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EXCLUSIVE
ENVIRONMENT
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Conservation

1. Community participation and awareness in solving water issues

- India is a welfare state, which is envisaged under the constitution of India. Therefore it is a duty of the State to provide basic amenities like water to the public and right to water is also considered as one of the fundamental rights under Article 21 of the constitution of India.
- More over Article 51 A of the Constitution of India casts duty upon every citizen of India, “to protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures.

Scope of community participation and awareness in solving water issues:

- As of June 25, 2019, nearly 65 percent of the country’s reservoirs were running dry.
- It is more and more evident that Government alone cannot tackle the situation of natural devastation and depletion of water bodies effectively without public participation.
- A combination of strategies including civic engagement programs addressing barriers to landowner engagement will be most effective for promoting civic engagement in water resource protection.
- Citizens are more likely to be civically engaged in water resource issues, if they feel a personal obligation to take civic action and perceive they have the ability to protect water resources.
- Public participating affords stakeholders the opportunity to influence that affects their lives.
- The participatory idea has been gradually infiltrating the environmental sphere over recent decades, and recently we have seen increasing citizen participation in environmental policy making and implementation.
- The concept of civic environmentalism where local people are involved in the planning and decision making process provides an increasingly popular alternative approach to environmental governance worldwide.
- The National Water Policy adopted by the Government of India in the year 1987 was revised in the year 2002 wherein it underscored Water Use Efficiency, Community Participation.

Indian experiences on conservation of water bodies and participatory approach:

- Reviving a Dead Kuttemperoor River: Kuttemperoor river, after being subjected to years of severe pollution and illegal sand mining, had almost vanished into obscurity until last year, when an initiative vehemently led by the Budhanoor gram panchayat in Alappuzha district did
the unimaginable. The operation, involved 700 labourers including men and women from Budhanoor panchayat, who were employed for the task under the MGNREGA scheme.

- **100 Ponds in 50 Days Drive**: In Kochi, the district administration’s 100 Ponds in 50 Days have turned out to be a role model for conservation of water sources. After launching the cleaning drive, 64 ponds in different parts of the district have got a fresh life.

- **Women fighting drought by restoring Water Bodies – Karnataka**: Women across Karnataka, in districts like Mandya, Gulbarga and Kolar, are taking the drought head on by toiling to revive water bodies themselves. In the Mandya district, women have taken it upon themselves to clean and desilt dry lakes and ponds, while the women of Gulbarga have revived 28 water bodies.

- **Saving Bangalore Water Bodies**: Various efforts are taken up to conserve the lakes of Bangalore. Both the governments as well as non-governmental organizations have made efforts to bring back the health of Bangalore lakes.

- **Paani Panchayat**: At Badauna Guggar village in Lalitpur district in Uttar Pradesh, the women have taken charge of water management. The village has a ‘paani panchayat’, where collective decisions are taken on conserving and using water.

- **Rural Women’s participation in Water Management in Maharashtra**: These remote villages are situated in the arid region of Vidarbha in the state of Maharashtra, India. The endeavor to have safe and sufficient drinking water helped the women in fighting not only against poverty but also oppression, exploitation and human rights violation.

- **Waste Water and Aqua-Culture-Ecological Miracle in Kolkata**: Kolkata Wetlands, the world’s only fully functional organic sewage management system. As for the East Kolkata Wetlands, this unique ecosystem impacts the daily lives of people in Kolkata and in the region in several ways. Maintained by farmers and fisher folk, these unique wetlands receive the city’s sewage, organically treat it with the help of sunshine, oxygen and microbial action and turn into a productive fish habitat nothing short of ecological magic.

- **Birkhabawari in Jodhpur, Rajasthan**: Located in the Umaid heritage site in a residential complex area. The Bawari structure not only stores rainwater but also acts as a recreational space for inhabitants. It also provides a good example of sustainable urban development practice in a low rainfall region, demonstrating the value of water by conserving rainwater.

- **Kudimaramathu project**: Kudimaramathu is an ancient Tamil concept of participatory management. It indicates the community’s role in conserving natural resources.

**Conclusion:**
Any programme cannot be successfully implemented without involvement of people, no matter what kind of policy it has or how effective the leadership is”. The biggest strength of democracy is public participation. The case of public participation typically focuses on three things namely functional gains to government, fairness and individual and collective fulfillment.

2. **Environment Impact Assessment (EIA)**

- Environmental Impact Assessment (EIA) is a process of evaluating the likely environmental impacts of a proposed project or development, taking into account inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse.

- **UNEP defines Environmental Impact Assessment (EIA)** as a tool used to identify the environmental, social and economic impacts of a project prior to decision-making.

- It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment and present the predictions and options to decision-makers.

- By using EIA both environmental and economic benefits can be achieved, such as reduced cost and time of project implementation and design, avoided treatment/clean-up costs and impacts of laws and regulations.

**Significance of EIA:**

www.insightsonindia.com
• EIA reports are a critical component of India’s environmental decision-making process.
• It acts as a detailed study of the potential impacts of proposed projects.
• It helps in predicting environmental impacts at an early stage in project planning and design.
• EIA-based approvals for most projects also involve the process of conducting public hearings, so that who are likely to be affected can be taken on board before approving the project.
• EIA links environment with development. The goal is to ensure environmentally safe and sustainable development.

Apprehensions related to EIA:
• There are **compromised decision-making on development and infrastructure projects**.
• Sometimes the EIA reports lack the expected degrees of honesty, owing to bias, corruption, exaggeration and wrong claims.
• There are several projects with significant environmental impacts that are exempted from the notification either because they are not listed in schedule I, or their investments are less than what is provided for in the notification.
• Public comments are not considered at an early stage, which often leads to conflict at a later stage of project clearance. Many projects with significant environmental and social impacts are approved without mandatory public consultation.
• One of the biggest concerns with the environmental clearance process is related to the quality of EIA report that are being carried out.
• There are so many cases of fraudulent EIA studies where erroneous data has been used, same facts used for two totally different places etc.
• There are many instances of missing or misleading information which understate the potential impact of the projects.
• Lack of awareness among the local people about the process of EIA, its significance for them, their own rights and responsibilities.
• Most of the time EIA reports are unavailable in local languages, thus local people are unable to decipher the reports, and are misled by the proponents.

Role of health impact analysis:
• **Health Impact Assessment (HIA)** is a practical approach used to judge the potential health effects of a policy, programme or project on a population, particularly on vulnerable or disadvantaged groups.
• HIA provides a way to engage with members of the public affected by a particular proposal. It also helps decision-makers make choices about alternatives and improvements to prevent disease or injury and to actively promote health.
• **It is based on the four interlinked values of democracy (promoting stakeholder participation), equity (considering the impact on the whole population), sustainable development and the ethical use of evidence.**

Conclusion:
EIA must be performed for new establishments or projects and for expansion or renovation of existing establishments. EIA studies the effect of the surrounding environment on the project as well as the effect of the project on the surrounding environment. EIA tries also to find ways of minimizing the environment impacts of the project. This study if implemented properly will ensure sustainability for the project especially that now it has become necessary to provide this assessment before starting any project.

3. Implementation of Environmental Safeguards
Failure to fully implement and enforce the environmental laws is one of the greatest challenges towards mitigating climate change.

India’s performance in implementation of environmental safeguards:
Like the Water Act, which was implemented in 1974, a number of laws and regulations have been existing for more than four decades now, but are proving to be ineffective.

The systems of accountability have been weakened, so monitoring is a huge problem.

India is ranked 177th out of 180 countries in the 2018 Global Environment Performance Index (EPI) rankings for being unable to improve its air quality, protect its biodiversity, and cut its greenhouse gas emissions.

Air pollution:-
  - India has highest number of cities which violate the threshold of healthy air limits
  - Coal-based power plants continue to be the major source of air pollution in the country as more than 300 coal thermal power plants still violate emission standards.

Wildlife:
  - Despite laws to protect wildlife protection, poaching and illegal trade of wild animals is a common practise till date. Also rise in man animal conflict is an indicator of lack of proper implementation of the laws.

More than two-thirds of the states/union territories in the country have neither bothered to comply with the orders passed by the Supreme Court, nor complied with the directions given by the Ministry of Environment, Forests and Climate Change (MoEF&CC).

Public awareness is poor
  - Lack of public hearings and social audit before implementing projects
  - Environmental impact assessment has often been neglected for projects.

Impact on clean environment:
  - Loss of biodiversity appears to affect ecosystems as much as climate change, pollution and other major forms of environmental stress.
  - Studies over the last two decades demonstrated that more biologically diverse ecosystems are more productive.
  - As a result, there has been growing concern that the very high rates of modern extinctions—due to habitat loss, overharvesting and other human-caused environmental changes—could reduce nature’s ability to provide goods and services such as food, clean water and a stable climate.
  - Scientific reports — such as the Global Biodiversity Outlook 5 — that have warned that further destruction of flora and fauna will have serious effects of humans.
  - This will affect the fundamental rights of citizen to a clean environment.

Way forward and conclusion:
  - There is a need to consider TSR Subramanian committee recommendations:
    - New bodies like National Environment Management Authority and State Environment Management Authority replacing CPCB and SPCB, to evaluate project clearance using technology and expertise.
    - Areas with 70% tree cover should be declared “no go zone”
  - Strengthen green regulations, introduce a stronger system of checks and balances, and make the clearance process more transparent and inclusive
  - The active involvement of Central/State Ministries and Departments is needed. Public and private entrepreneurs and entities as well as the public need to come forward to mainstream biodiversity.
  - There is a strong case for a new look at the draft EIA notification and all relevant stakeholders must be consulted and arrive at a consensual assessment mechanism.
  - Positive attitude on the part of each citizen is essential for effective and efficient enforcement of these legislations.
  - Also, institutional capacities must be strengthened which are currently filled with problems such as understaffing, lack of financial resources and low skill levels of workers.
  - Speed of justice delivery must be increased through special courts which improve compliance.
4. **Soil organic carbon (SOC)**

- Soil organic carbon (SOC) comes from plants, animals, microbes, leaves and wood, mostly found in the first metre or so. There are many conditions and processes that determine changes to SOC content including temperature, rainfall, vegetation, soil management and land-use change.
- In the presence of climate change, land degradation and biodiversity loss, soils have become one of the most vulnerable resources in the world.
- SOC can be lost as CO2 or CH4 emitted back into the atmosphere, eroded soil material, or dissolved organic carbon washed into rivers and oceans.

**Role of SOC in Human Well-being:**

- **Achieving the SDGs:**
  - As an indicator for soil health, SOC is important for its contributions to food production, mitigation and adaptation to climate change. Maintaining SOC storage at equilibrium or increasing SOC content towards the optimal level for the local environment can contribute to achieving the SDGs.
- **SOC and biodiversity:**
  - SOC improves soil structural stability by promoting aggregate formation which, together with porosity, ensures sufficient aeration and water infiltration to support plant growth.
  - SOC influences water holding capacity and porosity of the soil.
  - With an optimal amount of SOC, the water filtration capacity of soils further supports the supply of clean water.

**Way Forward**

- The Parliamentary Standing Committee on Agriculture in its 2016 report in fact recommended “revision of the existing fertiliser subsidy policy and promotion of organic fertilizers”.
- The government has been promoting a Soil Health Card scheme to measure the health of the soils in different parts of the country and in each farm. There is little policy support for natural farming and the alternatives.
- The ability of soils to sequester carbon is a win-win strategy for farmers, people and for climate change and it is time we stopped ignoring these at the policy levels.

**Conclusion:**

It is hoped that future policy will support the farming and conservation community to work together in feeding the world whilst at the same time promoting sustainable, viable and applicable agroecological practices towards sequestering carbon and conserving the rich diversity of life on the planet.

5. **Ground Water Depletion in India**

- Today, India is the largest user of the groundwater in the world with almost 90% being used for drinking water and almost 60-70% for irrigation. Current statistics also show that nearly 50% of urban water supply comes from groundwater.

