



INSIGHTSIAS

SIMPLIFYING IAS EXAM PREPARATION

INSTA MAINS 2021



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**ENVIRONMENT AND
DISASTER MANAGEMENT**

Table of Contents

Environment Protection / Climate Change	3
1. ENVIRONMENTAL CHALLENGES FROM SOCIETAL AND TECHNOLOGICAL PERSPECTIVES.....	3
2. IMPLEMENTATION OF ENVIRONMENTAL SAFEGUARDS.....	3
3. ACCLIMATISING TO CLIMATE RISKS	5
4. CLIMATE CONSCIOUSNESS	5
5. CLIMATE IN-JUSTICE.....	6
6. CORAL REEFS AND CLIMATE CHANGE.....	7
7. THE POTENTIAL OF INDIA'S CIRCULAR ECONOMY.....	8
8. NATURE-BASED SOLUTIONS TO FIGHT CLIMATE CRISIS	9
9. IMPACT OF CLIMATE CRISIS ON DAIRY SECTOR.....	11
10. CLIMATE CHANGE AND SEA LEVEL RISE	12
11. FOREST RESTORATION.....	13
12. CLIMATE RESILIENCE PLANS IN INDIAN CITIES.....	14
13. TACKLING THE CLIMATE CRISIS	15
14. PROTECTING INDIA'S NATURAL LABORATORIES.....	16
15. SEA LEVEL RISE	17
Environmental Pollution	19
1. MARINE PLASTIC POLLUTION	19
2. PLASTIC WASTE MANAGEMENT	20
3. GLOBAL CARBON TAX.....	21
4. ECO TAX.....	22
5. DECARBONISATION.....	23
6. AGING OUT INDIA'S COAL PLANTS.....	24
7. ALTERNATIVES TO SMOG TOWERS.....	24
8. CUTTING HFC-USE.....	26
Water Issues	27
1. WATER MANAGEMENT IN INDIA	27
2. COMMUNITY PARTICIPATION AND AWARENESS IN SOLVING WATER ISSUES.....	28
3. CONSERVING FRESH WATER SOURCES	30
4. INDIA'S WATER BEING EXPORTED AS AGRI-EXPORTS.....	31
5. INDIA'S DEEPENING WATER STRESS	32
Renewable Energy	34
1. INDIA'S SCOPE AND OPPORTUNITIES IN SOLAR ENERGY	34
2. PUSH FOR GREEN HYDROGEN	34
3. ATTRACTING CAPITAL FOR GREEN TRANSITION	35
4. TRANSITION TOWARDS GREEN TECHNOLOGY	36
5. INDIA'S OFFSHORE WIND ENERGY.....	37
6. CHALLENGES TO INDIA'S TRANSFORMATION FROM FOSSIL-FUEL TO RENEWABLE ENERGY	39
International Efforts.....	40
1. GLOBAL CLIMATE POLICY	40

2. GLOBAL METHANE PLEDGE	41
3. INDIA'S COMMITMENTS AT THE COP 26 SUMMIT	42
4. INDIA'S LEADERSHIP ON CLIMATE CRISIS.....	42
5. WHO AIR POLLUTION GUIDELINES	43
6. FIRST NOBEL FOR CLIMATE SCIENCE	44

Disaster Management..... 46

1. A RESILIENT FUTURE FOR UTTARAKHAND	46
2. DEVELOPMENT THAT IS MINDFUL OF NATURE	46
3. TACKLING GLACIAL BURST.....	48
4. MANAGING RISKS FROM OVERLAPPING HAZARDS	49
5. CHENNAI FLOODS	49
6. HYDROPOWER PROJECTS IN THE HIMALAYAS.....	51
7. FREQUENT OCCURRENCE OF CYCLONES.....	52

Miscellaneous 54

1. A 'ONE HEALTH' APPROACH.....	54
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Environment Protection / Climate Change

1. 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

- 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.
- 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.

2. 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 secured 168 rank in the 12th edition of the biennial **Environment Performance Index (EPI Index 2020)**. The country scored 27.6 out of 100 in the 2020 index.

- **India needs to re-double national sustainability efforts on all fronts**, according to the index.
- The country needs high-priority to critical issues such as air and water quality, biodiversity and climate change.
- **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).
- The judiciary's order failed to even curb illegal **rat hole mining and miners in Meghalaya** paid the price for that.
- Acting on the orders of the National Green Tribunal (NGT), the Meghalaya government in 2015, suspended rat hole mining and transportation of coal in the entire state. But four years later, illegal practices continue unabated in the state.
- **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.
- 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.
- **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.

3. Acclimatising to climate risks

- **A recent report by the Council on Energy, Environment and Water found that 75% of districts in India, home to over half the population, were vulnerable to extreme climate risks.**

Present Climate Risks

- Rising temperatures have led to a sharp increase in climate extreme events in recent years.
- The current trend of catastrophic climate events results from a mere 0.6 °C temperature rise in the last 100 years.
- Ignoring low probability risks could be catastrophic for the economy as well as society.
- **COVID-19 could be nature's warning against climate change.** Microbes are the bedrock which has regulated everything for billions of years: the atmosphere, the biome, the oceans and even the origin of species. They are the first to react to ecological changes.
- **According to experts, the current pandemic is not the real threat but simply a foreshadow of what is coming.**

Climate Events

- About three in four of India's districts are hotspots of extreme climate events such as cyclones, floods, drought, heat and cold waves, according to a study.
- While India witnessed 250 extreme climate events between 1970 and 2005, the country recorded 310 extreme climate events after 2005 alone.
- The intensity of floods increased eightfold and that of associated events such as landslides and heavy rainfall increased by over 20 times since 1970.
- **India is already the fifth most vulnerable country globally in terms of extreme climate events and it is all set to become the world's flood capital.**
- The frequency of cyclones has also doubled.
- **Over 40% of Indian districts now show a swapping trend: flood-prone areas are becoming drought-prone, and vice-versa.**

Way Forward

- At the recent Climate Ambition Summit, the UN Secretary-General underscored the importance of **adaptation and resilience to mainstream climate actions.**
- India should create an **Environment and Health De-risking Mission** to increase emergency preparedness, secure critical resources and build resilient infrastructure and governance systems to counter the increasing frequency and intensity of extreme climate events.
- Restoration, revival, and recreation of **traditional climate-resilient practices**, with a special focus on indigenous communities, often on the front lines of ecosystem conservation.
- India needs a comprehensive **Climate Risk Atlas** to present a **risk-informed decision-making toolkit for policymakers** at the national, State, and district level.
- To finance climate action, risk financing instruments should be supplemented by adaptation funds such as the Green Climate Fund.
- As the permanent chair of the Coalition for Disaster Resilient Infrastructure, **India should play a pivotal role in attracting private investments into climate-proofing of infrastructure.**

4. Climate Consciousness

- **It is common to hear policymakers refer to natural disasters as "acts of God".** But these are not the hand of God, but human-made global warming.
- Unless climate change is tagged as a primary culprit, climate action will continue to falter.

Recent Events

- The melting of the Himalayan glaciers and the floods and landslides in Uttarakhand have the fingerprints of global warming.
- In 2013, glacial flooding caused over 6,000 deaths in Uttarakhand.
- The United States has already witnessed many deadly avalanches since the beginning of 2021.
- In Kerala lack of regulation of mining, quarrying and dam construction in ecologically sensitive places, contributed to the massive floods and landslides in 2018 and 2019.

Instances of Global Warming

- As glacier cover is replaced by water or land, the amount of light reflected decreases, aggravating warming.
- This contributes to the sweltering heat in cities like Delhi and Hyderabad, or the epic floods in Chennai or Kerala.
- The extreme cold weather in Texas, like the double-digit negative temperatures seen in Germany earlier this year, is connected to Arctic-peninsula warming, at a rate almost twice the global average.
- Studies had flagged ice loss across the Himalayas, and the dangers to densely populated catchments.

Concerns / Challenges

- Even if major economies speed up climate mitigation, catastrophes like Uttarakhand will become more frequent due to the accumulated carbon emissions in the atmosphere.

Way Forward

- For India, a decisive switch is needed from highly polluting coal and petroleum to cleaner and renewable power sources.
- The acceleration of hazards of nature should prompt **countries to advance carbon neutrality targets, ideally by a decade.**
- **Including policies for climate mitigation in the government budget**, along with energy, roads, health and education.
- The government needs to launch a major campaign to mobilise climate finance.
- India's Central and State governments must **increase allocations for risk reduction**, such as better defences against floods, or **agricultural innovations to withstand droughts.**
- Events like Uttarakhand and Texas should be treated as lessons to change people's minds and for the public to demand urgent action.

5. Climate In-justice

- Global transformation is affecting the planet. But there is **no uniform transformation across the world.**
- Global temperature increased sharply after 1981 with little contribution from the developing countries as their industrialisation and urbanisation started later.
- **In 2015 at Paris Conference, India stressed a reframing of climate change to climate justice**, arguing that when countries such as India were becoming major industrial nations, they should not pay the price for the pollution caused by the West.

Treaty's inequity

- Inequity is built into the Climate Treaty.
- **Annual emissions make India the fourth largest emitter, but with cumulative emissions, India contributes a mere 3% compared with 26% for the United States and 13% for China.**
- According to the United Nations, **the richest 1% of the global population emits more than two times the emissions of the bottom 50%**; India has just half its population in the middle class.

- In the Paris Agreement, 'climate justice' was seen as a political statement, not policy statement. There is a need to set big ideas.

Role of infrastructure

- The global trend is that in an urbanised world, **two thirds of emissions come from middle class demands for infrastructure, mobility, buildings and diet.**
- There is no substitute to cement, steel and construction material, and worldwide they will need half the available carbon space.
- For developed countries, peaking of emissions came some 20 years after infrastructure saturation levels were reached and net-zero emissions are being considered some two decades even later.
- Future emissions in India will come from infrastructure, buildings and industry, and we cannot shift the trajectory much to reach comparable levels of well-being with major economies.

Coal Use

- Coal accounts for a quarter of global energy use, powered colonialism, and Asia uses three-fourth of it as coal drives industry.
- India with abundant coal reserves and per-capita electricity use that is a tenth that of the U.S. is under pressure to stop using coal, even though the U.S. currently uses more coal.
- For India's use of renewable energy and hydrogen as a fuel for electrification, requires international cooperation around technology development and transfer.

What is the Net-zero emissions target?

- Net-zero emission is the **method of balancing the greenhouse gas emissions** in the atmosphere by the greenhouse gas absorption from the atmosphere.
- In zero-carbon emission, the country will **focus on limiting carbon emission**. But in Net-zero carbon the country will focus on bringing the net carbon emission to zero.
- In the initial phase, the **country will focus on reducing human-caused emissions like burning fossil fuels, balancing factory emissions, etc.**
- But, gradually the Net-zero emissions can be extended to the remaining areas as well.
- Globally the **idea of net-zero emissions by 2050 gaining momentum**.
- There are other sections of environmentalists not in favour of adopting Net-zero emissions targets. They say that it is **unjust for developing countries**.

6. Coral reefs and climate change

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

Coral bleaching events

- A spike of 1–2°C in ocean temperatures sustained over several weeks can lead to bleaching, turning corals white.
- Over the last three years, reefs around the world have suffered from mass coral bleaching events as a result of the increase in global surface temperature caused by anthropogenic greenhouse gas emissions.
- Iconic reefs such as the **Great Barrier Reef in Australia and the Northwestern Hawaiian Islands in the United States** have all experienced their worst bleaching on record with devastating effects.
- The bleaching of the Great Barrier Reef in 2016 and 2017, killed around 50% of its corals.

- According to UNESCO, the coral reefs in all 29 reef-containing World Heritage sites would cease to exist by the end of this century if we continue to emit greenhouse gases under a business-as-usual scenario.
- If temperatures continue to rise, bleaching events will increase in intensity and frequency.

Why are Coral reefs Important?

- Coral reefs harbour the highest biodiversity of any ecosystem globally.
- Despite covering less than 0.1% of the ocean floor, reefs host more than one quarter of all marine fish species.
- Reefs provide a **variety of ecosystem services** such as subsistence food, protection from flooding and sustaining the fishing and tourism industries.
- Their disappearance will therefore have economic, social and health consequences.
- Coral reefs are also **key indicators of global ecosystem health**.
- They serve as an early warning sign of what may happen to other less sensitive systems, such as river deltas, if climate change is not urgently addressed.

Way Forward

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

7. The potential of India's circular economy

- Can India aspire to build a circular economy unicorn?
- Some might argue that India is naturally a circular economy. It might seem that we recycle everything.
- In reality, we are confronted with an exponentially growing waste problem.
- Herein lies the challenge and the opportunity.

Recycling

- **Recycling has three drivers: Need, responsibility, and wealth.**
- In India, we are driven by need — conserve and reuse to save money.
- As incomes rise, behaviour could tilt towards throwaway choices. Responsibility requires that, by understanding the impact of our choices, we reduce our footprint.
- Finally, recognition of business opportunities towards wealth creation from recycling and reuse.
- As economies evolve, we see these different drivers taking hold.
- For instance, in 2015, India produced 9% but consumed 5% of global plastic.
- But recycling rates for e-waste in 2020 were just 11.7% in largely developing Asia compared to 42.5% in Europe.
- While Europeans are not less consumerist, they have tapped into generating wealth from waste.
- Research finds that 44% of India's critical minerals could be sourced from e-waste, a multibillion-dollar opportunity.

Recent Success Stories

- Hyderabad-based Banyan Nation has developed a plastic washing technology using which recycled plastic can substitute for virgin plastic in fast-moving consumer goods (FMCG) industries.
- Ecoware (with a factory in Greater Noida) treats sugarcane bagasse to make food-grade packaging containers.

