution and chemical pollution).
- **Worst affected places:** Air pollution is most severe in **the Indo-Gangetic Plain**. This area contains New Delhi and many of the most polluted cities.
- **Causes:** Burning of biomass in households was the single largest cause of air pollution deaths in India, followed by coal combustion and crop burning.
- **Economic losses due to modern forms of pollution** have increased as a proportion of GDP between 2000 and 2019 in India. It amounts to 1 percent of GDP.

Efforts by India to combat air Pollution:**India has launched:**

- Pradhan Mantri Ujjwala Yojana programme.
- Q National Clean Air Programme.
- In 2019, a Commission for Air Quality Management in the National Capital Region.

Challenges ahead:

- India's air pollution control initiatives are not guided by a **centralised administrative organisation**.
- The general quality of the air has improved very **gradually and unevenly**.

5. Endosulfan victims case

The **Supreme Court** has slammed the Kerala government for State's inaction in providing relief to the **Endosulfan pesticide exposure victims**.

What is endosulfan?

It is a widely-banned pesticide with hazardous effects on human genetic and endocrine systems.

- It **does not occur naturally in the environment**.
- It is listed under the **Rotterdam Convention on the Prior Informed Consent**.
- Use of endosulfan is banned by **Stockholm Convention on Persistent Organic Pollutants**.

The **Supreme Court in India** has banned the manufacture, sale, use, and export of endosulfan throughout the country, citing its harmful health effects in 2011.

Uses:

Sprayed on crops like cotton, cashew, fruits, tea, paddy, tobacco etc. for control of pests in agriculture such as whiteflies, aphids, beetles, worms etc.

Effects on humans:

- This pesticide is a known carcinogen, neurotoxin and genotoxin (damages DNA).
- Endosulfan blocks the inhibitory receptors of the CNS, disrupts the ionic channels and destroys the integrity of the nerve cells.

Environmental effects:

- Endosulfan in the environment gets accumulated in food chains leading to higher doses causing problems.
- If Endosulfan is released to water, it is expected to absorb to the sediment and may bioconcentrate in aquatic organisms.

What is Kerala's case?

From the mid-70s, Kerala villages used aerial spraying of endosulfan on 4,600-ha. cashew nut plantation. Locals reportedly experienced illnesses, palsies and deformities.

6. Fly Ash

Popularly known as **Flue ash or pulverised fuel ash**, it is a coal combustion product.

Composition:

Composed of the **particulates that are driven out of coal-fired boilers together with the flue gases**.

- Depending upon the source and composition of the coal being burned, the components of fly ash vary considerably, but **all fly ash includes substantial amounts of silicon dioxide (SiO₂), aluminium oxide (Al₂O₃) and calcium oxide (CaO), the main mineral compounds in coal-bearing rock strata**.
- **Minor constituents include:** arsenic, beryllium, boron, cadmium, chromium, hexavalent chromium, cobalt, lead, manganese, mercury, molybdenum, selenium, strontium, thallium, and vanadium, along with very small concentrations of dioxins and PAH compounds. It also has unburnt carbon.

Health and environmental hazards:

- **Toxic heavy metals present:** All the heavy metals found in fly ash nickel, cadmium, arsenic, chromium, lead, etc—are toxic in nature. They are minute, poisonous particles accumulate in the respiratory tract, and cause gradual poisoning.
- **Radiation:** For an equal amount of electricity generated, fly ash contains a hundred times more radiation than nuclear waste secured via dry cask or water storage.

- **Water pollution:** The breaching of ash dykes and consequent ash spills occur frequently in India, polluting a large number of water bodies.
- **Effects on environment:** The destruction of mangroves, drastic reduction in crop yields, and the pollution of groundwater in the Rann of Kutch from the ash sludge of adjoining Coal power plants has been well documented.

However, fly ash can be used in the following ways:

1. Concrete production, as a substitute material for Portland cement, sand.
2. Fly-ash pellets which can replace normal aggregate in concrete mixture.
3. Embankments and other structural fills.
4. Cement clinker production – (as a substitute material for clay).
5. Stabilization of soft soils.
6. Road subbase construction.
7. As aggregate substitute material (e.g. for brick production).
8. Agricultural uses: soil amendment, fertilizer, cattle feeders, soil stabilization in stock feed yards, and agricultural stakes.
9. Loose application on rivers to melt ice.
10. Loose application on roads and parking lots for ice control.

7. Feasibility of a blanket ban on firecrackers

The Supreme Court had said **a blanket ban on firecrackers may not be possible.**

What has the Supreme Court said?

1. Strengthen the mechanism to stop misuse.
2. Measures ought to be in place to prevent the use of toxic chemicals in firecrackers.
3. Chief Secretaries, top administrative and police officials would be held personally liable if banned varieties of firecrackers were found to be used in any of the States (Supreme Court's 29th October order).

Recent observations made by the Supreme Court on the use of firecrackers:

- The Supreme Court said it cannot infringe the right to life of other citizens "under the guise of employment of few" while considering a ban on firecrackers.
- Have to strike a balance between employment, unemployment and right to life.

What is the issue?

- One study in Milan, Italy, quantified the increase in the levels of several elements in the air in one hour as 120 times for Strontium, 22 times for Magnesium, 12 times for Barium, 11 times for Potassium and six times for Copper.
- The Central Pollution Control Board conducted a study in Delhi in 2016, and found that the levels of Aluminium, Barium, Potassium, Sulphur, Iron and Strontium rose sharply on Deepavali night, from low to extremely high.
- Similar episodic spikes have been recorded in China and the U.K. Pollution from firecrackers affects the health of people and animals, and aggravates the already poor ambient air quality in Indian cities.

This has resulted in litigation calling for a total ban on firecrackers, and court orders to restrict the type of chemicals used as well as their volume. Many crackers also violate legal limits on sound.

Can green crackers make a difference?

The Council of Scientific and Industrial Research, through its National Environmental Engineering Research Institute (CSIR-NEERI), Nagpur, has come out with firecrackers that have "reduced emission light and sound" and 30% less particulate matter using Potassium Nitrate as oxidant.

- These crackers are named **Safe Water Releaser**, which minimises Potassium Nitrate and Sulphur use, but matches the sound intensity of conventional crackers, Safe Minimal Aluminium, where **Aluminium use is low and Safe Thermite Crackers with low Sulphur and Potassium Nitrate**.

Need of the hour:

While deciding on a ban on firecrackers, it is imperative to take into account the fundamental right of livelihood of firecracker manufacturers and the right to health of over 1.3 billion people of the country.

8. Stubble Burning

A study was conducted recently in six villages of Patiala, Punjab on Stubble Burning and impacts on health.

Key findings of the study:

1. Pollution from stubble burning significantly reduced lung function and was particularly harmful to rural women.
2. The concentrations of PM2.5, the category of unburnt carbon particles considered most harmful to respiratory health, was found to increase more than twice between the two phases, from 100 g/m3 to 250 g/m3.
3. During the crop residue burning period, a two to three-fold increase was noted in most of the respiratory symptoms including wheezing, breathlessness on exertion, cough in morning, cough at night, skin rashes, runny nose or itchiness of eyes etc. across all age groups (10-60 years).

Why farmers opt for stubble burning?

1. They do not have alternatives for utilising them effectively.
2. The farmers are ill-equipped to deal with waste because they cannot afford the new technology that is available to handle the waste material.
3. With less income due to crop damage, farmers are likely to be inclined to light up their fields to cut costs and not spend on scientific ways of stubble management.

Advantages of stubble burning:

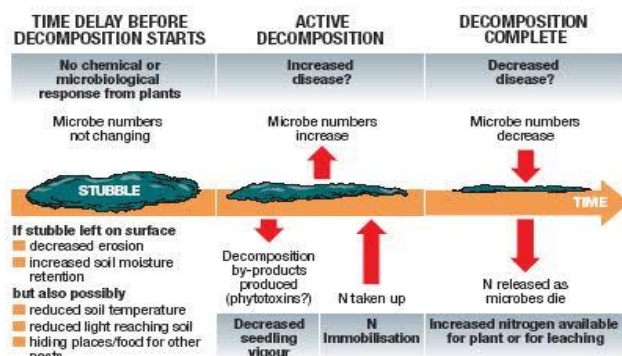
- It quickly clears the field and is the cheapest alternative.
- Kills weeds, including those resistant to herbicide.
- Kills slugs and other pests.
- Can reduce nitrogen tie-up.

Effects of Stubble Burning:

- **Pollution:** Open stubble burning emits large amounts of toxic pollutants in the atmosphere which contain harmful gases like methane (CH4), Carbon Monoxide (CO), Volatile organic compound (VOC) and carcinogenic polycyclic aromatic hydrocarbons. They may eventually cause smog.
- **Soil Fertility:** Burning husk on ground destroys the nutrients in the soil, making it less fertile.
- **Heat Penetration:** Heat generated by stubble burning penetrates into the soil, leading to the loss of moisture and useful microbes.

Alternative solutions that can avoid Stubble Burning:

1. Promote paddy straw-based power plants. It will also create employment opportunities.
2. Incorporation of crop residues in the soil can improve soil moisture and help activate the growth of soil microorganisms for better plant growth.



3. Convert the removed residues into enriched organic manure through composting.
4. New opportunities for industrial use such as extraction of yeast protein can be explored through scientific research.

What needs to be done- Supreme Court’s observations?

1. Incentives could be provided to those who are not burning the stubble and disincentives for those who continue the practice.
2. The existing Minimum Support Price (MSP) Scheme must be so interpreted as to enable the States concerned to wholly or partly deny the benefit of MSP to those who continue to burn the crop residue.

Chhattisgarh Model:

An innovative experiment has been undertaken by the Chhattisgarh government by setting up **gauthans**.

- A gauthan is a dedicated five-acre plot, held in common by each village, where all the unused stubble is collected through parali daan (people’s donations) and is converted into organic fertiliser by mixing with cow dung and few natural enzymes.
- The scheme also generates employment among rural youth.
- The government supports the transportation of parali from the farm to the nearest gauthan.
- The state has successfully developed 2,000 gauthans.

Bio-decomposer to tackle stubble burning

The Delhi government sees the bio-decomposer as a **solution to stubble burning** and has been urging other States to adopt this method. The government first sprayed it in 2020 and claimed that the results were positive.

Punjab Government has proposed to **use the paddy crop residue as fodder for animals, especially cattle.**

How were these bio-decomposers formed?

Pusa Decomposer is a mix of seven fungi that produce enzymes to **digest cellulose, lignin and pectin in paddy straw**.

- The fungi thrive at 30-32 degree Celsius, which is the temperature prevailing when paddy is harvested and wheat is sown.

Benefits of PUSA decomposers:

1. Improves the fertility and productivity of the soil as the stubble works as manure and compost for the crops and lesser fertiliser consumption is required in the future.
2. It is an efficient and effective, cheaper, doable and practical technique to stop stubble burning.
3. It is an eco-friendly and environmentally useful technology.

9. Global Methane Pledge

The Global Methane Pledge was **launched at the UN COP26 climate conference in Glasgow**.

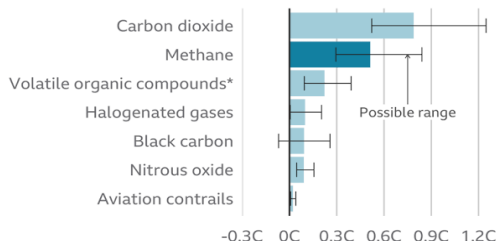
- It is an effort led jointly by the **United States and the European Union**.

Need for limiting the methane emissions:

- Methane is **the second-most abundant greenhouse gas in the atmosphere, after carbon dioxide**, and, therefore, pledges related to cutting down its emissions are significant.

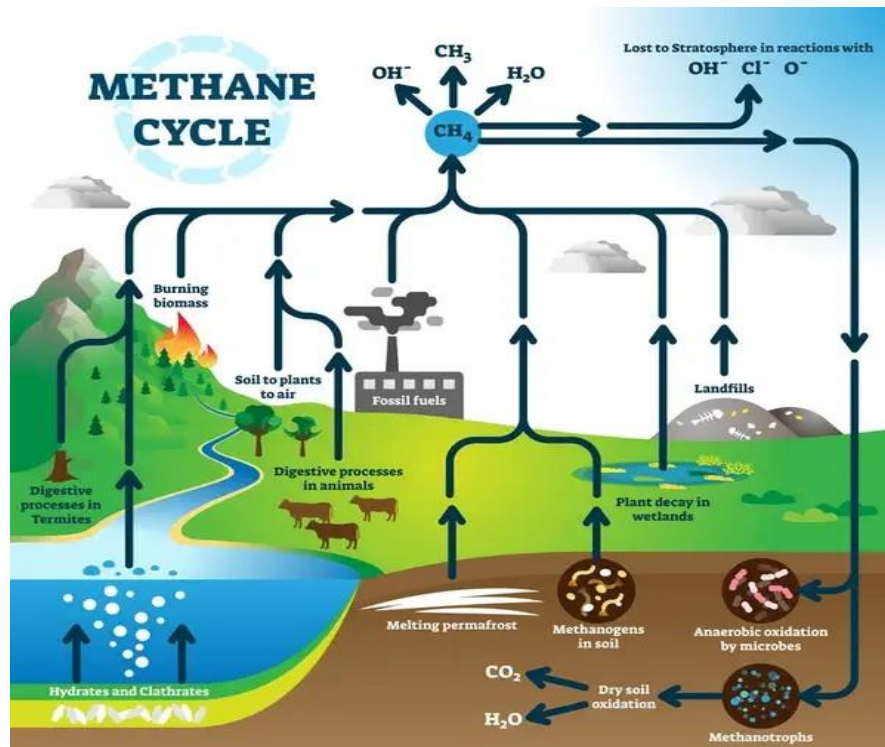
Methane is a major contributor to global warming

Contribution to warming in degrees Celsius



Figures are for contributions to 2010-2019 warming relative to 1850-1900
*Volatile organic compounds and carbon monoxide

- According to the latest Intergovernmental Panel on Climate Change report, **methane accounts for about half of the 1.0 degrees Celsius net rise in global average temperature since the pre-industrial era.**
- Rapidly reducing methane emissions is complementary to action on carbon dioxide and other greenhouse gases, and is regarded as the single most effective strategy to reduce global warming in the near term and keep the goal of limiting warming to 1.5 degrees Celsius within reach.



Sources of human-caused methane emissions:

- Most human-caused methane emissions came from three sectors: Fossil fuels, waste and agriculture.
- Oil and gas extraction, processing and distribution accounted for 23 per cent of methane emissions in the fossil fuel sector. Coal mining accounted for 12 per cent of emissions.
- Landfills and wastewater made up about 20 per cent of emissions in the waste sector. In the agricultural sector, livestock emissions from manure and enteric fermentation constituted for roughly 32 per cent and rice cultivation eight per cent of emissions.

TROPOSPHERIC OZONE (O₃)

Tropospheric ozone is a powerful greenhouse gas and air pollutant that is harmful to human health, agricultural crops and ecosystems.

SOURCES Tropospheric ozone does not have any direct emissions sources, rather it is formed when sunlight interacts with different pollutants.

LIFETIME IN ATMOSPHERE: WEEKS
Reducing the pollutants that form tropospheric ozone would generate rapid benefits for the climate and human health.

STRATOSPHERE
In the stratosphere, ozone protects the Earth from the sun's ultraviolet radiation.

TROPOSPHERE
At lower levels, ozone is a greenhouse gas and air pollutant that is the main ingredient of smog.

IMPACTS

- CLIMATE**
Contributes to global warming
- HEALTH**
Causes 1+ million pollution-related deaths every year and millions more chronic diseases
- AGRICULTURE & ECOSYSTEMS**
 - Toxic to many plants
 - Causes up to 15% in annual yield losses of soy, wheat, rice and maize

The world's land ecosystems capture and store about 30% of CO₂ emissions every year.

Tropospheric ozone damages plants and their ability to sequester CO₂, which doubles its climate impact.

Chemicals forming O₃: SUNLIGHT + METHANE (CH₄) + CARBON MONOXIDE (CO) + NON-METHANE VOLATILE ORGANIC COMPOUNDS (NMVOC) + NITROGEN OXIDES (NO_x)

Mitigation potential varied between countries and regions:

- Europe had the greatest potential to curb methane emissions from farming, fossil fuel operations and waste management.
- India had the greatest potential to reduce methane emissions in the waste sector. China's mitigation potential was best in coal production and livestock, while Africa's was in livestock, followed by oil and gas.
- The fossil fuel industry had the greatest potential for low-cost methane cuts.

Suggestions:

1. Human-caused methane emissions must be cut by 45 per cent to avoid the worst effects of climate change.
2. Such a cut would prevent a rise in global warming by up to 0.3 degrees Celsius by 2045.
3. It would also prevent 260,000 premature deaths, 775,000 asthma-related hospital visits annually, as well as 25 million tonnes of crop losses.

Three behavioural changes — reducing food waste and loss, improving livestock management and adopting healthy diets (vegetarian or with a lower meat and dairy content) — **could reduce methane emissions by 65–80 million tonnes per year over the next few decades.**

10. National Mission on use of Biomass in coal based thermal power plants

Commission for Air Quality Management recently reviewed the progress of **Biomass Co-firing.**

- Though some progress has been made towards co-firing, the CAQM finds the progress not up to the desired levels.

Background:

In May 2021, to address the issue of air pollution due to farm stubble burning and to reduce carbon footprints of thermal power generation, **Ministry of Power** decided to set up a **National Mission on use of Biomass in coal based thermal power plants.**

What is Biomass Cofiring?

It refers to the concurrent blending and combustion of biomass materials with other fuels such as natural gas and coal within a boiler, which reduce the use of fossil fuels for energy generation and emissions without significantly increasing costs and infrastructure investments.

Benefits of Cofiring:

1. Biomass cofiring is a promising technology to decrease the use of fossil fuels for energy generation and hence mitigate greenhouse gas emissions.
2. Coal and biomass cofiring accounts for the relevant advantages of a relative ease of implementation and an effective reduction of CO₂ and other pollutant (SO_x, NO_x) emissions to the atmosphere.
3. Cofiring biomass with coal may record no loss in total boiler efficiency after adjusting combustion output for the new fuel mixture.