**Status of Groundwater Depletion in India:**

- India accounts for 16-17% per cent of the world’s population living in less than 5 per cent of the global area, and has just 4 per cent of the global water resources.
- With the population rising, demand for water will increase manifold in coming years. According to the CWC, per capita availability in the country will decrease from 1,434 cubic metres in 2025 to 1,219 cubic metres in 2050.

- ‘Water and Related Statistics 2019’ report:
According to ‘Water and Related Statistics 2019’, a report published by the CWC, the annual replenishable groundwater resources in India (2017) are 432 BCM, out of which 393 BCM is the annual “extractable” groundwater availability.

The current annual groundwater extraction is 249 BCM, the largest user being the irrigation sector. This is why the government has called for alternatives to water-intensive crops such as paddy and sugarcane.

Problems with groundwater depletion:
- Lowering of the water table
- Reduction of water in streams and lakes
- Land subsidence: A lack of groundwater limits biodiversity and dangerous sinkholes result from depleted aquifers.
- Increased costs for the user
- Deterioration of water quality
- Saltwater contamination can occur.
- Crop production decrease from lack of water availability (40% of global food production relies on groundwater).
- Groundwater depletion interrupts the 'natural' water cycle putting disproportionately more water into the sea.
- As large aquifers are depleted, food supply and people will suffer.

Way Forward
- As aquifers and other groundwater sources are depleted at a rate greater than the recharge rate, artificial recharge is needed to maintain a lasting water supply to prevent complete withdrawal of groundwater in the near future.
- For arid climates with little precipitation, recharging groundwater can be achieved through using treated wastewater, natural runoff, and runoff from irrigation.
- The primary challenge of desalination is its high cost and energy consumption. Electricity makes up 63 per cent of the operational costs of seawater desalination plants. The plants contribute to water security but add stresses to the energy security.
- Some of the other methods and techniques for groundwater recharge:
  - Roof Top Rain Water, runoff harvesting through Recharge Pit, Recharge Trench, Tubewell, Recharge Well. Rain Water Harvesting through Gully Plug, Contour Bund, Gabion Structure, Percolation tank, Check Dam, Cement Plug, Nala Bund, Recharge shaft, Dugwell Recharge Ground Water Dams, Subsurface Dyke.

Conclusion:
The focus will be on arresting the rate of decline of groundwater levels as well as water consumption. Leveraging schemes like Atal Bhujal Yojana which seeks to strengthen the institutional framework and bring about behavioural changes at community level for sustainable groundwater resource management is vital. We need to have more community-led Water Security Plans.

6. E-waste Management
- E-waste is technically all waste electrical and electronic equipment (WEEE) discarded without the intent of reuse.
- It is one of the fastest growing waste streams in both developed and developing countries.

Present Status
- The volume of E-waste increased by 21% globally in the last 5 years.
- India, together with China and the United States, accounts for 38 per cent of this volume generated worldwide.
• E-waste generation in India increased by 43 per cent in just three years.
• The demand for electronics, especially in the form of information and telecommunication equipment, has been fueled by the ongoing novel coronavirus disease (COVID-19) pandemic.
• Today, we are a part of a new work culture where virtual is the new norm.
• As the demand for electronic equipment increases, so does the amount of E-waste generated.
• An attractive electronics market with new design and innovation as well as a downward pricing trend allure consumer to purchase new electronic products way before the older ones become dysfunctional.

Factors responsible for the growth of E-waste
• Rapid advances in technology.
• Economic growth
• Urbanisation processes
• Increasing demand for consumer electronic equipment
• Downward trend in prices

E-waste Crisis
• Experts predict that E-waste gets buried under the ground in landfills for centuries as it is not biodegradable.
• E-waste contains substances that are hazardous to human health, including, mercury, cadmium and lead.
• E-waste can pollute water sources and food-supply chains.
• Findings from many studies show increases in spontaneous miscarriages, still and premature births, as well as reduced birth weights and birth lengths associated with exposure to e-waste.

Concerns / Challenges
• Electronic waste (E-waste) represent a major environmental challenge in the world today.
• Majority of the progress in the extraction of valuable metals from E-waste or degradation of hazardous compounds through biotechnological or physicochemical processes is yet to travel from the lab to the land.
• Lack of information and awareness on responsible E-waste management among the populace.
• E-waste management in India is largely based on informal sector activities for collection, dismantling and recycling.
• The urban masses lack information about the presence of any recycling center in their respective cities.
• India notified the E-waste (Management) Rules, 2016, which made ‘extended producer responsibility’ (EPR) mandatory. The implementation of EPR remains extremely poor.
• The stored E-waste in houses, offices and educational institutes act as a barrier towards exploring the ‘urban mining’ potential.
• Non-collected e-waste is also a serious health and environmental hazard as it contains several toxic substances.
• With the absence of “good and credible data” in India, it would be difficult to enforce systems for managing e-waste.

Way Forward
• While the generation of E-waste shows no sign of saturation, its management and policy interventions remain utmost crucial.
• The solution lies in creating a circular economy of electronics.
• The producers should also have buy-back or return offers for old equipment, and plans to incentivise the consumer financially.
• E-waste contains both hazardous chemicals and valuable metal components. Thus, its management necessitates adequate research and development expertise, public participation and policy interventions.

• The valuable metals present in E-waste, if extracted, could lower the environmental burden of natural resource-based mining activities.

• This becomes more relevant when we aim to achieve the United Nations Sustainable Development Goals (SDG) by 2030.

• Engagement and awareness of the general public: Public as consumers are probably the most important part of any effective E-waste management solution.

• The Indian E-waste Rules are largely inspired by the European Union’s (EU) WEEE directive. India is an entirely different set up as compared to the EU and therefore the waste management initiatives should be ‘local specific’.

• The informal sector is central to a successful E-waste management strategy in India where it has an enormous presence.

• Need to sensitise the youth on E-waste. An informed youth population is instrumental in creating a new generation of responsible consumers.

• In India, there is a strong need for recognising recycling as an industry and creating conditions for it to become viable and sustainable.

• We also need to invest in technology that are cutting edge at the same time creates livelihood opportunity for our population.”

• India has lot to learn from Norway model of e-waste management.

7. Climate Smart Agriculture

Climate-smart agriculture (CSA) is an approach that helps to guide actions needed to transform and reorient agricultural systems to effectively support development and ensure food security in a changing climate.

What is climate-smart agriculture (CSA)

• Climate-smart agriculture (CSA) broadly works on three parameters.
  o sustainably increasing agricultural productivity and farmers’ incomes
  o adapting to climate change
  o reducing greenhouse gas emissions (GHG)

• Climate-smart agriculture considers adaptation and mitigation together in the context of building agricultural systems for food security.

Why climate-smart agriculture (CSA)

• To transit to a more sustainable food system and mitigate climate change while at the same time adapt to climate change.

• To increase productivity and efficiency of inputs (fertilizer and water use).

• To achieve food security and agricultural development goals by 2030.

• To make local communities resistant to droughts and floods.

• It can conserve soil health and make judicious use of water resources.

Evil of climate change

• Climate change—the increased frequency of extreme weather events such as droughts, floods and storms—is the most challenging issue of our age.

• The severity of floods and storms over the past 30 years has put the agriculture sectors of many developing countries at the risk of growing food insecurity.

• When we look at climate change, the issue of GHG is important.

• Around 41 per cent of GHG come from agriculture.
The livestock sector contributes to about 14.5 per cent of human-induced GHG, much of which is methane produced by ruminant digestion.

The most vulnerable are subsistence farmers who are prone to climate shocks.

**Practices that can reduce emissions from agriculture**
- Alternate wetting and drying of paddy.
- By reducing the frequency of irrigation (letting the fields drain periodically), methane emissions from flooded rice production can be cut in half.
- Increasing the productivity of milk and meat production.
- Increasing animal and herd productivity means that fewer animals are required to produce the same amount of milk or meat, which also reduces the emissions generated in producing that food.

**International efforts**
- FAO engages with Green Climate Fund and the Global Environment Facility and supports countries to access funds for the implementation of CSA projects.
- FAO has been hosting the Facilitation Unit of the Global Alliance for Climate-Smart Agriculture (GACSA).

**Way Forward**
- We need a change in economic policies to stop plundering of natural resources, prevent water contamination and land degradation.
- For CSA to become a reality an integrated approach responsive to specific local conditions is required.
- Coordination across agricultural sectors is essential to capitalize on potential synergies, reduce trade-offs and optimize the use of natural resources and ecosystem services.
- The current dynamics in international climate finance are in favour of CSA.
- There is potential for new and additional opportunities to use international financing for turning public and private agriculture investments into sustainable CSA investments.
- Global partnerships and knowledge sharing are critical pillars of the mitigation strategy.
8. **Global Carbon Tax**
   - One way to cut effluents while earning revenues is to price the carbon content of domestic production and imports.
   - India can be among the first movers in the developing world in taxing and switching from carbon-intensive fuels.

**Emission trading and Carbon Tax**
   - One way to price carbon is through emission trading, i.e., setting a maximum amount of allowable effluents from industries, and permitting those with low emissions to sell their extra space.
   - Pilot projects on carbon trading in China have shown success.
   - Another way is to put a carbon tax on economic activities — for example, on the use of fossil fuels like coal, as done in Canada and Sweden.
   - Canada imposed a carbon tax at $20 per tonne of CO2 emissions in 2019, eventually rising to $50 per tonne.
   - A carbon tax at $35 per tonne of CO2 emissions in India is estimated to be capable of generating some 2% of GDP through 2030.
   - International Monetary Fund endorsed the European Union’s plan to impose carbon levies on imports.
   - India should also use the power of a large buyer in international trade, to impose a carbon tariff as envisaged by the EU.
   - Focusing on trade is vital because reducing the domestic carbon content of production alone would not avert the harm if imports remain carbon-intensive.
   - Therefore, leading emitters should use their monopsony, diplomacy and financial capabilities to forge a climate coalition with partners.
   - A carbon tax is less likely to face political opposition while creating avenues for businesses and growth.

**Sharing the burden by the global south**
   - The global South, which has historically contributed less to the problem happens to be at the receiving end of the lifestyle choices made by the global North.
   - Even at present, global south per capita carbon emissions are much smaller in comparison to the countries in the global North.
   - A genuine global consensus on the mitigation of this problem is unfortunately missing.
   - In the absence of a collective agreement, the environment is becoming the casualty.

**Correcting injustice**
   - The first priority is to fundamentally change the energy infrastructure, which requires massive investments.
   - The countries at the top, apart from funding their own energy transition, must partially support the transition for the countries at the bottom.
   - The global energy transition can be financed through a system of the global carbon tax.

**India’s Action**
   - India has committed to 40% of electricity capacity being from non-fossil fuels by 2030, and lowering the ratio of emissions to GDP by one-third from 2005 levels.
   - It is in the country’s interest to take stronger action before 2030, leading to no net carbon increase by 2050.
   - India is among the nations that are hardest hit by climate impacts.
   - There is growing public support for climate action, but we need solutions that are seen to be in India’s interest.
Way Forward

- Climate change is a global problem, and a global problem needs a global solution.
- All nations must climb down the emissions ladder without giving up on their standard of living.
- Both the worlds (global north and global south) need to contribute to avert this danger in their self-interest.
- The burden of adjustment cannot be equal when the relationship between the two worlds has been historically unequal (climate injustice funnel).
- A just approach would involve a global sharing of the responsibility among countries according to their respective shares in global emissions.
- For India, market-oriented approach to tax and trade carbon domestically and to induce similar action by others through international trade and diplomacy offers a way forward.

9. Environmental Challenges from Societal and Technological Perspectives

- Mankind’s progress has had unintended consequences on the environment.
- These include climate change, extreme weather events and the reduced availability of potable water.
- Predictions made back in the 1980s about climate change are starting to come true.

Human Progress and its Impact on Environment

- Unintended consequences of human progress over the past decades have begun to adversely impact the environment.
- The layer of ozone is being depleted due to our excessive use of aerosol chemicals.
- Extreme weather events around the world appear to be more common than before.
- Cities like Chennai and Mumbai get flooded during the monsoon, and yet run out of water later in the year.
- At the current rate of consumption, two-thirds of the world’s population may face water shortages by 2025.
- This also leads to other issues like the spread of water-borne diseases.