Concerns/ Challenges

- **The ban on single-use plastics has not been followed through.**
- In the absence of effective standards in India for biodegradable materials, the startups must invest in getting certified in developed countries.
- Although expensive, this is critical for product and quality differentiation.
- Bank loans for the startups in circular economy are too small.
- **The absence of enabling policies keeps circular economy businesses small-scale, often informal, uncertified and undifferentiated.**

Way Forward

- **Innovation is key**, and startups in the circular economy need innovation in product and process.
- Informing customers is crucial. From explaining what biodegradable means to offering online courses on sustainable living.
- Digitising thousands of informal recyclers, to trace its supply chain.
- Policy could mandate an **increasing share of recycled plastic in FMCG industries** (just like policy mandated renewable purchase obligations for power utilities).
- **The idea of growth needs redefinition.** Rather than repeat sales of unsustainable products to meet quarterly targets, in the circular economy growth indicates: scalable models; minimalist lifestyles; women's entrepreneurship; gender-sensitive employment; and including informal enterprises in formal value chains.
- **India has immense resources — people, capital, supply chains and scale — to find value in waste.**
- A billion-dollar-valued circular economy unicorn can indeed emerge if **technology, finance, policy and behavioural change could create markets** where none existed.

8. Nature-based solutions to fight climate crisis

- The environment, energy and climate ministers from the 'Group of 20' (G20) economies expressed their commitments towards addressing the challenges presented by urbanisation, climate change and biodiversity loss.
- A major emphasis was placed on the **inclusion of nature-based solutions (NbS) in fight against the climate crisis.**

Nature-based solutions to climate change

- Nature-based solutions (NbS) to climate change involve **conserving, restoring or better managing ecosystems to remove carbon dioxide from the atmosphere.**
- **Forests** are probably the most well-known nature-based solution for climate change, but there are many more - including **peatlands, mangroves, wetlands, savannahs, coral reefs and other landscapes.**
- NbS is a relatively new concept that was widely discussed after the Conference of Parties (CoP) 25.
- Several countries are already piloting projects based on NbS.

Why is it important?

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

Progress of NbS in some G20 countries

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

How Nature based Solutions can benefit India

- The G20 countries recognise the need to share the best practices and increase international cooperation among countries.
- **India can potentially leverage these global practices and harness multiple benefits** by implementing NbS.
- Planting mangroves can play a crucial role in **climate-proofing India's coastal cities**.
- NbS can be an effective tool in **mitigating urban heat island problems**, urban flooding and poor air quality to develop resilient cities.
- Programmes such as GrowGreen, funded by the European Union or the Sponge City programme in China, have been exemplary examples of managing urban floods and addressing urban heat stress.

Way Forward

- Promoting nature-based solutions and prioritizing actions that could have climate benefits.
- Need to **increase investment in high-quality nature-based solutions**.
- Developing initiatives that harness nature-based solutions in countries around the world and emphasise the benefits of protecting and restoring nature to businesses, communities and governments.
- Advocating for **policy changes** and the increased inclusion of nature-based solutions for climate in national climate targets.
- To ensure long-term resilience, projects involving nature-based solutions should adhere to four high-level principles.
 - Nature-based solutions are not an alternative to decarbonization;
 - They need to involve a wide range of ecosystems;
 - They should be designed in partnership with local communities while respecting Indigenous and other rights; and
 - They must support biodiversity, from the level of the gene to the ecosystem.
- The world must invest now in nature-based solutions that are ecologically sound, socially equitable and designed to pay dividends over a century or more.

9. Impact of Climate Crisis on Dairy Sector

- Harvesting animals for **dairy and animal-based products in India is a major source of livelihood for 150 million dairy farmers.**
- The products are a source of nutrition and food security for a significant chunk of the population.

Dairy Sector in India

- The **dairy sector accounts for 4.2 per cent of the national gross domestic product.**
- India has transitioned from a milk-deficient country to the **largest producer of milk globally.**
- The **Anand model (Amul)**, which has been replicated across the country, boosted milk production and made dairy the second-largest employment sector after agriculture in India.

The ecological footprint of dairy

- The dairy industry has again galvanised the debate around **harmful consequences of animal harvesting on climate**, with the charge being led by non-profit People for the Ethical Treatment of Animals (PETA).
- Multinational companies have also been accused of promoting **water-intensive dairy industry in Punjab** and the neighbouring states, which is fast depleting groundwater.
- Traditionally, these were less water-intensive wheat-growing states.
- **Agriculture contributes approximately 16 per cent of India's greenhouse gas (GHG) emissions** which is released by cattle during dairy farming.
- Methane from animal waste contribute to 75% of total greenhouse emissions from the dairy sector.
- The alarming loss of biodiversity is attributed to **water- and energy-intensive crops needed to feed the cattle.**
- India is increasingly becoming water-stressed due to exploding human and cattle population growth.
- India inefficiently uses two-three times more water to grow its major food crops compared to its peers.
- The situation will likely worsen in the coming years.

Plant-based alternatives

- Amul recently launched an advertising campaign, that plant-based alternatives are the way forward to create a sustainable food system.
- In **developed countries vegan movement is gaining momentum** due to ecological and health benefits of plant-based food including milk.
- Social media campaigns and celebrity endorsements have inspired millions of people across the world, including India, to adopt plant-based diets that have proved beneficial to human health, environment and the planet.

New age activism and changing consumer perceptions

- The conditions in cattle rearing have been widely condemned. These include
 - artificial insemination,
 - widespread use of growth hormones to boost milk production,
 - injecting oxytocin into milch cattle,
 - slaughter of male calves,
 - abandoning cattle that are sterile, and
 - selling livestock to slaughterhouses and tanneries when they can no longer produce milk.
- Despite guidelines for appropriate handling of cattle, the cruel practices continue unabated to boost production efficiencies as demand for dairy and meat continues to grow.

- **Animal exploitation** through animal farming, destruction of natural habitats, livestock-associated deforestation, hunting and trading of wildlife are the leading cause of zoonotic diseases caused by germs that spread between animals and humans.
- The novel coronavirus disease (COVID-19) pandemic is the latest in the long list of such diseases.
- Widespread evidence suggests that adoption of plant-based diets and lifestyles, referred to as veganism, may result decrease the threat of zoonotic diseases.

Way Forward

- **Dairy producers cannot ignore the climate consequences of the sector.** They need to proactively ramp up production of plant-based human food alternatives to dairy products.
- Otherwise they may risk being forced to do so reactively by government regulation.
- With livelihoods of 150 million at stake, policymakers will need to identify alternative employment opportunities for the displaced masses.
- **Large-scale social forestry** could be an answer to address this fall-out, with positive consequences to the planet.

10. Climate Change and Sea Level Rise

- The recently published Intergovernmental Panel on Climate Change (IPCC) Assessment Report is a clarion call for climate action.
- It provides one of the most expansive scientific reviews on the science and impacts of climate change.

Findings from the Report

- The report discusses different shared socio-economic pathways for the future with varying levels of greenhouse gas (GHG) emissions.
- It is extremely likely that average warming will exceed 2°C near mid-century.
- The average global temperature is already 1.09°C higher than pre-industrial levels and CO₂ concentration in the atmosphere is currently 410 ppm compared to 285 ppm in 1850.

Climate change and sea level rise

- Close to 700 million people worldwide live along the coast and there continue to be plans to expand coastal cities.
- Therefore, **understanding the risks involved from climate change and sea level rise in the 21st and 22nd centuries is crucial.**
- Sea level rise will continue after emissions no longer increase, because oceans respond slowly to warming.
- **Sea level rise occurs mainly due to the expansion of warm ocean waters, melting of glaciers on land, and the melting of ice sheets in Greenland and Antarctica.**
- Global mean sea level (GMSL) rose by 0.2m between 1901 and 2018.

Uncertainties

- Ice sheets can destabilise rapidly as the water gets warm.
- Ice cliffs can collapse swiftly, leading to rapid sea level rise; this is **marine ice cliff instability (MICI).**
- Changes in ice-ocean interactions can cause extensive and rapid sea level rise.
- According to the **UN Environment Programme Emissions Gap Report**, the world is heading for a temperature rise above 3°C this century, which is double the Paris Agreement aspiration.
- And there is deep uncertainty in sea level projections for warming above 3°C.

Vulnerability in India

- Communities along the coast in India are vulnerable to sea level rise and storms, which will become more intense and frequent.
- They will be accompanied by storm surges, heavy rain and flooding.
- Even the 0.1m to 0.2m rise expected along India in the next few decades can cause frequent coastal flooding.

Way Forward

- Adaptation to sea level rise must include a range of measures, along with **coastal regulation**, which should be stricter, as it has become with each update of the Coastal Regulation Zone.
- Coastal communities should be alerted in advance and protected during severe weather events.
- Natural and other barriers should be considered in a limited manner to protect certain vulnerable areas.
- Retreat should be part of the adaptation strategies for some very low-lying areas.

11. Forest Restoration

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

Importance of Forests

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

Forest Degradation

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

Forest Restoration

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

Situation in India

- Nearly 5.03% of Indian forests are under protection area (PA) management needing specific restoration strategies.
- The remaining areas witness a range of disturbances including grazing, encroachment, fire, and climate change impacts.

- Much of the research done so far on restoration is not fully compatible with India's diverse ecological habitats.
- The relevance of local research duly considering ecological aspects, local disturbances and forest-dependent communities is vital to formulate guidelines.

Concerns / Challenges

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

Way Forward

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

12. Climate resilience plans in Indian cities

- **India is becoming increasingly urban.** Its cities or city-like villages are sites where the **twin challenges of climate change and inclusive development** will be won or lost.
- Climate resilience plans in Indian cities focus on isolated risks rather than preparing for multiple, intersecting risks.

Present Status

- Indian cities have often been singled out for not doing enough on climate change.
- The recurrent experiences of floods, water scarcity, cyclones and storm surges are filtering up into urban development policy.
- Most cities report targeted projects to deal with heat waves and water scarcity, followed by inland flooding, extreme rainfall, and growing disease incidence.
- Coastal flooding, sea-level rise, and cyclones are discussed less often despite India's long coastline.
- **Multiple risks converge and reinforce each other** — for example, seasonal cycles of flooding and water scarcity in Chennai.

Efforts by Various States

- The **UN-backed 'Race to Zero' global campaign** aims to create jobs while meeting goals of climate change and sustainable development.
- Recently Maharashtra announced that 43 cities across the State will join the 'Race to Zero' global campaign.

- Cities such as Ahmedabad, which has had a **Heat Action Plan (HAP)** since 2010, its success evident from reduced heat mortality.
- The model of Combining infrastructural interventions (painting roofs white) and behavioural aspects (building public awareness on managing heat) has now been scaled up to 17 cities across the country.
- **Nature-based solutions** such as mangrove restoration in coastal Tamil Nadu and urban wetland management in Bengaluru have **demonstrated how restoring ecosystem health can sustain human systems.**
- The urban parks provide cooling benefits and wetlands regulate urban floods.

Concerns / Challenges

- Inadequate finances and political will at city scales constrain developing sustainable Indian cities.
- What is less discussed is inadequate institutional capacity in existing government departments to reorient ways of working.

Way Forward

- Moving away from looking at risks in isolation and planning for multiple, intersecting risks.
- This would mean **transforming the ways our cities operate and expand.**
- Focusing on changing behaviours and lifestyles.
- One emerging example is **urban farming** where citizens are interpreting sustainability at a local and personal scale.
- This can mean **growing one's own food and simultaneously enhancing local biodiversity;** composting organic waste and reducing landfill pressure; and creating awareness about food growing.

13. Tackling the climate crisis

- The recently published Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report makes a clarion call for climate action.

What the IPCC report says

- The past decade (2011-2020) was warmer by 1.09°C than the period from 1850 to 1900, and the 1.5°C global warming threshold is likely to be breached soon.
- The **IPCC report warns India against more intense heat waves, heavy monsoons and rise in weather extremes in the future.**

Responses to climate change through adaptation

- **Responses to climate change vary from place to place** as there are differences in production systems, agro-climatic and socio-economic conditions across the country.
- The **pressure to speed up mitigation and adaptation is at an all-time high.**
- With escalating climatic risks, there is an **urgency to adopt adaptation strategies.**
- A development-centric approach that aligns climate change, food security, and livelihood perspectives is crucial for reducing poverty and distress migrations.
- **Encourage private sector participation for investment in adaptation technologies** in areas such as agriculture, health, infrastructure, insurance and risk management.
- **Proactive and timely need-based adaptation** is important. Without it, there will be a huge fiscal burden in the future.

India's Commitments to mitigate Climate Change

- The **Global Climate Risk Index (2021)** ranked India the seventh-most affected country by weather extremes.

- India is doing well in achieving its mitigation commitments of reducing emission intensity and enhancing renewable capacity.
- India is targeting 450 gigawatts of renewable energy capacity by 2030 and it has launched mega solar and green hydrogen missions.
- The **Shoonya programme by NITI Aayog**, aims to accelerate adoption of electric vehicles.
- India has some dedicated initiatives towards adaptation, such as the **National Action Plan on Climate Change and the National Adaptation Fund**.
- A breakthrough on adaptation and resilience actions is needed to save hard-earned developmental gains and adjust to new climate conditions.

Strengthening adaptation and resilience

- India can be more prepared for climate change with **high-quality meteorological data**.
- With **improved early warning systems and forecasting**, we can tackle the crisis better.
- Premier research institutes can be roped in to develop regional climate projections for robust risk assessments.
- It is necessary to **develop well-functioning markets for environmentally friendly products** and disseminate them for the desired behavioural change.
- **Protecting mangroves and forests to address climate-related risks** by blending traditional knowledge with scientific evidence and encourage local and non-state actors to actively participate.
- Major social protection schemes must be climate-proofed. For continuous monitoring and evaluation, **effective feedback mechanisms** must be developed for mid-course correction.
- Periodic fine-tuning of State Action Plans on Climate Change is crucial.