11. Why does India need a transition strategy away from fossil fuel

To counter the rising oil prices and ensure sustainability, India needs a transition strategy away from fossil fuels.

Why India needs to look out for alternatives?

- India will depend on imports for 85% of oil and half its fuel needs. It can elevate oil manufacturing by 20% by higher managing present fields however, for extra, it needs main discoveries, which have not come by in a very long time.

Therefore, India must search options reminiscent of electrical, photo voltaic, fuel or biogas to exchange LPG.

What's the main concern now?

The **United Nations Environment Programme's (UNEP) latest Production Gap Report** has revealed that **15 of the top fossil fuel producing countries, including India, are not prepared to meet the requirements of the 2015 Paris Climate Agreement.**

- Paris Agreement seeks to keep global warming “well below 2 degrees” above pre-industrial levels.

What needs to be done?

In order for the world to meet the Paris Agreement goals, “global coal, oil, and gas production (and consumption) have to start declining immediately to be consistent with limiting warming to 1.5°C.”

Challenges ahead for India:

India doesn't have a federal level policy on scaling down production of fossil fuels, or ensuring a just transition into renewable energy.

Why is there a need to limit the use of fossil fuels?

Global cost of air pollution from fossil fuels is high: It was around \$2.9 trillion per year, or \$8 billion per day, which was 3.3 per cent of the world's GDP at the time.

- India is estimated to bear a cost of \$150 billion from air pollution caused by fossil fuels.

Overall Challenges ahead:

1. As of now, human activities have already caused global temperatures to rise by about 1 degree Celsius above pre-industrial levels (1950-1900).
2. Currently, countries' emissions targets are not in line with limiting global warming to under 1.5 degrees.

Need of the hour for India:

1. Reduce emphasis on domestic exploration.
2. Increase productivity of producing fields.
3. Increase strategic reserves.
4. Restructure and reorganize public sector petroleum companies.
5. Avoid siloed thinking.

12. Lessons from China's Pollution Control**Similarities between Beijing and Delhi**

- The **population size** of both cities, Beijing and Delhi, is comparable.
- Delhi also shares with Beijing the **different stages in dealing with urban air pollution.**
- It starts with **targeting primary pollutants** (SO₂, NO₂, PM₁₀, and CO), with the Government playing the main role.
- Later, **secondary pollutants**, or particulate matter leading to smog, primarily PM_{2.5}, **become the main focus** for control with a regional coordination mechanism.

Lessons from Beijing

- The UN Environment Programme's review of Beijing's control of air pollution provides useful lessons for policymakers.
- Beijing focuses on providing **early warning** to effectively reduce the level of pollution under adverse weather conditions.
- In case of forecasted heavy pollution, **warnings are issued at least 24 hours in advance** through the media.
- It uses **high-resolution satellite remote sensing and laser radar** for quality monitoring.
- Over 1,000 **PM_{2.5} sensors** throughout the city will accurately identify high-emission areas.

Approach to urbanisation

- Beijing did not shut down polluting units, not restrict car ownership and travel, and did not improve fuel standards.
- Smart cities such as New York, London and Beijing provide **more space for public transport** and **mixed land use spatial planning** minimising travel.
- Beijing's 7th Ring Road to ease congestion is 1,000 kilometres long, and even before buildings came up, the metro link was operational.
- Beijing already has more than 550 km of metro, more than one-and-half times that of the Delhi Metro.
- **In China, 72% of travel is completed by public transport** compared with 37% in Japan, 17% in Europe and 10% in the U.S.

Vehicle policy

- Particulate matter is the most difficult to control, it leads to smog and serious health issues, and is largely caused by vehicle emissions.
- Systematic study on **PM2.5 source apportionment** in Beijing has found that vehicle emissions were nearly half the main source.
- **Phasing out older vehicles** made the most significant contribution.
- Beijing plans to have 48 lakh charging points by 2022 to push the use of electric vehicles.
- Delhi has nearly two times the number of registered vehicles than Beijing, which is increasing at a faster pace.

Other Innovative Steps

- **Local regulation** controlled the total emission amount leading to upgrading the industrial production processes.
- **Economic incentives** were tailored to the specific problem, with **subsidies to high-polluting enterprises to close their production**.
- **Differentiated fees** were charged **according to the concentration of waste gas emissions** for those who chose to remain in production.
- Enforcement at the municipal and State levels is coordinated.
- **Independent evaluations** review the air quality management system, analyse new challenges, and provide recommendations for enabling further improvement in air quality.

13. Flex Fuel Vehicles

An FFV is a modified version of vehicles that could **run both on gasoline and doped petrol with different levels of ethanol blends**.

- FFVs will allow vehicles to use all the blends and also run on unblended fuel.
- FFVs have compatible engines to run on more than 84 percent ethanol blended petrol.
- FFVs are aimed at reducing the use of polluting fossil fuels and cutting down harmful emissions.
- For India, FFVs will present a different advantage as they will allow vehicles to use different blends of ethanol mixed petrol available in different parts of the country.
- Also, these vehicles are a logical extension of the Ethanol Blended Petrol (EBP) programme launched by the Union Ministry of Petroleum and Natural Gas in January 2003.

Renewable Energy

What Is Renewable Energy?

- Renewable energy, often referred to as clean energy, comes from natural sources or processes that are constantly replenished. For example, sunlight or wind keep shining and blowing, even if their availability depends on time and weather.
- **India ranks 3rd in renewable energy country attractive index in 2021.**
- India's installed renewable energy capacity has increased 286% in the last 7.5 years and stands at more than 151.4 Giga Watts (including large Hydro), which is about 39 per cent of the country's total capacity (as on 31st December 2021).
- India has achieved its NDC target with total non-fossil based installed energy capacity of 158.17 GW which is 40.2% of the total installed electricity capacity.
- **Up to 100% FDI is allowed under the automatic route for renewable energy generation and distribution projects subject to provisions of The Electricity Act, 2003.**
- **The following is the break up of total installed capacity for Renewables, as of 31 December 2021:**
 - Wind power: 40.08 GW
 - Solar Power: 49.34 GW
 - BioPower: 10.61 GW
 - Small Hydro Power: 4.83 GW
 - Large Hydro: 46.51 GW
- Government of India has set targets to reduce India's total projected carbon emission by 1 billion tonnes by 2030, reduce the carbon intensity of the nation's economy by less than 45% by the end of the decade, **achieve net-zero carbon emissions by 2070 and expand India's renewable energy installed capacity to 500 GW by 2030.**
- The Union Cabinet chaired by the Prime Minister has given its approval to introduce the **Production-Linked Incentive (PLI) Scheme in High Efficiency Solar PV Modules** for Enhancing India's Manufacturing Capabilities and Enhancing Exports – Atmanirbhar Bharat.

1. Why Renewable Energy

- **Sustainable:** Energy generated from renewable sources will be cleaner and greener and more sustainable.
- **Employment opportunities:** Inclusion of a newer technology simply means more employment opportunities for the working population of the country.
- **Market assurance:** From the economy point of view, renewable sources provide the market and revenue assurance which no other resources can provide.
- **Power supply:** Providing 24*7 power supply to 100% of the households, sustainable form of transports are some of the goals that can only be achieved through sustainable power that comes from renewables.

2. India's Renewable Energy Challenge

Social Cost

- Shift to renewable energy would leave the conventional plants under-utilised, lower than maximum technically feasible limit.
- Investments made in these plants would be deemed as sunken cost due to revenue loss.
- Banking sector which has extended loans to Coal plants would come under stress.
- Opportunity cost of land used for solar power plant. It requires 5-6 acres per 1 MW as per Ministry of New and Renewable energy.
- Those employed in coal plants risk losing their jobs.

Hidden Costs / Challenges**Sunlight**

- a) Sunlight is available only during the day. Photovoltaics (PV) delivers electricity only when the sun shines.
- b) The peak demand in India is during the evening when solar energy (unless stored) is not available.

Plant Load Factor

- a) The highest PLF (Plant Load Factor) for solar power plants is considered to be only about 20 percent, and many rooftops give less.
- b) Load factor is a measure of the output of a power plant compared to the maximum output it could produce.

Solar panels

- a) Solar panels require much more space to generate the same amount of power as fossil fuel or nuclear power generators.
- b) Additional worries include concerns on panel quality/lifespan, and whether costs will continue to fall.
- c) There are issues relating to maintenance of solar panels, especially in the context of dust and pollution.
- d) The quality of solar panels manufactured on mass scale is already causing problems.

Rooftop Solar

- a) Rooftop solar is far behind schedule to meet the 40GW goal.
- b) Small deployments cost more than grid-scale farms.

Hydro power

- a) Hydro power generation is a good complement and India has enormous potential. However this potential has not been tapped on account of environmental considerations.
- b) India even lags behind in deployment of pumped hydro capacity, the most proven and cost-effective large-scale storage technology.
- c) Some dams cause significant climate impacts through the emissions of methane from the decomposition of biomass in reservoirs.
- d) Other dams cause serious ecological problems through habitat destruction.
- e) They can also block the migration of aquatic species and reduce sediment flow and nutrient transport, which affects floodplains and deltas.

Wind Power

- a) Wind is also seasonal, especially in coastal regions.
- b) Turbines might cause noise and aesthetic pollution.
- c) Birds have been killed by flying into spinning turbine blades

Bio Energy

- a) Biomass power becomes more favourable to ecosystems only when used with carbon capture and storage.

Way Forward

- Strong financial measures are required to finance the solar projects.
- Innovative steps like green bonds, institutional loans and clean energy fund can play a crucial role.
- Promotion of research and development in renewable energy sector, especially in storage technology.
- Along with prioritizing designing microgrids, public policy attention is needed for developing battery technologies at scale for local applications.
- India needs a Solar Waste Management and Manufacturing Standards Policy.
- India's bid to play a leadership role in setting up a World Solar Bank is laudable. It could galvanize domestic efforts and give the country a global voice in the push for a clean planet.

3. Solar Energy in India

- Solar energy has emerged as India's most practical and environment friendly alternative for meeting all of its energy needs.
- **Due to the country's geographical position and topography, solar power has a significant potential in the country.**
- India has showed its interest to become lead member of the **World Solar Bank (WSB)**, a multilateral lender proposed by the International Solar Alliance (ISA).
- Setting up the WSB will add heft to India's credentials as a clean energy champion

Present Status

- The **installed capacity of solar energy in India has witnessed 18 times increase between 2014 and 2021.**
- As a result, India's current share of non-fossil sources based installed capacity of electricity generation is more than 40 per cent.
- India is currently ramping up the manufacturing of solar panels and cells.
- India imports close to 90% of its solar cells and module requirements. 80% of this is from China.
- The Union government announced the **production-linked incentive scheme for solar photovoltaic panels manufacturing** in India.

India's Role

- The establishment of International Solar Alliance (ISA) initiated by India, is the first international treaty-based organization headquartered in India.
- Under '**One sun One World One Grid**', India seeks to replicate its global solar leadership by encouraging the phased development of a single globally connected solar electricity grid to leverage the multiple benefits (Low cost, Zero pollution) of solar energy.
- India has pledged to mobilize more than US \$ 1000 billion of investments needed by 2030 for massive deployment of solar energy.
- **India's Bhadla Solar Park** is the largest solar power park in the world, which contribute to an operational capacity of 2245MW.
- India expects to reach 450 GW of renewable energy capacity by 2030, with solar energy accounting for around 280 GW.

Challenges

- India's solar energy development is largely built over imported products.
- India is facing challenge to balance Prioritising domestic goals and WTO commitments.
- India is dependent on Chinese imports for solar equipment, such as solar cells, panels, etc.
- The dumping of products is leading to profit erosion of local manufacturers.
- Land availability in India for solar plant is less due to high population density.
- China's strong manufacturing base is giving stiff challenge to domestic manufacturer.
- India's solar waste is estimated to be around 1.8 million by 2050, which needs to be tackled.
- There is little fiscal space for large public investment in renewables, while private investment in renewables at scale is just starting.
- The willingness of developed countries to make available adequate low-cost finance and required technologies remains uncertain.

Way Forward

- **Strong financial measures** are required to finance the solar projects.
- Innovative steps like green bonds, institutional loans and clean energy fund can play a crucial role.
- Promotion of research and development in renewable energy sector, especially in storage technology.

- Along with prioritizing designing microgrids, public policy attention is needed for developing battery technologies at scale for local applications.
- India needs a **Solar Waste Management and Manufacturing Standards Policy**.

Conclusion

- India's bid to play a leadership role in setting up a World Solar Bank is laudable.
- It could galvanize domestic efforts and give the country a global voice in the push for a clean planet.

4. Impact of Solar Energy on Ecology

Examining India's solar ambitions from an ecological standpoint

- India's solar energy ambition requires closer examination, particularly from an ecological standpoint.
- **The generation of gigawatts of solar power requires vast stretches of open lands with year-round sunshine.**
- Over half of India's terrain is sunny and semi-arid which are too dry to support forests with a continuous canopy.
- These **Open Natural Ecosystems (ONEs)**, are diverse, ranging from woodland savannas, scrublands and grasslands, to rocky outcrops, ravines and dunes.
- ONEs also have a remarkable assemblage of animal species and they also provide valuable ecological services.
- Research shows that under certain environmental conditions, ONEs can sequester more carbon than if trees were planted on them.
- ONEs also support grazing-based livelihoods of millions of pastoralist and agro-pastoralist communities across the country.
- Successive governments have carried forward a colonial legacy of terming ONEs as 'wastelands' and sought to make them 'productive'.
- Unlike with forests, there are no conservation laws that protect against diversion of biodiversity-rich ONEs.
- Renewable energy technologies — are heavily reliant on open spaces.
- The great Indian bustard, is being displaced by these projects and killed in collisions with overhead power lines.
- In Kutch, communities displaced from their traditional grazing lands by renewable energy projects have been protesting these projects.

Alternative solution to grid-scale solar

- An alternative solution to grid-scale solar on **Open Natural Ecosystems (ONEs)** lies in **roof-top solar installations**.
- There are places that have already been designated for industrial purposes — where largescale production of solar is possible.
- Maharashtra Industrial Development Corporation has a land bank of over 2.5 lakh acres. If even 20% of this area was used for solar power generation, it would generate nearly 16-gigawatt hour/year.
- Given that these industrial zones are major consumers of power, such **localised generation and utilisation will cut transmission losses**.
- **Rooftops of public buildings** can also offer an opportunity for solar installations, as has been done with railway stations in some cities.
- Another alternative involves the use of **agrivoltaics on degraded agricultural lands**.
- Deploying solar panels in a manner that allows for cultivation below them has dual benefits.
- The shade from the solar panels reduces evapo-transpiration and saves water, and the panels benefit from increased efficiency due to the cooling effect from the plants below them.

- There is 11 million hectares of degraded agricultural lands in the semi-arid and sub-humid regions of India.
- If such areas were used for agrovoltatics, it could potentially transform the rural economy of these regions.

5. Rooftop solar scheme

The Ministry of New & Renewable Energy has allowed households to get rooftop solar panels installed by themselves or by any vendor of their choice and a photograph of the installed system for distribution utility is sufficient to avail benefits or subsidy under the **Rooftop solar scheme**.

Benefits of rooftop solar:

- An alternative source of electricity to that provided by the grid.
- **Environmental benefits:** It reduces the dependence on fossil-fuel generated electricity.
- **Ability to provide electricity to those areas that are not yet connected to the grid** — remote locations and areas where the terrain makes it difficult to set up power stations and lay power lines.

What is the potential for rooftop solar in India?

The Ministry of New and Renewable Energy has pegged the market potential for rooftop solar at 124 GW.

Challenges associated:

- **Variability in supply** because of variations in efficiency of the solar panels and sunlight.
- Additional cost for **storage facilities**.
- **Residential areas also come with the associated issues of use restrictions of the roof** — if the roof is being used for solar generation, then it cannot be used for anything else.
- The **subsidised tariffs** charged to residential customers undermine **the economic viability of installing rooftop solar panels**.

6. India's Role

- The establishment of **International Solar Alliance (ISA)** initiated by India, is the first international treaty-based organization headquartered in India.
- Under '**One sun One World One Grid**', India seeks to replicate its global solar leadership by encouraging the phased development of a single globally connected solar electricity grid to leverage the multiple benefits (Low cost, Zero pollution) of solar energy.
- India has pledged to mobilize more than US \$ 1000 billion of investments needed by 2030 for massive deployment of solar energy.
- **India's Bhadla Solar Park** is the largest solar power park in the world, which contribute to an operational capacity of 2245MW.

7. Offshore wind energy

- Offshore wind energy refers to the deployment of wind farms inside the water bodies. They utilise the sea winds to generate electricity.



India's Potential

- **India can generate 127 GW of offshore wind energy with its 7,600 km of coastline**, according to the MNRE.
- The total wind energy potential is 302 GW at a 100-meter hub height, according to the National Institute of Wind Energy (NIWE).

- 36 GW of offshore wind energy potential exists off the coast of Gujarat and nearly 35 GW exists off the Tamil Nadu coast.

Offshore Wind Energy: Benefits

- In India, where land is limited and the population is increasing, large wind farms positioned over water bodies will be vital.
- It is proven that **offshore wind turbines are more efficient** compared to onshore ones.
- **Wind speed over water bodies is high** and is consistent in direction. As a result, offshore wind farms generate more electricity per installed capacity.
- **Fewer offshore turbines are required** to produce the same capacity of energy as compared to onshore ones.
- As the **offshore wind is stronger during the daytime**, it ensures a more consistent and efficient electricity generation when consumer demand is at its highest.
- Offshore wind farms have a **higher capacity utilisation factor (CUF)** than onshore wind farms. Therefore, offshore wind power allows for longer operating hours.

Challenges of offshore wind energy

- Local substructure manufacturers, installations vessels and trained workers are lacking in India.
- Offshore wind turbines require stronger structures and foundations than onshore wind farms. This can cause **higher installation costs**.
- Offshore wind tariffs in India are expected to range between Rs 7-9 per unit, compared to Rs 2.8-2.9 per unit for onshore wind.
- Distribution companies (DISCOMS) in India are loss-making and unable to build infrastructure to help transition to renewable energy sources.
- The action of waves and even high winds, particularly during **storms or hurricanes, can damage wind turbines**.
- Offshore wind farms require **maintenance** that is more costly and difficult to perform.