Environmental Challenges in the context of Technology and Society

- Technology is one of the key attributes of today’s human society.
- On one hand, our tech-centred orientation is one of the primary causes of our alienation from nature.
- On the other, technology can help us cope with the environmental stresses being faced by human society.
- Technology is one of the major factors inducing environmental pollution.
- To accommodate technological progress, humans have always sacrificed the environment.
- This has led to complex issues like climate change and wide-scale biodiversity loss.
- Environmental migration is one of the key issues that future generations will need to cope with.
- Complexity of how humanity should respond to environmental migrants.
- The United Nations forecasts that there could be up to 1 billion environmental migrants by 2050, mostly from coastal areas.
- Thus, Environmental disturbance is the unintended consequences of human progress.

Way Forward

- We must think about diversification of livelihoods at a community level, building resilience, and policies for environmental migrants.
- We must redefine the needs of an individual, and understand the reasons behind increasingly consumeristic lifestyles across the globe.
• It is evident that our challenges related to the environment are interwoven with challenges from societal, technological and philosophical perspectives.
• We must confront these challenges holistically, and evolve sustainable pathways through individual, societal and state actions.

10. 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.
• The **Compensatory Afforestation Fund Act (CAMPA), 2016** was enacted to manage the funds collected for compensatory afforestation which till then was managed by ad hoc Compensatory Afforestation Fund Management and Planning Authority (CAMPA).

**Impact on the forest dwellers and tribes:**
• Rules don’t have provision for getting consent of the Gram Sabhas (only mention consultation) and provision for transferring funds to the Gram Sabha.
• There is a difference between consultation and consent. Moreover, VFCs aren’t statutory bodies. The Forest Rights Act (FRA) gives rights to the Gram Sabha and this is in violation of that law.
• The rules ignore the rights of forest dwellers and tribal. They also said that the new CAF rules are against existing laws ensuring forest rights and self-governance for communities living in Scheduled Areas.
• The Rules do not take The Provisions of the Panchayats (Extension to Scheduled Areas) Act, 1996 (PESA) into consideration.
• The rules are clearly a deliberate attempt to bypass the FRA (Forest Right Act) entirely.

**Way forward:**
• The Rules should be implemented through the Gram Sabha and not the Van Sanrakshan Samiti under Joint Forest Management.
• The audit by Gram Sabha should be conducted mandatorily.
• Transparency and accountability should be mandatory and the forest department should be answerable to the Gram Sabha.
• Local species should be planted in compensatory afforestation process.
• Artificial regeneration must not be allowed and provisions should be made by Gram Sabha’s to select species.

11. Environmental Regulations

• The landslide in Idukki district of Kerala has claimed more than 30 lives thus far and rendered several families homeless. This was a result of incessant rains leading to flood like situation, 2nd time in a row in last 2 years.
• Such hazards are increasingly becoming very common in other parts of India, due to the vagaries of climate change. Moreover, the impact of climate change is not limited to landslides, but it also results in devastating floods co-existing along with long dry spells and loss of biodiversity.
• Anthropogenic changes and natural exploitation for economic growth are the major contributors to climate change and its effects. This is due to the underlying thought that development policies promote economic well-being, while environmental policies have been seen to be restricting it.

**Environmental disasters in the recent past:**
Landslips or landslides have been a recurrent phenomenon in the Western Ghat state of Kerala. Data from the Geological Survey of India shows that Kerala has experienced 67 major landslide events and several minor ones from 1961-2013. The National Landslide Susceptibility Mapping (NLSM) programme of the Geological Survey of India notes that nearly 13 of the State’s 14 districts are prone to landslides. As part of a National Landslide Susceptibility Mapping (NLSM) programme, the Geological Survey of India mapped States facing high landslide risk to assess the vulnerability of the districts to landslides. This included states in the Western Ghats, the north-eastern States, Jammu and Kashmir and Uttarakhand.

Developmental goals are breaching the environmental sustainability:
- **Neglect of environmental principles** is a key reason why natural hazards end up causing a significant number of avoidable casualties.
- Any exercise to scientifically ascertain the risk from natural hazards to a region are barely implemented in the right spirit.
- **Unregulated quarrying and the unscientific cutting of slopes into hills** aggravates the risk of soil erosion and subsequently increases the risk of landslides.
- In pursuit of providing welfare to vulnerable sections of society, the government has provided a bulk of subsidies.
- However, subsidised nature of services like energy and electricity leads to their overuse and undermines environmental sustainability.
- Further, subsidies also undermine the revenue base and limit the government’s capacity to invest in new, cleaner technologies.

Development remains the greatest pursuit as well as a challenge, faced by humanity. However, despite the unprecedented economic and social progress that has been made over the last century, poverty, famine and environmental degradation still persist on a global scale. Moreover, environmental deterioration and climate change have started to show irrevocable damages to the developmental progress made so far. Thus, development goals must be pursued without breaching environment regulations.

**12. Eco-Centrism**
- The Supreme Court in Centre for Environmental Law v Union of India 2013 ruled that Eco-centrism is nature-centred, where humans are part of nature and non-humans have intrinsic value.
- In other words, **human interest does not take automatic precedence** and humans have obligations to non-humans independently of human interest.
- The principle of eco-centrism was relied upon by the Court in highlighting the importance of protecting the fauna and flora.
- The need for eco-centrism:
  - In **ethical terms**: eco-centrism expands the moral community (and ethics) from being just about ourselves. It means we are not concerned only with humanity; we extend respect and care to all life, and indeed to terrestrial and aquatic ecosystems themselves.
  - In **ecological terms**: eco-centrism reminds us that all life is interdependent and that both humans and nonhumans are absolutely dependent on the ecosystem processes that nature provides. An anthropocentric conservation ethic alone is wholly inadequate for conserving biodiversity.

- The first-ever Global Assessment Report on Biodiversity and Ecosystem Services by Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).
- It primarily looked or analysed the impact of economic development on nature and ecosystems.
- Key Findings of the report:
  - The report identified a range of risks, from the disappearance of insects vital for pollinating food crops, to the destruction of coral reefs that support fish populations that sustain coastal communities, or the loss of medicinal plants.
  - Productivity in 23 per cent of global land has reduced due to land degradation.
  - Up to $577 billion in annual global crops are at risk from pollinator loss and 100-300 million people are at increased risk of floods and hurricanes because of loss of coastal habitats and protection.
- Way forward:
  - The report says there is still an opportunity for human beings to live in harmony with nature.
  - But there has to be a change in the way how natural resources are governed, and things are produced and consumed.
  - The findings will also add to pressure for countries to agree bold action to protect wildlife at a major conference on biodiversity due to take place in China towards the end of next year.

14. Biodiversity Conservation

- The overwhelming message from the global assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) is that human beings have so rapaciously exploited nature, and that species belonging to a quarter of all studied animal and plant groups on earth are gravely threatened.
- Benefits of Biodiversity conservation:
  - Nature provides ecosystem services which are vital for food production, for clean air and water, provision of fuel for millions, absorption of carbon in the atmosphere, and climate moderation.
  - Conservation of biological diversity leads to conservation of essential ecological diversity to preserve the continuity of food chains.
  - Biological diversity provides immediate benefits to the society such as recreation and tourism.
  - Biodiversity conservation serves as an insurance policy for the future.
- Threats to Biodiversity:
  - Ecological economists have for years pointed to the extreme harm that humanity as a whole is courting by modifying terrestrial, marine and freshwater ecosystems to suit immediate needs, such as rising agricultural and food output and extracting materials that aid ever-increasing consumption.
  - Expanding agriculture by cutting down forests has raised food volumes, and mining feeds many industries, but these have severely affected other functions such as water availability, pollination, maintenance of wild variants of domesticated plants and climate regulation.
  - Losses from pollution are usually not factored into claims of economic progress made by countries, but as the IPBES assessment points out, marine plastic pollution has increased tenfold since 1980, affecting at least 267 species.
- Impacts of biodiversity on economic activities of a country:
  - Agriculture, forestry and fisheries products, stable natural hydrological cycles, fertile soils, a balanced climate and numerous other vital ecosystem services depend upon the conservation of biological diversity.
Food production relies on biodiversity for a variety of food plants, pollination, pest control, nutrient provision, genetic diversity, and disease prevention and control. Both medicinal plants and manufactured pharmaceuticals rely on biodiversity.

15. Man-Tiger Conflicts
The causes and impacts of the man-tiger conflicts are:

- A rising tiger population is forcing the animal to seek out new hunting grounds, as tigers need a huge prey base.
- Continued destruction and divergence of forest lands.
- People are increasingly encroaching into the country’s traditional wild spaces and animal sanctuaries.
- Tigers are used to travelling long distances, most of which fall outside the protected areas.
- **Example**: A tiger, fitted with a tracking collar, was found to have travelled 500 km in 72 days, starting from its habitat in the 138 sq. km Bor Tiger Reserve in Wardha district. It travelled through Amravati and Nagpur before getting electrocuted on a farm in Wardha.
- Wildlife experts’ claim that territorial animals do not have enough space within reserves and their prey do not have enough fodder to thrive on. This is forcing the wild animals to move out and venture close to human habitation in search of food.
- There is no mapping of the tiger corridors, or any of the well-defined routes that the tigers may be using for migration and resettlement.
- There is no buffer zone between wildlife and human settlements. The hamlets on the fringes of the jungle have expanded rapidly.
- About **16 tigers have been killed** in road and train accidents over the past five years.
- The ‘four-laning’ of the national highway running through the Pench Tiger Reserve and Kanha Tiger Reserve, and the widening of the railway line in central India from narrow gauge to broad gauge, for the fragmentation of the habitat.

**Impacts of Man-Tiger conflicts:**

- Crop Damage.
- Animal Deaths.
- Loss of Human Life.
- Injuries to People.
- Injuries to Wildlife.
- Livestock Depredation.

**Government Initiatives to reduce the man-tiger conflicts are:**

- **Providing LPG to villagers**: LPG should be provided to those villagers who frequently go to the forest areas specially wildlife habitats to fetch fuel wood for their chullahs.
- Assistance to state government for construction of boundary walls and solar fences around the sensitive areas to prevent the wild animal attacks.
- Encouraging state government for creation of a network of protected areas and wildlife corridors for conservation of wildlife.
- **Information technology** like radio collars, GPS, satellite uplink facilities are used by research institutions to monitor the movement of wild animals
- Centrally sponsored schemes of project tiger, project elephant and integrated development of wildlife habitats.

In order to be truly effective, prevention of human-wildlife conflict has to involve the full scope of society: international organizations, governments, NGOs, communities, consumers and individuals. Solutions are possible, but often they also need to have financial backing for their support and development.
16. Methanol Based Economy

- Methanol is the future of fuel in India.
- The methanol economy is a future economy in which methanol and dimethyl ether replace fossil fuels as a means of energy storage, transportation fuel, and raw material for synthetic hydrocarbons and their products.
- Across the world, methanol is emerging as a clean, sustainable transportation fuel of the future.

Why Methanol Based Economy:

- Methanol is a clean burning drop in fuel which can replace both petrol & diesel in transportation & LPG, Wood, Kerosene in cooking fuel.
- Methanol Economy is the “Bridge” to the dream of a complete “Hydrogen based fuel systems”.
- Methanol is a scalable and sustainable fuel, that can be produced from a variety of feedstocks like Natural Gas, Coal, Bio-mass, Municipal Solid waste and CO2.
- Methanol can be a major market in India, besides helping us reduce oil imports by 20%.
- The development of methanol-based technology could turn energy-importing India into an energy-exporting country.
- The gaseous version of Methanol can blended with LPG and can be excellent substitute for diesel in large buses and trucks.
- To adopt Methanol as a transport fuel, it requires minimal infrastructure modifications and capital.
- Methanol can be stored economically over a long time and command a higher value in the commodities market.