14. Protecting India's natural laboratories

- Like social diversity, **India's geodiversity**, or variety of the **geological and physical elements of nature**, is **unique**.
- India has tall mountains, deep valleys, sculpted landforms, long-winding coastlines, hot mineral springs, active volcanoes, diverse soil types, mineralised areas, and globally important fossil-bearing sites.
- It is long known as the **world's 'natural laboratory' for geo-scientific learning**.

Geo-heritage Sites in India:

1. Geo-heritage refers to the geological features which are **inherently or culturally significant** offering insight to earth's evolution or history to earth science or that can be utilized for education.
2. **Geological Survey of India (GSI)** is the parent body which is making efforts towards identification and protection of geo-heritage sites/national geological monuments in the country.
3. **Some of these sites are:** Marine Gondwana fossil park in Chhattisgarh; Siwalik vertebrate fossil park in Himachal Pradesh; Stromatolite park in Rajasthan; Pillow lava in Karnataka, Eparchaeon unconformity and Tirumala hills in Andhra Pradesh, Lonar Lake in Maharashtra, etc.

The development juggernaut of unregulated activities:

1. Despite international progress in this field, the **concept of geo-conservation has not found much traction in India**.
2. **Many fossil-bearing sites** have been destroyed in the name of development.
3. For example, the high concentration of iridium in the geological section at Anjar, Kutch district, provides evidence for a massive meteoritic impact that caused the extinction of dinosaurs about 65 million years ago.

4. This site was destroyed due to the **laying of a new rail track in the area**. Similarly, a national geological monument exhibiting a **unique rock called Nepheline Syenite in Ajmer district** of Rajasthan was destroyed in a road-widening project.
5. The **Lonar impact crater** in Buldhana district of Maharashtra is an **important geo-heritage site of international significance**.
6. It is under threat of destruction, although conservation work is now in progress under the High Court's supervision.
7. Natural assets, once destroyed, can never be recreated. And if they are uprooted, they lose much of their scientific value.

Lack of geological literacy in India:

1. The **geological features and landscapes** that evolved over billions of years through **numerous cycles of tectonic and climate upheavals** are recorded in India's rock formations and terrains, and are part of the **country's heritage**.
2. For example, the Kutch region in Gujarat has dinosaur fossils and is our version of a Jurassic Park.
3. The **Tiruchirappalli region of Tamil Nadu**, originally a **Mesozoic Ocean**, is a store house of Cretaceous (60 million years ago) marine fossils.
4. Broken loose from a supercontinent 150 million years ago, the **Indian landmass**, with all its strange-looking plants and animals, drifted northwards all by itself **for 100 million years** until it settled under the southern margin of the Asian continent. It got entwined with the **world's youngest plate boundary**.
5. To know how physical geography gets transformed into a **cultural entity**, we need to **study the environmental history of the Indus River Valley**, one of the cradles of human civilisation. India offers plenty of such examples.

Conclusion:

- The Geological Survey of India had submitted a **draft legislation for geo-heritage conservation** to the Ministry of Mines in 2014, but it did not make any impact. But the government's apathy continues.
- As the **climate of the future is uncertain**, decision-making is difficult.
- Learning from the geological past, like the warmer intervals during the **Miocene Epoch** (23 to 5 million years ago), whose climate can be reconstructed using proxies and simulations, may **serve as an analogue for future climate**.
- The **awareness accrued through educational activities** in geo-heritage parks will make it easy for us to memorialise past events of climate change and appreciate the **adaptive measures** to be followed for survival.

15. Sea level rise

- Close to **700 million people worldwide** live along the coast and there continue to be **plans to expand coastal cities**.
- Therefore, **understanding the risks** involved from climate change and sea level rise in the 21st and 22nd centuries is crucial.
- Sea level rise occurs mainly due to the **expansion of warm ocean waters**, melting of glaciers on land, and the melting of ice sheets in Greenland and Antarctica. Global mean sea level (GMSL) rose by 0.2m between 1901 and 2018.
- The recently published **Intergovernmental Panel on Climate Change (IPCC) Assessment Report** from Working Group I, '**Climate Change 2021: The Physical Science Basis**', is a **clarion call for climate action**.
- It provides one of the most expansive scientific reviews on the science and impacts of climate change.

Vulnerability in India:

1. Communities along the coast in India are **vulnerable to sea level rise and storms**, which will become **more intense and frequent**.
2. They will be accompanied by **storm surges, heavy rain and flooding**.
3. Even the 0.1m to 0.2m rise expected along India in the next few decades can **cause frequent coastal flooding**.

Conclusion:

1. **Adaptation to sea level rise** must include a range of measures, along with coastal regulation, which should be stricter, not laxer, as it has become with each update of the Coastal Regulation Zone.
2. The government should not insure or bail out speculators, coastal communities should be **alerted in advance** and protected during severe weather events, natural and other barriers should be considered in a **limited manner** to **protect certain vulnerable areas**, and retreat should be part of the **adaptation strategies for some very low-lying areas**.

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Environmental Pollution

1. Marine Plastic Pollution

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

Plastic Pollution

- Plastic pollution threatens food safety and quality, human health, coastal tourism, and contributes to climate change.

What is the Issue?

- **Floating plastic debris are currently the most abundant items of marine litter.**
- Plastic has been detected on shorelines of all the continents, with more plastic materials found near popular tourist destinations and densely populated areas.
- **The main sources of marine plastic are land-based, from urban and storm runoff, sewer overflows, inadequate waste disposal and management, industrial activities, construction and illegal dumping.**
- Under the influence of solar UV radiation, wind, currents and other natural factors, plastic fragments into small particles, termed **microplastics or nanoplastics**.

Threat to Marine Environment

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

Impacts on food and health

- Invisible plastic has been identified in tap water, salt and are present in all samples collected in the world's oceans, including the Arctic.
- Several chemicals used in the production of plastic materials are known to be carcinogenic and interfere with the body's endocrine system, causing developmental, reproductive, neurological, and immune disorders in both humans and wildlife.
- When marine organisms ingest plastic debris, these contaminants enter their digestive systems, and overtime accumulate in the food web.
- The transfer of contaminants between marine species and humans through consumption of seafood has been identified as a health hazard, but has not yet been adequately researched.

Other Impacts

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

International Efforts

- **The United Nations Environment Program (UNEP) considers plastic marine debris and its ability to transport harmful substances as one of the main emerging issues affecting the environment.**

- At the 2015 G7 summit in Bavaria, Germany, the risks of microplastics were acknowledged in the Leaders' Declaration.
- **Legal efforts have been made at the international and national levels to address marine pollution.** The most important are
 - the 1972 Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matter (or the London Convention),
 - the 1996 Protocol to the London Convention (the London Protocol), and
 - the 1978 Protocol to the International Convention for the Prevention of Pollution from Ships (MARPOL).
- However, compliance with these laws is still poor, partly due to limited financial resources to enforce them.

Way Forward

- **Recycling and reuse of plastic materials** are the most effective actions available to reduce the environmental impacts of open landfills and open-air burning.
- Support for **research and innovation to develop new products to replace single-use plastics** are also necessary to prevent and reduce plastic pollution.
- Sufficient litter and recycling bins can be placed in cities, and on beaches in coastal areas.
- Governments, research institutions and industries also need to work collaboratively **redesigning products in order to reduce microplastics waste** from pellets, synthetic textiles and tyres.
- This will **require solutions which go beyond waste management, to consider the whole lifecycle of plastic products, from product design to infrastructure and household use.**

2. Plastic Waste Management

The **Plastic Waste Management Amendment Rules** notified by the Centre acknowledge the gravity of pollution **caused by plastic articles** of everyday use, particularly those that have no utility beyond a few minutes or hours.

Plastic waste problem around the globe:

Pollution due to single use plastic items has become an important environmental challenge confronting all countries.

1. **Only nine percent** of the plastic waste produced between 1950 and 2015 was recycled globally, according to a study by researchers from the University of California, Santa Barbara, and others.
2. Out of the nine per cent, **only 10 per cent was recycled more than once**; 12 per cent was incinerated, and 79 per cent ended up in landfills or oceans and other water bodies.

Plastic Waste Management Amendment Rules, 2021:

1. The Environment Ministry has notified the **Plastic Waste Management Amendment Rules, 2021.**
2. These rules prohibit specific single-use plastic items which have "**low utility and high littering potential**" by 2022.
3. The permitted thickness of the plastic bags, currently 50 microns, will be increased to 75 microns from 30th September, 2021, and to 120 microns from the 31st December, 2022.
4. Plastic bags with higher thickness are more easily handled as waste and have **higher recyclability.**

Way Forward:

1. As consumers, we should ensure that all plastic waste leaving our homes is segregated and is **not contaminated with food waste.**

2. Managing plastic waste requires **effective knowledge**, not only among those who produce the plastic but also among those who handle it.
3. Citizens have to bring **behavioural change** and contribute by not littering and helping in waste segregation and waste management.
4. To encourage innovation in development of alternatives to identified single use plastic items and **digital solutions to plastic waste management**, the **India Plastic Challenge – Hackathon 2021**, has been organized for students of Higher Educational Institutions and start-ups recognized under Start-up India Initiative.

3. 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.
- 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.**

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.

4. Eco Tax

- The COVID-19 pandemic has forced countries all over the world to rethink climate change and the need for preservation of the environment.
- Fiscal reforms for managing the environment are important, and India has great potential for revenue generation in this aspect.

Fixing the eco tax rate

- Environment regulation, may take several forms:
 - command and control;
 - economic planning/urban planning;
 - environmental tax (eco tax)/subsidies; and
 - cap and trade.
- India currently focuses majorly on the command-and-control approach in tackling pollution.
- Environmental regulations may have significant costs on the private sector in the form of slow productivity growth and high cost of compliance, resulting in the possible increase in the prices of goods and services.
- The success of an eco tax in India would depend on its architecture, that is, how well it is planned and designed.
- It should be credible, transparent and predictable.
- This requires an evaluation of the damage to the environment based on scientific assessments.
- This would include the adverse impacts on the health of people, climate change, etc.
- The **eco tax rate may, thus, be fixed commensurate to the marginal social cost** so evaluated.

Environmental tax reforms

- Environmental tax reforms generally involve three complementary activities:
 - eliminating existing subsidies and taxes that have a harmful impact on the environment;
 - restructuring existing taxes in an environmentally supportive manner; and
 - initiating new environmental taxes.
- Tax revenues can be generated through eco taxes.
- The revenue can be used to a greater extent for the provision of environmental public goods and addressing environmental health issues.
- **There is a need to integrate environmental taxes in the GST framework as highlighted by the Madras School of Economics in its studies.**
- In India, eco taxes can target three main areas:
 - differential taxation on vehicles in the transport sector purely oriented towards fuel efficiency and GPS-based congestion charges;
 - in the energy sector by taxing fuels which feed into energy generation; and
 - waste generation and use of natural resources.

Impact on the GDP

- **The implementation of an environmental tax in India will have three broad benefits: fiscal, environmental and poverty reduction.**
- Environmental tax reforms can mobilise revenues to finance basic public services.
- The revenue can finance research and the development of new technologies.
- Most countries' experiences suggest negligible impact on the GDP, though such revenues have not necessarily been used for environmental considerations.

Conclusion

Hence, this is the right time for India to adopt environmental fiscal reforms as they will reduce environmental pollution and also generate resources for financing the health sector.

5. Decarbonisation

- **Decarbonisation is the reduction of carbon dioxide emissions through the use of low carbon power sources, achieving a lower output of greenhouse gases into the atmosphere.**

Recent Events and the reasons behind

- **A chunk of the Nanda Devi broke off and triggered flash floods downstream.**
- **A severe cold snap crashed the electricity grid system in Texas.**
- In both cases, the authorities were caught unprepared.
- The planners had incorporated emergency response procedures for cold waves and floods, but they had not anticipated such extremes of weather conditions.
- One reason for the **lack of preparedness** is the presumption, based on historical data, that such sharp shifts in natural conditions are infrequent — once in several decades.
- The Texas electricity system was standalone and unconnected to the other states. It could not therefore draw on the surplus power available elsewhere to mitigate the shortfall.
- The tragedy in Uttarakhand also reflected the costs of institutional fragmentation and lack of coordination in decision making.
- The suggestions made in the aftermath of the Kedarnath flooding regarding land use and watershed management and securing an optimal balance between construction and the Himalayan ecology had not, been implemented.
- This is because **energy is a concurrent subject and there is no one ministerial or regulatory body responsible for this domain.**
- The two events have raised questions about the reliability of renewables as a source of electricity in times of emergency.
- One reason why solar and wind did not pick up the power slack in Texas was because the grid was not resilient enough to absorb the surge in the flow of intermittent renewable electrons.
- A similar problem faces India. Its transmission system is also not capable of managing the energy transition.
- This problem will clearly have to be addressed if decarbonisation is to proceed smoothly.

What could significantly slow the pace of progress

- Poorly designed planning systems.
- Fragmented physical and regulatory oversight mechanisms for the energy ecosystem.
- Lack of investment in energy infrastructure.

Need of the hour

- **To ensure Decarbonisation translates into effective action on the ground, policy makers will have to build structures that reflect the woven, multidimensional, interdependent and interconnected nature of the energy ecosystem.**
- This means creating mechanisms that facilitate **inter-ministerial and inter-state collaboration** within the country and multilateral cooperation internationally.

- India must come forward to establish a multilateral forum of governments, corporates, financial institutions and civil society under the umbrella — “**Alliance for a Carbon Net Zero world**”.

6. Aging out India’s Coal Plants

- In the Union Budget address for 2020-21, the Finance Minister said that the shutting down of old coal power plants, which are major contributors to emissions, will aid the achievement of India’s Nationally Determined Contributions.