Way Forward

- Ministry of New and Renewable Energy can set specific wind **Renewable purchase obligation (RPO)** targets for each state just like it does for solar.
- If excise duties and GST could be waived for wind farm components, early project development will be more affordable.
- Discoms can adopt **feed-in tariff (FIT) regulations** and make offshore wind power procurement mandatory. A feed-in tariff is a policy tool designed to promote investment in renewable energy sources.
- A **long-term contract and price guarantee** reduces the inherent risk in renewable energy production, encouraging investment and development.
- Discoms can ensure **priority payments for offshore wind projects**.
- The underwater power evacuation and subsea substations could be developed by the Power Grid Corporation of India Ltd. This would reduce the risk faced by offshore wind farm developers.

8. Green Hydrogen

- Hydrogen when produced by electrolysis using renewable energy is known as Green Hydrogen which has no carbon footprint.
- India can become a hub for green hydrogen as the country has an inherent advantage in the form of abundant renewable energy.

Indian Oil Corporation (IOC), Larsen & Toubro (L&T), and ReNew Power (ReNew) have signed a binding term sheet to set up a Joint Venture (JV) company to develop the green hydrogen sector in India.

- The Joint Venture will aim to supply green hydrogen at an **“industrial scale”**.

- **India, being a tropical country, has a significant edge in green hydrogen production** due to its favourable geographical conditions and abundant natural resources.
- Therefore, at the recently held World Economic Forum in Davos, Switzerland, India said it will emerge as the leader of green hydrogen by taking advantage of the current energy crisis across the globe.

Efforts in this regard:

- The Centre has released **draft guidelines on the National Hydrogen Mission** which aims to increase production to 5 million metric tonnes (MMT) by 2030 to meet about 40 percent of domestic requirements.
- The centre is considering a proposal to introduce a Rs 15,000-crore **Production Linked Incentive (PLI) scheme for electrolysers**.
- Recently the centre notified a green hydrogen and green ammonia policy that offers 25 years of free power for any new renewable energy plants set up for green hydrogen production before July 2025.
- The government is also planning to introduce mandates requiring that the oil refining, fertiliser and steel sectors procure green hydrogen for a certain proportion of their requirements.

Significance of Green Hydrogen:

- Green hydrogen energy is vital for India to **meet its Nationally Determined Contribution (INDC) Targets** and ensure regional and national energy security, access and availability.
- Green Hydrogen can act as an energy storage option, which would be essential to meet intermittencies (of renewable energy) in the future.
- In terms of mobility, for long distance mobilisations for either urban freight movement within cities and states or for passengers, Green Hydrogen can be used in railways, large ships, buses or trucks, etc.

SIMPLIFYING IAS EXAM PREPARATION

Benefits:

- It is a clean-burning molecule, which can decarbonize a range of sectors including iron and steel, chemicals, and transportation.
- Renewable energy that cannot be stored or used by the grid can be channelled to produce hydrogen.

Tapping Green Hydrogen

- As of now, 75% of India's energy demand is met by coal and oil, which is expected to increase.
- Therefore, **green hydrogen must be tapped to tackle the dependence on fossil fuel**.
- Hydrogen generated through renewable energy sources is called green hydrogen.
- **Green hydrogen is a crucial weapon in India's arsenal to fight climate change**.
- It improves the long-term energy storage capabilities of renewable energy.
- It is also the most promising solution to decarbonise sectors like cement, steel, and refineries.
- It is thus an essential solution to reach the 1.5°C climate scenario.

Transition towards green hydrogen

- Several major economies are adopting legislation to catalyse global efforts towards transitions to green hydrogen.
- More than 30 countries have hydrogen road maps and over 200 large-scale hydrogen projects across the value chain.
- **Governments worldwide have committed to more than \$70 billion in public funding, according to Hydrogen Council, to develop a hydrogen economy.**

- With its abundant and cheap solar energy, India has the upper hand to tap into these investments and lead global efforts in transitioning to green hydrogen.

Scaling up the use of green hydrogen

- Nearly 70% of the investments required to produce green hydrogen through electrolysis goes into generating renewable energy.
- With India's solar capacity increasing nearly 3,000 times in less than a decade, it gives India a unique head start in scaling up the use of green hydrogen.
- India can reduce its carbon emissions and annual import bills by developing a value chain for hydrogen from its diverse applications.

Concerns / Challenges

- According to a study, **hydrogen affects the pipelines it travels in** and appliances that use it.
- **Hydrogen embrittlement** can weaken metal or polyethylene pipes and increase leakage risks, particularly in high-pressure pipes.
- Hydrogen embrittlement is a situation when the pipeline becomes brittle due to diffusion of hydrogen into the material.

Way Forward

- Government funding and long-term policies that attract private investments are essential to boost green hydrogen.
- Hydrogen's cross-sectoral capabilities should be exploited.
- A few key sectors with low transition costs, such as refineries, fertilizers and natural gas, should be mandated to use hydrogen.
- Shipping, aviation and energy storage should be mandated to use green hydrogen in the long run.
- **Enforcing time-bound mid- and long-term policies would inspire the private sector to invest more in green hydrogen.**
- India should aim to produce 4-6 million tonnes of green hydrogen per annum by the end of the decade and export at least 2 million tonnes per annum.

Forest, Deforestation and Desertification

1. International Day of Forests

Observed on: 21st March every year since 2012.

The organizers are the United Nations Forum on Forests and the Food and Agriculture Organization of the United Nations (FAO), in collaboration with Governments, **the Collaborative Partnership on Forests** and other relevant organizations in the field.

Background:

The occasion was established, and the date fixed, on November 28, 2012, by a resolution of **the United Nations General Assembly (UNGA)**. The aim behind observing the International Day of Forests is to 'celebrate and raise awareness of the importance of all types of forests.'

Theme 2022:

- "Forests and sustainable production and consumption".

Did you know?

- Forests are home to about 80% of the world's terrestrial biodiversity, with more than 60,000 tree species.
- Around 1.6 billion people depend directly on forests for food, shelter, energy, medicines and income.
- The world is losing 10 million hectares of forest each year - about the size of Iceland.

State of Forest Report 2021:

The **biennial report** by the Forest Survey of India (FSI) is an assessment of the country's forest resources.

Highlights of the Report:

- India's forest and tree cover has risen by 2,261 square kilometers in the last two years with **Andhra Pradesh growing the maximum forest cover of 647 square kilometers**.
- The **total tree-and-forest cover in the country** includes an increase of 1,540 square kilometres of forest cover and 721 sq km of tree cover compared to the 2019 report.
- India's total forest and tree cover is now spread across 80.9 million hectares, which is **24.62 per cent of the geographical area of the country**.
- **The top five states in terms of increase in forest cover** are Andhra Pradesh (647 sq km), Telangana (632 sq km), Odisha (537 sq km), Karnataka (155 sq km) and Jharkhand (110 sq km).
- **The gain in forest cover or improvement in forest canopy density may be attributed** to better conservation measures, protection, afforestation activities, tree plantation drives and agroforestry.
- **Among the mega cities in the country**, Ahmedabad has been the biggest loser when it comes to forest cover.

States with maximum forest cover:

- **Area-wise**, Madhya Pradesh has the largest forest cover in the country followed by Arunachal Pradesh, Chhattisgarh, Odisha and Maharashtra.
- 17 states/UTs have above 33 per cent of the geographical area under forest cover.

Mangrove cover in the country:

- There is an increase of 17 sq km in mangrove cover in the country as compared to the previous assessment of 2019.
- Total mangrove cover in the country is 4,992 sq km.

- **Top three states showing mangrove cover increase** are Odisha (8 sq km) followed by Maharashtra (4 sq km) and Karnataka (3 sq km).

Challenges:

- **The north-east did not show positive results as the current assessment** showed a decrease of forest cover to the extent of 1,020 sq km in the region.
- **Arunachal Pradesh lost the maximum forest cover of 257 sq km**, followed by Manipur which lost 249 sq km, Nagaland 235 sq km, Mizoram 186 sq km and Meghalaya 73 sq km.
- **In total 140 hill districts of the country**, the forest cover has been reduced by 902 sq km in the last two years. In the 2019 report, the forest cover in the hill regions had increased by 544 sq km.

Efforts by Government to increase forest cover in the country:

To achieve India's aim of increasing additional carbon sink of 2.5 to 3 billion tonnes CO2 equivalent by 2030, **Nagar Van Yojna** has been introduced to increase the tree cover and joined with the second phase of Green Mission in the next five years.

Significant features of ISFR 2021:

1. In the present ISFR 2021, FSI has included a new chapter related to **the assessment of forest cover in the Tiger Reserves, Corridors and Lion conservation area of India.**
2. A new initiative of FSI has also been documented in the form of a chapter, where **the 'Above Ground Biomass'** has been estimated. FSI, in collaboration with Space Application Centre (SAC), ISRO, Ahmedabad, initiated a special study for estimation of Above Ground Biomass (AGB) at pan-India level, using L- band of **Synthetic Aperture Radar (SAR) data.**
3. FSI in collaboration of with Birla Institute of Technology & Science (BITS) Pilani, Goa Campus has performed a study based on **'Mapping of Climate Change Hotspots in Indian Forests'**. The collaborative study was carried out with the objective to map the climatic hotspots over the forest cover in India, using computer model-based projection of temperature and rainfall data, for the three future time periods i.e. year 2030, 2050 and 2085.
4. **The report also contains information on various parameters State/UT wise.** Special thematic information on forest cover such as hill, tribal districts, and north eastern region has also been given separately in the report.

2. Forest Fires

Forest fires in Uttarakhand and Himachal Pradesh have scorched numerous hectares of greenery.

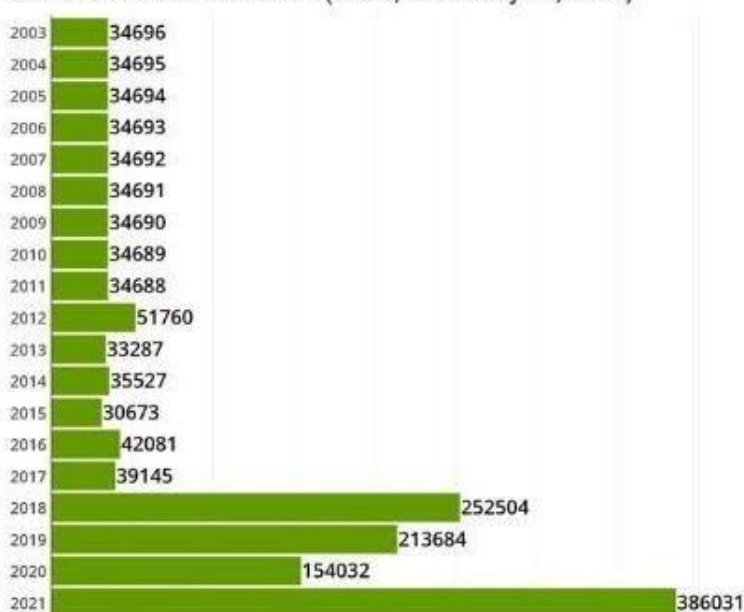
How's the situation?

In April, Himachal reported about 750 forest fires, while Uttarakhand reported more than 1,500.

Why are Uttarakhand and Himachal Pradesh vulnerable to forest Fires?

Except for periods of precipitation in monsoon and winter, the forests remain vulnerable to wildfires.

Number of forest fire alerts (Jan 1, 2003-May 28, 2021)



- **In the summer season**, forest fires occur frequently in the low and middle hills of the state, where forests of Chir Pine are common.
- **During the post-monsoon season and in winters**, forest fires are also reported in higher areas, including parts of Shimla, Kullu, Chamba, Kangra and Mandi districts, where they usually occur in grasslands.

How have other places prone to forest fires fared so far?

Apart from Himachal and Uttarakhand, Assam, Madhya Pradesh, Maharashtra, Tripura, Mizoram and Odisha report frequent forest fires annually.

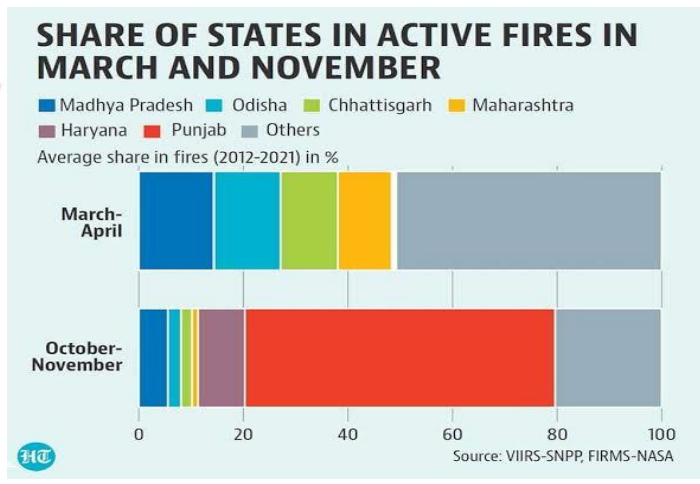
Causes of the fire:

Natural causes such as lightning or rubbing of dry bamboos with each other can sometimes result in fires, but forest officials maintain that **almost all forest fires can be attributed to human factors**.

- Setting up a temporary hearth to cook food by the **herdsman and minor forest produce gatherer may leave behind a smouldering fire**, it can develop into a forest fire.
- Also, when people **burn their fields to clear them of stubble**, dry grass or undergrowth, the fire sometimes spreads to the adjoining forest.
- A spark can also be produced when dry pine needles or leaves fall on **an electric pole**.

Other causes:

- Lack of soil moisture.
- Rainfall deficiency.
- Natural causes such as lightning, high atmospheric temperatures and low humidity.



What is done to prevent and control forest fires?

To prevent and control forest fires the following can be done:

- Forecasting fire-prone days using meteorological data.
- Clearing camping sites of dried biomass.
- Early burning of dry litter on the forest floor.
- Growing strips of fire-hardy plant species within the forest.
- Creating fire lines in the forests are some of the methods to prevent fires (fire lines are strips in the forest kept clear of vegetation to prevent the fire from spreading).

What efforts are being taken to protect forests from fire?

- Since 2004, the FSI developed the **Forest Fire Alert System** to monitor forest fires in real time.
- Real-time fire information from identified fire hotspots is gathered using **MODIS sensors (1km by 1km grid)** and electronically transmitted to FSI.
- **National Action Plan on Forest Fires (NAPFF)**: It was launched in 2018 to minimise forest fires by informing, enabling and empowering forest fringe communities and incentivising them to work with the State Forest Departments.
- **The Forest Fire Prevention and Management Scheme (FPM)** is the only centrally funded program specifically dedicated to assisting the states in dealing with forest fires.

3. Forest Restoration

- Despite various international conventions and national policies in place to improve green cover, **there is a decline in global forest cover.**
- This is the prime reason for forest restoration activities to become increasingly popular and declaring **2021-2030 as the UN Decade on Ecosystem Restoration.**

Importance of Forests

- Covering nearly 30% land surface of the earth, forests around the globe provide a **wide variety of ecosystem services and support diverse species.**
- They also **stabilise the climate, sequester carbon and regulate the water regime.**

Forest Degradation

- The **State of the World's Forests report 2020**, says that since 1990, around 420 million hectares of forest have been lost through deforestation, conversion and land degradation.
- India lost 4.69 MHA of its forests for various land uses between 1951 to 1995.
- Dependence on forests by nearly 18% of the global human population has put immense pressure on ecosystems; in India, this has resulted in the degradation of 41% of its forests.

Forest Restoration

- Restoration means bringing back the degraded or deforested landscape to its original state by various interventions.
- This helps to improve ecological functions, productivity and create resilient forests with multifarious capabilities.
- **India joined the Bonn Challenge with a pledge to restore 26 MHA of degraded and deforested land by 2030.**
- India has brought 9.8 million hectares since 2011 under restoration, is an achievement.
- Continued degradation and deforestation need to be tackled effectively to achieve the remaining target of restoration.
- Recent research has shown that **naturally regenerated forests tend to have more secure carbon storage.**

Situation in India

- Nearly 5.03% of Indian forests are under protection area (PA) management needing specific restoration strategies.
- The remaining areas witness a range of disturbances including grazing, encroachment, fire, and climate change impacts.
- Much of the research done so far on restoration is not fully compatible with India's diverse ecological habitats.
- The relevance of local research duly considering ecological aspects, local disturbances and forest-dependent communities is vital to formulate guidelines.

Concerns / Challenges

- Forest restoration and tree planting are leading strategies to fight global warming by way of carbon sequestration.
- However, **planting without considering the local ecology can result in more damage.**
- Planting a forest in the wrong places such as savannah grasslands could be disastrous for local biodiversity.
- **Adequate financing is one of the major concerns** for the success of forest restoration.
- The contribution of corporates in restoration efforts so far has been limited to 2% of the total achievement.
- The involvement of multiple stakeholders in forest restoration is bound to cause a conflict of interests among different stakeholders.

Way Forward

- Restoration, being a scientific activity, needs research support for its success.
- It is **fundamental to consider the local ecology before implementing any restoration efforts** to retain their biodiversity and ecosystem functions.
- The active approach of restoration includes tree planting and the involvement of communities.
- Active engagement of stakeholders including NGOs, awareness and capacity building of stakeholders with enabling policy interventions and finance can help to achieve the remaining 16 MHA restoration objectives for India.
- The need of the hour is an inclusive approach encompassing these concerns with the required wherewithal.

4. World Forestry Congress adopts Seoul Forest Declaration

The **Seoul Forest Declaration** was an outcome of the discussions held at the recently concluded **XV World Forestry Congress in Seoul, South Korea.**

- This was the second congress held in Asia, with Indonesia hosting the first Congress in Asia in 1978.

Seoul Forest Declaration:

- It identifies priority areas with potential to lead to a **green, healthy and resilient future.**
- It urges that **responsibility for forests should be shared and integrated across institutions, sectors and stakeholders.**
- **Investment in forest and landscape restoration globally needs to triple by 2030.**
- Move towards a **circular bioeconomy and climate neutrality.**

What is Forest landscape restoration?