International Practice

- Methanol Economy is being actively pursued by China, Italy, Sweden, Israel, US, Australia, Japan and many other European countries.
- 10% of fuel in China in transport Sector is Methanol. China alone produces 65% of world Methanol and it uses its coal to produce Methanol.
- The Technology has acquired commercial maturity and countries like Iceland are producing in meaningful quantities already.
- Israel, Italy have adopted the Methanol 15% blending program with Petrol.

India’s First Methanol-based Cooking Fuel

- The Namrup-based Assam Petrochemicals Limited (APL) rolled out the country’s first methanol-based cooking fuel project- ‘Green and Clean Fuel Pilot Project on Methanol Cooking Stove’.
- This is seen as India’s first step towards realising the concept of “methanol economy”.
- The project has been promoted by NITI Aayog.

17. Protecting India’s Wetlands

- Wetlands are defined as: “lands transitional between terrestrial and aquatic eco-systems where the water table is usually at or near the surface or the land is covered by shallow water”.
- Wetlands are important, both economically and ecologically; providing food, water, livelihood, fisheries, birdlife, controlling floods, and acting as a natural filter for groundwater.
- Significant socio-economic values include constant water supply, fuelwood, medicinal plants, agriculture, energy resource, wildlife resource, transport, recreation and tourism.
- Wetlands are also important as a genetic reservoir for various species of plants including rice.

Threats to wetlands
• The world has already lost 35% of its wetlands since 1970.
• We lose wetlands three times faster than forests.
• India has nearly 30,000 wetlands of which we are losing 2-3% each year.
• In the latest census, Ernakulam district in Kerala saw a drop of 37% in waterbirds as its wetlands face continued threats from road construction and waste dumping.
• There is no National Wetland Policy, which is a requirement under the Ramsar treaty obligation by India.
• Several water bodies of Delhi NCR have either been encroached upon or turned into garbage dumps.
• Most of the wetlands in the urban areas are under threat.
• The loss of wetlands leads to environmental and ecological problems, which have a direct impact on the socio-economic benefits of the associated populace.
• Climate change and sea level rise could also affect wetlands.

Conservation of wetlands
• Showing an early commitment to protecting wetlands, India became one of the first signatories to the Ramsar Convention in 1981.
• The good work in Chilika continues and today it is the largest wintering ground for migratory birds on the subcontinent.
• National Wetland Conservation Programme (NWCP), a MoEFCC scheme under which funds are allocated to wetland site management, and asking the states to identify wetlands of importance in their state for such management.

Wetlands (Conservation and Management) Rules, 2017
• In September 2017, India adopted the Wetlands (Conservation and Management) Rules, 2017.
• It prohibits conversion of wetland for non-wetland uses, setting up of industries near wetlands, and waste dumping into the water.

Way Forward
• With the level of urbanisation likely to increase from 30% to 50% in the next decade, a legal framework to protect these wetlands and their catchments are urgently needed.
• There is enough evidence, both internationally and at home, that involving citizens, especially those who live near wetlands—a is a good way to achieve conservation success.
• This helped in reviving the Mangalajodi Wetland located at the northern edge of Chilika.
• Focussing on directing CSR funds towards protecting wetlands could also be useful.
• The database of wetlands in India is not complete and money needs to be invested in groundwork and diligent survey of wetland areas across the country.
• It is therefore necessary to notify the wetlands, clearly demarcating the wetland boundary and zone of influence of the wetlands.
• The Government of India should enact a wetland conservation act, on the lines of the Forest Conservation Act, 1980.
• The government ought to become a facilitator, while society should become caretaker of wetlands.

18. Natural Capital and its Preservation
• Natural capital represents the combined value of all biodiversity — life-forms, flora and fauna.
• It provides services such as water purification and supply, waste assimilation and the cleaning of air and water, regulation of pests and diseases, and soil nutrient cycling and fertility.
• Natural capital valued in financial terms:
There have been many studies that have calculated natural capital’s value in financial terms. The financial value of India’s forests, for example, timber and fuel wood, and ecological services such as carbon sequestration, is estimated to be $1.7 trillion. Street trees in California provide $1 billion per year in ecosystem services, through atmospheric regulation and flood prevention.

- ‘Earth Overshoot Day’, a date when humanity’s annual resource consumption for the year overshoots the earth’s capacity to regenerate it, has advanced every year at an alarming rate.
- A recent study shows that India will become water scarce by 2025.
- Within a century, our food production could see a loss of 10-40% if these trends continue.

Crossing the limits of Natural Capital Stocks:
- Scientists have identified nine earth system processes which mark the safe zones, beyond which there is a risk of ‘irreversible environmental change’.
- Four of these boundaries have now been crossed
  - Climate change.
  - Loss of biosphere integrity.
  - Land system change.
  - Altered biogeochemical cycles, such as phosphorus and nitrogen cycles.
- This means that human activity has altered the balance of a few delicate equilibriums.
- The effects are: changing weather patterns, accelerated extinction events for both flora and fauna, and global warming.

Ecological collapse can soon come, examples being the Darfur region in Sudan and countries in the Horn of Africa. All were subject to rapid socio-economic decline.

Integrating natural capital assessment and valuation into our economic system is critical to usher in a truly sustainable future for India.

India should seek to publish “green GDP” figures that take into account depreciation of natural capital stock due to economic exploitation and environmental degradation. This can follow the template provided by the UN’s System of Environmental-Economic Accounting.
Environmental Pollution

1. Paris Agreement isn’t Enough

Introduction
- The Paris Agreement is a voluntary agreement in which countries are free to choose their climate targets, called nationally determined contributions (NDCs).
- Countries are also supposed to self-differentiate based on their responsibility for causing climate change and their capability to mitigate it.

Present Crisis
- The world is not only suffering because of Covid and economic distress. It’s also reeling due to climate disasters.
- The year 2020 is likely to be one of the three warmest years on record, and 2011-20 will be the warmest decade on record.
- 2020 has witnessed increasing wildfires, new extreme temperatures on land, sea and especially in the Arctic, a record number of hurricanes in the Atlantic.

Reliance on Fossil Fuels
- Extreme weather events have not deterred countries from investing in fossil fuels.
- In 2020, G20 countries have committed over $230 billion in fossil fuel industry to revive the economy, compared to $150 billion in clean energy.
- The US, UK, Canada, Russia and India are pursuing major expansions in fossil fuel supply.
- Fossil carbon dioxide (CO2) emissions (from fossil fuels and carbonates) dominate total GHG emissions.

Flaws in the Paris Agreement
- Developed countries are expected to take up higher emission cuts than developing countries.
- But if a rich country doesn’t commit to a higher target, no one can question or demand a revision.
- Besides, if a country fails to meet its NDCs, there is no penalty.
- The Paris Agreement is, therefore, based on goodwill and moral persuasion.
- The fact is every country is looking out for its own narrow interest.
- This is the reason why the Agreement will not be able to limit warming below 2°C.
- Therefore, the world would make a big mistake by putting all its efforts into the Paris Agreement to meet the climate goals.

Concerns / Challenges
- Even after Five years of the Paris Agreement was signed, the global efforts to fight climate change are in tatters.
- Despite a 7% decline in CO2 emissions due to the economic slowdown in 2020, the current policies of the countries have put the planet on a 3.2°C temperature increase trajectory.
- The ‘Emission Gap Report 2020’, finds that the G20 nations, who account for 80% of global greenhouse gas (GHG) emissions, are collectively not on track to meet their modest Paris Agreement commitments.
- Since the beginning, countries have viewed climate negotiations as an economic and not as an environmental negotiation.
- For instance, Donald Trump believes that reducing emissions will hurt the US economy and benefit China, so he walked out of the Paris Agreement.
- George Bush did the same with the Kyoto Protocol.
- China despite being the world’s largest polluter, its NDCs are woefully inadequate and compliant with 4°C warming.
Today, more than two-thirds of the richest 100 entities on the planet are corporations and they have been responsible for 71% of the global emissions since 1988.

Way Forward

- We need a radically different strategy to stimulate actions from the government, private sector and civil society to put the world on track to the 1.5°C goal.
- In many sectors, including the most crucial energy sector, economic growth and emission reduction can go hand-in-hand.
- The costs of renewable energy are already cost-competitive or will become competitive very soon with fossil fuel technologies.
- So, the reason for countries to compete with each other for carbon space is becoming immaterial every passing day.
- If countries cooperate, the cost of cleaner technologies can be reduced faster, which will benefit everyone.
- We will need multiple multilateral, regional, and sectoral platforms to drive transformation.
- Climate action will have to be made part of every existing and new platform and treaty as a distributed global effort.
- We need concrete actions from citizens (especially the wealthiest 1% who account for more than twice the emissions of the poorest 50%) and the private sector to reduce emissions.
- Today Corporations are the problem, but they are also the solution. They have the resources to decarbonise, and they must be held accountable if they fail to do so.

Conclusion

Five years since the Paris Agreement, we are at an inflection point; the world needs a bold vision and leadership to turn the tide.

2. Low-Carbon Inclusive Growth

Various facets of India’s LCIG:

- Policy measures to reduce emissions fall into two categories, namely: reducing energy requirement by promotion of energy efficiency, and by increasing the use of low carbon energy sources in the supply.
- Policy instruments can essentially be classified into five categories: Energy Pricing, Carbon Tax, Cap & Trade, Subsidy and Regulation.
- Energy pricing: is a critical policy instrument that promotes efficient use of energy and leads to selection of appropriate technology and energy mix.
- Energy efficiency: has a transcendental role in any modern economy. Labelling and Star Rating has been found to be effective in promoting the use of more energy efficient appliances. Consumers seem to react rationally to energy saving.
- Policy for Energy Efficient Buildings: The potential for energy saving in annual energy use for commercial buildings has been estimated to be around 30 percent. The ECBC has already been made mandatory for large commercial buildings in some states.
- To promote energy efficiency in industries, a Perform, Achieve and Trade (PAT) Scheme has been introduced by the Bureau of Energy Efficiency. The PAT scheme covers some 400 large designated consumers (DCs) in 9 sectors including power generation.

Coal Cess and Direct Carbon Tax: An Analysis

- India imposed a cess on domestically produced and imported coal and set up the National Clean Energy and Environment Fund (NCEEF) back in 2010. The policy design was to earmark part of the revenues from the coal cess for the NCEEF that, in turn, funded research and innovative projects in clean energy.
• The coal cess revenues were also used for other needs such as the rejuvenation of the Ganga. The coal cess is levied on the dispatch of coal and lignite by coal producers and discourages coal consumption by increasing its cost. For this reason, India’s INDC further specifies that “the coal cess translates into a carbon tax equivalent.
• Coal cess penalises the carbon emitted from coal, but spares that from other fossil fuels—e.g. oil and natural gas. Thus, an indirect carbon tax cannot induce efficient fuel-switching away from fossil fuels towards cleaner sources of energy.
• Coal cess is not a progressive in ensuring distributing revenues uniformly to all household groups across-the-board or preferentially to the low income/consumption-expenditure.