Need for shutting down of old coal power plants

- Some research studies have also argued in favour of it, citing the **economic and the environmental benefits** of shutting down coal plants older than, say, 25 years.
- The land so vacated can be put to alternative use.
- **It would be uneconomical for old plants to install pollution control equipment.**
- Recently Central Electricity Regulatory Commission (CERC) allowed Delhi’s BSES distribution company to exit its 25-year-old power purchase agreement with the National Thermal Power Corporation Limited’s Dadri-I generating station.
- Thermal power companies, which produce three-fourths of the country’s electricity, account for some 80% of its **industrial emissions of particulate matter, sulphur- and nitrous-oxides, which cause lung diseases, acid rain and smog.**

Risks with retirement

- There are also several old plants, which generate at lower costs.
- Plants such as Rihand, Singrauli (both Uttar Pradesh), and Vidhyanchal (Madhya Pradesh), are all over 30 years old and have very low generation costs of around ₹1.7/kWh, which is lower than the national average.
- This may be due to **locational advantage rather than efficiency**, as older plants are likely to be located closer to the coal source, reducing coal transport costs.
- This highlights that **efficiency does not naturally translate to savings.**
- Total savings in generation cost from shutting down plants older than 25 years would be less than ₹5,000 crore annually, which is just 2% of the total power generation cost.
- These savings may not be sufficient to even pay for the fixed costs (such as debt repayment) that would have to be paid anyway, even if the plants are prematurely retired.
- **Aggressive early retirement of coal-based capacity, without detailed analyses, could result in real or perceived electricity shortage in some States.**

Way Forward

- Old thermal capacity, with lower fixed costs, is a prime candidate to play until other technologies (such as storage) can replace them at scale.
- **Using age as the only lever to drive these decisions can prove counter-productive.**
- Instead, a more **disaggregated and nuanced analysis**, considering the various technical, economic and operating characteristics of individual plants would be appropriate to make retirement-related decisions.
- Coal-fired power plants have to ensure that they **curtail sulphur dioxide and nitrous oxide emissions** by implementing appropriate technology.
- Focusing on such **detailed analysis can derive long-term economic and environmental benefits.**

7. Alternatives to smog towers

- Two new smog towers have been recently inaugurated in Delhi. Bengaluru and Chandigarh also installed smog towers this year.

- Mumbai's clean air plan indicates a financial requirement of ₹25 crore for installing air filtration units at major traffic intersections in the city.

How benefit are Smog Towers

- The Delhi government claims that the newly installed smog tower in Connaught Place could reduce air pollution levels by 80%.
- But **there is no scientific evidence of smog towers or any other outdoor air filtration units improving air quality in cities.**
- The smog tower installed in China's Xi'an and another one installed in Beijing did not prove to be effective and were not scaled up.
- **Smog towers create an illusion of progress towards clean air while diverting public money away from proven solutions.**
- The data on the effectiveness of the newly installed smog towers should be made available publicly for independent evaluation.

Concerns / Challenges

- Of the 132 cities in the country that currently don't meet the **National Ambient Air Quality Standards**, 75 do not have a single real-time monitoring station.
- Until last year, over 75% of our city clean air plans did not contain vital information on emissions from different polluting sources.
- In a recent study, it was found that nearly half the urban slum households in six States still **rely on biomass and other polluting fuels for their cooking needs.**
- **Household emissions increase during winter that increases exposure to indoor air pollution and poses health risks.**

Air pollution monitoring

- Policymakers should **expand air pollution monitoring in areas with limited or no air quality monitoring** and strengthen forecasting capacity across cities.
- For areas with no monitoring infrastructure, **alternatives like low-cost air quality monitors** in combination with satellite observations should be explored.
- Cities should strengthen their air quality forecasting systems by collaborating with scientific institutions.
- These forecasts should be used in rolling out preventive measures such as travel restrictions, pausing commercial activities.

Emission inventories

- City-level emission inventories must be updated periodically.
- These data are critical to identify key sources of air pollution and design effective clean air plans as per the local context.

Improve air quality in urban slum

- Targeted efforts must be made to improve air quality for urban slum dwellers who have no access to clean cooking energy.
- Policymakers must focus on providing LPG connections to these households along with ensuring sustained usage of LPG as the primary fuel.

Strengthen enforcement capacity

- **Cities should strengthen their enforcement capacity to check on egregious and episodic polluters.**
- India is witnessing a rising democratic demand for clean air. But this cannot be met by unproven technological fixes.

8. Cutting HFC-use

- The Union Cabinet, had given its approval for **ratification of the Kigali Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer** for phase down of Hydrofluorocarbons (HFCs) by India, adopted by the Parties to the Montreal Protocol on October, 2016 at 28th Meeting of the Parties to the Montreal Protocol held at Kigali, Rwanda.

Background:

- **India became a Party to the Montreal Protocol on Substances that Deplete the Ozone Layer** on 19 June 1992 and since then has ratified the amendments to the Montreal Protocol.
- Though the present approval of the Cabinet, India will be ratifying the Kigali Amendment to the Montreal Protocol for phase down of Hydrofluorocarbons.
- **India has successfully met the phase out targets of all the Ozone Depleting Substances as per the Montreal Protocol Schedule.**

Major Impact, including employment generation potential:

- Hydrofluorocarbons. phasedown is expected to **prevent the emission of up to 105 million tonne of carbon-dioxide equivalent of greenhouse gases**, helping to avoid up to 0.5 degree Celsius of global temperature rise by 2100, while continuing to protect the ozone layer.
- Implementation of HFC phase down through the adoption of low-global warming potential and energy-efficient technologies will **achieve energy efficiency gains and carbon dioxide emissions reduction - a "climate co-benefit,"**
- HFCs phase down implementation will involve synergies with on-going government programmes and schemes of the Government of India with the objective to **maximize the economic and social co-benefits, besides environmental gains.**
- There would be scope for **domestic manufacturing of equipment as well as alternative non-HFC and low-global warming potential chemicals** to enable the industry to transition to the low global warming potential alternatives as per the agreed HFC phase down schedule. In addition, there would be **opportunities to promote domestic innovation for new generation alternative refrigerants and related technologies.**

India's climate commitments:

1. India has assumed a leadership role in **ozone action under the Montreal Protocol**, and its ratification of the Amendment presents a plethora of opportunities, especially in manufacturing of low warming potential (LWP) refrigerant manufacturing and related innovation.
2. The fact that the country came out with a **Cooling Action Plan in 2019**, and set targets for reducing and offsetting the climate-threatening (and otherwise planet harming) effects of cooling and refrigeration is evidence of exemplary climate responsibility.
3. India is also one of the very few nations whose climate commitments put it on the path to pulling its weight to keep warming under 2°C by 2100.

Water Issues

1. Water Management in India

- India's rapid urban growth is putting pressure on its public service arrangements — especially its management of water and sanitation services.
- **The safe and reliable availability of water and sanitation proved to be the first line of defence against the scourges of COVID-19.**

Supply-demand gap in Water and Sanitation Services

- The supply-demand gap is expected to widen by 50 per cent by 2030.
- At least five Indian cities are already reported to have joined the list of world's 20 largest water-stressed cities.
- Bangalore and Chennai, source their waters from a distance of 95 kilometres and 200 km, respectively.
- It puts heavy burden on the states' exchequers by demanding exorbitant amount of funds for the design, installation and operation of water supply systems.
- It also **languishes the residents of these cities dependent on a single source of water and also inter-regional conflicts over water sharing as well climate-related shocks.**

Dependence on Monsoon

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

Impact of Climate Change

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

Improper Urban Planning

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

India's Water Management Practice

- **As an extension of India's colonial history, management of water was part of public institutions.**
- While this lead to systematic exclusion of public's opinions in informing the design and implementation protocols of large public schemes.
- The development projects took the form of multi-purpose dams, irrigation canals, public water distribution systems, etc.

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

Rooftop rainwater harvesting

- Rooftop rainwater structures engender a transformative wave of public engagement in water management.
- **A country-wide behavior change campaign can be launched along the lines of Swachh Bharat Mission that motivate people to adopt rooftop rainwater harvesting structures in their private premises.**
- Local non-profits and private stakeholders can be roped in to build area specific water conservation plans in partnership with local residents.

2. Community participation and awareness in solving water issues

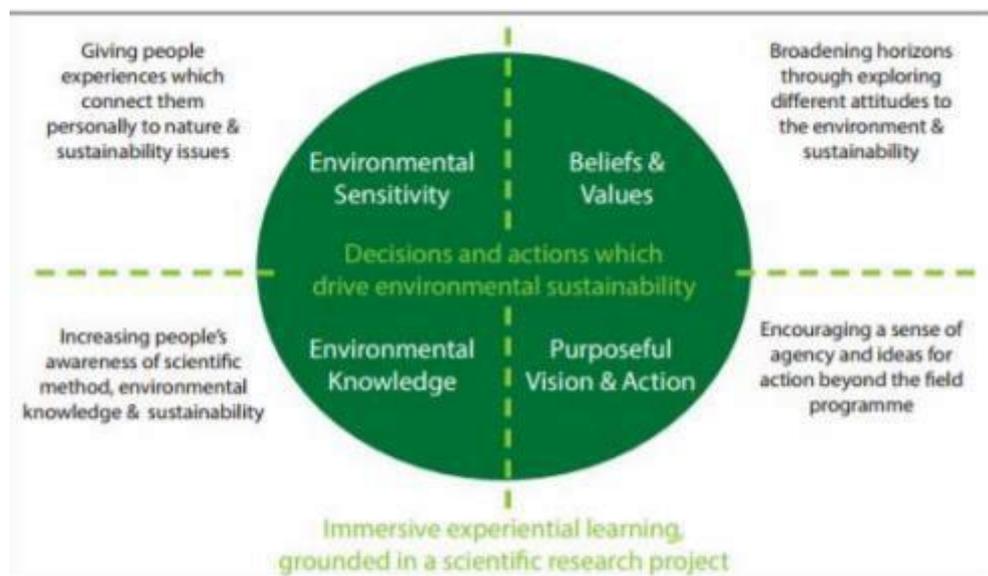
- India is a welfare state, which is envisaged under the constitution of India.
- Therefore, it is a duty of the State to provide basic amenities like water to the public.
- Article 51 A of the Constitution of India casts duty upon every citizen of India, “to protect and improve the natural environment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

Scope of community participation and awareness in solving water issues

- **It is more and more evident that Government alone cannot tackle the situation of depletion of water bodies effectively without public participation.**
- A combination of strategies including civic engagement programs will be most effective for promoting civic engagement in water resource protection.
- Public participating affords stakeholders the opportunity to influence that affects their lives.
- 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.
- The **National Water Policy**, revised in the year 2002 wherein it underscored Water Use Efficiency, Community Participation.

Participatory Irrigation Management

- Participatory approaches hold promise not only in mapping and understanding aquifers in urban spaces, but also in developing participatory strategies for urban groundwater management



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, when an initiative 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, around 64 ponds in different parts of the district have got a fresh life.
- **Women fought drought by restoring Water Bodies in Karnataka**
 - In the Mandya district, women took it upon themselves to clean and desilt dry lakes and ponds, while the women of Gulbarga revived 28 water bodies.
- **Saving Bangalore Water Bodies**
 - 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**
 - 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.
- **Kudimaramathu project**
 - Kudimaramathu is an ancient tamil concept of participatory management.
 - It indicates the community's role in conserving natural resources.

Way Forward

- **The biggest strength of democracy is public participation.**
- Any programme cannot be successfully implemented without involvement of people, no matter what kind of policy it has or how effective the leadership is.
- Valuing citizen knowledge, interests and values is important especially at local level.

- **Locals can bring value to the decision-making process with unique knowledge of region, and awareness of the social dynamics** help negate any potential negative effects of any efforts to protect the environment.

3. Conserving Fresh water sources

- While we are still in the grip of the COVID-19 pandemic, which is airborne, we have forgotten that another such blight could well come from contaminated water.

Present Status

- NITI Ayog and WaterAid, have found that **over 70% of India's surface and groundwater is contaminated by human and other waste** and is likely to carry viruses.
- The practice of keeping animals locked together for mass production of meat produces an artificial environment that can birth mutations in erstwhile dormant viruses.
- Earlier, in the wild, animals were far away from human habitats. The viruses they harboured remained isolated.
- But today's practices can spawn viruses that can easily transfer to the human population.

A source of virus

- Once the virus has found its way into the human population, it is bound to proliferate in wastewater.
- In England, Wales and Scotland, several wastewater samples were tested and were found to carry traces of SARS-CoV-2.
- Remnants of the virus have also been detected in raw sewage across Sydney.
- Research at the University of Stirling in Scotland indicates that the SARS-CoV-2 virus can spread through sewage water.
- This is an alarming prospect for us as **river water or lake water, which carries human waste, sewage, and toxic waste, can be a very generous host for viruses.**
- A huge section of the population in India uses polluted water from sources like rivers, lakes, or groundwater for drinking.

Decontaminating our water bodies

- Decontaminating our water bodies and groundwater could take several decades.
- The **Rhine river in Germany, after 50 years of cleaning and stopping the inflow of pollutants and human waste, is still not fit for drinking.**
- The Indian government has announced '**Nal se Jal**' scheme to provide drinking water connections to every rural household by 2024.
- Since most of the water sources are contaminated, the only way to purify water is through reverse osmosis (RO).
- But though RO removes contaminants, it also takes out all the healthy minerals and nutrients required by the human body.
- To neutralise the virus, we would need an ultraviolet aquaguard treatment, but it is costly.

Faulty Development Model

- We have destroyed our natural living resources in our rush for development.
- Our development model is always focused on artificial infrastructure, building highways, industrial plants, high-rise structures. In doing this, we kill our natural resources.
- As a result, we are **running out of natural infrastructure** at an alarming pace.
- Developed countries have stable landscapes and populations whereas India has a growing population, which means there will be growing consumption.