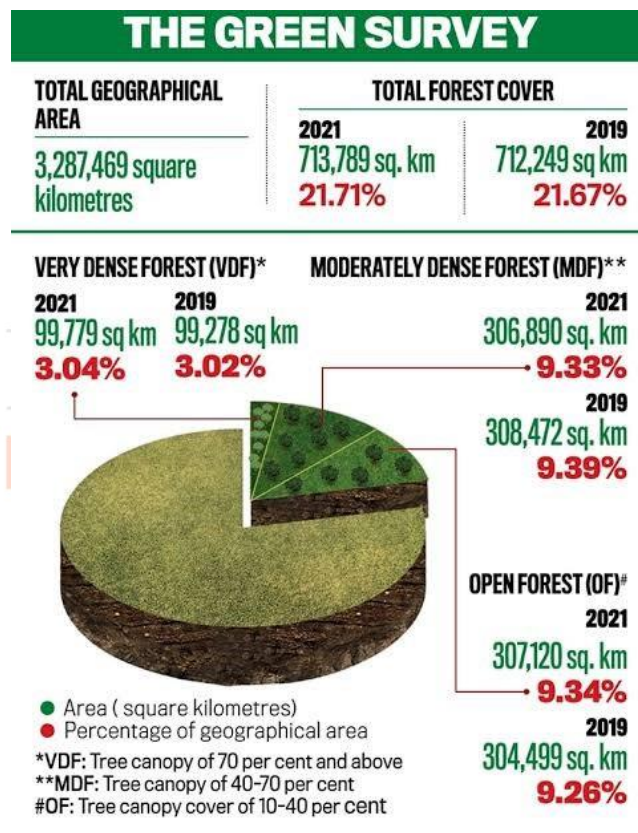
- It is the ongoing process of regaining ecological functionality and enhancing human well-being across deforested or degraded forest landscapes.
- FLR is **more than just planting trees** – it is restoring a whole landscape to meet present and future needs and to offer multiple benefits and land uses over time.

5. Tiger Density in India

Preliminary findings of a study by the **Wildlife Institute of India(WII)** suggest that **the density of tigers in the Sunderbans may have reached the carrying capacity of the mangrove forests,** leading to frequent dispersals and a surge in human-wildlife conflict.

- This high density will force tigers to move out of forests in search for new areas. Recently, around eight tigers have entered into villages in Sunderbans and all of them were captured and released into the wild.

Factors that determine tiger density:



- Availability of food and space.
- Tolerance levels exhibited by the locals who live around them to policymakers who decide management strategies.

Key facts related to tiger population:

1. As per the **World Wide Fund for Nature**, the number of tigers dropped by 95 per cent over the past 150 years.
2. India is the land of royal tigers and current tiger population stands at 2967 which is **70 per cent of the global tiger population**.
3. **Madhya Pradesh has the highest number of tigers at 526**, closely followed by Karnataka (524) and Uttarakhand (442).
4. Kanha Tiger Reserve in Madhya Pradesh is **the first tiger reserve in India to officially introduce a mascot, Bhoorsingh the Barasingha**.

Conservation efforts- National and Global:

1. **The National Tiger Conservation Authority (NTCA)** has launched the **M-STRIPES** (Monitoring System for Tigers – Intensive Protection and Ecological Status), a mobile monitoring system for forest guards.
2. At the **Petersburg Tiger Summit in 2010**, leaders of 13 tiger range countries resolved to do more for the tiger and embarked on efforts to double its number in the wild, with a popular slogan '**T X 2**'.
3. **The Global Tiger Initiative (GTI)** program of the World Bank, using its presence and convening ability, brought global partners together to strengthen the tiger agenda.
4. Over the years, the initiative has institutionalised itself as a separate entity in the form of the **Global Tiger Initiative Council (GTIC)**, with its two arms –**the Global Tiger Forum and the Global Snow Leopard Ecosystem Protection Program**.
5. **The Project Tiger**, launched way back in 1973, has grown to more than 50 reserves amounting to almost 2.2% of the country's geographical area.

Protection Status:

1. **Indian Wildlife (Protection) Act, 1972:** Schedule I.
2. **International Union for Conservation of Nature (IUCN) Red List:** Endangered.
3. **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES):** Appendix I.

6. Cheetah reintroduction project

The cheetah, which became extinct in India after Independence, is all set to return with the Union Government launching an action plan.

Under the '**Action Plan for Introduction of Cheetah in India**', 50 of these big cats will be introduced in the next five years.

What is reintroduction and why reintroduce Cheetah now?

- 'Reintroduction' of a species means releasing it in an area where it is capable of surviving.
- Reintroductions of large carnivores have increasingly been recognised as a strategy to conserve threatened species and restore ecosystem functions.
- The cheetah is the only large carnivore that has been extirpated, mainly by over-hunting in India in historical times.
- India now has the economic ability to consider restoring its lost natural heritage for ethical as well as ecological reasons.

Cheetah reintroduction programme in India:

The Wildlife Institute of India at Dehradun had prepared a ₹260-crore cheetah re-introduction project seven years ago.

- India has plans to reintroduce cheetahs at the Kuno National Park in Sheopur and Morena districts of **Madhya Pradesh's Gwalior-Chambal region**.
- This could be the world's first inter-continental cheetah translocation project.

Reasons for extinction:

- The reasons for extinction can all be traced to man's interference. Problems like human-wildlife conflict, loss of habitat and loss of prey, and illegal trafficking, have decimated their numbers.
- The advent of climate change and growing human populations have only made these problems worse.
- With less available land for wildlife, species that require vast home range like the cheetah are placed in competition with other animals and humans, all fighting over less space.

7. Human Animal Conflict

Standing Committee on Science, Technology, Environment and Climate Change has submitted its report.

- The report analyses **the Wildlife (Protection) Amendment Bill, 2021** tabled in the Lok Sabha in December 2021.

Significance:

While **Standing Committee reports on Bills** usually stick to criticism of text of the Bill, this report devoted space to the question of Human Animal conflict— a subject not mentioned in the proposed amendments — as it was “a complex issue as serious as hunting” and needed “legislative backing.”

Key recommendations to reduce human - animal conflict:

- The report recommends an HAC Advisory Committee to be headed by the Chief Wild Life Warden, who can consult the committee to act appropriately.
- Such a committee with few members and in-depth technical knowledge for evolving effective site-specific plans/ mitigation strategies including recommendations on changing cropping patterns and for taking critical decisions at short notice, empowered under the law is necessary.

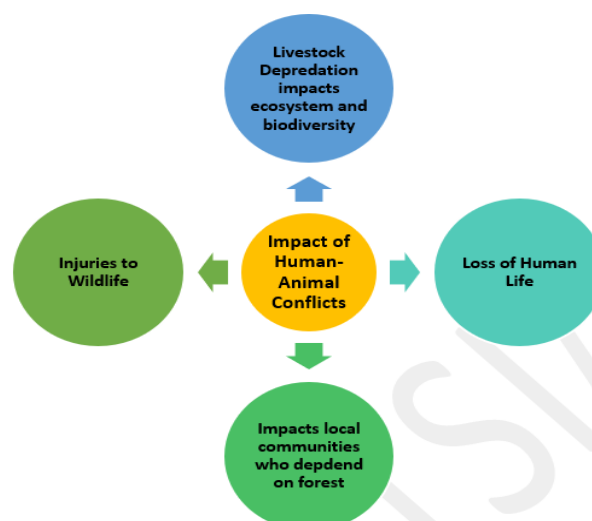
WWF and UNEP report on Human-wildlife conflict:

A report titled, **A future for all - the need for human-wildlife coexistence**, was released by the **World Wide Fund for Nature (WWF)** and the **UN Environment Programme (UNEP)** in July 2021.

Highlights of the Report:

1. Conflict between humans and animals is one of the main threats to the long-term survival of some of the world's most iconic species.
2. Globally, conflict-related killing affects more than 75 per cent of the world's wild cat species. It also affects polar bears and Mediterranean monk seals as well as large herbivores such as elephants.
3. Global wildlife populations have fallen an average of 68 per cent since 1970.

Indian scenario:



1. Over 500 elephants were killed between 2014-2015 and 2018-2019, mostly due to human-elephant conflict.
2. During the same period, 2,361 people were killed as a result of conflict with elephants.
3. India will be most-affected by human-wildlife conflict because it had the world's second-largest human population as well as large populations of tigers, Asian elephants, one-horned rhinos, Asiatic lions and other species.

What needs to be done?

Completely eradicating human-wildlife conflict is not possible. But well-planned, integrated approaches to managing it can reduce conflicts and lead to a form of coexistence between people and animals.

Sonitpur Model:

1. In Sonitpur district in Assam, destruction of forests had forced elephants to raid crops, in turn causing deaths of both, elephants and humans.
2. In response, WWF India had developed the 'Sonitpur Model' during 2003-2004 by which community members were connected with the state forest department.
3. They were given training on how to work with them to drive elephants away from crop fields safely.
4. WWF India had also developed a low-cost, single strand, non-lethal electric fence to ease the guarding of crops from elephants.
5. Afterwards, crop losses dropped to zero for four years running. Human and elephant deaths also reduced significantly.

Advisory for management of Human-Wildlife Conflict (HWC) approved by Standing Committee of National Board of Wildlife (SC-NBWL):

1. **Empower gram panchayats** in dealing with the problematic wild animals as per the Wildlife (Protection) Act, 1972.
2. Utilise **add-on coverage under the Pradhan Mantri Fasal Bima Yojna** for crop compensation against crop damage due to HWC.
3. Augment fodder and water sources within the forest areas.
4. **Other measures:** The advisory prescribes inter-departmental committees at local/state level, adoption of early warning systems, creation of barriers, dedicated circle wise Control Rooms with toll free hotline numbers which could be operated on 24X7 basis.

The Union Environment Ministry has constituted a **"permanent" coordination committee** that includes the Ministry of Railways and the Environment Ministry to prevent elephant deaths on railway tracks.

Key measures taken:

1. Setting up of a Permanent Coordination Committee between the Ministry of Railways (Railway Board) and the MoEFCC for preventing elephant deaths in train accidents.
2. Clearing of vegetation along railway tracks to enable clear view for loco pilots.
3. Using signage boards at suitable points to alert loco pilots about elephant presence.
4. Moderating slopes of elevated sections of railway tracks.
5. Setting up underpass/overpass for safe passage of elephants.
6. Regulation of train speed from sunset to sunrise in vulnerable stretches.
7. Regular patrolling of vulnerable stretches of railway tracks by frontline staff of the Forest Department and wildlife watchers.

Eco Bridges as a solution:

1. Eco Bridges are wildlife corridors also known as wildlife crossing that are a link of wildlife habitat which connects two larger areas of similar wildlife habitat.

2. It connects wildlife populations that would otherwise be separated by human activities or structures such as roads and highways, other infrastructure development, or logging and farming, etc.
3. Eco Bridges aims at enhancing wildlife connectivity.
4. These are made up of native vegetation i.e., it is overlaid with planting from the area to give a contiguous look with the landscape.

Forest Ministry guide to managing human-elephant conflict (Best Practices):

1. Retaining elephants in their natural habitats by creating water sources and management of forest fires.
2. **Elephant Proof trenches** in Tamil Nadu.
3. **Hanging fences and rubble walls** in Karnataka.
4. Use of chili smoke in north Bengal and playing the sound of bees or carnivores in Assam.
5. **Use of technology:** Individual identification, monitoring of elephants in south Bengal and sending SMS alerts to warn of elephant presence.

Efforts by Private Organizations in this regard:

- **Asian Elephant Alliance**, an umbrella initiative by five NGOs, had, last year, come together to secure 96 out of the 101 existing corridors used by elephants across 12 States in India.
- **NGOs Elephant Family, International Fund for Animal Welfare, IUCN Netherlands and World Land Trust** have teamed up with Wildlife Trust of India's (WTI) in the alliance.

Efforts aimed at conservation of Elephants and their corridors at all- India level:

- **'Gaj Yatra'**, a nationwide campaign to protect elephants, was launched on the occasion of World Elephant Day in 2017. The campaign is planned to cover 12 elephant range states.
- The campaign aims to create awareness about elephant corridors to encourage free movement in their habitat.

8. UNEP Frontiers report

The **United Nations Environment Programme (UNEP)** recently released its latest **annual Frontiers report**.

Highlights of the report:

Focus areas:

Urban noise pollution, wildfires and phenological shifts – the three topics of this Frontiers report – are issues that highlight the urgent need to address **the triple planetary crisis of climate change, pollution and biodiversity loss**.

Concerns:

- **Wildfires are predicted to worsen in the coming years and decades.** The trends towards more dangerous fire-weather conditions are likely to increase due to rising concentrations of atmospheric greenhouse gases and the attendant escalation of wildfire risk factors.
- **Vulnerable areas:** There has been a rapid expansion of cities towards forest areas in many regions in recent decades. This wild land-urban interface is the area where wildfire risks are most pronounced. For example, rising fires in California, United States.
- **Lightning and pollution:** With rising forest fires, the world is very likely to see more frequent incidences of lightning.
- **Fire-induced thunderstorms** are a new danger posed by rising wildfires. These thunderstorms contribute to more dangerous conditions for fires on the ground.
- **Noise pollution in cities is a growing hazard to public health:** Unwanted, prolonged and high-level sounds from road traffic, railways, or leisure activities impair human health and well-being.

- **Phenological shifts** occur when species shift the timing of life cycle stages in response to changing environmental conditions altered by climate change. The concern is that interacting species in an ecosystem do not always shift the timing in the same direction or at the same rate.
- **These phenological shifts** are increasingly disturbed by climate change, pushing plants and animals out of synch with their natural rhythms and leading to mismatches, such as when plants shift life cycle stages faster than herbivores.

Key Recommendations:

1. Increase vegetation in urban environments.
2. Provide soundscape planning (considers contextual characteristics of the place, including perceived acoustic parameters, physical features, natural factors, purpose, usage and user community).
3. Noise barriers along highways or railways.
4. Preventive approach by engaging vulnerable groups. Appreciating and adopting indigenous fire management techniques.
5. Focus on long-range weather forecasting and remote-sensing capabilities such as satellites.
6. Increasing ecological connectivity through habitat corridors.
7. Promoting genetic diversity and increasing the chances of successful adaptation.

9. Kasturirangan Committee on Western Ghats

Recently, Karnataka Chief Minister informed the Centre that the state is opposed to the Kasturirangan Committee report on Western Ghats.

- He said that declaring Western Ghats as ecologically sensitive zone would adversely affect the livelihood of people in the region.

What did the Gadgil Committee say?

- It defined the boundaries of the Western Ghats for the purposes of ecological management.
- It proposed that this entire area be designated as ecologically sensitive area (ESA).
- Within this area, smaller regions were to be identified as ecologically sensitive zones (ESZ) I, II or III based on their existing condition and nature of threat.
- It proposed to divide the area into about 2,200 grids, of which 75 per cent would fall under ESZ I or II or under already existing protected areas such as wildlife sanctuaries or natural parks.
- The committee proposed a Western Ghats Ecology Authority to regulate these activities in the area.

Why was Kasturirangan Committee setup?

None of the six concerned states agreed with the recommendations of the Gadgil Committee, which submitted its report in August 2011.

- In August 2012, then Environment Minister constituted a High-Level Working Group on Western Ghats under Kasturirangan to “examine” the Gadgil Committee report in a “holistic and multidisciplinary fashion in the light of responses received” from states, central ministries and others.
- The Kasturirangan report seeks to bring just 37% of the Western Ghats under the Ecologically Sensitive Area (ESA) zones — down from the 64% suggested by the Gadgil report.

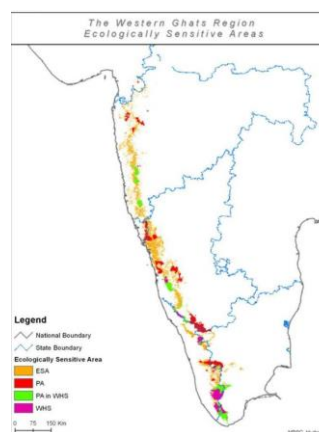
Recommendations of Kasturirangan Committee:

- A ban on mining, quarrying and sand mining.
- No new thermal power projects, but hydro power projects allowed with restrictions.
- A ban on new polluting industries.
- Building and construction projects up to 20,000 sq m was to be allowed but townships were to be banned.

- Forest diversion could be allowed with extra safeguards.

Importance of western ghats:

- The Western Ghats is an extensive region spanning over six States. It is the home of many endangered plants and animals. It is a **UNESCO World Heritage site**.
- It is one of the **eight “hottest hot-spots” of biological diversity in the world**.
- According to UNESCO, the Western Ghats are older than the Himalayas. They influence Indian monsoon weather patterns by intercepting the rain-laden monsoon winds that sweep in from the south-west during late summer.



NOTES

10. Compensatory Afforestation Fund Management and Planning Authority (CAMPA)

The Compensatory Afforestation Fund Management and Planning Authority (CAMPA) has so far disbursed ₹48,606 crore to 32 States. Chhattisgarh and Odisha have had the maximum amount transferred to them.

What are CAMPA funds?

CAMPA funds are part of long-pending dues of the Compensatory Afforestation Fund (CAF), a ₹54,000-crore tranche collected for nearly a decade as environmental compensation from industry, which has razed forest land for its business plans.

What is Compensatory Afforestation?

Compensatory afforestation means that every time forest land is diverted for non-forest purposes such as mining or industry, the user agency pays for planting forests over an equal area of non-forest land, or when such land is not available, twice the area of degraded forest land.

Water Management

1. India's Water Management Practices

- India's rapid urban growth is putting pressure on its public service arrangements — especially its management of water and sanitation services.

Dependence on Monsoon

- Water availability in India depends on the patterns of precipitation.
- The southwest monsoon alone accounts for 70-75 per cent of the total precipitation falling in India.
- The regions along the west coast and the north-eastern states witness heavy rainfall events within limited time duration.

Impact of Climate Change

- **With temperatures rising due to changing climate, precipitation patterns vary.**
- The towns and cities are facing water shortages during the summer months and experiencing floods during monsoon.
- **Climate changes are expected to increase precipitation, which will come in the form of reduced rainy days but more days of extreme precipitation events.**

Improper Urban Planning

- The way Indian cities have sprung and continues to develop also pose a risk to their future sustainability.
- **Concretisation of urban landscapes is increasing flood peaks** from 1.8-8 times and volume of flood by up to six times.
- Storm water drainage systems are designed for rainfall intensity of 20-25 millimetre per hour duration. The carrying capacities of these drains easily get overwhelmed during the incidences of heavy precipitation.
- **Illegal encroachment along storm water drains and urban rivers** also aggravates the situation.