Advantages of carbon tax over coal cess:
• **Impact on Revenue**: Taxing fossil fuels is one of the larger contributors to exchequers globally and India is no exception. A report estimated that a carbon tax @ $ 35 per tonne of CO2 emissions levied by India in phases from 2017 to 2030 can yield more than 2% of GDP, thereby compensating the loss from taxing fossil fuels (Rs 5.5 lakh crore for FY20).
• **Impact on Innovation**: Carbon taxes accelerate the development of innovative business models around clean energy like solar powered automobiles, solar drones, zero energy buildings, super grids, utility scale battery production etc.
• **Impact on investment**: More than US$ 42 billion has been invested in India’s renewable energy sector since 2014 and India rank’s 3rd globally in the EY Renewable Energy Country Attractive Index 2019.
• **Impact on employment**: Utility-scale renewables sector have already created 100,000 jobs (2020), and the current targets are likely to generate another 1.3 million direct jobs. This if harnessed with skilling and re-skilling of workforce can be panacea to unemployment problems caused of Covid-19.
• **Impact on health care infrastructure**: India is also exploring the case for ensuring universal rural healthcare through a sustainable energy path: a CEEW study has shown that primary healthcare centres in Chhattisgarh with battery supported solar PV systems (costing just Rs 28/ person) have better outcomes, especially in maternal and neonatal cases, due to power supply for medical equipment and storage of drugs.
• **Impact on pollution**: India loses a significant $150 bn pa owing to just air pollution (Green peace 2020). Studies by acclaimed institutions have established that the use of solar and wind energy reduce pollution levels by as much 80-97%. India’s total renewable capacity was around 35.7% (Sep 19) of the total installed generation capacity consequent to which CO2 emissions fell by around 1% in FY 20. India aims to have 275 GW (by 2027) from renewable/clean energy, and has pledged a 33-35% reduction in the emissions intensity of its economy by 2030, compared to 2005 levels. This is expected to have far-reaching impact across sectors like health care, urbanisation, transportation, power etc.
• **Impact on India’s NDC’s**: A carbon tax would definitely push India towards cleaner fuels and it will automatically ensure a step closer to India’s NDC’s as per Paris Accord of 2015.
• **Impact on social infrastructure**: India has been imposing a form of carbon tax in case with coal cess. The government now aims to use this cess to clean the Ganga or build toilets. This can also help us achieve social objectives.

**Conclusion:**
Carbon tax is one of the potent options to nudge the adoption of green tech and, if used wisely, can generate significant results in a short span along with considerable long term dividends. A calibrated introduction of Carbon Tax with an effective market for ETS, would go a long way in making the transition financially viable and widen the participation of stakeholders ensuring low carbon inclusive growth whilst protecting our environment.

### 3. Stubble Burning and Air Pollution
Why do farmers burn paddy stubble?
• Stubble burning is the **easiest and most cost-effective option.**
• Farmers who are unable to use or sell straw are burning it. Non-basmati straw is not used as animal fodder and hence is burnt.
• Small farmers and tenant farmers are more likely to burn the stubble as they have **fewer resources and risk appetite for using alternative technologies.**

**Agriculture’s contribution to air pollution**
• The Indo-Gangetic plain is one of the world’s largest and rapidly-growing ammonia hotspots.
• Atmospheric ammonia, which comes from fertiliser use, animal husbandry, and other agricultural practices combines with fossil-fuel burning to form fine particles.
• The burning of one tonne of paddy straw releases 3kg particulate matter, 60kg carbon monoxide, 1,460kg carbon dioxide, 199kg ash and 2kg sulphur dioxide.
• The **stubble burning shoots up the carbon dioxide levels in the air** by 70%.
• The concentration of carbon monoxide and nitrogen dioxide also rises by 7% and 2.1% respectively, triggering respiratory and heart problems.
• PM2.5 emitted from stubble burning in just 60 days is 4-5 times what all Delhi vehicles emit in the entire year.

**Impact of Subsidies**
• The irony of agricultural pollution is that taxpayers are essentially paying for it through a system of subsidies.
• Much of the policy attention has focused on how to change the disposal of paddy stubble, but the current system of subsidies is the reason that there is stubble on these fields.
• **Free power** — and consequently, **“free” water**, pumped from the ground — is a big part of what makes **growing rice in Indo-Gangetic plains attractive.**
• **Open-ended procurement of paddy**, despite the bulging stocks of grains with the Food Corporation of India, adds to the incentives.
• Subsidies account for almost 15 per cent of the value of rice being produced in Punjab-Haryana belt.
• **Fertiliser Subsidy**
  o The roots of rising ammonia pollution lie in the way fertiliser is used.
  o Fertiliser, particularly urea in granular form, is highly subsidised.

**What farm fires cost India**
• The **International Food Policy Research Institute (IFPRI)** has estimated economic and health costs of air pollution caused due to stubble burning in North India — which is around $30 billion or Rs 2 lakh crore per year.
• This is more than thrice the amount the Union government spent in its budget for the health sector.

**Concerns / Challenges**
• There has been a ban on burning this agricultural residue, but the State authorities have not been able to entirely stop it.
• The rapid pace of burning of crop residue in Punjab despite being provided a large number of machines under the **crop residue management (CRM)** is a cause of concern for the state government.
• The claims of various district administrations of various village panchayats passing resolutions against stubble burning are falling flat.
• Within a month when paddy stubble burning had started, the field fires have recorded almost threefold increase when compared with previous year.
• Though rentals for machines have been waived off, small farmers are finding it tough to pay for cost of diesel.
• **Happy seeder** costs Rs 1.50 lakh and requires a 65-horsepower tractor. Small farmers cannot afford to buy the machinery, even with a subsidy of 50% at current rates.

• Stubble burning also causes poor visibility due to smoke resulting in accidents at far-off places.

**International Examples**

• **China** banned burning crop residue in 1999 and imposed heavy fines.

• Crop residue management (CRM) in China has “in situ” focus which helps balance composition of nitrogen, phosphorus and potassium in the soil.

• In **Australia**, comprehensive guidelines exist to check crop residue burning.

• The **United Kingdom** banned crop residue burning in 1993.

**Way Forward**

• **What we need is a solution that is scientific, affordable, and culturally adaptable.**

• We can redesign the Combine Harvester to cut the paddy straw from the plant’s base to remove the stem.

• The straw can either be sold or used as mulch in zero tillage agriculture.

• We can even incorporate a baling machine to the Combine to bale the straw, which can then be easily transported and sold.

• Agriculture conservation should be promoted with “low lignocellulosic” crop residues such as rice, wheat and maize.

• The Economic Survey noted that thermal power plants in the vicinity ought to be encouraged to undertake co-firing of crop residues with coal.

• We can replace products made of single-use plastic with stubble.

• Delhi government could impose a “clean air” tax/cess on the people of Delhi and use the funds to pay the farmers of Punjab/Haryana to abandon burning crop stubble/use an alternate method of disposal.

4. **Regulation of Single-Use Plastic**

• Single-use plastics (SUPs), or disposable plastics, are products that are used only once before they are thrown away.

• A FICCI study estimates that 43 per cent of India’s plastics are used in packaging and much of it is single-use plastic.

• Close to 20 states in India have imposed a partial or total ban on single-use plastics at one time or another.

**Present Status in India**

• Unnecessary single-use plastic entering our homes in the form of covers for invitation cards, magazines, bread wrappers and advertisements.

• Rising e-commerce in India with people buying from companies like Amazon and Flipkart that use single-use plastic for disposable packaging.

• India is enriching other countries by buying their crude oil and ruining its own environment by converting it into plastic waste.

• This is unfortunate, as it would have put India at the forefront of regulations to solve plastic

• Alternatives to single-use plastics are not immediately available.

• India, which uses about 14 million tonnes of plastic annually, lacks an organised system for management of plastic waste, leading to widespread littering.

• A study by FICCI points out that fast-growing consumption has brought us to a point where consumption has clearly outstripped India’s current capacity to recycle plastics.

**Plastic Pollution**
Plastic waste is at epidemic proportions in the world’s oceans with an estimated 100 million tonnes dumped there, according to the United Nations.

Scientists have found large amounts of micro plastic in the intestines of deep-dwelling ocean mammals like whales.

The toxins, poisons and persistent pollutants present in plastic products leach and enter human bodies where they cause several diseases, including cancer.

India has made progress in its efforts to reduce plastic waste:

- The Plastic Waste Management Rules, 2016 are clear that producers, importers and brand owners must adopt a collect-back system for the plastic they introduce into the environment.
- Voluntary initiatives are having an impact in many States, as citizens reduce, reuse and sort their waste.
- In 2016, Sikkim banned usage of packaged drinking water in government offices and government events. Second, it banned the use of Styrofoam and thermocol disposable plates and cutlery in the entire state.

Positive Developments

- There are hundreds of solutions and alternatives to single-use plastics.
- Many have been developed by startups led by environmentally focused entrepreneurs — ecopreneurs.
- For scaling up, this requires visionary leadership in corporations, capital from investors, and collaborative efforts between competitors within industries.
- Some examples of upstream innovations are bioplastics made from algae.
- Some bioplastics like PHAs (polyhydroxyalkanoates) are soil- and marine-safe — that is, they safely degrade in the environment.
- Indian entrepreneurs have created solutions that can replace packaged plastic bottled water in most locations.
- To date, over 14,000 km of so-called plastic roads have been built which are long-lasting and free of pot-holes.

International examples:

- The success of imposing a plastic bag fee has also been established in cities like Chicago and Washington, showing that such interventions could be effective in shaping behaviour change.
- The European Union is mulling new laws to ban some everyday single-use plastic products including straws, cutlery and plates citing plastic litter in oceans as the concern prompting the action.
- Encouraging plogging:
  - Picking up litter while jogging or strolling was kick-started on a small scale in a small part of Stockholm, it has spread across the globe and India can adopt this as well.

Way Forward

- India Inc must embrace solutions rather than lobbying against regulations.
- It can create a golden opportunity for India to lead the world in innovations to solve plastic pollution.
- Where plastic cannot be eliminated, the next best option is reusability, like replacing plastic bottles with glass bottles.
- Where single-use plastic cannot be avoided, a plethora of technologies can help recover and sort the waste.
- Examples are smart bins, sorting machines, reverse vending machines and smart packaging technologies that make it easier to separate different materials.
- Once sorted, there are many options to recover value from waste plastics.
• We need more innovative ideas and a fundamental change in mindsets to minimise the use of single-use plastic.
• It is high time we also turn to the larger challenge of plastic waste management if we want to continue to avail of the advantages offered by plastics in our modern lifestyle.
• Marine plastic pollution is a “planetary crisis,” and we should hope for a “Paris-style” global treaty aimed at tackling it. We cannot transform our world into a ‘plastic planet’. What is needed is collective public effort to stop plastic pollution and safeguard our ecosystem/biodiversity.

5. **Microplastics**

- Microplastics are small plastic particles in the environment that are generally smaller than 1mm down to the micrometer range. Microplastics can be formed by fragmentation of large plastic waste material.
- Microfibres from washing of textiles, microbeads used in cosmetics and even paint from land run-offs can dump microplastics in the ocean. According to a 2017 International Union for Conservation of Nature (IUCN) report, microplastics are estimated to constitute up to 30% of marine litter polluting the oceans.
- **Concerns posed by Microplastics:**
  - Microplastics escape the filtration and treatment processes for waste water and end up in sites of nature.
  - This is resulting in significant global impacts on wildlife from marine environment pollution.
  - Microplastics are found in the viscera of dead sea birds, reptiles like turtles, whales etc.
  - It holds the potential for both bioaccumulation and biomagnification.
  - Once the microplastics enter foodchain, they carry synthetic chemical compounds such as PCBs and PAHs, which are carcinogenic.
  - Unlike POPs (Persistent Organic Pollutants) or chlorofluorocarbons (CFCs), Plastic pollution has received little attention in terms of international agreements.
  - **Microplastics make up 94 percent** of an estimated 1.8 trillion pieces of plastic in the patch. But that only amounts to eight percent of the total tonnage.

- **Measures needed:**
  - Local actions are required for mitigating plastic pollution, using mechanisms such as bans on plastic bags, maximum daily limits for emissions into watersheds, and incentives for fishing gear retrieval.
  - Microbeads in cosmetics, daily use items must be banned globally.
  - Effective policies must take into account all stages of the lifecycle of plastic—connecting producers to users and ultimately to waste managers.
  - Nonprofits like 5 Gyres are now pushing an agenda toward public awareness, corporate responsibility and the idea of a circular economy — an economy that focuses on keeping waste to a minimum while maximizing materials’ use.
  - Fossil fuel subsidies incentivise the plastic market. Hence, Countries should **end fossil fuel subsidies**. Annually, 4–8% of oil is used to produce raw plastic.

6. **Air Pollution**

- According to WHO, of the 20 most polluted cities in the world, the top 14 are Indian cities.
- In India, air pollution is the third highest cause of death among all health risks, ranking just above smoking.