Freshwater sources

- **There are two unpolluted fresh water sources left in the country.**

- **The first is the water lying below our forests;**
- **Second is the aquifers that lie below the floodplains of rivers.**
- Both these sources provide natural underground storage and are renewable.
- The rains provide natural recharge year after year and it is this recharge which can be used to water our cities and towns.
- The aquifers underlying forests can provide healthy mineral water purely for drinking purposes.
- The river floodplains are a great source of water for cities.
- The Yamuna floodplains in Delhi already use such a scheme to provide water to a million people each year.

Way Forward

- **There is no technological substitute for living natural resources like pristine natural water and soil.** This means that we must conserve and use our natural living resources.
- The water beneath our forests is as good as natural spring water. We must safeguard it for our own lives and for future generations.
- **Forests and floodplains must be declared as water sanctuaries.**
- Such schemes work with nature rather than against it.
- **It is important to remember that these evolutionary resources, once lost, will be lost forever.** If we don't realise this, it will only be our loss.

4. India's water being exported as agri-exports

- It is critical for us to adopt the **circular water management model of treating and rejuvenating wastewater at source**, along with efficient water management strategies to reduce water demand.
- India's agricultural exports registered a growth of 17.34 per cent, garnering \$41.25 billion in foreign exchange for 2020-21 despite the novel coronavirus disease (COVID-19) pandemic.

Concerns over India's Agricultural Exports

- The improved agricultural exports assure relief, yet have their failings.
- This is because they **deplete an equivalent amount of irrigation water** permanently from the country's resource base.
- India has witnessed a continued decline in its per capita water availability — by 60 per cent over the last 50 years because of increasing water use by the irrigation sector.
- The agricultural exports for 2020-21 are equivalent to the annual drinking water needs of 1,500 villages with a population of 1,000.
- **Agricultural exports reduce the imbalance in trade and earn hard currency while causing social and environmental fallouts.**
- Export of 17.7 million tonnes of rice and 7.5 million tonnes of sugar is the same as the export of 50.4 billion cubic metres of water.
- **Agri-export houses are earnestly exporting virtual water, especially groundwater**, all for a dime.
- Globally, India is one of the largest water exporters.

Virtual Water Trade (VWT)

- Virtual Water Trade (VWT) is slowly altering the global hydrological cycle in many ways.
- **Water-guzzling activities are getting outsourced for production to other countries.**
- Thus, crops, meat, leather, chemicals and industrial goods are imported to ensure a positive water balance.
- **If the future wars will be about water, then the weaponisation is in using VWT.**
- Persian Gulf and North African countries are forced to import virtual water due to acute shortages.

- Mexico imports maize and in doing so, it saves 12 billion cubic metres per year of its national water resources.
- **VWT, covering both export and import, is here to stay and cannot be avoided, just as oil import is accepted as critical for economic growth.**

Impact

- **The impact of Virtual water export on coming generations would be more catastrophic if corrective actions are not taken at the earliest.**

Way Forward

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

5. India's deepening water stress

- The complexity and scale of the water crisis in India calls for a locus specific response and integrate the ongoing work of different Ministries and Departments through new configurations.

Understanding the Water Sources

- We need to understand the sources from which the country draws water to meet its varying needs.
- In the rural areas, 80%-90% of the drinking water and 75% of the water used for agriculture is drawn from groundwater sources.
- In urban areas, 50%-60% of the water supply is drawn from groundwater sources, whereas the remaining is sourced from surface water resources.
- According to the **composite water management index released NITI Aayog in 2019, 21 major cities were on the brink of exhausting groundwater resources.**
- The study also points out that by 2030, the demand for water is projected to be twice the available supply.

The Chennai example

- **In Chennai in 2019, life came to a standstill and parts of the city went without piped water for months.**
- Many have cited the poor rainfall received in Chennai in the previous year as one of the main reasons for the water crisis. However, ground-level factors have been equally responsible.
- Chief among these is that the city has been built by incrementally encroaching floodplains and paving over lakes and wetlands.
- **The lack of space for water to percolate underground prevented rainwater from recharging the aquifers.**
- This was further exacerbated by the **loss of green cover** to make way for infrastructure projects.

- Such a situation leads to flooding during normal rainfall due to stagnation, and drought-like conditions due to the prevention of underground water storage.
- Other cities in India would echo these manifestations in varying degrees owing to a lack of sustainable urban planning.

Lessons from rural Punjab

- The draft report of the Central Ground Water Board concluded that **Punjab would be reduced to a desert in 25 years if the extraction of its groundwater resources continues unabated.**
- 82% of Punjab's land area has seen a huge decline in groundwater levels, wherein 109 out of 138 administrative blocks have been placed in the 'over exploited' category.
- Groundwater extraction which was at 35% in the 1960s and 1970s, rose to 70% post the Green Revolution.
- Cultivation of water intensive crops such as paddy have further aggravated water depletion, even turning water saline.
- Immediate measures need to be taken to replenish groundwater through **participatory groundwater management approaches along with water budgeting, aquifer recharging and community involvement.**

Way Forward

- For addressing the water crisis in urban areas, the Ministry of Jal Shakti must reconfigure its relationship with other Ministries and Departments.
- **Effective land and water zoning regulations** would protect urban water bodies, groundwater sources, wetlands and green cover.
- **Enhance waste water recycling and water recharge activities** targeting aquifers and wells through rainwater harvesting.
- Governance and management should increasingly interact and draw from the expertise of fields such as hydrology (watershed sustainability), hydrogeology (aquifer mapping and recharge) and agriculture sciences (water-sensitive crop choices and soil health).
- **The importance given to groundwater conservation should not ignore surface water conservation** including the rivers and lakes which are in a critical state due to encroachment and pollution.
- The Ministry of Jal Shakti must focus on protecting and conserving water resources on the one hand and minimising and enhancing efficiency of water usage on the other.

Renewable Energy

1. India's Scope and Opportunities in Solar Energy

- Recently India showed interest to become lead member of the **World Solar Bank (WSB)**, a multilateral lender proposed by the International Solar Alliance (ISA).
- The idea of a WSB has gained traction as many ISA member countries may have difficulty raising finances on their own.
- Setting up the WSB will add heft to India's credentials as a clean energy champion

India's Role

- The establishment of International Solar Alliance (ISA) of more than 122 countries initiated by India, is the first international treaty-based organization headquartered in India.
- Under '**One sun One World One Grid**', India seeks to replicate its global solar leadership by encouraging the phased development of a single globally connected solar electricity grid to leverage the multiple benefits (Low cost, Zero pollution) of solar energy.
- India has pledged to mobilize more than US \$ 1000 billion of investments needed by 2030 for massive deployment of solar energy.
- The **world's largest solar power park, the Pavagada Solar Park in Karnataka, has now**
- In 2014, the country had less than 3 gigawatt (GW) of installed solar capacity. That figure has now reached about 37 GW.

Challenges

- India's solar energy development is largely built over imported products.
- India's domestic content requirement clause is facing legal challenge at WTO.
- India is dependent on Chinese imports for solar equipment, such as solar cells, panels, etc.
- Land availability in India for solar plant is less due to high population density.
- China's strong manufacturing base is giving stiff challenge to domestic manufacturer.
- India's solar waste is estimated to be around 1.8 million by 2050, which needs to be tackled.

Way Forward

- Strong financial measures are required to finance the solar projects. **Innovative steps like green bonds, institutional loans and clean energy fund can play a crucial role.**
- Promotion of research and development in renewable energy sector, especially in storage technology.
- Along with prioritizing designing microgrids, public policy attention is needed for developing battery technologies at scale for local applications.
- India needs a **Solar Waste Management and Manufacturing Standards Policy.**

Conclusion

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

2. Push for Green Hydrogen

What is Green Hydrogen

- "**Green**" hydrogen is a zero-carbon fuel made by electrolysis, using renewable power from wind and solar to split water into hydrogen and oxygen.
- Hydrogen, or H₂ fuel cells leave only water vapour and heat as emissions, and provide as much combustive energy as fossil fuels.
- It is increasingly being touted as a way to decarbonise emissions-intensive heavy industry and transport sectors.

Present Status

- The global target is to produce 1.45 million tonnes of green hydrogen by 2023.
- Currently, India consumes around 5.5 million tonnes of hydrogen, primarily produced from imported fossil fuels.
- In 2030, according to an analysis by the Council on Energy, Environment and Water (CEEW), green hydrogen demand could be up to 1 million tonnes in India.

Concerns / Challenges

- A key challenge has been portability and transporting the gas.
- Several challenges in scaling up the commercial-scale operations of green hydrogen persist.
- Currently costs of production of Green Hydrogen are too high to be competitive with other fuels.
- Most renewable energy resources that can produce low-cost electricity are situated far from potential demand centres.

Way Forward

- **To facilitate the development of “green” hydrogen, India needs to develop a consistent code of standards.**
- Decentralised hydrogen production must be promoted through open access of renewable power.
- We must take steps to blend green hydrogen in existing processes, especially the industrial sector.
- **Improving the reliability of hydrogen supply by augmenting green hydrogen with conventionally produced hydrogen will improve the economics of the fuel.**
- Policymakers must facilitate investments in early-stage research and development needed to advance the technology for use in India.
- India needs to secure supplies of raw materials that are needed for this technology.
- Major institutions like the DRDO, BARC and CSIR laboratories have been developing electrolyser and fuel-cell technologies.
- **There is a need for a manufacturing strategy that can leverage the existing strengths and mitigate threats by integrating with the global value chain.**

Conclusion

- Even before it has reached any scale, green hydrogen has been said as the flag-bearer of India’s low-carbon transition.
- Hydrogen may be lighter than air, but it will take some heavy lifting to get the ecosystem in place.

3. Attracting Capital for Green Transition

- India is a signatory of and strong advocate for the **United Nations Framework Convention on Climate Change (UNFCCC)**, and the only large country on track for emissions reduction as agreed under the Paris convention.
- The International Energy Agency (IEA) estimates that India will need to invest \$1.4 trillion over the next 20 years in the process.

Clean Energy Investment

- Transition to clean energy will **require large investment needs.**
- Such investments include technologies that may be
 - nascent and hence susceptible to failure even after deployment of significant capital,
 - expensive and hence unaffordable by citizens and consumers of some countries, or
 - simply too novel or patent-protected for seamless transfer between various nations.

- Green financing requires finding the right capital willing to take risks of failure.
- **The three Cs of green financing are Countries, Companies and Carbon markets.**

Countries

- The **pressure on net zero targets by countries will increase.**
- The recent change in political priorities towards climate change around the world means that funds like the Green Climate Fund (GCF) could see renewed large inflows.
- Such funds can become appropriate conduit for **financing high-risk or long-gestation technologies in developing countries.**

Companies

- Large fossil fuel companies have been in the news due to court rulings directing them to be aggressive in reducing their carbon footprint.
- **Surveys show that the young, millennial consumer is more willing to back products of companies that are environmentally conscious.**
- Companies are naturally gravitating to **Green Frontier technologies.**

Carbon markets

- As countries move towards net zero, they will hit binding constraints on the carbon that companies (or consumers) in such countries can emit.
- To keep commitments, countries will need to move to some version of cap-and-trade systems.
- If companies need to exceed the available units of emissions, they will need to buy 'carbon credits' from firms within or outside.
- Carbon markets can create significant resources for transfer between countries—making many projects viable in developing countries.

Way Forward

- **Large funding requirements in India require support from policymakers to crowd-in private investment.**
- Policy innovation is required in
 - identifying technologies that work for India and nurturing these into viable businesses,
 - executing fair and just transition plans for impacted people and industries, and
 - enabling new instruments and sources of capital from the 3Cs above for financing to flow more efficiently.
- **As India moves to its aim of a cleaner, greener \$5-trillion economy, a roadmap for attracting green finance needs to be put in place.**

4. Transition towards Green Technology

- **India has slowly begun to realise pollution is not only causing environmental degradation but it is also a fundamental threat to growth and development.**
- If not taken seriously and contained, it will have a deep impact on the economy.

Clean Technologies

- There is an inevitable demand for clean technologies.
- Major developments in clean energy technology have paved the way for business opportunities from the '**green economy transition**'.
- Countries that upskill appropriately and create industries to manufacture it has much to gain.
- They can accumulate value from the export of clean technologies and gain access to international markets.

- **China has already positioned itself as the world's leading exporter of affordable photovoltaic cells.**
- Europe is innovating in wind and Japan and the USA are giving out patents in electrical vehicles.
- Countries mastering green technology early have a comparative advantage over others in the green market of goods / services.

India's stand

- In terms of scale, India is in an advantageous position.
- It has an established industry in low-carbon environmental goods and services (LCEGS).
- It has the third-highest LCEGS sales in Asia.
- About 13% of India's high-value patents are related to green tech.
- India has a large scope of having a green boom in the coming years as it already has a market for green goods / services.
- Some of the reforms are needed for the full-scale development of the sector as a whole.