India's Water Management Practice

- **Despite building large dams and infrastructures, India has now become a 'water-stressed' country, with**
 - only about 6-8 per cent of installed water storage capacity,
 - growing incidences of water pollution,
 - falling freshwater biodiversity and
 - prevailing inequities in water supply and sanitation services distribution.
- To make matters worse, there are growing concerns over
 - environmental degradation,
 - involuntary displacement of local population,
 - stringent land acquisition policies,
 - complexity of transboundary negotiations for risks and benefits sharing, and
 - huge cost escalation and time lags
- **Decision-makers must look for solutions in the collective efforts of the citizens in managing their issues locally.**

Rooftop rainwater harvesting

- Rooftop rainwater structures engender a transformative wave of public engagement in water management.

- A country-wide behaviour change campaign can be launched along the lines of Swachh Bharat Mission that motivate people to adopt rooftop rainwater harvesting structures in their private premises.
- It is observed that the design, construction and maintenance of these structures are left with the individual households with little or no regulation and monitoring from the concerned urban local bodies.
- Local authorities should, therefore, accord explicit attention to the designing and management criteria in their respective byelaws and work to strengthen the enforcement thereof.
- Local non-profits and private stakeholders can be roped in to build area specific water conservation plans in partnership with local residents.

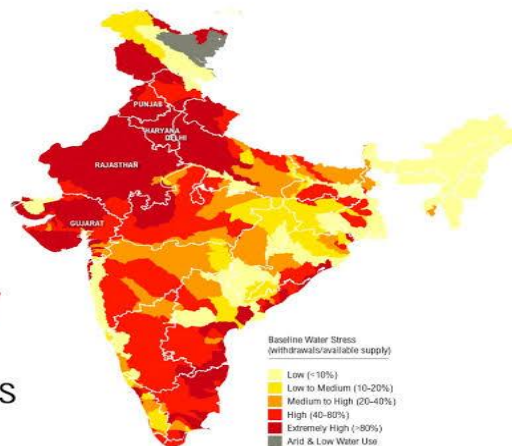
2. World Water Day

- Observed on 22 March every year.
- Observed since 1993.
- Coordinated by UN-Water – the UN’s inter-agency collaboration mechanism for all freshwater related issues – in collaboration with governments and partners.

Water, a human right:

- In 2010, the UN recognized “the right to safe and clean drinking water and sanitation as a human right that is essential for the full enjoyment of life and all human rights.”
- The human right to water entitles everyone, without discrimination, to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic use; which includes water for drinking, personal sanitation, washing of clothes, food preparation, and personal and household hygiene.

54%
of India
Faces
**High to
Extremely
High
Water Stress**

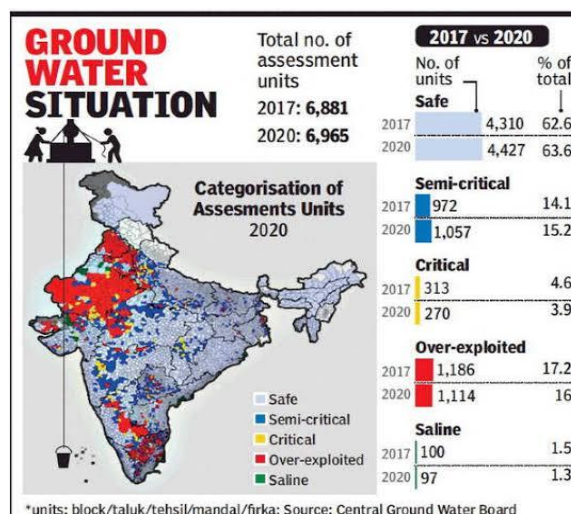


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People are left behind without safe water for many different reasons. Some of them include:

1. Sex and gender.
2. Race, ethnicity, religion, birth, caste, language, and nationality.
3. Disability, age and health status.
4. Property, tenure, residence, economic and social status.
5. Other factors, such as environmental degradation, climate change, population growth, conflict, forced displacement and migration flows can also disproportionately affect marginalized groups through impacts on water.



Why conserve groundwater?

1. Groundwater reserves are already under pressure as the global population explodes and crop production rises in lockstep.
 2. Extreme weather events such as drought and record rainfall — have both made worse by our heating planet — could have another long-lasting impact on how quickly reserves replenish.
 3. Only half of all groundwater supplies are likely to fully replenish or re-balance within the next 100 years — potentially leading to shortages in drier areas.
 4. The process through which rainwater is filtered through bedrock and accumulated underground can take centuries and varies greatly by region.
 5. As climate change delivers longer droughts and bigger superstorms, the extremes of rainfall become more pronounced, impacting groundwater reserves for generations to come.
- **Sustainable Development Goal 6 (SDG 6)** aims to ensure availability and sustainable management of water for all by 2030. By definition, this means leaving no one behind.
 - In addition to it, **the International Decade for Action on Water for Sustainable Development (2018-2028)** is being observed.

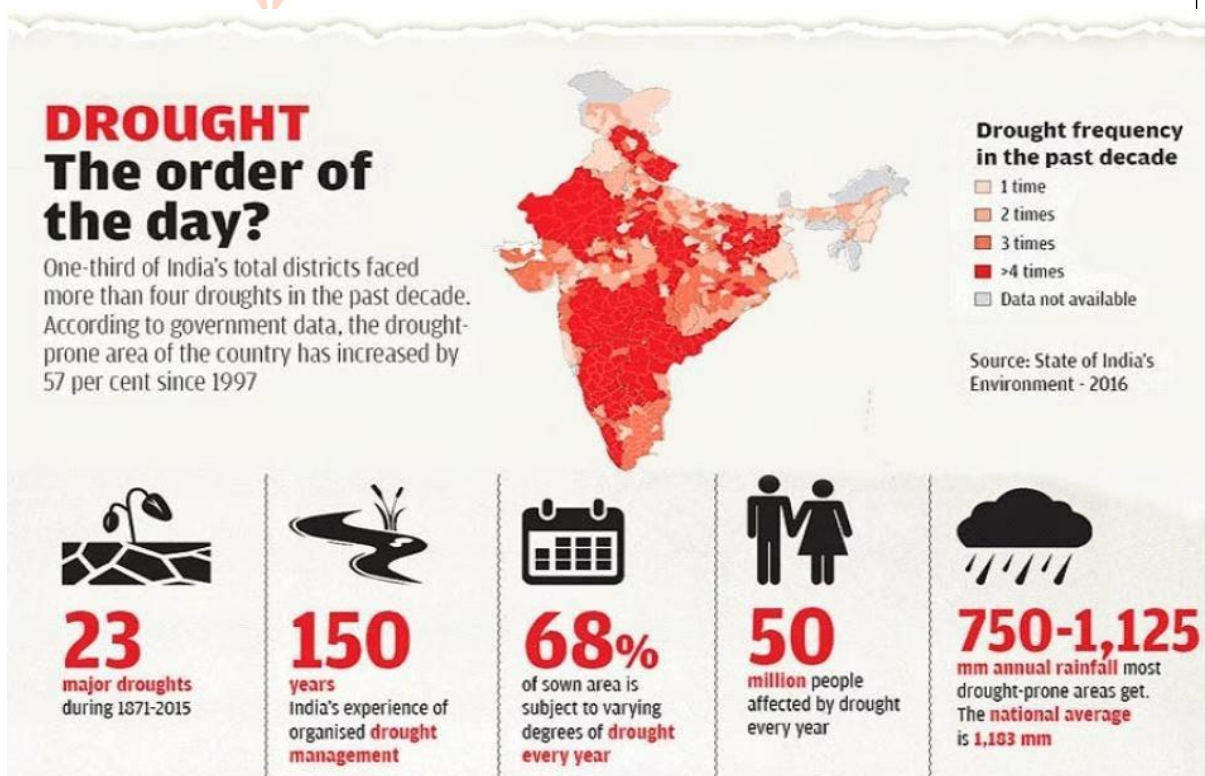
3. [Drought in Numbers, 2022 report](#)

The **Drought in Numbers, 2022 report** was released on May 11 at the ongoing 15th Conference of Parties (CoP15) to the United Nations Convention to Combat Desertification (UNCCD).

- The latest assessment analysed droughts and impacts on life and livelihood over 122 years covering 196 countries.

Highlights of the Report:

- The **frequency and duration of drought is increasing** at an alarming rate across the world since the onset of the 21st century.
- An entire new generation is growing up being “water scarce”.
- Since 2000, there has been a 29 per cent increase in frequency and duration of droughts in the world.
- **Drought is considered a slow onset disaster**, thus giving enough time to prepare for it. But in recent decades, drought has emerged as one of the biggest drivers of human life loss and economic loss among weather-related disasters.



Water scarcity and Drought in India – what the report says?

- India has featured in the assessment as one of severely drought-impacted countries. Nearly two-thirds of the country suffered drought during 2020-2022.
- Geographically, India's drought vulnerability compares with that of sub-Saharan Africa.
- The effect of severe droughts was estimated to have reduced India's gross domestic product by 2-5 per cent over the 20 years from 1998-2017.

Concerns for India:

- India's drought-prone area has increased by 57 per cent since 1997.
- One-third of India's districts have faced more than four droughts over the past decade and 50 million people are affected by drought every year.
- Some 97.85 million hectares — nearly 30 per cent of the country's land — underwent land degradation during 2018-19.
- Drought impacts India's dominantly rainfed agriculture that accounts for 60 per cent of the sown area on average.

4. Ammonia in Yamuna

Water supply was disrupted in parts of Delhi when ammonia levels in the **Yamuna river** remained high on 16th April, 2022.

- The concentration of ammonia in the river was 7.4 ppm (parts per million), seven times the level of around 1 ppm that the Delhi Jal Board's water treatment plants (WTPs) can process.

What is the acceptable limit?

The acceptable maximum limit of ammonia in drinking water, **as per the Bureau of Indian Standards, is 0.5 ppm.**

Contamination:

It may find its way to ground and surface water sources through industrial effluents or through contamination by sewage.

- If the **concentration of ammonia in water is above 1 ppm it is toxic to fishes.**
- In humans, long term ingestion of water having ammonia levels of 1 ppm or above may cause damage to internal organs.

Why is Yamuna so polluted?

1. **The sewage treatment plants** of Delhi are major contributors of the Pollutants being discharged in the river.
2. **Pollutants discharge** from different types of industry is also a major issue.
3. **Agriculture activities** along the banks of the river in Delhi contributes to river pollution.
4. **Agricultural waste and pesticide discharge** from the Haryana field also contributes to the pollution.
5. **The low volume of water flow** in the river causes the pollutants to accumulate and raise the pollution level.

What needs to be done?

1. Stringent implementation of guidelines against dumping harmful waste into the river.

Frothing in Yamuna:

A layer of froth was seen floating over parts of the Yamuna river near Kalindi Kunj recently. The **froth is a sign of a polluted river.**

What causes frothing in the Yamuna?

- The release of untreated or poorly treated effluents, including sewage from those parts of the city that are not connected to the sewerage network and industrial waste, could lead to frothing.
- Surfactants and phosphates from detergents in households and industrial laundry find their way into the river, as all the sewage is not treated.

2. Making sure untreated sewage does not enter the water.
3. Maintain a sustainable minimum flow, called the ecological flow. This is the minimum amount of water that should flow throughout the river at all times to sustain underwater and estuarine ecosystems and human livelihoods, and for self regulation.

Challenges ahead:

1. Delhi depends on Haryana for up to 70 per cent of its water needs.
2. Haryana, with a large number of people involved in agriculture, has water paucity issues of its own.
3. Both states have argued over maintaining 10 cumecs (cubic meter per second) flow in the Yamuna at all times.
4. Both states have approached the courts several times over the past decade to get what they call an equitable share of water.
5. The lack of a minimum ecological flow also means accumulation of other pollutants. After water is extracted from the river for treatment in North East Delhi, what flows is mostly untreated sewage and refuse from homes, runoff from storm water drains and effluents from unregulated industry.

5. Sabarmati river conservation

Gujarat High Court had taken suo motu cognizance of the slow death of **Sabarmati river** due to effluent discharge. In this regard, it has delivered a judgement recently.

The High Court order:

- Industrial units found to have discharged pollutants into the Sabarmati river in Gujarat will not be provided water and power.
- They will also be penalised, named and shamed.
- All such polluting units will also be banned from participating in any industrial fair, public-private partnership events, etc.

Water as a public trust:

In our Constitution, water resources are held in public trust. Therefore, the court decided to use **the 'Public Trust Doctrine'** to apply stringent provisions against permitting municipal bodies or industries from polluting rivers.

Challenges:

The Sabarmati, for 120 km of its 371 km course, is in its death throes. This is especially true for the stretch of the river along the Sabarmati riverfront in Ahmedabad.

- The excessive presence of pollutants in the river and the lack of natural flow has done irreparable damage to the river.
- Effluents and sewage from industrial units are continuously being discharged into the Sabarmati river.
- Despite all this, industrial units have been provided legal permission to carry out these activities.

Need of the hour:

Rivers are our lifeline since we are completely dependent on them for our existence. The major reason behind this alarming situation is our utter ignorance and carefree attitude towards our environment and maintaining rivers and riversides.

- So, it is high time that we take some stringent actions in this regard.
- Each and every individual should understand that rivers belong to all of us.
- It is a joint responsibility of each and every individual to keep them clean.

6. 'Nal Se Jal' Yojana

An allocation of Rs 60,000 crore has been made to cover 3.8 crore households in 2022-23 under **Har Ghar, Nal Se Jal scheme**.

Nal Se Jal Yojana:

Launched in 2019.

Nodal Agency: Ministry of Jal Shakti

- **Aim:** To provide piped drinking water to every rural home by 2024
- It is a **component of the government's Jal Jivan Mission**.

Implementation:

- The scheme is based on a unique model where **paani samitis (water committee)** comprising villagers will decide what they will pay for the water they consume.
- **The tariff they fix will not be the same for everyone in the village.** Those who have large households will pay more, while poor households or households where there is no earning member, will be exempted.

Need for:

- According to a 2018 NITI Aayog report, 600 million Indians face high to extreme water stress and about two lakh people die every year due to inadequate access to safe water.
- By 2030, the country's water demand is projected to be twice the available supply, implying severe water scarcity for hundreds of millions of people and an eventual ~6% loss in the country's GDP.

Studies also show that 84% of rural homes have no access to piped water, with more than 70% of the country's water contaminated.

7. State of the world's land and water resources for food and agriculture

As per the recently released, '**The State of the world's land and water resources for food and agriculture (released by FAO)**', water and land resources are being pushed to limits due to human actions.

- **Due to population increase**, agricultural land available **per capita for crops and animal husbandry declined by 20 per cent** between 2000 and 2017.
- It was reported that almost a third of rain-fed cropland and nearly a half of irrigated land are subject to human-induced land degradation which primarily affected the fertility of the soil
- Over 60 per cent of irrigated areas are degraded in northern Africa, south Asia and the middle east-western Asia.
- The rapid growth of cities had a significant impact on land and water resources.

Challenge going forward:

The degradation of the resources might continue unabated to meet the food security needs of the ever-growing population since by 2050 agriculture will need to produce almost 50 per cent more food, livestock fodder and biofuel than in 2012 to satisfy global demand and keep on track to achieve **"zero hunger" by 2030**.

Steps to be taken to meet food security without degrading the resources

- Local consumption and weather patterns need to be kept in mind while formulating the policies. **Ex:** Avoid growing sugarcane in those areas where water is deficient; encouraging organic farming etc.
- A meaningful engagement with the key stakeholders – farmers, pastoralists, foresters and smallholders – directly involved in managing soils and conserving water in agricultural landscapes is crucial.
- Use of technology to reverse the degradation in the resources
- Reforms in water and land-governance policies.

Some of the steps taken in India to prevent degradation in regard include- soil health card, scientific irrigation methods (Pradhan Mantri Krishi Sinchai Yojana, Desert development program, Pradhan Mantri Krishi Sampada Yojana etc.)

8. Terrestrial water storage (TWS)

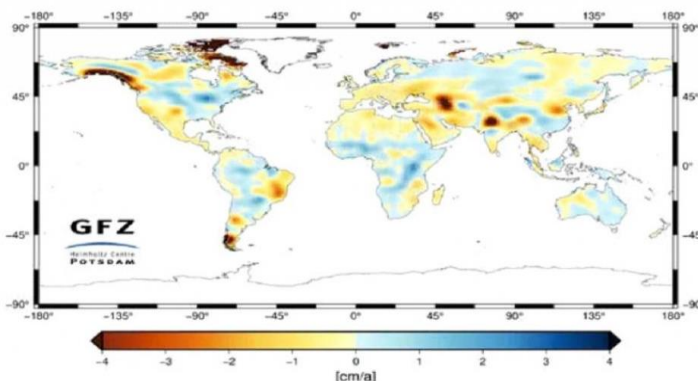
A report on **terrestrial water storage (TWS) loss- 2021 State of Climate Services-** was recently released by the **World Meteorological Organization (WMO)**.

What is terrestrial water storage (TWS)?

TWS is the sum of all water on the land surface and in the subsurface, ie **surface water, soil moisture, snow and ice and ground water.**

Highlights of the report:

1. Overall, terrestrial water storage (TWS) dropped at a rate of 1 cm per year in 20 years (2002-2021).
2. The biggest losses have occurred in **Antarctica and Greenland.**
3. Many highly populated, lower latitude locations have also experienced TWS losses.
4. **India is the ‘topmost hotspot of TWS loss’:** India has recorded the highest loss in terrestrial water storage if the loss of water storage in Antarctica and Greenland is excluded.
5. In India, **the TWS has been lost at a rate of at least 3 cm per year.** In some regions, the loss has been over 4 cm per year too.
6. **The northern part of India has experienced the maximum loss within the country.**

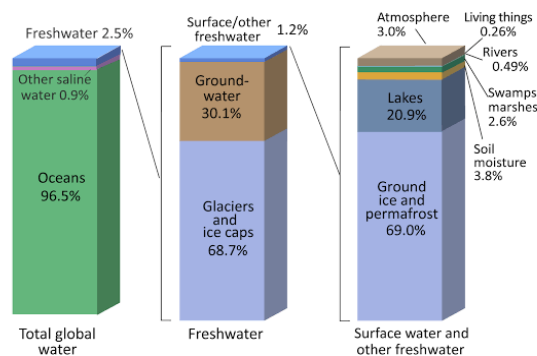


Challenges ahead:

Water resources across the world are under tremendous pressure due to **human and naturally-induced stressors.**

- These include population growth, urbanisation and decreasing availability of freshwater.
- Extreme weather events too have been responsible for the pressure on water resources realised across sectors and regions.