**Impact of air pollution on the economy:**
- According to a report by the United Nations Environment Programme (UNEP), India had the highest share of welfare costs (or a loss of income from labour), of about $220 billion (about
₹1.4 trillion), in South and South-East Asia of a combined total of $380 billion from mortality due to air pollution.

- In addition to human lives lost, there's an estimated global cost of $225 billion in lost labour, and trillions in medical costs, Greenpeace report says.
- A 2014 study estimated that air pollutants were responsible for 19% of the loss in yields in wheat production in India in 2010.

**Way forward:**

- Short term measures should be accompanied by measures that increase the forest cover of the land and provide farmers with an alternative to burning the remains of their crops.
- From an urban development perspective, large cities should reorient their investments to prioritise public transport, favouring electric mobility.
- Incentives for adoption of alternate mobility technologies should be promoted.
- The World Bank has said it is keen to enhance its lending portfolio to tackle air pollution, opening a new avenue for this.
- Governments should make the use of personal vehicles in cities less attractive through strict road pricing mechanisms like Congestion tax, Green-house Gas tax
- Addressing vehicular emissions is within India’s grasp but requires a multi-pronged approach. It needs to combine the already-proposed tighter emission norms (in form of BS VI), with a push for shared mobility and public transport and adoption of alternate mobility technologies.
- NCAP should take precedence from emerging practices in the country—pollution cess in Delhi on truck entry, big diesel cars, and diesel fuel sales and the coal cess—to generate dedicated funds to finance clean air action plan.
- Tackle road dust by mechanised sweeping and water-sprinkling but what would be more beneficial is if the sides of the roads could be paved or covered with grass that holds the soil together and stops the production of the dust in the first place.
- Attention to non-technological aspects such as urban planning, to reduce driving, and to increase cycling, walking, and use of public transport are needed.

**7. Pesticide Pollution**

- Agriculture in India is largely dependent on chemicals including pesticides and their usage has a huge impact on the health of humans, animals, biodiversity and the environment.
- In 2015, the National Crimes Records Bureau recorded 7,672 cases of poisoning due to accidental intake of insecticides/pesticides, out of which 7,060 died.
- **Pesticides are regulated in India through the Insecticides Act, 1968 and Insecticides Rules, 1971,** the experiences in administering this Act over the last five decades has exposed certain gaps. In this context, the union cabinet has recently approved the Pesticides Management Bill, 2020.

**Pesticides usage in India:**

- India is the fourth-largest producer of pesticides in the world, with the market segmentation tilted mainly towards insecticides, with herbicides on the increase in the recent past.
- It is reported that eight states consume more than 70% of the pesticides used in India. Amongst the crops, paddy accounts for the maximum share of consumption (26-28%), followed by cotton (18-20%), notwithstanding all the hype around Biotechnology.
- There are 292 pesticides registered in the country, and it is estimated that there are around 104 pesticides that are continued to be produced/ used in India that have been banned in two or more countries in the world.

**Impacts of Pesticide pollution:**

- Agrochemicals are causing serious hazards and certain pesticides may affect the human endocrine and immune systems and may promote the development of cancer.
• Pesticides go up the food chain by working their way through the environment and into the soil or the water systems after which they are eaten by aquatic animals or plants and ultimately humans. This process is called Biomagnification.
• Excessive use of fertilizers may pollute the underground water with nitrate and it is so much hazardous to livestock.
• Contamination of soil and water with toxic agrochemicals (e.g., phosphate fertilizer contaminated with heavy metals, pesticides and herbicides etc.) are a particular concern.
• Monocrotophos, a pesticide killed huge populations of birds in USA and was eventually banned.

Way forward:
• The existing fertilizer subsidy policy should be revised, and a new policy which is more favourable to Indian conditions should be formulated.
• Promotion of organic fertilizers.
• A Policy should be put in place to incentivize the use of bio-fertilizers. Farmers should be provided with financial and technical support to enable them to switch to organic farming on a large scale.
• Legal action for using banned pesticides like DDT for agriculture.
• A Fertilizer Development and Regulating Authority should be established to streamline the process of certification, quality checks, innovations, and fixing prices of fertilizers.
• Balanced use will also reflect in reduced water consumption, while at the same time protecting water bodies from run-off pollution.
• Farmer awareness about balanced fertilization should be stepped up through the coordinated efforts of the departments of agriculture, cooperation & farmers’ welfare and fertilizers, besides the network of the Indian Council of Agricultural Research’s Krishi Vigyan Kendras.

Conclusion:
The need of the hour is to switch priorities and subsidies from chemical to organic farming as shown by the State of Sikkim. Andhra Pradesh launched a ‘Zero Budget Natural Farming’ Project to phase out chemicals by 2024.
The government should divert the undeserved subsidies from the chemical farming sector to the organic farming sector and assist/train farmers across the country to make the transition to organic farming practices and thereby enhance their livelihoods, and protect their lives.

8. Solid Waste Management
Current Situation of MSW in India:
• The World Bank study revealed that India was the world’s highest waste-generating nation.
• According to a 2016 estimate given by the study, India’s annual waste generated is likely to touch 387.8 million tonnes in 2030 and 543.3 million tonnes by 2050.
• The silver lining, though, is the fact that while India’s total waste production is the highest, Bermuda and the US topped the list when it came to per person generation of waste every day.
• On a daily basis, the country produces more than 1.50 lakh metric tonne (MT) of solid waste, according to a 2019 India Today report. With almost 15,000 MT of garbage remaining exposed every day, it has become a significant reason for rising pollution levels.
Some of the major issues concerning solid waste management are:

- Absence of segregation of waste at source
- Lack of funds for waste management at ULBs.
- Unwillingness of ULBs to introduce proper collection, segregation, transportation and treatment/ disposal systems.
- 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 due to lack of awareness
- Lack of community participation towards waste management and hygienic conditions
- Lack of sewage management plan.
- 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 MSW.

Steps needed:

- The key to efficient waste management is to ensure proper segregation of waste at source and to ensure that the waste goes through different streams of recycling and resource recovery as stated in the Solid Waste Management Rules, 2016.
- Waste to energy is a key component of SWM. Installation of waste-to-compost and biomethanation plants would reduce the load of landfill sites.
- 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.
- Construction and demolition waste should be stored, separately disposed off, as per the Construction and Demolition Waste Management Rules, 2016.
- Responsibilities of Generators have been introduced to segregate waste into three streams, Wet (Biodegradable), Dry (Plastic, Paper, metal, wood, etc.) and domestic hazardous wastes (diapers, napkins, empty containers of cleaning agents, mosquito repellents, etc.) and handover segregated wastes to authorized rag-pickers or waste collectors or local bodies.
- Sensitization of citizens as well as government authorities, community participation, involvement of NGOs. Littering should be prohibited.
- International Best practices should be emulated. South Korea is one of the few countries to separate and recycle food waste. It has also launched landfill recovery projects such as the Nanjido recovery project which have successfully transformed hazardous waste sites into sustainable ecological attractions.

9. Desertification

- Desertification is the degradation of land in arid, semi-arid and dry sub-humid areas. It is caused primarily by human activities and climatic variations.
- It occurs because dryland ecosystems, which cover over one-third of the world’s land area, are extremely vulnerable to overexploitation and inappropriate land use.
- United Nations Convention to Combat Desertification (UNCCD) is the sole legally binding international agreement linking environment and development to sustainable land management.
- UNCCD Estimate of Desertification:
o **Land & Drought:**
  ▪ India has witnessed an increase in the level of desertification in 26 out of 29 states between 2003-05 and 2011-13, according to the State of India’s Environment (SoE) 2019 in Figures.

o **Land & Human Security:**
  ▪ By 2045, some 135 million people may be displaced as a result of desertification.
  ▪ Achieving *land degradation neutrality*—by rehabilitating already degraded land, scaling up sustainable land management and accelerating restoration initiatives.

o **Land & Climate:**
  ▪ Restoring the soils of degraded ecosystems has the potential to store up to 3 billion tons of carbon annually.
  ▪ Its rehabilitation and sustainable management are critical to combating climate change.

- **UNCCD 2018-2030 Strategic Framework:** It is the most comprehensive global commitment to achieve Land Degradation Neutrality (LDN) in order to restore the productivity of vast expanses of degraded land, improve the livelihoods of more than 1.3 billion people, and reduce the impacts of drought on vulnerable populations to build.

- **Way forward:**
  o **Lessons from the world:**
    ▪ In Africa, several countries have come together to form a 12,000 sq.km “great green wall” extending from Senegal to Djibouti with the participation of local communities.
    ▪ **People’s participation** is crucial in reclaiming lands. China’s “great green wall” project is on a massive scale and is now starting to show results.
  o National governments could consider building large green belts, prioritise forestry programmes and launch projects of fixing and stabilising sands.

10. **Ocean Acidification**
- Ocean acidification is an emerging global problem.
- Around a third to a half of the CO2 released by human activities is absorbed into the oceans which has a direct, chemical effect on seawater, which we call ocean acidification.
- Ocean acidification is progressing rapidly around the world, new research has found.
- Plastic pollution, overfishing, global warming and increased acidification from burning fossil fuels means oceans are increasingly hostile to marine life.
- **Ocean acidification has the potential to affect food security.** By 2100, the global annual costs of mollusc loss from ocean acidification could be over US$100.
- Ocean acidification is affecting the coastal estuaries and waterways.
- Acidification could **damage the Arctic tourism economy** and affect the way of life of indigenous peoples.
- The capacity of the ocean to absorb CO2 decreases as ocean acidification increases.
- The **Arabian Sea is witnessing acidification of its surface waters**, a consequence of excessive carbon dioxide in the atmosphere.
- Study shows rapidly decreasing presence of marine phytoplankton in the western Indian Ocean.
- A report warns that the **Indian Ocean may be reduced to an ecological desert**, given the levels of ocean warming.
Climate Change

1. Climate Change

- Climate change is any significant long-term change in the expected patterns of average weather of a region (or the whole Earth) over a significant period of time.
- Climate change is inextricably linked with society, economics, politics, and people’s way of life.
- Global warming above pre-industrial levels has touched about 1 degree Celsius.
- The IPCC’s “Special Report on Global Warming of 1.5°C” revealed that the impacts and costs of 1.5 degrees Celsius of global warming will be far greater than expected.
- The Intergovernmental Panel on Climate Change says a 1.5°C average rise may put 20-30% of species at risk of extinction. If the planet warms by more than 2°C, most ecosystems will struggle. Coral reefs are projected to decline by a further 70-90% at 1.5°C.
- The IPCC 1.5 report basically says, at the current rates at which we are producing greenhouse gases, we are looking at a couple of decades really before what we have available is exhausted.
- IPCC said that climate change could have “irreversible” and “catastrophic” impacts if the global average temperatures were allowed to rise beyond 2 degrees Celsius.
- At one level, for many people climate change has become an existential problem, a problem that risks undermining the conditions for productive life and therefore a problem that does not override but certainly permeates all kinds of other issues.
- For many others, climate change is a distant problem that is overwhelmed by more immediate issues.
- Sea levels have risen between four and eight inches in the past 100 years. Current projections suggest that sea levels could continue to rise between 4 inches and 36 inches over the next 100 years.
- The World Health Organization estimates that climate change is causing tens of thousands of deaths every year.
- Experts predict that by 2030, climate change will cause an additional 250,000 deaths each year from malaria, diarrhoeal disease, heat stress and undernutrition alone.
- Climate change lengthens the transmission season and expands the geographical range of many diseases like malaria and dengue.
- The Climate Adaptation Management and Innovation Initiative of the World Food Programme develops climate-induced food insecurity analyses and practices to inform programming and decision-making.
- Climate refugees can be found all over the world, displaced by coastal flooding in Dhaka, by hurricane Maria in Puerto Rico, or due to the desertification of Lake Chad in West Africa.
- International Centre for Integrated Mountain Development’s (ICIMOD) “Hindu Kush Himalaya Assessment” reveals that more than 35 per cent of the glaciers in the region could retreat by 2100, even if the global temperature rise is capped at 1.5º C.
- Coral reefs would decline by 70-90 percent with global warming of 1.5°C, whereas virtually all (> 99 percent) would be lost with 2°C.