Transition towards Green Technology

- India is currently planning on one of the largest green energy projects that will generate 20,000 megawatts (MW) of solar power and 3,000 MW from wind farms.
- **Green technology is not cheaper but is labour-intensive. This is a boon for India as it will create employment opportunities for our abundant labour force.**
- The more we use green technology, the more it will expand our base for employment leading to economic development in the long run.
- By the adoption of green technologies, global warming and our dependence on non-renewable sources of energy has been reduced gradually.
- This will be a **win-win situation for India in terms of both environmental sustainability and economic development.**

SIMPLIFYING IAS EXAM PREPARATION

Green Technology Patents

- There is a dire need to establish a robust innovation system, and facilitate access and reform the effective intellectual property systems.
- This will help keep the development, evolution and innovation in green technology, products and services.
- To protect such innovations in the country and across the globe, **the intellectual property system plays a crucial role.**
- All green tech innovations are protected through the development of '**green intellectual property**'.
- About 13 per cent of India's high-value patents are related to green tech, which is in line with the world average.
- India is not a leading inventor of green-tech systems, although it performs significantly better than other low- to middle-income nations.
- India fall behind in comparison to the United States, Japan and South Korea, who are long-standing innovators and account for nearly 60 per cent of the world's green tech patents.
- **If India goes steady with the reforms and innovations in the green intellectual property segment and supportive policies, it will outstand others in terms of investments and foreign direct investments in green market.**

5. India's offshore wind energy

- Offshore wind energy refers to the **deployment of wind farms inside the water bodies.** They utilise the sea winds to generate electricity.
- Offshore wind turbines produce electricity which is returned to shore through cables buried in the ocean floor.

Present Status

- India's capacity to generate electricity from wind reached 39.2 gigawatts (GW) a year in March 2021.
- The Union Ministry of New and Renewable Energy (MNRE) has set a target of installing 5 GW of offshore capacity by 2022 and 30 GW by 2030.

India's Potential

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

Offshore Wind Energy: Benefits

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

Challenges of offshore wind energy

- Offshore wind turbines require stronger structures and foundations than onshore wind farms. This can cause **higher installation costs**.
- Offshore wind tariffs in India are expected to range between Rs 7-9 per unit, compared to Rs 2.8-2.9 per unit for onshore wind.
- The action of waves and even high winds, particularly during **storms or hurricanes, can damage wind turbines**.
- Offshore wind farms require **maintenance** that is more costly and difficult to perform.

Way Forward

- MNRE can set specific wind **Renewable purchase obligation (RPO)** targets for each state just like it does for solar.
- If excise duties and GST could be waived for wind farm components, early project development will be more affordable.
- Discoms can adopt **feed-in tariff (FiT) regulations** and make offshore wind power procurement mandatory. A feed-in tariff is a policy tool designed to promote investment in renewable energy sources.
- FiT can be used to promote offshore wind power in the early stages of development until it becomes economically viable.
- A **long-term contract and price guarantee** reduces the inherent risk in renewable energy production, encouraging investment and development.
- Discoms can ensure **priority payments for offshore wind projects**.

- The **underwater power evacuation and subsea substations** could be developed by the Power Grid Corporation of India Ltd. This would reduce the risk faced by offshore wind farm developers.

6. Challenges to India's transformation from fossil-fuel to renewable energy

- A recent Council for Energy, Environment and Water (CEEW) report has highlighted the challenges to India's transformation from a fossil-fuel-dependent economy to one based on renewable energy.
- There is the major constraint of finance. The transformation will involve **massive high-cost, high-risk, long-gestation investments**.
- There is little fiscal space for large public investment in renewables, while private investment in renewables at scale is just starting.
- The willingness of developed countries to make available adequate low-cost finance and required technologies remains uncertain.
- India has negotiated hard to tie up access to such financing and technologies. The results are still awaited.
- Another major constraint is **access to land**.
- Creating renewable power generation capacity for a net-zero economy could require between 4% to 6% of India's land mass.
- Tapering off of fossil-fuel-based power generation and closure of coal mines will be resisted by the owners as well as workers employed at these establishments.



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International Efforts

1. Global Climate Policy

- India asserted at the virtual Climate Ambition Summit, that it is well on its way to not just fulfilling its national pledge on emissions reduction, but exceeding the commitment.

India's Emissions status

- Among the 'major economies', India will meet its Paris Agreement target for 2030.
- Its per capita emissions are one-third of the global average and it will remain within its share of ecological space.
- The **Emissions Gap Report 2020** includes India among nine G20 members who are on track to achieve their unconditional commitments under the Paris pact, based on pre-COVID-19 projections.
- In sustainability benchmark like housing size and density, public bicycle transport and eliminating food waste, India is doing better than the West.

Inequality in Climate Treaty

- **Inequity is built into the climate treaty, which considers total emissions, size, and population.**
- India is the fourth largest emitter, even though, according to the United Nations, the richest 1% of the global population emits more than two times the emissions of the bottom 50%.
- **The link between well-being, energy use and emissions is not on the global agenda.**
- Carbon neutrality meaning balancing emitting carbon with absorbing carbon from the atmosphere in forests does not hold good for latecomers like India.
- Such countries with young population, and are growing fast to reach comparable levels of well-being with those already urbanised.
- The challenge is to change wasteful behaviour in the West.
- **Coal accounts for a quarter of energy use. It powered colonialism.**
- **India, with abundant coal reserves and per capita electricity use that is one-tenth that of the U.S., is under pressure to stop using coal.**

Infrastructure Development and Carbon Emissions

- **Reconstruction in the West after World War II led to acceleration of material use, resulting emissions and sharp rise in global temperature around 1970, before growth commenced in Asia.**
- Urban transformation requires huge amounts of iron and steel, cement, construction materials and energy for infrastructure.
- In an urbanised world, two-third of emissions arise from the demand of the middle class for infrastructure, mobility, buildings and diet.
- Infrastructure worldwide has used half of total materials, mainly construction, cement and steel, which have no substitute, and will need half of the available carbon space.
- Peaking of emissions comes some 20-30 years after saturation of infrastructure has been achieved, as in the case of the West.

Global Climate Risk Index

- The **Intergovernmental Panel on Climate Change (IPCC)**, under the aegis of the United Nations, **defines climate risk** as the likelihood of unfavourable impacts occurring as a result of severe climate events interacting with vulnerable environmental, social, economic, political or cultural conditions.
- The international environmental think tank '**Germanwatch**' released the *Global Climate Risk Index 2021*.
- The Global Climate Risk Index analyses quantified impacts of extreme weather events, in terms of fatalities and impact of extreme weather events.
- The latest version of the GCRI, published in January 2021, ranked 180 countries based on the impact of extreme weather events and associated socio-economic data from 2000-2019.
- There are **deep fault lines** in the methodology and interpretation of the country rankings.

Emissions by Different Countries

- By 1950, the contribution of the U.S. to total emissions peaked at 40%. It has declined to approximately 26%, the largest in the world.
- North America and Europe, with less than one-quarter of the world population, are responsible for almost half of global material use.
- China, with four times the population of the U.S., accounts for 12% of cumulative emissions.
- Transport emissions are the fastest-growing emissions worldwide and have surpassed emissions from generation of electricity in the U.S. Transport emissions are the symbol of Western civilisation.

India's Role

- India has the soft power to bring together the high and low emitters.
- India must highlight its unique national circumstances.
- For example, the meat industry, especially beef, contributes to one-third of global emissions.
- Indians eat just 4 kg of meat a year compared to those in the European Union who eat about 65 kg and Americans who eat about 100 kg. The average American household wastes nearly one-third of its food.
- India has the credibility and legitimacy to push an alternate 2050 goal for countries currently with per capita emissions below the global average.
- India, in the UN Security Council, must push new ideas based on its civilisational and long-standing alternate values for the transition to sustainability.

2. Global Methane Pledge

- The **Global Methane Pledge** was launched at the **UN COP26 climate conference** in Glasgow.
- **Methane is the second-most abundant greenhouse gas** in the atmosphere, after **carbon dioxide**, and, therefore, pledges related to cutting down its emissions are significant.

What is the Global Methane Pledge?

- The pledge was first announced in September by the US and EU, and is essentially an agreement to **reduce global methane emissions**.
- One of the central aims of this agreement is to **cut down methane emissions by up to 30 per cent from 2020 levels by the year 2030**.
- According to the latest Intergovernmental Panel on Climate Change report, methane accounts for about half of the 1.0 degrees Celsius net rise in global average temperature since the pre-industrial era.
- **Rapidly reducing methane emissions** is complementary to action on carbon dioxide and other greenhouse gases, and is regarded as the single most effective strategy to reduce global warming in the near term and keep the goal of limiting warming to 1.5 degrees Celsius within reach.

Why is dealing with methane important for climate change?

- According to the **International Energy Agency (IEA)**, while methane has a much shorter atmospheric lifetime (12 years as compared to centuries for CO₂), it is a much more potent greenhouse gas simply because **it absorbs more energy while it is in the atmosphere**.
- In its factsheet on methane, the UN notes that methane is a **powerful pollutant** and has a global warming potential that is 80 times greater than carbon dioxide, about 20 years after it has been released into the atmosphere.
- Significantly, the average methane leak rate of 2.3 per cent “erodes much of the climate advantage gas has over coal”.

- The IEA has also said that more than 75 per cent of methane emissions can be mitigated with the technology that exists today, and that up to 40 per cent of this can be done at no additional costs.

Recently, Indian Council of Agricultural Research (ICAR) has developed an **anti-methanogenic feed supplement 'Harit Dhara' (HD)**, which can cut down cattle methane emissions by 17-20% and can also result in higher milk production.

3. India's commitments at the COP 26 Summit

- 1-billion-tonne reduction in its total projected emissions from now until 2030. This is the first time that India has taken any climate target in terms of its absolute emissions.
 - According to the World Resources Institute, India's total greenhouse gas emissions were about 3.3 billion tonnes in 2018. It's projected to rise above 4 billion tonnes per year by 2030.
 - That would mean between now and 2030, India could be emitting anywhere between 35 to 40 billion tonnes at the current rates of growth. Cutting 1 billion tonnes would, therefore, represent a reduction of 2.5 to 3 per cent in its absolute emissions in the business-as-usual scenario in the next nine years.
- India's Net Zero target of 2070.
 - In its climate action plan submitted under the Paris Agreement, India had promised to reduce its emissions intensity, or emissions per unit of GDP, by 33 to 35 per cent by the year 2030 compared to 2005 levels.
- Reducing 1 billion tonnes of emissions by 2030 and expanding non-fossils capacity to 500 GW.

INDIA'S 5-POINT ROADMAP UNVEILED

- 1 TAKE NON-FOSSIL**
energy capacity to 500 GW by 2030
- 2 NET ZERO BY 2070:**
India rejected calls to announce a target so this is a give. Net zero means all man-made GHG emissions must be removed from atmosphere through absorption in processes like photosynthesis or physical removal
- 3 MEET 50% OF ENERGY**
requirements from renewables by 2030
- 4 REDUCE TOTAL**
projected carbon emissions by 1 bn tonnes from now to 2030
- 5 REDUCE ECONOMY'S**
carbon intensity to less than 45% by 2030

4. India's leadership on climate crisis

India-US Partnership

- **India-US Climate and Clean Energy Agenda 2030 Partnership** was launched at the Leaders' Summit on Climate called by US President Joe Biden.
- The United States has set an economy-wide target of reducing its net greenhouse gas emissions by 50-52 percent below 2005 levels in 2030.
- **India has set a target of installing 450 GW of renewable energy by 2030.**
- The partnership will aim to
 - mobilise finance and speed clean energy deployment;
 - demonstrate and scale innovative clean technologies needed to decarbonise sectors including industry, transportation, power, and buildings; and
 - build capacity to measure, manage, and adapt to the risks of climate-related impacts.

Flaws in India's Actions

- **While substantially increasing Renewable Energy (RE), India is also expanding fossil fuel extraction and use.**
 - The government has auctioned 60 new coal mining blocks, and several new thermal power stations are being considered.
 - This includes mining in some of the most biodiverse forests in Central India.
 - **While public transportation has been given more investment in the 2021 budget, there is no discouragement of private cars, and fossil fuel use continues to rise.**
- India includes mega-hydropower in RE, despite the ecological and social havoc it causes.

- RE production is mostly of the mega-park type. The Ministry of New and Renewable Energy (MNRE) said that 10,000 sq km in seven states are available for such parks.
 - These projects have serious ecological and social impacts but do not need an environmental impact assessment, under the assumption that RE is necessarily “clean” and eco-friendly.
 - About 60,000 hectares of Kachchh’s ecologically fragile grassland-desert ecosystem have been allotted to energy mega-parks.
 - The Government’s target is 40 GW of rooftop solar, but poor policy back-up has hindered it.
- A shift from petrol-diesel to electric cars, would significantly expand devastating mining across the world.
 - This is a consequence of **thinking of climate and ecological crises only from a carbon perspective, ignoring biodiversity loss and pollution.**
 - Unless luxury and wasteful consumption is eliminated, unsustainability and people’s displacement are inevitable.

Viable Alternatives

- Viable alternatives have been demonstrated across the world.
- The Delhi government is supporting 150 government schools to generate rooftop solar energy, helping them save Rs 8.8 crore on electricity and earn Rs 8.5 crore from selling power back to the grid.
- A study in the US shows that **rooftop solar can create 30 times more jobs than mega-solar parks.**
- **Integrated power micro-grids** can provide adequate power for entire villages and urban neighbourhoods, and be locally managed.

Way Forward

- Intense civil society pressure could force appropriate action by the Government.
- Consumer behaviour that uses wasteful and luxury power can be changed and regulated, and power redistributed to those who do not have enough.
- All this should be part of the National Energy Policy.
- While we all have a right to the energy, we cannot keep demanding more and more, nor can we allow the unsustainable and inequitable ways in which it is produced and distributed.
- **Without us sustaining the earth, the planet will not sustain us. In this, India needs to show global leadership.**

5. WHO Air Pollution Guidelines

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

New air quality guidelines

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

Air Pollution and its effects

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

Concerns / Challenges

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

Way Forward

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

6. First Nobel for climate science

2021 Nobel Prize in Physics recognizes three scientists for their work in weather and climate modeling and the human effects on global warming.