Where is Earth's Water?



Credit: U.S. Geological Survey, Water Science School. <https://www.usgs.gov/special-topic/water-science-school>
Data source: Igor Shiklomanov's chapter "World fresh water resources" in Peter H. Gleick (editor), 1993, Water in Crisis: A Guide to the World's Fresh Water Resources. (Numbers are rounded).

Steps Taken by The Government:

1. MGNREGA for water conservation.
2. Jal Kranti Abhiyan.
3. National Water Mission.
4. National Rural Drinking Water Programme.
5. NITI Aayog Composite Water Management Index.
6. Formation of Jal Shakti Ministry and Jal Jeevan Mission.

9. International Blue Flag Certification

Two more Indian Beaches (Kovalam in Tamil Nadu and Eden in Puducherry) get covered International Blue Flag Certification. India now has **10 Blue Flag beaches.**

- This is another recognition of **India's commitment to protect and conserve the pristine coastal and marine ecosystems** through holistic management of the resources.

What is the Blue flag certification?

- **Blue Flag certification** is a globally recognised eco-label accorded by "**Foundation for Environment Education in Denmark**" based on **33 stringent criteria**.
- The **Blue Flag Programme for beaches and marinas** is run by the **international, non-governmental**, non-profit organisation the '**Foundation for Environmental Education (FEE)**.'
- It was **started in France in 1985** and has been implemented in Europe since 1987, and in areas outside Europe since 2001, when South Africa joined.
- Neat and clean beaches are an indicator that the coastal environment is in good health and the **Blue Flag certification** is a global recognition of India's conservation and sustainable development efforts.
- A waving "Blue Flag" is an indication of **100% compliance to these 33 stringent criteria** and sound health of the beach.

What is the 'Blue Flag Beach'?

- The 'Blue Flag' beach is an 'eco-tourism model'.
- It marks out beaches as providing tourists and beachgoers clean and hygienic bathing water, facilities/amenities, a safe and healthy environment, and sustainable development of the area.

10. Water Convention

- The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) was adopted in Helsinki in 1992 and **entered into force in 1996**.
- The Convention is a unique **legally binding instrument** promoting the sustainable management of shared water resources, the implementation of the Sustainable Development Goals, the prevention of conflicts, and the promotion of peace and regional integration.

Implementation:

1. The Water Convention requires Parties to prevent, control and reduce transboundary impact, use transboundary waters in a reasonable and equitable way and ensure their sustainable management.
2. Parties bordering the same transboundary waters have to cooperate by entering into specific agreements and establishing joint bodies.
3. As a framework agreement, the Convention does not replace bilateral and multilateral agreements for specific basins or aquifers; instead, it fosters their establishment and implementation, as well as further development.

11. Circular Water Management

- It is critical for us to adopt the **circular water management model of treating and rejuvenating wastewater at source**, along with efficient water management strategies to reduce water demand.

Concerns over India's Agricultural Exports

- India has witnessed a continued decline in its per capita water availability — by 60 per cent over the last 50 years because of increasing water use by the irrigation sector.
- The agricultural exports for 2020-21 are equivalent to the annual drinking water needs of 1,500 villages with a population of 1,000.
- **Agricultural exports reduce the imbalance in trade and earn hard currency while causing social and environmental fallouts.**

- Export of 17.7 million tonnes of rice and 7.5 million tonnes of sugar is the same as the export of 50.4 billion cubic metres of water.
- Globally, India is one of the largest water exporters.

Virtual Water Trade (VWT)

- Virtual Water Trade (VWT) is slowly altering the global hydrological cycle in many ways.
- Several countries have begun to act early, adopting the VWT route to address worldwide water distress.
- **Water-guzzling activities are getting outsourced for production to other countries.**
- Thus, crops, meat, leather, chemicals and industrial goods are imported to ensure a positive water balance.
- If the future wars will be about water, then the weaponisation is in using VWT.
- Persian Gulf and North African countries are forced to import virtual water due to acute shortages.
- Mexico imports maize and in doing so, it saves 12 billion cubic metres per year of its national water resources.
- VWT, covering both export and import, is here to stay and cannot be avoided, just as oil import is accepted as critical for economic growth.

Impact

- The visible impact on a national scale remains unnoticed as a mere one to four per cent of the total water gets depleted per annum through the agri-exports route.
- However, this impact is significant enough to create an enormous imbalance at the local level in different regions where crops are grown.
- Globalisation of local water resources is operationalised covertly.
- **The impact of Virtual water export on coming generations would be more catastrophic if corrective actions are not taken at the earliest.**

Way Forward

- **'Water Value'** is the mantra for positively altering the shortfalls through imports.
- Importing water-intensive crops and products enables countries to balance their increasing water demand while exporting less water-intensive commodities.
- **Improving the local water resource base** as adopted by several countries including Germany, France, Italy, the UK, Netherlands, the United States, China and Japan.
- VWT risks need to be integrated into the policy framework to help anticipate the concerns and design management practices.
- It is essential to define the limits of VWT to safeguard the interests of future generations.
- A national guideline needs to be designed to help map the volumes of water already lost from the hydrological cycle due to export and ways to offset the loss through improved management strategies.
- **Design 'water renewal credit' similar to 'Carbon credit', that can revive wastewater into productive use.**
- It is critical to adopt the **circular water management model** of treating and rejuvenating wastewater at source.

Waste Management

1. E-Waste:

- Electronic-Waste and the term is used to describe old, end-of-life or discarded electronic appliances.
- It includes their components, consumables, parts and spares.
It is categorized into 21 types under two broad categories:
 - Information technology and communication equipment.
 - Consumer electrical and electronics.
- Laws to manage e-waste have been in place in India since 2011, mandating that only authorized dismantlers and recyclers collect e-waste.
- **E-waste (Management) Rules, 2016 was enacted in 2017.**
- India's first e-waste clinic for segregating, processing and disposal of waste from household and commercial units has been set-up in **Bhopal, Madhya Pradesh.**
- International E-Waste Day has been observed on **October 14** every year since 2018.

- Consumer goods companies and makers of electronics goods have to ensure at least **60% of their electronic waste is collected and recycled by 2023 with targets to increase them to 70% and 80% in 2024 and 2025**, respectively, according to a draft notification by the **Environment Ministry** made public this week.
- The rules bring into effect a system of trading in certificates, akin to carbon credits, that will allow companies to temporarily bridge shortfalls.

Impacts of e-waste:

- **Toxicity:** E-waste consists of toxic elements such as Lead, Mercury, Cadmium, Chromium, Polybrominated biphenyls and Polybrominated diphenyl.
- **Effects on Humans:** Some of the major health effects include serious illnesses such as lung cancer, respiratory problems, bronchitis, brain damages, etc due to inhalation of toxic fumes, exposure to heavy metals and alike.
- **Effects on Environment:** E-waste is an environmental hazard causing groundwater pollution, acidification of soil and contamination of groundwater and air pollution due to the burning of plastic and other remnants.

E- waste in India:

- According to the Central Pollution Control Board (CPCB), India generated more than 10 lakh tonnes of e-waste in 2019-20, an increase from 7 lakh tonnes in 2017-18. Against this, the e-waste dismantling capacity has not been increased from 82 lakh tonnes since 2017-18.
- In 2018, the Ministry of Environment had told the tribunal that 95% of e-waste in India is recycled by the informal sector and scrap dealers unscientifically dispose of it by burning or dissolving it in acids.

Efforts by India to manage e-waste:

Laws to manage e-waste have been in place in India since 2011, mandating that only authorised dismantlers and recyclers collect e-waste.

Basel Convention on the Control of the Trans-boundary Movement of Hazardous Waste, 1992:

The Basel Convention started to address e-waste issues since 2002 which include, among others, environmentally sound management; prevention of illegal traffic to developing countries and; building capacity around the globe to better manage e-waste.

- The Mobile Phone Partnership Initiative (MPPI) was adopted by the sixth meeting of the Conference of the Parties to the Basel Convention.
- The Nairobi Declaration on the Environmentally Sound Management of Electrical and Electronic Waste and decision IX/6 adopted by the ninth meeting of the Conference of the

Parties (COP9) gave a mandate to the Secretariat to implement a work plan for the environmentally sound management of e-waste.

Rotterdam Convention, 2004:

The Convention seeks to promote exchange of information (through Prior Informed Consent) among Parties over a range of potentially hazardous chemicals (includes pesticides and industrial chemicals) that may be exported or imported.

2. E-waste (Management) Rules, 2016

- The **Ministry of Environment, Forest and Climate Change** notified the E-Waste Management Rules, 2016 in supersession of the E-waste (Management & Handling) Rules, 2011.
- Over **21 products (Schedule-I)** were included under the purview of the rule.
- It included **Compact Fluorescent Lamp (CFL) and other mercury containing lamps**, as well as other such equipment.
- For the first time, the rules brought the producers under Extended Producer Responsibility (EPR), along with targets.
- Producers have been made responsible for the collection of E-waste and for its exchange.
- Various producers can have a separate Producer Responsibility Organization (PRO) and ensure collection of E-waste, as well as its disposal in an environmentally sound manner.
- The role of State Governments has been also introduced to ensure safety, health and skill development of the workers involved in dismantling and recycling operations.
- A provision of penalty for violation of rules has also been introduced.
- **Urban Local Bodies (Municipal Committee/Council/Corporation)** have been assigned the duty to collect and channelize the orphan products to authorized dismantlers or recyclers.
- Allocation of proper space to existing and upcoming industrial units for e-waste dismantling and recycling.

3. Plastic waste management

In another step toward eliminating **single-use plastic**, the Union Environment Ministry has launched "**Prakriti**", a mascot to spread greater awareness about small changes that can be sustainably adopted in the lifestyle for a better environment.

During the event, following green initiatives were launched for plastic waste management:

1 – National Dashboard on Elimination of Single Use Plastic and Plastic Waste Management (MoEFCC):

- This aims to connect all stakeholders including Central Ministries/ Departments, State/UT Governments, etc. through one platform and track status and progress made for elimination of single use plastic & effective management of plastic waste.

2 – Extended Producer Responsibility (EPR) Portal for Plastic Packaging (CPCB):

- This portal will look after tasks that will help in overall operational functions like improving accountability, traceability, transparency and facilitating ease of reporting compliance to EPR Obligations by Producers, Importers and Brand-owners.

3 – Mobile App for Single Use Plastics Grievance Redressal (CPCB):

- This app will allow citizens to check sale/usage/manufacturing of single use plastic in their region and tackle the plastic menace.

4 – Monitoring module for single use plastic (CPCB):

- This will be for local bodies, State pollution control board/PCCs and CPCB, etc. to invent details of single use plastic production, its sale & usage, etc. in commercial establishments at district level, and on-ground enforcement of ban on single use plastics.

5 – **Industrial production of Graphene from Waste Plastic (G B Pant NIHE & NRDC)** will promote more industries to come forward to upcycle plastic waste.

Enforcement is key for the ban to be effective.

- The government also needs to address important structural issues such as policies to regulate the use of plastic alternatives, improve recycling and have better waste segregation management.
- In addition to improving recyclability, investment in research and development for alternatives should also be a priority.

Efforts by Government in this regard:

- To tackle the challenge of plastic pollution, Prime Minister Narendra Modi announced India's pledge to phase out Single-Use Plastics (SUPs) by 2022.
- India's plastic waste management rules 2016 were amended banning the import of plastic waste SUVs with effect from July 2022 onward.

Why plastics?

- As plastic is cheap, lightweight and easy to produce, it has led to a production boom over the last century, and the trend is expected to continue in the coming decades, according to the United Nations.
- But countries are now struggling with managing the amount of plastic waste they have generated.

About 60% of plastic waste in India is collected — that means the remaining 40% or 10,376 tons remain uncollected.

Role of waste pickers

- Waste pickers, working in dangerous and unsanitary conditions, have picked up what we throw away.
- They form the base of a pyramid that includes scrap dealers, aggregators and re-processors.
- **By diverting waste towards recycling and reuse, waste pickers also subsidise local governments responsible for solid waste management.**
- They reduce the amount of waste accumulating in cities, water bodies and dumpsites and increase recycling and reuse.
- Unfortunately, most informal waste pickers remain invisible.
- Between 1.5 and 4 million waste pickers in India work without social security, health insurance, minimum wages or basic protective gear.
- EPR funds could be deployed for registration of the informal sector actors and building their capacity.
- Without strong government regulation, the millions of workers will stand to lose their livelihoods.

Government's strategy:

A government committee has identified the single use plastic (SUP) items to be banned based on an index of their utility and environmental impact. It has proposed a three-stage ban:

1. **The first category** of SUP items proposed to be phased out are plastic sticks used in balloons, flags, candy, ice-cream and ear buds, and thermocol that is used in decorations.
2. **The second category, proposed to be banned from July 1, 2022**, includes items such as plates, cups, glasses and cutlery such as forks, spoons, knives, straws, trays; wrapping and

'Meendum Manjappai' scheme:

Tamil Nadu has launched the **'Meendum Manjappai'** campaign aimed at **creating awareness on the usage of cloth bags instead of single-use plastic bags.**

packing films used in sweet boxes; invitation cards; cigarette packets; stirrers and plastic banners that are less than 100 microns in thickness.

3. **A third category of prohibition** is for non-woven bags below 240 microns in thickness. This is **proposed to start from September next year.**

Challenges ahead:

1. It is not going to be an easy task given that close to 26,000 tons of plastic waste is generated across India every day, of which more than 10,000 tons stays uncollected.
2. A significant amount of plastic ends up in rivers, oceans and landfills.

What needs to be done?

1. The government has to do a thorough economic and environmental cost-benefit analysis.
2. The plan has to take into account social and economic impacts for the ban to be successful.
3. We need better recycling policies because resources are poor and there needs to be a much broader strategy.

4. Single-use plastics

The Centre has banned the use of ‘single-use plastic’ from July 1, 2022. The manufacture, import, stocking, distribution, sale and use of following single-use plastic, including polystyrene and expanded polystyrene, commodities shall be prohibited with effect from the 1st July, 2022

Single-use plastics or disposable plastics:

- They are **used only once** before they are thrown away or recycled.
- **Petroleum-based plastic is non biodegradable** and usually goes into a landfill where it is buried or it gets into the water and finds its way into the ocean.
- In the process of breaking down, it releases toxic chemicals (additives that were used to shape and harden the plastic) which make their way into our food and water supply.

IISc researchers find a way to substitute for single-use plastics.

- By combining non-edible oils and cellulose extracted from agricultural stubble, the researchers made biodegradable, multi-use polymer sheets. This can make a substitute for single-use plastic that can, in principle, help mitigate the problem of accumulating plastic waste in the environment.

Plastic Waste Management (Amendment) Rules, 2022:

• **Classification of Plastics:**

Category 1: Rigid plastic packaging will be included under this category.

Category 2: Flexible plastic packaging of single layer or multilayer (more than one layer with different types of plastic), plastic sheets and covers made of plastic sheet, carry bags, plastic sachet or pouches will be included under this category.

Category 3: Multi-layered plastic packaging (at least one layer of plastic and at least one layer of material other than plastic) will be included under this category.

Category 4: Plastic sheet or like used for packaging as well as carry bags made of compostable plastics fall under this category.

• **Plastic Packaging:**

Reuse of rigid plastic packaging material has been mandated in the guidelines to reduce the use of fresh plastic material for packaging.

Efforts for a plastic-free society

PROHIBITED	ALTERNATIVES
Ear buds with plastic sticks 	Bamboo and other wooden sticks for buds 
Plastic flags	Cloth flag with wooden stick
Plastic cutlery items 	Stainless steel, ceramic, earthen, biodegradable cups, wooden forks and spoons
Wrapping or packaging films	Cellophane/cellulose film, recycled paper, recycled cardboard

- **Extended Producer Responsibility Certificates:**
It allows for sale and purchase of surplus extended producer responsibility certificates.
- **Centralised Online Portal:**
The government has also called for establishing a centralized online portal by Central Pollution Control Board (CPCB) for the registration as well as filing of annual returns by producers, importers and brand-owners, plastic waste processors of plastic packaging waste by 31st March, 2022.
- **Environmental Compensation:**
It will be levied based upon polluter pays principle, with respect to non-fulfilment of EPR targets by producers, importers and brand owners, for the purpose of protecting and improving the quality of the environment and preventing, controlling and abating environment pollution.
- **Committee to Recommend Measures:**
A committee constituted by the CPCB under the chairmanship of CPCB chairman will recommend measures to the environment ministry for effective implementation of EPR, including amendments to Extended Producer Responsibility (EPR) guidelines.
- **Annual Report on EPR Portal:**
State Pollution Control Board (SPCBs) or Pollution Control Committees (PCCs) have been tasked to submit an annual report on EPR portal with respect to its fulfillment by producers, importers and brand-owners and plastic waste processors in the state/Union Territory to the CPCB.

5. World's Marine Plastic Pollution

- Over 300 million tons of plastic are produced every year for use in a wide variety of applications.
- **At least 8 million tons of plastic end up in our oceans every year, and make up 80% of all marine debris from surface waters to deep-sea sediments.**

What is the Issue?

- **Floating plastic debris are currently the most abundant items of marine litter.**
- Plastic has been detected on shorelines of all the continents, with more plastic materials found near popular tourist destinations and densely populated areas.
- The main sources of marine plastic are land-based, from urban and storm runoff, sewer overflows, inadequate waste disposal and management, industrial activities, construction and illegal dumping.

Threat to Marine Environment

- Plastic pollution is the most widespread problem affecting the marine environment.
- Marine species ingest or are entangled by plastic debris, which causes severe injuries and deaths.
- Marine wildlife such as seabirds, whales, fishes and turtles, mistake plastic waste for prey, and most die of starvation as their stomachs are filled with plastic debris.
- Floating plastics also contribute to the spread of invasive marine organisms and bacteria, which disrupt ecosystems.