Is the 1.5°C target attainable?

- The IPCC report suggests possible pathways to attain the 1.5°C objective.
- It would involve much sharper and quicker emission cuts by big emitters like China, the US, the European Union and India.
- These pathways are likely to be heavily dependent on the success of carbon removal technologies.
- No such technology exists yet, but several possibilities are being explored.

Challenges in addressing climate change:

- Regional Inequality:
The indifferent behaviour by the developed countries has led to partial success of many global initiatives. Eg. Kyoto Protocol.

- **Developed Countries not taking responsibility:**
  - Developed nations are unwilling to accept the responsibility and are moving away from global agreements. Eg. USA rejecting the Paris deal.

- **Finance:**
  - Electric mobility, certainly is a green measure, but is actually expensive, in immediate terms, in terms of cost per vehicle kilometre.

- **Technology:**
  - Commercialization of technology in form of Patents, evergreening has made it unaffordable.

- **Case Study:** A scientific study of wind farms in the Western Ghats, a UNESCO-listed range of mountains and forest spanning India’s west coast, found that predatory raptor birds were four times rarer than in adjacent areas. Their absence cascaded down the food chain and radically altered the density and behaviour of the birds’ prey. There was, in particular, an explosion in the raptors’ favourite meal: fan-throated lizards.

- **Way Forward**
  - To limit ourselves to 1.5°C, global net anthropogenic CO2 emissions should reduce by about 45 per cent from 2010 levels by 2030, and should reach net-zero around 2050.
  - Use of coal should reduce steeply and its share in electricity mix should be reduced to close to 0 per cent by 2050.
  - Real emission reductions can be achieved through a combination of new and existing technologies, including sustainable bio-based feedstocks, product substitution, and carbon capture, utilisation and storage (CCUS).
  - Wealthy nations like the U.S., and those of the EU argued that emissions from developing countries are consistently rising and they need to commit to more serious emission cuts. A consensus needs to be developed at the earliest.
  - Concerning mitigation, distinction between Developed and developing Parties must be maintained in accordance with the principles of Equity, CBDR and other provisions of the UN Conventions.

- **Concept of Green Financing in India:**
  - In India the concept of green financing is nascent.
  - Measures to encourage green-bonds could help raise finances needed to “green” India’s economy.

2. **Implications of changing climate**

India is one of the most vulnerable countries in the world to projected climate change. The country is already experiencing changes in climate and the impacts of climate change, including water stress, heat waves and drought, severe storms and flooding, and associated negative consequences on health and livelihoods.

- **Implications of Climate change:**
  - The region, with glaciers receding at an average rate of 10–15 meters per year. If the rate increases, flooding is likely in river valleys fed by these glaciers, followed by diminished flows, resulting in water scarcity for drinking and irrigation.
  - All models show a trend of general warming in mean annual temperature as well as decreased range of diurnal temperature and enhanced precipitation over the Indian subcontinent.
  - Increased precipitation including monsoonal rains is likely to come in the form of fewer rainy days but more days of extreme rainfall events, with increasing amounts of rain in each event, leading to significant flooding.
• **Growing emissions of aerosols** from energy production and other sources may suppress rainfall, leading to drier conditions with more dust and smoke from the burning of drier vegetation, affecting both regional and global hydrological cycles and agricultural production.

• Uncertainties about monsoonal changes will affect farmers’ choices about which crops to plant and the timing of planting, reducing productivities. The large segment of poor people (including smallholder farmers and landless agricultural workers) may be hardest hit, requiring government relief programs on a massive scale.

**Implications of changing climate on various aspects of Indian region:**

• **Agriculture**: Millions of subsistence and farmers will experience hardship and hunger through being less able to predict climate conditions.

• **Water**: Glacier melt may yield more runoff in the short term but less in the medium and long terms. More severe storms (especially cyclones) will cause more damage to infrastructure and livelihoods and exacerbate salt water intrusion in storm surges.

• **Exacerbation of Inequality**: The welfare of those who are affected by climate change and who have limited means to adapt may act as a force that can change governments, strain public budgets, and foster unrest.

• **Migration**: India receives immigrants from a number of countries. Under climate change conditions, it may be flooded with many more, particularly from Bangladesh. Such migration may exacerbate tension between the two countries as well as putting a strain on Indian central and state governments.

• **Adaptive capacity** in India varies by state, geographical region, and socioeconomic status. Studies point to influential factors such as water availability, food security, human and social capital, and the ability of government (state and national levels) to buffer its people during tough times. *Where adaptive capacity is low, the potential is greater for impacts to result in displaced people; deaths and damage from heat, floods, and storms; and conflicts over natural resources and assets.*

**Measure taken to combat climate change in India:**

• India’s Nationally Determined Contributions

• National Action Plan on Climate Change (NAPCC).

• International Solar Alliance (ISA).

• State Action Plan on Climate Change (SAPCC)

• FAME Scheme for E-mobility.

• Atal Mission for Rejuvenation & Urban Transformation (AMRUT) for Smart Cities.

• Environment Impact Assessment.

• Pradhan Mantri Ujjwala Yojana.

• UJALA scheme.


The INDCs submitted by the countries under Paris agreement are grossly inadequate to contain the temperature rise within the desirable limit. In India, rising threats of climate change aggravated by increasing inequality requires a proactive policy that factors in the unique threats to different regions (e.g. floods in the Ganga basing and drought in Vidarbha region) in the development programs. The strategy to adapt to this crisis needs to protect the worst affected victims — the poor and the marginalized along with the environment.

### 3. Impact of Climate Change on Food Production

• Climate change is adversely affecting the production of key crops such as wheat and rice, with some countries faring far worse than others. This is as per research, published in the journal PLOS ONE.
• The study found that about half of all food-insecure countries are experiencing decreases in crop production — and so are some affluent industrialised countries in Western Europe.
• Crops like soybean and gram are likely to benefit from higher level of CO2 in atmosphere, which helps in CO2 fertilisation.
• A recent study of global vegetable and legume production concluded that if greenhouse gas emissions continue on their current trajectory, yields could fall by 35 percent by 2100 due to water scarcity and increased salinity and ozone.
• **Climate change will not only affect crops—it will also impact meat production, fisheries and other fundamental aspects of our food supply.**
• **Heat waves**, which are expected to become more frequent, **make livestock less fertile and more vulnerable to disease.** Dairy cows are especially sensitive to heat, so milk production could decline.
• Aquaculture of fresh water species is also affected by sea level rise as saltwater can move upstream in rivers.
• For example, in the Mekong Delta and Irawaddy region of Vietnam and Myanmar, the booming catfish aquaculture could be affected by saltwater intrusion.
• **Groundwater:**
  o About 10 percent of the crops grown in the world’s major food production regions are irrigated with groundwater that is non-renewable.
  o Aquifers are being drained faster than they’re refilling—a problem which will only get worse as the world continues to heat up.
  o This is happening in major food producing regions such as the U.S. Great Plains and California’s Central Valley, and in Pakistan, India, northeastern China, and parts of Iran and Iraq.
• **Impacts on India’s agriculture profile due to climate change:**
  o India is fortunate to have the monsoon, but it is also uniquely vulnerable to rising temperatures.
  o With **rain-fed agriculture** practised in over 67% of our total crop area, weather variability can lead to heavy costs, especially for coarse grains (which are mostly grown in rain-fed areas).
  o The World Bank report warned that by the 2040s, India would see a significant reduction in crop yields because of extreme heat
  o Any significant decline in summer rains would devastate Indian agriculture. Climate change related phenomena have consequences, especially for marginal farmers.
  o They potentially face a huge decline in household income and rise in household poverty through exacerbated droughts.
  o As agriculture contributes 16 per cent to India’s GDP, climate change causes about 1.5 per cent loss in GDP.
  o According to 2018 Economic Survey, India incurs losses of about $9-10 billion annually due to extreme weather events. It also noted farmers’ income losses from climate change would be between 15 % and 18 % on an average
• **Way forward:**
  o **Increasing area under permaculture** could result in a total reduction of gigatons ofCO2, from both sequestration and reduced emissions.
  o Applying Farm yard Manure, compost or by practising organic farming to improve the soil organic matter which can help in improvement of soil health.
  o Develop climate-smart agriculture practices.
  o Adoption of **Zero Budget Natural Farming (ZBNF) and Organic farming.**
  o Promoting Drought / temperature tolerant varieties and water saving paddy cultivation methods (**System of Rice Intensification (SRI)**).
  o Investment in R&D is needed to spur innovations in sustainable climate-friendly and climate-proof productivity, and the private sector can help on this.
4. Global warming and Climate change
   - Global warming is the heating of Earth’s climate system observed since the pre-industrial period (between 1850 and 1900) due to human activities, primarily fossil fuel burning, which increases heat-trapping greenhouse gas levels in Earth’s atmosphere.
   - Climate change is a long-term change in the average weather patterns that have come to define Earth’s local, regional and global climates.

Contribution of Global warming and Climate Change in extreme weather events:
   - Human activities have already raised the global temperature by one degree centigrade compared to the pre-industrial levels. The global warming is now likely to reach 1.5 degree between 2030 and 2052 if it continues to rise at the current rate.
   - The world is already witnessing the consequences of 1 degree global warming in the form of extreme weather events, rising sea levels and diminishing Arctic sea ice. There will be long-lasting or irreversible changes like the loss of some ecosystems if the temperature rises further.
   - South Asia, particularly India, Pakistan and China are hotspots in a warming world. IPCC report warns that global warming is occurring faster than anticipated and that it can have devastating impacts if steps are not taken to cut down emissions.
   - India will be among the worst hit countries that may face wrath of calamities like floods and heatwaves, and reduced GDP. Other impacts include intensified droughts and water stress, habitat degradation, and reduced crop yields.
   - Extreme temperature in India will affect agriculture, water resources, energy, and public health sectors. It will “disproportionately affect disadvantaged and vulnerable populations through food insecurity, higher food prices, income losses, lost livelihood opportunities, adverse health impacts, and population displacements”.
   - The impact on India could be devastating, last year apart from the six cyclonic storms that formed over the northern Indian Ocean, India experienced “high impact weather” events. There were extreme heavy rainfall, heat and cold waves, snowfall, thunderstorms, dust storms, lightning and floods.
   - The region, with glaciers receding at an average rate of 10–15 meters per year. If the rate increases, flooding is likely in river valleys fed by these glaciers, followed by diminished flows, resulting in water scarcity for drinking and irrigation.

Way forward
   - To limit ourselves to 1.5°C, global net anthropogenic CO2 emissions should reduce by about 45 per cent from 2010 levels by 2030, and should reach net-zero around 2050.
   - Use of coal should reduce steeply and its share in electricity mix should be reduced to close to 0 per cent by 2050.
   - To limit global warming, countries will have to change policies in sectors like land, energy, industry, buildings, transport, and urban development.
   - India needs to focus on improving air quality which can deliver returns in health and productivity as well as the recovery of monsoon.

5. Coastal Erosion and Climate Change
Impact of Climate Change
   - Climate change disproportionately devastates the developing world including India.
   - India’s 7,500-kilometer-long coastline is considered the world’s most vulnerable to the impacts of climate change.
   - Extreme temperatures, changes in rainfall, the incidence of extreme weather events, and sea-level rise are all expected to increase.
Climate change could cause a quarter of a million more deaths per year between 2030-2050 due to heat exposure, diarrhea, malaria, and malnutrition worldwide.

Coastal climate change has led to conflict and mass migration.

Sea Level Rise
- Depending on various emissions scenarios, it is projected that the sea level in the Asia-Pacific region could rise between 0.4-0.6 meters, and temperature could see increases of up to 2.6-4.8 degrees by 2100.
- Sea-level rise inundation of cropland with more and more saltwater flooding and transforms agricultural areas into brackish areas.
- As the world’s largest delta region, Sagar Island in the Bay of Bengal has been a climate change “hotspot”.
- Coastal erosion is happening here faster than anywhere in the world.
- Research indicates that the Sundarbans, Kolkata, and Dhaka would not be immune from sea level rise.
- Continued land degradation decreases the prospects even further for fishermen.
- As sea levels rise, salinization creeps into the soil and can ruin crops for multiple seasons while devastating farmer livelihoods.
- When water rushes in from the sea, the Aquaculture plots are ruined and access to freshwater becomes increasingly difficult.
- Unprotected communities are more vulnerable to increased food, water, and health insecurity.