First recognition for climate scientists:

1. This is the **first time, climate scientists** have been awarded the Physics Nobel. The IPCC had won the Peace Nobel in 2007, an acknowledgement of its efforts in creating awareness for the fight against climate change,
2. While a Chemistry Nobel to Paul Crutzen in 1995, for **his work on the ozone layer**, is considered the only other time someone from **atmospheric sciences** has won this honour.
3. The recognition of Manabe and Hasselmann, therefore, is being seen as an **acknowledgment of the importance that climate science** holds in today's world.

Mainstreaming climate science:

1. Several scientists said that the **delayed recognition to climate science** couldn't have come at a more appropriate time.
2. **Climate change is the biggest crisis facing the world**, and the humanity, today.

- Unfortunately, there still are some people, and governments, that are not convinced of the reality, although that is changing quickly.
- Apart from the fact that the recognition of Manabe and Hasselmann is richly deserved and long awaited, this Nobel Prize will, hopefully, also **help in more people believing in climate science.**

Conclusion:

- Until very recently, climate science was not considered important even in scientific circles.
- Perhaps that was because our **weather forecasts** were not very accurate. Not everyone appreciated the fact that this science itself was uncertain and chaotic.
- Weather forecasts** have become far **more accurate**, the evidence on climate change have been compelling, thanks to the works of scientists like Manabe and Hasselmann. This Nobel Prize would **probably help in further mainstreaming of climate science.**

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Disaster Management

1. A resilient future for Uttarakhand

- Days after a glacier burst in the Chamoli district of Uttarakhand caused flash floods, the scientific community were struggling to understand what triggered the disaster.
- The incident was reminiscent of the 2013 disaster in Uttarakhand.

The glacier burst

- The occurrence of the glacier burst was attributed to erosion, a build-up of water pressure, an avalanche of snow or rocks, landslides or an earthquake under the ice.
- Experts also identified large-scale human settlements and expansion of agricultural activities leading to massive deforestation, as a possible trigger.

Why is Uttarakhand vulnerable?

- Uttarakhand is located in the midst of young and unstable mountains, and is subject to intense rainfall.
- Natural characteristics can't be solely responsible for devastations witnessed in the State.
- For years experts have voiced their fears about an impending disaster due to climate change, rapid and indiscriminate construction activities, and the subsequent ecological destruction in the region.

Present Crisis

- **Anthropogenic activities** could destroy the natural barriers that control avalanches and floods, thereby enhancing the possibilities of a glacial lake outburst flood.
- **The Hindu Kush Himalaya Assessment Report (2019) had pointed out that one-third of the Hindu Kush Himalaya's glaciers would melt by 2100.**
- There have also been allegations about the use of explosives in the construction of dams and other infrastructure.
- Haphazard construction of dams was causing irreversible damage to the region.

Way Forward

- Scrutiny into the construction of hydroelectric power projects in Uttarakhand.
- Investing in resilience planning, especially in flood prevention and rapid response.
- **Climate proofing the infrastructure** such as by applying road stabilisation technologies for fragile road networks.
- Strengthening embankments with adequate scientific know-how.
- Reassessing development of hydropower and other public infrastructure.
- Establishing implementable policies and regulatory guidelines to **restrict detrimental human activities, including responsible eco- and religious tourism policies.**
- Investing in training and capacity building to **educate and empower local communities to prevent and manage risks effectively.**

Conclusion

India needs to urgently rise up to the challenge by applying innovative and inclusive solutions that support nature and marginalised communities, to restore and rebuild a resilient future for Uttarakhand.

2. Development that is mindful of nature

- **Environmental disaster** has struck Kerala once again. Unusually heavy rains caused landslides in Kottayam and Idukki.
- With a population density of 860 persons/sq. km against an all-India average of 368 persons/sq. km (Census 2011), **Kerala experiences very high pressure on the land.**

Land-use change: Settlement of the highlands instead of Coastal plains:

1. Historically, most of the settlements were **concentrated in the coastal plain**, the adjoining lowlands and parts of the midlands.
2. However, this scenario has **altered now**, with **significant land-use change** across topographic boundaries.
3. Population growth, agricultural expansion, economic growth, infrastructure development, particularly **road construction** and **intra-State migration** have all led to **settlement of the highlands**.
4. Kerala is experiencing **high growth of residential buildings**. Such a pace of construction has **serious implications** for the **geo-environment**.
5. The demand for construction materials, with the attendant quarrying and excavations, is altering the landscape.
6. This has resulted in gross disturbance of the character of the terrain evolved through weathering and formation of soil under natural vegetation cover.

On the unchecked land use pattern in the hilly districts:

1. It is important that for the **hilly districts of Idukki and Wayanad**, both the local and State authorities should rely on **scientific reports on the landslide vulnerabilities** to reach decisions on land allocations for various constructions.
2. While deciding on it, **local soil properties and slope stability** should be important factors to be considered rather than political expediency.
3. The incidents of landslides in the State have increased exponentially over the last several years.

The hesitancy towards the implementation of the recommendations by the Western Ghats Ecology Expert Panel, commonly known as the Gadgil Committee, on **protection of the Western Ghats** is the best example of this. We can now see how prescient they were.

Review of two projects must be done:

1. The most recent landslide in Kerala should lead the government to **immediately review two major projects** with a potential to **lower ecological security**.
2. The first of these is the **Silver Line project**, a light railway connecting the two extremities of the State.
3. As the Kochi Metro network was being expanded, a prominent entrepreneur of the city rightly observed that it needs a **sewage disposal system** more than it needs a rapid transit network.

Way Forward:

1. Climate change, population growth and related economic aspects should have compelled Kerala to move towards a **more integrated, catchment-based approach** to the management of land and water, if necessary, through **environmental legislation**.
2. A key component of this **integrated catchment-based approach** is the recognition that only by strengthening the natural processes, the rivers would be able to find their pathways for flood waters.
3. For that to happen, the immediate need is **to develop flood zonation maps** for various catchment areas.
4. For the long term, these maps **available locally** should be **used for land zonation** and thus help the residents to move out in exchange for land elsewhere. The same procedure should be followed also in the case of landslides.
5. We need to follow the **land zonation map** in identifying the areas vulnerable to landslides and discourage building houses in such places.

Conclusion:

A **comprehensive master plan on land utilisation strategy** based on a clear environmental vision needs to be prepared at macro and micro-levels to ensure that encroachment is minimal. These documents should contain clear guidelines for constructions, including recommended designs of houses, that will **match with local landscape and scenery**.

3. Tackling Glacial Burst**What are Glacial Lake Outburst Floods (GLOFs).**

- When glaciers melt, the water in glacial lakes accumulates behind loose, natural “glacial/moraine dams” made of ice, sand, pebbles and ice residue.
- A GLOF refers to the flooding that occurs when the water dammed by a glacier or a moraine is released suddenly.
- Unlike earthen dams, the weak structure of the moraine dam leads to the abrupt failure of the dam on top of the glacial lake.
- A failure of the dam has the potential of releasing millions of cubic metres of water in a short period, causing catastrophic flooding downstream.

Formation of new Glacial lakes

- Glacial retreat due to climate change occurring in most parts of the Hindu Kush Himalaya has given rise to the formation of numerous new glacial lakes, which are the major cause of GLOFs.
- Since glaciers in the Himalayas are in a retreating phase, glacial lakes are growing.
- Potentially dangerous lakes can be identified based on
 - field observations,
 - records of past events,
 - geomorphologic and geotechnical characteristics of the lake/dam and
 - surroundings, and other physical conditions.

How well is India prepared?

- While some work on identification of such lakes has been done by Central Water Commission (CWC).
- Some aspects are still a work in progress like: a robust early warning system, and a broad framework for infrastructure development, construction and excavation in vulnerable zones.
- In contrast to other countries, there are no uniform codes for excavation, construction and grading codes in India.
- There are no widely accepted procedures or regulation in India for land use planning in the GLOF/Landslide Lake Outburst Floods (LLOFs) prone areas.

Early warning systems (EWS) in India

- The number of implemented and operational GLOF EWS is still very small, even at the global scale.
- India has a remarkable history of successful warnings in relation to Landslide Lake Outburst Floods (LLOFs), dating back to the 19th century.

NDMA Guidelines / Recommendations

- The NDMA guidelines say that risk reduction has to begin with
 - identifying and mapping such lakes,
 - taking structural measures to prevent their sudden breach, and
 - establishing mechanism to save lives and property in times of a breach.
- NDMA has recommended use of Synthetic-Aperture Radar imagery to automatically detect changes in water bodies, including new lake formations, during the monsoon months.

- Restricting constructions and development in GLOF/Landslide Lake Outburst Floods (LLOFs) prone areas is a very efficient means to reduce risks at no cost.
- **Apart from specialised forces such as NDRF, ITBP and the Army, there is a need for trained local manpower.**
- **Experience has shown that over 80 percent of search and rescue is carried out by the local community.**
- These local teams can assist in planning and setting up emergency shelters, distributing relief packages, identifying missing people, and addressing the needs for food, healthcare, water supply etc.
- Psychological counselling of victims, apart from dissemination of accurate information through press conferences and mass media.

4. Managing Risks From Overlapping Hazards

- Cyclones along the Western and Eastern coasts amidst the pandemic alert us to the need for **year-long preparedness, a multi-disciplinary approach** to averting disasters and reducing vulnerabilities.

Recent Incidents

- Within a span of a week, first the Western Coast and then the eastern coast was battered with cyclones —Tauktae in the west and Yaas in the east.
- While cyclones and storms are not unusual on the Eastern coast, what was unique this time was that an **environmental hazard happened in the middle of another mega hazard – the Covid-19 pandemic.**
- The flooding the Yaas cyclone caused took the adversity to a different scale altogether and the overall hazard is much larger than the triggering cyclone.

Past Incidents

- History shows that millions of hectares over the Ganga-Brahmaputra flood plains and the delta have been subjected to riverine and flash floods regularly.
- The densely populated riverine areas, the sand bars, and the deltas are continuously subjected to river bank erosion.

Way Forward

- We need to take cognisance of the fact that such overlapping hazards could be a recurrent phenomenon.
- Accordingly, the disaster risk reduction activities need to be geared up.
- Any sustained change in reducing disaster risk would require a clinical understanding of the risk drivers.
- It is important that lessons are drawn from such adversities and **proactive planning is taken on war-footing** in other areas to avoid similar sad state of events.
- **Risk can be managed and minimised through a plethora of year-round activities** that combines
 - reduce the probability of the occurrence of the hazards.
 - preparation strategies like early warning.
 - arrangement of adequate spaces for evacuation.
 - risk mitigation and adaptation strategies.
- We need a **multidisciplinary approach** to risk reduction which would reduce the intensity of the risk.

5. Chennai Floods

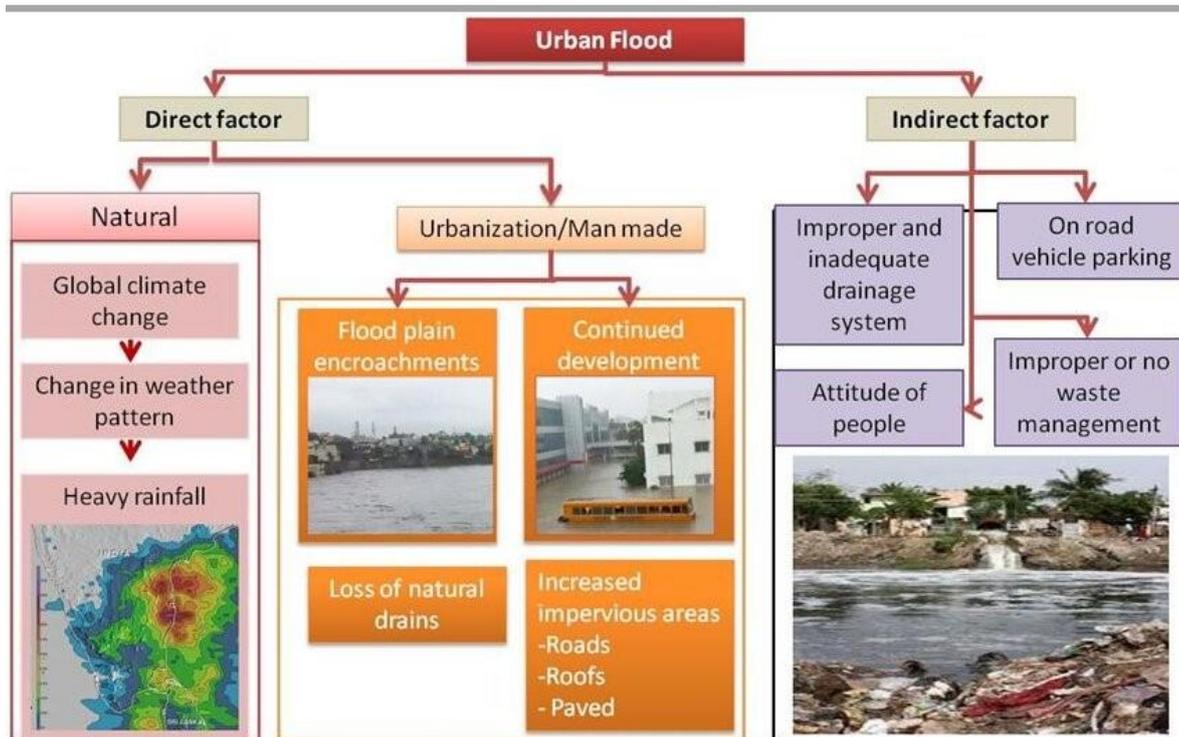
- Chennai and several other parts of Tamil Nadu **received heavy rainfall**, leading to **waterlogging and damage to homes.**

- The Madras High Court brought up the **flooding in Chennai** while hearing a public interest litigation on **removing encroachments** to ensure that roads in the city are wide enough.