Impacts on food and health

- **Invisible plastic has been identified in tap water**, salt and are present in all samples collected in the world's oceans, including the Arctic.
- Several chemicals used in the production of plastic materials are known to be **carcinogenic** and interfere with the body's endocrine system, causing developmental, reproductive, neurological, and immune disorders in both humans and wildlife.
- When marine organisms ingest plastic debris, these contaminants enter their digestive systems, and overtime accumulate in the food web.

- The transfer of contaminants between marine species and humans through consumption of seafood has been identified as a **health hazard**, but has not yet been adequately researched.

Other Impacts

- If plastic waste is incinerated, it releases carbon dioxide into the atmosphere, thereby increasing carbon emissions.
- Plastic waste damages the aesthetic value of tourist destinations, leading to decreased tourism-related incomes.
- It leads to major economic costs related to the cleaning and maintenance of the sites.

International Efforts

- Global concern and public awareness regarding the impact of plastic on the marine environment are currently increasing.
- **The United Nations Environment Program (UNEP) considers plastic marine debris and its ability to transport harmful substances as one of the main emerging issues affecting the environment.**
- At the 2015 G7 summit in Bavaria, Germany, the risks of microplastics were acknowledged in the Leaders' Declaration.
- **Legal efforts have been made at the international and national levels to address marine pollution.** The most important are
 - the 1972 Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matter (or the London Convention),
 - the 1996 Protocol to the London Convention (the London Protocol), and
 - the 1978 Protocol to the International Convention for the Prevention of Pollution from Ships (MARPOL).
- However, compliance with these laws is still poor, partly due to limited financial resources to enforce them.

Way Forward

- There is an urgent need to explore the use of existing legally binding international agreements to address marine plastic pollution.
- **Recycling and reuse of plastic materials** are the most effective actions available to reduce the environmental impacts of open landfills and open-air burning.
- Support for **research and innovation to develop new products to replace single-use plastics** are also necessary to prevent and reduce plastic pollution.
- Governments, research institutions and industries also need to work collaboratively **redesigning products in order to reduce microplastics waste** from pellets, synthetic textiles and tyres.
- This will **require solutions which go beyond waste management, to consider the whole lifecycle of plastic products, from product design to infrastructure and household use.**

6. Guidelines on Extended Producers Responsibility (EPR) on plastic packaging

The government has notified **the Guidelines on Extended Producers Responsibility (EPR) on plastic packaging under Plastic Waste Management Rules, 2016**. The guidelines will come into effect from 1st July 2022.

The guidelines also include:

- Specifications for reuse, recycling, use of recycled plastic content, and end-of-life disposal of non-recyclable plastic packaging.
- setting up a **centralised online portal by Central Pollution Control Board (CPCB)** for the registration as well as filing of annual returns by producers, importers and brand-owners, plastic waste processors of plastic packaging waste by March 31.

- Producers of plastic packaging will have to manage **35% of the 'Q1' waste in metric tonnes in 2021-22**. Q1 is calculated by adding the last two years' average weights of plastic packaging material sold and pre-consumer plastic packaging waste, and subtracting the annual quantity of plastic packaging supplied to brand owners.
- **The EPR target** will be increased to 70% in 2022-23 and 100% from 2023-24 onwards.
- **The recycling obligation for producers** will be 50% for rigid plastics in 2024-25, 60% in 2025-26, 70% in 2026-27, and 80% from 2027-28 onwards.
- **Environmental compensation** shall be levied based upon polluter pays principle, with respect to non-fulfilment of EPR targets by producers, importers and brand owners, for the purpose of protecting and improving the quality of the environment and preventing, controlling and abating environment pollution.
- For the first time, **the guidelines allow for the sale and purchase of surplus extended producer responsibility certificates**. Thus setting up a market mechanism for plastic waste management.

Significance:

Along with prohibition of identified single-use plastic items, the new guidelines in India will:

- Reduce pollution caused due to littered plastic waste.
- Promote development of new alternatives to plastics.
- Provide a roadmap for businesses to move towards sustainable plastic packaging.
- Provide a framework to strengthen the circular economy of plastic packaging waste.
- Boost for formalization and further development of the plastic waste management sector.

What are Plastic Waste Management Rules?

MoEFCC notified **the Plastic Waste Management Rules** on March 18, 2016, and **the Solid Waste Management Rules** on April 8 the same year.

- As **plastic waste is part of solid waste**, therefore, both the rules apply to managing plastic waste in the country.
- The Plastic Waste Management Rules mandate minimising the generation of plastic waste, avoiding littering, ensuring segregated storage of the waste at source, and handing it over.
- The rules also mandate the responsibilities of local bodies, gram panchayats, waste generators, retailers, and street vendors to manage plastic waste.
- **The rules cast EPR** on producers, importers, and brand-owners. Extended Producer Responsibility shall be applicable to both pre-consumer and post-consumer plastic packaging waste.

7. [UNEA plastic pollution resolution](#)

A resolution at the recent **fifth session of the United Nations Environment Assembly (UNEA-5.2)** held in Nairobi sought **to end plastic pollution and forge an international legally binding agreement by 2024**. It was hosted by **the UN Environment Programme**.

- The resolution will pertain to marine ecosystems as well, and will include both binding and voluntary approaches from member states.

Need for a binding resolution to limit plastic pollution:

Plastic production has risen exponentially in the last decades and now amounts to some **400 million tons per year**— a figure set to double by 2040.

The impacts of plastic production and pollution on **the triple planetary crisis of climate change, nature loss and pollution** are a catastrophe in the making:

1. Exposure to plastics can harm human health, potentially affecting fertility, hormonal, metabolic and neurological activity, and open burning of plastics contributes to air pollution.
2. By 2050 greenhouse gas emissions associated with plastic production, use and disposal would account for 15 percent of allowed emissions, under the goal of limiting global warming to 1.5°C (34.7°F).

3. More than 800 marine and coastal species are affected by this pollution through ingestion, entanglement, and other dangers.
4. Some 11 million tonnes of plastic waste flow annually into the oceans. This may triple by 2040.

A shift to a circular economy can reduce the volume of plastics entering oceans by over 80 per cent by 2040; reduce virgin plastic production by 55 per cent; save governments US\$70 billion by 2040; reduce greenhouse gas emissions by 25 per cent; and create 700,000 additional jobs – mainly in the global south.

8. Lead poisoning

Recently, high levels of lead were found in the blood of thousands of children living around the Kabwe mine in Zambia.

How it costs countries?

Childhood lead exposure is estimated to cost lower- and middle-income countries almost USD \$1 trillion due to lost economic potential of these children over their lifetime.

Factors contributing to lead poisoning:

1. Informal and substandard recycling of lead-acid batteries.
2. Increase in vehicle ownership, combined with the lack of vehicle battery recycling regulation and infrastructure.
3. Workers in dangerous and often illegal recycling operations break open battery cases, spill acid and lead dust in the soil.
4. They also smelt the recovered lead in crude, open-air furnaces that emit toxic fumes poisoning the surrounding community.



Need of the hour:

A coordinated and concerted approach across the following areas:

1. Proper Monitoring and reporting.
2. Prevention and control measures.
3. Management, treatment and remediation.
4. Public awareness and behaviour change.
5. Legislation and policy.
6. Global and regional action.

Conclusion:

It is clear from evidence compiled that lead poisoning is a much greater threat to the health of children than previously understood. Although much more research needs to be conducted, enough data have recently emerged for decisive action to begin – and it must begin now.

9. Solid Waste Management (SWM) in Urban Areas

- Solid waste management (SWM) refers to **the process of collecting and treating solid wastes**.
- It also **offers solutions for recycling items that do not belong to garbage or trash**.
- Managing waste properly is essential for building sustainable and liveable cities.

Present Situation of SWM in India

- As per the SBM 2.0 guidelines, the total quantity of waste generated by urban areas in India is about **32 lakh tonnes daily**.
- Of this only about 25% is being processed; the rest is disposed of in landfills every year.
- Most cities have confined themselves to collection and transportation of solid waste. Processing and safe disposal are being attempted only in a few cases.
- The CPCB report also reveals that **only 68% of the MSW generated in the country is collected** of which, **28% is treated by the municipal authorities**.
- Disappearance of urban water bodies and wetlands in urban areas can be attributed to illegal dumping of Construction & Demolition waste.
- Most of the dumpsites of megacities have reached way beyond their capacity and permissible height limit of 20 meters.

Major issues concerning solid waste management

- Absence of segregation of waste at source
- Lack of funds for waste management at ULBs.
- Lack of technical expertise and appropriate institutional arrangement
- Lack of infrastructure and technology
- Lack of involvement from the private sector and non-governmental organisations
- Indifference of citizens towards waste management
- About 70% of the plastic packaging products turn into plastic waste within a short period.
- Unorganized vendors and markets, existence of slum areas and Corruption are other issues plaguing MSWM.

Concerns / Challenges

- The dumpsites being open and easily accessible, have become a site for further dumping by the public aggravating the situation.
- Most of the waste is often disposed in unregulated dumps or openly burned.
- These practices create serious health, safety, and environmental consequences.
- Poorly managed waste serves as a breeding ground for disease vectors, contributes to global climate change through methane generation, and can even promote urban violence.

Way Forward

- State governments should provide financial support to ULBs to improve their waste management system under various schemes and programs.
- Initiatives like Smart Cities Mission, AMRUT should provide significant funding to improve civic services infrastructure.
- Waste to energy is a key component of SWM. Installation of waste-to-compost and bio-methanation plants would reduce the load of landfill sites
- There is a need to encourage research and development so as to reinvent waste management system in India.
- The focus should be on **recycling and recovering from waste** and not landfill.
- Further, it is important to encourage recycling of e-waste so that the problem of e-waste.
- Public- Private Partnership models for waste management should be encouraged.

- **Sensitization** of citizens as well as government authorities, community participation, involvement of NGOs.
- International Best practices should be emulated. South Korea is one of the few countries to separate and recycle food waste.

Conclusion

- Municipal solid waste management (MSWM) is one of the major environmental problems of Indian cities. The need of the hour is scientific, sustainable and environment friendly management of wastes.



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International Environmental Convention

1. Stockholm Convention on POPs

European Commission has proposed to tighten limits for a range of persistent organic pollutants (POPs) to tackle contamination in recycled products, health and environment.

What are POPs?

In 1995, the Governing Council of the United Nations Environment Programme (UNEP) called for global action to be taken on POPs, which it defined as **“chemical substances that persist in the environment, bio-accumulate through the food web, and pose a risk of causing adverse effects to human health and the environment”**.

About Stockholm Convention on POPs:

Signed in 2001 and **effective from May 2004** (Ninety days after the ratification by at least 50 signatory states).

Aims to **eliminate or restrict** the production and use of **persistent organic pollutants (POPs)**.

Sources of POPs:

- Improper use and/or disposal of agrochemicals and industrial chemicals.
- Elevated temperatures and combustion processes.
- Unwanted by-products of industrial processes or combustion.

Is it legally binding?

Yes. **Article 16** of the Convention requires that effectiveness of the measures adopted by the Convention is evaluated in regular intervals.

Other Conventions dealing with POPs:

Convention on Long-Range Transboundary Air Pollutants (LRTAP), Protocol on Persistent Organic Pollutants (POPs).

Recent developments:

The Union Cabinet, in 2021, approved the Ratification of **seven chemicals** listed under **the Stockholm Convention** on Persistent Organic Pollutants (POPs).

- The Cabinet has also delegated its **powers to ratify chemicals** under the Stockholm Convention to the Union Ministers of External Affairs (MEA) and Environment, Forest and Climate Change (MoEFCC) in respect of POPs already regulated under the domestic regulations.

2. Kunming Declaration on biodiversity conservation

The “Kunming Declaration” was adopted by over 100 countries in the ongoing virtual 15th meeting of the Conference of the Parties (COP) to **the United Nations Convention on Biological Diversity (UNCBD)**.

Theme of the COP-15: “Ecological Civilization: Building a Shared Future for All Life on Earth”.

Kunming Declaration:

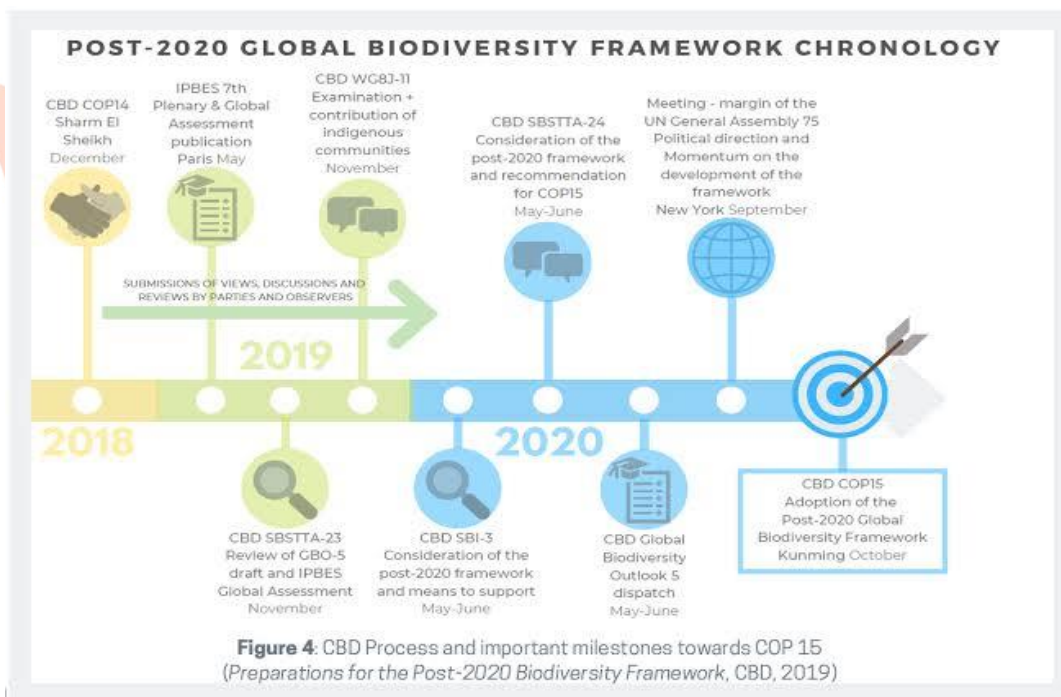
- It calls upon the parties to “mainstream” biodiversity protection in decision-making and recognise the importance of conservation in protecting human health.
- By adopting this, the nations have committed themselves to support the development, adoption and implementation of an effective post-2020 implementation plan, capacity building action plan for the Cartagena Protocol on biosafety.

- Signatory nations should ensure that the post-pandemic recovery plans contribute to the conservation and sustainable use of biodiversity, promoting sustainable and inclusive development.
- The declaration expects signatory nations to synchronize Biodiversity plans with the three UN decades program which are on ‘Sustainable Development’, ‘Ecosystem Restoration’, ‘Ocean Science for Sustainable Development’.

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Convention on Biological Diversity, 1992:

The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives:

1. The conservation of biological diversity.
2. The sustainable use of the components of biological diversity.
3. The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

The Convention was opened for signature on 5 June 1992 at the United Nations Conference on Environment and Development (the Rio “Earth Summit”).

- This convention is a legally binding framework treaty that has been ratified by 180 countries.

- The CBD Secretariat is based in Montreal, Canada and it operates under the United Nations Environment Programme.
- The areas that are dealt by convention are conservation of biodiversity, sustainable use of biological resources and equitable sharing of benefits arising from their sustainable use.
- The convention came into force in 1993. Many biodiversity issues are addressed including habitat preservation, intellectual property rights, biosafety and indigenous people's rights.

30 by 30 Target:

The declaration made a reference to the '30 by 30' target which is a key proposal being debated at the COP15, that would afford 30% of the Earth's land and oceans protected status by 2030.

- Apart from this, the goal to halve the use of chemicals in agriculture and stop creating plastic waste is also being debated.

3. Montreal Protocol

World Ozone Day is celebrated on **16th September each year** to commemorate the signing of the **Montreal Protocol**.

- **This international environmental treaty** for phasing out of production and consumption of **Ozone Depleting Substances** came into force on this day in 1987.
- The Day is celebrated every year **to spread awareness among people about the depletion of Ozone Layer** and the measures taken/ to be taken to preserve it.

The theme World Ozone Day 2021: "Montreal Protocol - Keeping us, our food and vaccines cool".

Montreal Protocol:

The Montreal Protocol on Substances that Deplete the Ozone Layer (the Montreal Protocol) is an international agreement made in 1987.

- It was **designed to stop the production and import of ozone depleting substances** and reduce their concentration in the atmosphere to help protect the earth's ozone layer.
- The Montreal Protocol sits under the **Vienna Convention for the Protection of the Ozone Layer** (the Vienna Convention).

What is the 'Kigali Amendment'?

Kigali Amendment was adopted by the **Parties to the Montreal Protocol on October, 2016** at 28th Meeting of the Parties to the Montreal Protocol held at Kigali, Rwanda.

- **Under the Kigali Amendment;** Parties to the Montreal Protocol will phase down production and consumption of Hydrofluorocarbons, commonly known as HFCs.
- All amendments and adjustments of the Montreal Protocol, prior to the Kigali Amendment have Universal support.

India's achievements in implementation of Montreal Protocol:

- India, as Party to the Montreal Protocol since June 1992, has been successfully implementing the Montreal Protocol.
- **India has phased out** Chlorofluorocarbons, Carbon tetrachloride, Halons, Methyl Bromide and Methyl Chloroform for controlled uses in line with the Montreal Protocol.
- **Currently Hydrochlorofluorocarbons are being phased out** as per the accelerated schedule of the Montreal Protocol.
- **Hydrochlorofluorocarbons Phase out Management Plan (HPMP) Stage-I** has been successfully implemented from 2012 to 2016 and **HPMP Stage-II** is currently under implementation from 2017 and will be completed by 2023.
- **Government of India has recently decided to Ratify the Kigali Amendment** to the Montreal Protocol.