Cyclones and Storm Surges
- A high incidence (30.6 percent) of post-traumatic stress disorder was reported after a cyclone that struck India in 1999.
- Coastal flooding, which often comes to the delta, has important health implications. Cyclones, storm surges and flooding can become vectors for a host of water-borne illnesses.
- In the 19th century, cholera spread across the world from the waters of the Ganges delta, becoming a global pandemic.

India’s Position
- The multitude of climate stressors India faces is: increasingly severe storms (cyclones), floods, heatwaves, droughts, water stress, disease, poor air quality, food insecurity, and mass displacement.
- India has the largest share of the global poor population exposed to all kinds of climate risks and megacities with high population densities.
- In a Global Climate Risk Index 2020 India was ranked fifth in the world for countries affected in 2018-19 by extreme weather events.
- Since 2004, India has experienced 11 of its 15 warmest recorded years and is “highly vulnerable to extreme heat.
- Glacial melt from the Himalayas has doubled since 2000 and in the last 40 years approximately 25 percent of glacial ice has been lost.
- Melting Himalayan glaciers and loss of snow accumulation pose a significant risk to stable and reliable water resources to major rivers such as the Ganges, Indus and Brahmaputra.
- There is decline of sediment flow through the Ganges and its tributaries due to upstream constructions (including the Farakka barrage), which arrest the sediments in their upstream.
- Hence, the soil formation of the delta (the Ganges delta is formed by the sediments brought in by the Ganges and its tributaries) is largely inhibited.
- Finding an equilibrium between mitigating climate change and development necessities will be a challenge.
- Many countries, including India, is not meeting targets set during previous climate accords.
However, **India has put the issue of climate change higher on its foreign policy agenda**, has increased the domestic awareness of the climate issue, and has seen a rise of green technologies taking off in the business sector.

**Mangrove forest**
- In the Indian delta region, the mangrove forest is a crucial natural blockade against cyclones, storm surges, and tides.
- Mangroves also act as vital “carbon sinks,” efficiently removing CO2 through natural carbon capture.
- In 1999, during a super cyclone that struck Orissa, research found that villages with wider mangroves experienced significantly fewer deaths than ones with narrower or no mangroves.
- Degradation of the mangrove ecosystem has severely depleted the most important trees in the Sundarbans: The Sundari tree.
- The number of Sundari trees has decreased by 76 percent in 70 years.
- Sundari tree are under severe threat from the lack of freshwater reaching the Sundarbans and increasing amounts of salt water inundating them from the sea.
- More Chinese dams are also planned for the Brahmaputra basin, which could devastate the Himalayas, subsequently starving Sundarban mangroves of their last freshwater resources.

**Way Forward**
- India should lead the demand for greater and accelerated collective ambition towards mitigation efforts at the global level.
- Need for an urgent **global and national climate action**.
- Careful preparation for epidemics before the arrival of a cyclone is important to ensure a rapid response and control of outbreaks.
- Need for more attention and investment towards a **nature-based solution like large scale mangrove plantation**.
- To increase disaster preparedness, stronger coastal embankments, shelters, and reforestation initiatives, a coordinated response will be needed in vulnerable areas.
- Further investments today will minimize climate change multipliers.

### 6. Climate Change and Water
- In a world driven by climate change, water as a public resource, has become crucial.
- **Changing climate has significant impact on water** — direct or indirect — leading to serious social and economic issues in highly vulnerable countries such as India.

**Present Crisis**
- Climate change is **disrupting the water cycle** and severely affecting those who live in already water-stressed areas.
- Last year close to 200 districts in the country experienced both flood and drought in the same season.
- The **disruption of water cycle** will invariably impact those areas that are already water stressed.
- According to the United Nations’ World Water Development Report 2018, some 3.6 billion people across the world live in areas that witness water scarcity for at least a month in a year.
- By 2050, this number would rise to 5.7 billion.

**Impact/ Consequences**
- The impacts of climate change are being felt **across many social, economic, environmental and political systems.**
- Climate change will bring about a **fundamental change** in the India’s most important water supplier: The **monsoon**.
• Millions of poor are struggling to live with low adaptive capacity, fast diminishing reliable water resources, large-scale wetland degradation and unsustainable water management.
• India’s National Water Mission has warned that climate change will impact both surface and groundwater sources in the country.
• Fall in surface water availability due to changing rainfall pattern increases dependency on groundwater.
• Groundwater level has been receding at an alarming rate in many parts of India.
• In the coastal zones, this is leading to salinity intrusion in aquifers.
• Climate change impacts will have direct consequences for water security with its reflection on food security.
• A recent study by the International Food Policy Research Institute found that more than half the world’s population and approximately half of global grain production will be at risk due to water stress by 2050.
• Aquatic species are generally more sensitive to water temperatures and water bodies can be impacted by climate change, affecting fish growth and viability.
• Floods contaminate freshwater supplies, heighten the risk of water-borne diseases and create breeding grounds for disease-carrying insects.
• Shortage of reliable water often leads to disputes over water sharing in transboundary water resources.

Concerns/ Challenges
• People with lower socio-economic status, migrants and refugees are most vulnerable to the impact of climate change on water.
• The impacts of climate change are experienced differently by men and women due to their gender roles and relationships in society.
• Forced migration due to climate change is taking place in many parts of the world, particularly in Africa and Asia.
• Safe water is becoming a costly commodity. Even today, in certain countries, bottled water costs more than fruit juice.
• The World Economic Forum has ranked water crises as number one in global risks.

Way Forward
• The strategy to adapt to this crisis needs to protect the worst affected victims — the poor and the marginalised.
• Our small water harvesting structures need to be retrofitted to endure the extreme weather events.
• Traditional water management systems, such as tanks, wells and ponds, had inbuilt sustainability and stood the test of time.
• Their inbuilt sustainability needs to be brought back through different designs and interventions.
• Urban spaces too must create provisions for water storage systems including treatment plants.

7. Coral Reefs and Climate Change
• Coral reefs are among the most threatened ecosystems on Earth, largely due to unprecedented global warming and climate changes, combined with growing local pressures.
• 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.

Why are Coral reefs important?
• Coral reefs harbour the highest biodiversity of any ecosystem globally and directly support over 500 million people worldwide, mostly in poor countries.
• Despite covering less than 0.1% of the ocean floor, reefs host more than one quarter of all marine fish species.
• Provide a wide variety of ecosystem services such as subsistence food, protection from flooding and sustaining the fishing and tourism industries.
• Their disappearance will have economic, social and health consequences.
• A 2015 study by WWF projects that the climate-related loss of reef ecosystem services will cost US$500 billion per year or more by 2100.
• Coral reefs are also key indicators of global ecosystem health.

Ocean Warming
• As the planet has warmed from mounting emissions, the oceans warmed first and fastest, absorbing 90% of that excess heat.
• IPCC report warned that damage to the oceans is accelerating and may be at the point of irreversibility.
• Half of all coral reef systems have already been destroyed, putting a quarter of marine life at risk.
• Under the influence of ever-increasing CO2 emissions, marine heatwaves have doubled in frequency since 1982 and are increasing in intensity.

Consequences
• Lost reefs will leave nearby coastlines even more vulnerable to erosion and storms
• Sea-level rise could go up by as much as two feet this century.
• Coral reefs are the source for seafood supplies and tourism revenue.
• Almost 20% of gross domestic product in the Maldives is directly tied to reefs.
• Coral bleaching could leave 680 million people who live in low-lying coastal zones in a bind, especially those in smaller island states.
• Communities that depend on seafood may face risks to nutritional health and food security.
• Even in high-income countries, the deterioration can lead to economic loss.

Concerns / Challenges
• 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.
• Tourism is itself an environmental stressor that can damage reefs from uncontrolled development and poor waste management
• The coral reef cover in Lakshadweep has shrunk by as much as 40% in just 18 years

Way Forward
• Switching away from emissions-intensive fishing and aquaculture operations to eating lower carbon sources of ocean protein, such as sustainably harvested fish, seaweed and kelp
• 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.
• Sustaining and restoring coral reefs should be treated as an asset, and long-term investments should be made for their preservation.
• Investments should include support for research such as genetic selection of heat-resistant corals that can withstand rising global temperatures.
Miscellaneous

1. **Climate Budget Tagging (CBT)**
   - Climate Budget Tagging (CBT) is a tool for monitoring and tracking of climate-related expenditures in the national budget system.
   - It provides comprehensive data on climate change relevant spending, enabling government to make informed decisions and prioritize climate investments.

**Present Status**
- According to the recent Climate Policy Initiative (CPI), India’s tracked green investment flows fall far short of its financing requirements.
- The estimated $38 billion investments directed towards mitigation sectors between FY16-18 are disproportionately allocated between sectors.

**Need for climate budget tagging**
- CBT encourages planning officers and policy managers to incorporate climate considerations in project design.
- CBT enables public scrutiny on government’s and donors’ spending on tackling climate change issues strengthening accountability and transparency.
- It will help identify, classify, and weigh climate-relevant spending, thereby enabling the tracking of such expenditures.
- It will also facilitate more informed engagements between the government and development partners to mobilise additional resources.
- India needs investment at a minimum, $2.5 trillion until 2030 according to India’s Nationally Determined Contribution.
- It took India a decade to raise awareness and build capacity at national and state levels for gender budgeting.
- We cannot afford to spend equivalent time in developing a tagging tool.

**Benefits of climate budget tagging**
- It raises awareness and understanding of climate change.
- It mobilises resources.
- It improves monitoring and reporting.
- Adherence to such methods will help India attract more international funding for climate action.

**International Experience**
- Nepal is one of the first countries to adopt a climate budget tagging.
- The Government of Bangladesh (GoB) adopted a Climate Fiscal Framework (CFF) in 2014 which proposes a climate expenditure tracking framework (CETF).

**Concerns / Challenges**
- There are challenges in defining and tracking green finance across its value chain in India.
- There is no mechanism to weigh the climate relevance in various national and state-level government schemes and tag them as ‘green’.
- This absence makes budgeting the country’s mitigation action in its annual financial plan a challenge.

**Way Forward**
- It is time to align budgetary outlays in a manner responsive to climate change for sustained policy action.
- Mitigating the effects of climate change will need to be at the forefront of economic growth.
India needs to adopt a “Climate Budget Tagging (CBT)” tool. The CBT could be rolled out in a similar way that other social priorities are tagged. For example, the gender, scheduled castes & scheduled tribes, and child development component of the budget has made it easier for the government to review and recognise the impact of budgetary support on these sections. The government needs to restructure the way it reports schemes and action plans to facilitate meaningful intra and inter-state comparison of the climate objectives. Need for building consensus on the definition of green finance for both public and private actors to weigh their activities for climate relevance. Training on climate tagging should be considered in the context of broader capacity building efforts.

2. **The Urban Heat Island Effect**

- **Urban heat island (UHI)** means urban areas getting significantly warmer compared with the surrounding areas.
- UHIs are formed as vegetation is replaced by asphalt and concrete for roads, buildings and other structures to meet the growing population.
- UHI is most noticeable during the summer and winter.
- Most cities in India and in the world are warmer than surrounding non-urban areas due to the urban heat island effect.
- Delhi is 4-12°C warmer due to the urban heat island effect.
- Research shows that urban heat island effect **contributes to climate warming** by about 30%.
- The **increase in water temperature** affects aquatic life, especially the metabolism and reproduction of aquatic species.
- Setting up a kitchen garden and using high solar reflective index paint helps in reducing the Urban Heat Island Effect.
- The policy makers should strike a balance by providing equal opportunities at village & town levels thereby checking migration & concentration of population at urban areas.