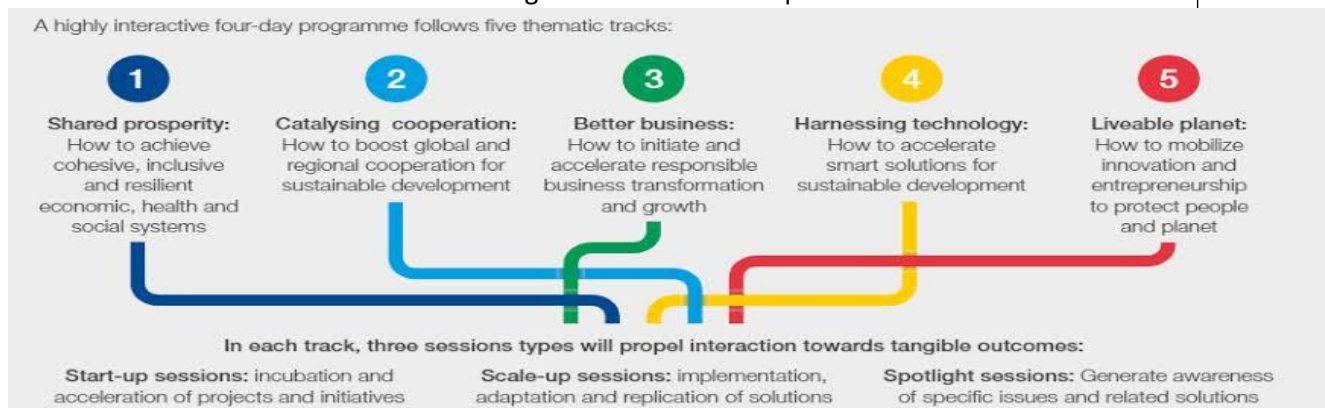
Benefits of ratification of the Kigali Amendment:

- HFC phasedown is expected **to prevent the greenhouse gas emissions**, helping prevent climate change and would benefit the people.
- The industry producing and consuming Hydrofluorocarbons **will be phasing out Hydrofluorocarbons as per the agreed schedule under and transition to non-HFC** and low global warming potential technologies.

4. World Sustainable Development Summit

21st edition of the event was inaugurated recently.

Theme: Towards a Resilient Planet: Ensuring a Sustainable and Equitable Future.



About the World Sustainable Development Summit:

- It is the annual flagship event of **The Energy and Resources Institute (TERI)**.
- It is **the sole Summit on global issues taking place in the developing world**.
- It provides a platform for global leaders and practitioners to discuss and deliberate over climatic issues of universal importance.
- It strives to provide long-term solutions for the benefit of the global community by assembling the world's most enlightened leaders and thinkers on a single platform.

What is sustainable development?

'Development which meets the needs of the present without compromising the ability of future generations to meet their own needs'.

- This most widely accepted definition of Sustainable Development was given by **the Brundtland Commission** in its report **Our Common Future (1987)**.
- Sustainable development (SD) calls for concerted efforts towards building an inclusive, sustainable and resilient future for people and planet.

Three core elements of sustainable development are:

- Economic growth, social inclusion and environmental protection. It is crucial to harmonize them.

Coral Bleaching

- Coral reefs harbour the highest biodiversity of any ecosystem globally and directly support over 500 million people worldwide, mostly in poor countries.
- They are among the most threatened ecosystems on Earth, largely due to unprecedented global warming and climate changes, combined with growing local pressures.

Why are Coral reefs Important?

- Coral reefs harbour the highest biodiversity of any ecosystem globally.
- Despite covering less than 0.1% of the ocean floor, reefs host more than one quarter of all marine fish species.
- Reefs provide a variety of ecosystem services such as subsistence food, protection from flooding and sustaining the fishing and tourism industries.
- Their disappearance will therefore have economic, social and health consequences.
- Coral reefs are also key indicators of global ecosystem health.
- They serve as an early warning sign of what may happen to other less sensitive systems, such as river deltas, if climate change is not urgently addressed.
- The value of goods and services provided by coral reefs is estimated to be \$2.7 trillion per year. This includes \$36 billion in coral reef tourism.
- The net economic value of the world's coral reefs could be nearly tens of billions of dollars per year.

1. What is Coral bleaching?

- Basically bleaching is when the corals expel a certain algae known as **zooxanthellae**, which lives in the tissues of the coral in a symbiotic relationship.
- About 90% of the energy of the coral is provided by the zooxanthellae which are endowed with chlorophyll and other pigments. They are responsible for the yellow or reddish brown colours of the host coral. In addition the zooxanthellae can live as endosymbionts with jellyfish also.
- When a coral bleaches, it does not die but comes pretty close to it. Some of the corals may survive the experience and recover once the sea surface temperature returns to normal levels.

Coral bleaching events

- A spike of 1–2°C in ocean temperatures sustained over several weeks can lead to bleaching, turning corals white.
- Over the last three years, reefs around the world have suffered from mass coral bleaching events as a result of the increase in global surface temperature caused by anthropogenic greenhouse gas emissions.
- Iconic reefs such as the Great Barrier Reef in Australia and the Northwestern Hawaiian Islands in the United States have all experienced their worst bleaching on record with devastating effects.
- The bleaching of the Great Barrier Reef in 2016 and 2017, killed around 50% of its corals.
- According to UNESCO, the coral reefs in all 29 reef-containing World Heritage sites would cease to exist by the end of this century if we continue to emit greenhouse gases under a business-as-usual scenario.
- If temperatures continue to rise, bleaching events will increase in intensity and frequency.

Challenges ahead:

1. Persistent rise of land and sea temperatures is a threat to corals.
2. The survival of corals is likely to drop below 50 per cent if sea surface temperatures increase by one degree.

- All of the world's reefs will bleach by the end of the century unless the world acts together to reduce carbon emissions.

Way Forward

- Limiting global average temperature to well below 2°C above pre-industrial levels in line with the Paris Agreement provides the only chance for the survival of coral reefs globally.
- Reinforcing commitments to the Paris Agreement must be mirrored in all other global agreements such as the Sustainable Development Goals.
- There also needs to be a transformation of mainstream economic systems and a move towards circular economic practices.
- Economic systems need to rapidly move to the low greenhouse gas emission scenario to enable global temperature decrease.
- A move away from current economic thinking should include the benefits provided by coral reefs, which are currently not taken into account in mainstream business and finance.
- Therefore, sustaining and restoring coral reefs should be treated as an asset, and long-term investments should be made for their preservation.
- Investments should also include support for research at the frontiers of biology, such as genetic selection of heat-resistant corals that can withstand rising global temperatures.

2. Coral bleaching at the Great Barrier Reef

Scientists have warned that **the Great Barrier Reef** will face a critical period of heat stress over the coming weeks, following the most widespread coral bleaching the natural world has ever endured.

About Great Barrier Reef:

The Great Barrier Reef Marine Park, which spreads across a length of over 2,300 km and is roughly the size of Italy, is home to about 3,000 coral reefs, 600 continental islands, 1,625 type of fish, 133 varieties of shark and rays and 600 types of soft and hard corals. It is a **world heritage site**.

What are Coral reefs?

Coral reefs are important hotspots of biodiversity in the ocean. Corals are animals in the same class (Cnidaria) as jellyfish and anemones. They consist of individual polyps that get together and build reefs.

Significance:

Coral reefs support a wide range of species and maintain the quality of the coastal biosphere.

Corals control the level of carbon dioxide in the water by converting it into a limestone shell. If this process does not take place, the amount of carbon dioxide in the ocean water would increase significantly and affect ecological niches.

Threats:

- Coral reefs are threatened by climate change.



- When the sea surface temperature increases beyond a tolerable limit, they undergo a process of bleaching.

3. Global Coral Reef Monitoring Network

Global Coral Reef Monitoring Network (GCRMN) has released a report on the status of coral reefs across the world.

- The report, the first of its kind in 13 years, underlined the catastrophic consequences of global warming but said that **some coral reefs can be saved by arresting greenhouse gases.**

Highlights of the report:

1. In the last decade, the world lost about 14 per cent of its coral reefs.
2. **Threats:** Ocean-acidification, warmer sea temperatures and local stressors such as overfishing, pollution, unsustainable tourism and poor coastal management.
3. **Impact of global warming:** Coral reefs across the world are under relentless stress from warming caused by climate change. **Coral bleaching events** caused by rise in elevated sea surface temperatures (SST) were responsible for coral loss.
4. **Loss of hard coral cover:** There has been a steady decrease in hard coral cover in the last four decades since 1978 when the world lost nine per cent of its corals. The decrease is disconcerting because live hard coral cover is an indicator of coral reef health.
5. **Algal bloom:** Algal bloom on coral ridges are a sign of stress on the structures. Since 2010, the amount of algae on the world's coral reefs has increased by about 20 per cent.



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Mangroves

- A **mangrove** is a shrub or small tree that grows in coastal saline or brackish water. The term is also used for tropical coastal vegetation consisting of such species.
- They are located on the intermediate zone between the land and the sea and represent one of the best examples of ecotone. They **require warm saline water** and so they are situated along tropical coastlines. Mangrove plants survive in the saltwater zones between water and land.
- Mangroves have a “**complex salt filtration system**” and **complex root system to cope with salt water immersion and wave action**.
- Mangrove forests serve an important role in **stabilizing and reinforcing coastlands**. In this way, they protect these coastlands from erosion that results from action of waves and tides that occur regularly. **They act as a shield against storms**.
- **Ecologically**, they **provide habitat** for a diverse array of terrestrial and marine organisms. The area of mangroves has greater species diversity as it is the junction of terrestrial and marine ecosystems.

1. Benefits of Mangroves

- Diversity of mangrove roots and their position gives mangroves an important role as habitats for numerous species.
- Mangroves also act as a refuge for corals from ocean acidification
- Mangroves filter and trap sediment from run-off and river water before it reaches adjacent ecosystems.
- Reduces the turbidity of the water and allowing essential light to reach ecosystems
- Mangroves are among the most carbon-rich forests in the tropics. They help in carbon sequestration.
- Conservation and restoration of mangroves can therefore contribute significantly to climate change mitigation.
- Their ability to trap organic sediment and thus store carbon, they are referred to as ‘blue carbon’ sinks.
- Shoreline protection based on mangrove tree and root structures in reducing erosion.
- Food resources for animals such as migratory birds and fish
- Visual amenity where selected mangrove trees provide shoreline beautification.

2. Threats to Mangrove Ecosystem

- They are destroyed for the conversion of the area for agricultural purposes, fuel, fodder and, salinization, mining, oil spills, aqua cultural (shrimp farming), use of chemical pesticides & fertilizers, industrial purposes.
- From seas – Sea level rise, cyclones and tsunami, coastal erosion, oil spills
- From rivers – Polluted water
- From Communities– Destroyed for fuel, fodder
- Plastic bags and other waste is a major threat for mangroves.
- Goats can destroy mangrove seedlings and damage mature trees.

Nature of Mangrove Destruction

- Rapidly increasing development has put numerous direct and indirect pressures on coastal ecosystems
- Climate Change is likely to further intensify the loss of biodiversity.
- With increases in extreme weather events, sea-level rise, warming of the sea surface temperatures and ocean acidification social, economic and environmental problems will be faced by the people of India.

- Human activities, including conversion to aquaculture, coastal development, overexploitation of timber and pollution, have been the primary causes of mangrove loss
- Mangroves are destroyed through defoliation, erosion, burial by sediment and uprooting by high winds
- High levels of salinity, heavy metals and chlorine.

3. Sunderbans Mangroves

- **Need for Conservation**

- a. It has a unique population of tigers
- b. Helps to sustain millions of people with food, water and forest products.
- c. The mangrove tree species, including the Sundari, which has historically helped the local economy in the construction of boats and bridges

- **Concerns**

- a. There is evidence of loss of forest cover in the Indian Sundarbans.
- b. Climate change appears to be an emerging threat to the Sundarbans Mangroves.

- **Solution**

- a. Local actions that will protect the banks from erosion, and policies that address the pressures created on natural resources
- b. Promote ecotourism to raise awareness and funds
- c. International climate finance to be channelled to India and Bangladesh for the region's preservation, given its global uniqueness.
- d. Local communities must be pulled out of poverty to relieve the pressure on natural resources.
- e. Encourage Climate research and social science
- f. The Information Technology should be utilized effectively to spread the awareness regarding the issue of Sundarbans.

4. Conservation of Mangroves

- **The State Forest Report 2019 mentions the following conservation techniques for Mangroves:**

- -The state of Gujarat uses **direct seed sowing, raised bed plantations, and fishbone channel plantations** to restore degraded mangroves.
- -State of Andhra Pradesh has established **Eco-Development Committees and Van Samrakshan Samithi** to implement conservation projects in mangrove areas.
- -The state of Maharashtra has been implementing restoration, protection, regeneration, and maintenance techniques to conserve mangroves.

- The organization **Global Mangrove Alliance (GMA)** is supporting the target of increasing mangrove coverage by 20 percent over current extent by 2030.

- **Mangroves for the Future (MFF)** is an initiative co-chaired by IUCN and the United Nations Development Programme (UNDP).

- It is held that the organisation is running mangrove restoration and sustainable development projects with gender integration as a core strategy in several Asian countries.
- Participatory, community-based project approaches ensure that women's and men's voices are considered equally and aim to improve women's social and economic empowerment.

- **Case Study** The **Guyana Mangrove Restoration Project is another bright example**. It saw women take a central leadership role with their efforts to increase the resilience of Guyana's coasts against flooding and coastal erosion. Women were most severely impacted upon by coastal flooding and erosion of Guyana's coast. Women were provided with resources for economic empowerment and capacity building trainings. As a result of these positive measures, women got positively involved with various activities like honey production,

tourism activities and mangrove cultivation. The active participation of women catalysed the formation of a women-led volunteer organisation for mangrove awareness and restoration as well as the '**Mangrove Cooperative Society**' to support other women with training and resources on activities like beekeeping.

5. Mangrove Conservation and Sustainable Development Goals (SDGs):

Nurturing and nourishing mangroves helps fulfil multiple objectives like improving the life of aquatic animals, reducing poverty and hunger, enhancing the quality of life of coastal communities etc. **The importance of restoration and protection of mangroves is amply reflected in Sustainable Development Goal (SDG) 14** (which focuses on sustainably governing our oceans and coasts and recognises mangroves' immense value to local communities). But **restoring mangrove forests also supports the achievement of many other SDGs like:**

- Eliminating poverty and hunger (SDG 1 and SDG 2),
- Ensuring livelihoods and economic growth (SDG 8),
- Taking actions against climate change impacts (SDG 13) and
- Halting biodiversity loss (SDG 15).

6. Way Forward

- Wherever possible, **preservation of existing mangroves** is to be prioritised
- The long-term solution to coastal and marine ecosystem degradation requires a holistic and integrated approach.
- **People's involvement** in mangrove management on public lands, Plantation of mangroves for creating green belts and post-planting monitoring.
- **Community ownership** and sense of responsibility is important in long-term successful conservation and restoration efforts
- Programmes to **raise people's awareness** of the importance of mangroves, e.g. through films, exhibitions, newspapers, study tours in the mangrove forests, establishment of mangrove parks and celebration of Mangrove Conservation Day.
- **Enforcement of environmental protection laws**
- Integration of environmental management principles, such as biodiversity conservation into economic production activities is necessary.
- Environmentally sustainable livelihoods to reduce pressure on coastal ecosystems
- **Bridging gaps between existing policies and implementation** and promoting best practices in collaborative coastal forest protection.
- As mangroves age, they store proportionally more carbon in their biomass because of higher productivity. Protection of mangroves should, prioritise older stands.

Wetland

1. Wetlands

We can find wetlands wherever water bodies meet the land.

- Wetlands include mangroves and marshes, peatlands, rivers, lakes and other water bodies, deltas, floodplains and swamps in forested areas, paddy-fields and coral reefs.

Why wetlands are crucial for a healthy planet?

The health of people on our planet depends on healthy wetlands.

- 40% of the world's species live or breed in wetlands.
- Wetlands are "nurseries of life" - 40% of animals breed in wetlands.
- Wetlands are "kidneys of the earth" - they clean the environment of pollutants.
- Wetlands "matter for climate change" - they store 30% of land based carbon.
- Wetlands "minimize disaster risks" - they absorb storm surge.

Ramsar Convention:

- The Ramsar Convention is an international agreement promoting the conservation of wetlands.
- The Convention was adopted at Ramsar in Iran in 1971 and came into force in 1975. Almost 90% of the UN member states are part of the Convention.

Montreux Record:

Montreux Record under the Convention is a register of wetland sites on the List of Wetlands of International Importance where changes in ecological character have occurred, are occurring, or are likely to occur as a result of technological developments, pollution or other human interference.

It is **maintained as part of the Ramsar List.**

- The Montreux Record was established by Recommendation of the Conference of the Contracting Parties (1990).
- Sites may be added to and removed from the Record only with the approval of the Contracting Parties in which they lie.
- **Currently, two wetlands of India are in Montreux record:** Keoladeo National Park (Rajasthan) and Loktak Lake (Manipur).

Chilka lake (Odisha) was placed in the record but was later removed from it.

Two more Ramsar sites announced on World Wetlands Day:

Two new sites are- Khijadiya wildlife sanctuary in Gujarat and Bakhira wildlife sanctuary in Uttar Pradesh.

- Now, India has a network of **49 such sites, the highest in South Asia**, covering 10,93,636 hectares.

2. World Wetlands Day

When is it celebrated? 2nd Feb Every Year.

Significance: The day also marks the anniversary of the signing of **the Convention on Wetlands of International Importance (Ramsar Convention) in Ramsar, Iran, on 2 February 1971.**

Protection: Wetlands are currently protected under different designations, including **the Ramsar Convention on wetlands, the UNESCO Man and Biosphere Programme** and others, and some of these overlap.

Significance of World Wetlands Day 2022:

The **World Wetlands Day 2022** is significant as this is **the first time that the day will be observed as a United Nations International Day.**

Theme for 2022: "Wetlands Action for People and Nature".

3. Assam wetland at risk

Degradation of Assam's Deepor Beel due to anthropogenic forces

More on this:

- **Human activities which have caused this destruction-** dumping of garbage, construction of roads and railways, construction of warehouses, tourism activities
- This degradation has caused death of elephants in railway accidents, fewer elephants visiting the wetland due to deteriorating quality of water due garbage dumping, reduction in the number of fishes available for fishermen etc.

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