Polluting and destroying natural urban water bodies:

1. As the incidence of **climate variability and extreme weather** events increases, urban flooding becomes more and more common.
2. While the **untimely heavy rains** can be attributed to climate variability, the urban flooding is largely due to an unplanned urbanisation.
3. A major issue in India cities. Lakes can store the excess water and regulate the flow of water.
4. Indian cities are becoming **increasingly impervious to water**, not just because of increasing built up but also because of the nature of materials used (hard, non-porous construction material that makes the soil impervious).
5. However, pollution of natural urban water bodies and converting them for development purposes has **increased risk of floods**.
6. **Reduced infiltration** due paving of surfaces which decreases ground absorption and increases the speed and amount of surface flow.
7. **Old and ill maintained drainage system** is another factor making cities in India vulnerable to flooding.
8. Lack of attention to **natural hydrological system** and lack of flood control measures.

Causes of Urban Floods



Unplanned urbanisation of Anthropogenic activity:

1. India has a **long coastline of 7,500 km** and an estimated **14% of India's total population** lives alongside it that traverses nine states, 77 towns and cities including some of the fastest-growing such as Mumbai, Chennai, and Kochi making them more prone to flood due to adjacent sea and erratic monsoonal behaviour.
2. **A 2016 UN report** estimated that 40 million people in India will be at risk from sea-level rise by 2050.

- Urban flooding is significantly different from rural flooding as urbanization leads to developed catchments which increases the flood peaks from 1.8 to 8 times and flood volumes by up to 6 times.

Lessons for India from other countries experiences:

- The floods in Europe call attention to the global need for countries to implement **ecologically sensitive flood protection measures**.
- The Dutch have gone beyond their conventional dependence on dikes, dams, walls and gates to protect themselves from floods.
- Their **current disaster resilience mantra is to live with water, build with nature and make room for the river**.
- They champion **creating adequate space for rivers** to overflow by protecting floodplains from human interference, deepening riverbeds and creating alternate channels for excess water.
- After two major floods in 1993 and 1995, the Dutch embarked on several projects to **widen riverbanks and reshape the areas around rivers**.

Way Forward:

- The management of urban flooding has to be treated **holistically in a multi-disciplinary manner**.
- Science and technology** can play a significant role in improved monitoring, modelling/ forecasting, and decision-support systems.
- One method for improving the **preparedness for urban flooding** is by setting up a vulnerability-based geospatial framework to generate and analyze different scenarios.
- It helps in **identifying and planning** for the most effective/ appropriate actions in a **dynamic way** to incorporate day-to-day changes that take place in urban areas, having the potential to alter the prevailing vulnerability profile.
- Innovative approaches** like Sponge Cities- wetland restoration, flushing systems using collected rooftop water, and public spaces as flexible water retention facilities can be applied to Indian urban areas.
- Other such methods include permeable material for roads and pavement, green roofs and harvesting systems in buildings.

6. Hydropower projects in the Himalayas

The Environment Ministry, in an affidavit placed in the Supreme Court, had disclosed that it has permitted **seven hydroelectric power projects**, which are reportedly in advanced stages of construction, to go ahead.

What's the history of hydropower projects in the Himalayas?

- In the aftermath of the **Kedarnath floods of 2013** that killed at least 5,000 people, the Supreme Court had halted the development of hydroelectric projects in Uttarakhand pending a review by the Environment Ministry on the role such projects had played in **amplifying the disaster**.
- A 17-member expert committee, led by environmentalist Ravi Chopra, was set up by the Ministry to **examine the role of 24 such proposed hydroelectric projects** in the Alaknanda and Bhagirathi basin, which contains the Ganga and several tributaries.
 - The **Chopra committee** concluded that 23 projects would have an "irreversible impact" on the ecology of the region.
- Following this, six private project developers, whose projects were among those recommended to be axed, impleaded themselves in the case on the ground that since their projects had already been cleared for construction before the Kedarnath tragedy, they should be allowed to continue.

4. The SC directed a **new committee** to be set up to examine their case.
 1. This **committee, led by Vinod Tare** of the Indian Institute of Technology, Kanpur, concluded that **these projects** could have a **significant environmental impact**.
5. The Environment Ministry in 2015 set up yet **another committee, led by B.P. Das**, who was part of the original committee, but had filed a **“dissenting report”**.
 1. The Das committee recommended all six projects **with design modifications to some**, and this gives lie to the Environment Ministry’s current stance. The Power Ministry seconded the Environment Ministry’s stance.
6. In Feb 2021 also, **Uttarakhand floods** washed away at least two hydroelectric power projects — the 13.2 MW Rishiganga hydroelectric power project and the Tapovan project on the Dhauliganga river, a tributary of the Alakananda.

What are the challenges such projects face?

1. Following the break in the Raunthi glacier that triggered floods in the Rishiganga river in Uttarakhand on February 7, which washed away at least two hydroelectric power projects, environmental experts have attributed the **glacial melt to global warming**.
2. **Glacier retreat and permafrost thaw** are projected to decrease the stability of mountain slopes and increase the number and area of glacier lakes.
3. **Climate change** has driven **erratic weather patterns** like increased snowfall and rainfall.
4. **The thermal profile of ice**, say experts, **was increasing**, which means that the temperature of ice that used to range from -6 to -20 degree C, was now -2 degree C, making it **more susceptible to melting**.
5. It was these changing phenomena that made infrastructure projects in the Himalayan regions risky.
6. **Expert committees recommend** that there should be **no hydropower development beyond an elevation of 2,200 metre in the Himalayan region**.
7. Moreover, with increased instances of cloudbursts, and intense spells of rainfall and avalanches, residents of the region were also placed at **increased risk of loss of lives and livelihood**.

Conclusion:

Though the Centre is committed to hydropower projects because it’s a **renewable source of power**, but the **ecological damage of hydropower projects** in Himalayan region (especially in Uttarakhand) combined with the reduced cost of solar power means that government should not favour any further greenfield hydropower projects in the region.

Government should adhere to the recommendation made by the expert committees that there should be no hydropower development **beyond an elevation of 2,200 metre** in the Himalayan region.

7. Frequent occurrence of Cyclones

The **severe cyclones, Tauktae and Yaas** caused **massive damage to infrastructure, the agricultural sector, and houses**.

More frequent in occurrence of Tropical Cyclones:

1. **Increasing sea surface temperatures** in the **northern Indian Ocean** and the geo-climatic conditions in India have led to a rise in the frequency of devastating cyclones in the coastal States accounting for **7% of the global tropical cyclones**, according to **India Meteorological Department (IMD), 2013 data**.
2. Every year, around **five to six tropical cyclones** are formed in the Bay of Bengal and the Arabian Sea; of these, two to three turn severe.

3. **The World Bank and the United Nations (2010) estimate** that around 200 million city residents would be exposed to storms and earthquakes by 2050 in India.
4. Between 1891 and 2020, out of the 313 cyclones crossing India's eastern and western coasts, 130 were classified as severe cyclonic storms.

Economic losses notified by various reports:

1. As stated earlier, cyclones led to an **increase in the fiscal burden** of governments through increased spending to implement effective cyclone preparation measures.
2. As a result, **direct government expenditure** on natural calamities **increased 13 times**.
3. **The Asian Development Bank's report** in 2014 estimated that India would suffer a **loss of around 1.8% of GDP annually by 2050** from climate-related events.
4. **India lost around 2% of GDP and 15% of total revenue** over 1999-2020.
5. According to the **Global Climate Risk Index report 2021**, India ranks the seventh worst-hit country globally in 2019 due to the frequent occurrence of extreme weather-related events.

The economic costs of cyclones:

1. Among the natural disasters, **cyclones** constituted the **second most frequent phenomena** that occurred in **15% of India's total natural disasters** over 1999-2020.
2. **Cyclones** are the **second most expensive** in terms of the costs incurred in damage, accounting for **29% of the total disaster-related damages after floods (62%)**.
3. In addition, they are the **third most lethal disaster in India** after earthquakes (42%) and floods (33%).

Case study for Disaster Preparedness: Measures in Odisha:

1. In the aftermath of the 1999 super cyclone, the Government of Odisha took up **various cyclone mitigation measures** which included installing a disaster warning system in the coastal districts, and construction of evacuation shelters in cyclone-prone districts.
2. Other steps were the setting up of the **Odisha State Disaster Management Authority (OSDMA)**, conducting regular cabinet meetings for disaster preparedness, and building the **Odisha Disaster Rapid Action Force (ODRAF)**.
3. All these activities have helped to minimise the toll from cyclonic storms such as Hudhud, Fani, Amphan, and Yaas.

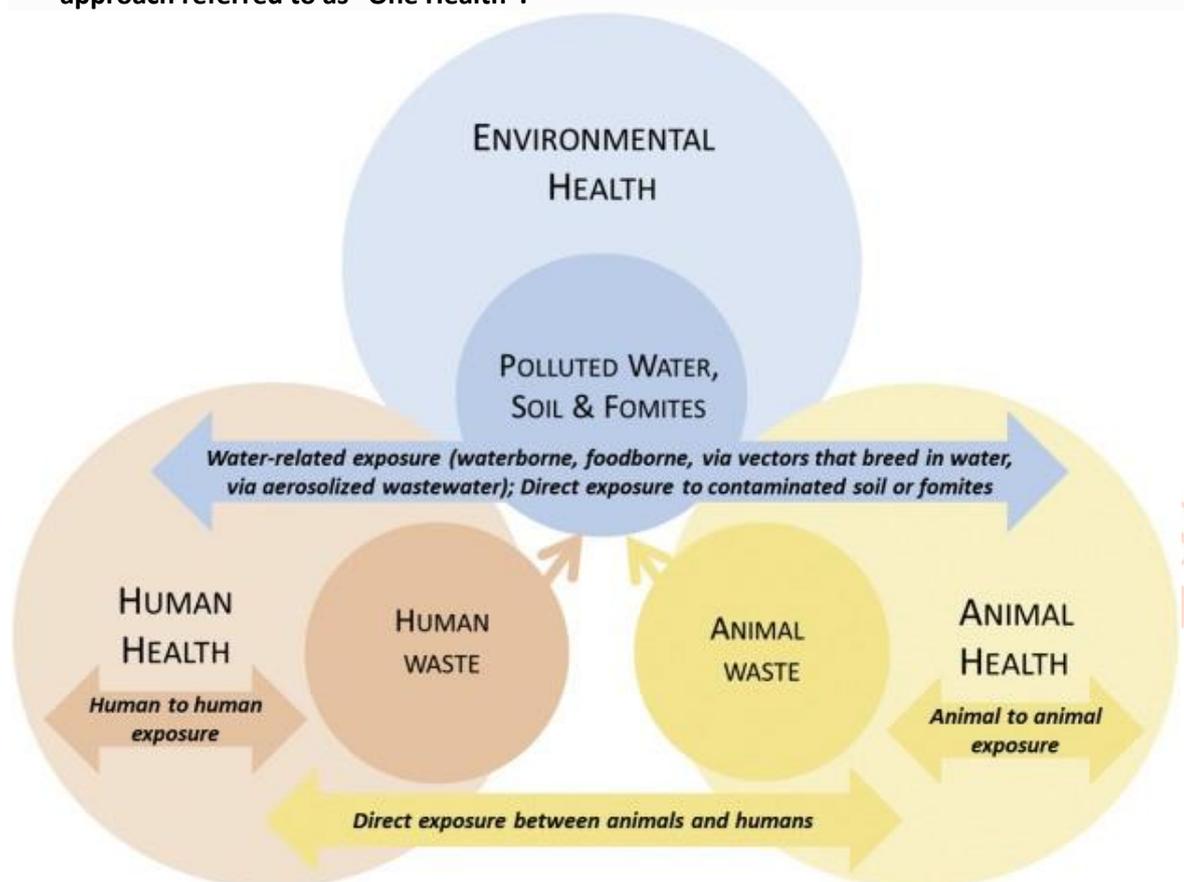
Way Ahead: Essential steps

1. First, it is imperative to **improve the cyclone warning system and revamp disaster preparedness measures**.
2. Second, the Government must widen the cover under **shelterbelt plantations** and help **regenerate mangroves in coastal regions** to lessen the impact of cyclones.
 1. In addition, adopting cost-effective, long-term mitigation measures, including building **cyclone-resilient infrastructure** such as constructing storm surge-resilient embankments, canals and **improving river connectivity** to prevent waterlogging in low-lying areas are important.
3. Third, **installing disaster-resilient power infrastructure** in the coastal districts, providing concrete houses to poor and vulnerable households, and creating **massive community awareness campaigns** are essential.
4. Finally, **healthy coordination** between the **Centre and the States** concerned is essential to **collectively design disaster mitigation measures**.

Miscellaneous

1. A 'One Health' approach

- The **father of modern pathology**, Rudolf Virchow, emphasised in 1856 that there are **essentially no dividing lines between animal and human medicine**.
- This concept is ever more salient as the world continues to grapple with the COVID-19 pandemic.
- Discussions that took place around World Veterinary Day, on April 24, 2021, focused on acknowledging the **interconnectedness of animals, humans, and the environment**, an approach referred to as "One Health".



One Health Approach:

- One Health recognizes that the **health of humans, animals and ecosystems are interconnected**.
- It involves application of a coordinated, collaborative, multi-disciplinary and cross-sectoral approach to address potential or existing risks that originate at the **animal-human-ecosystems interface**.
- It also encourages **synergistic collaboration** to achieve common public health goals.

The **transboundary impact of viral outbreaks** in recent years such as the Nipah virus, Ebola, Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS) and Avian Influenza has further reinforced the need for us to consistently document the **linkages between the environment, animals, and human health**.

India's framework, plans:

1. **India's 'One Health' vision** derives its blueprint from the agreement between the **tripartite-plus alliance** comprising the Food and Agriculture Organization of the

United Nations (FAO), the World Organisation for Animal Health (OIE), the World Health Organization (WHO) and the United Nations Environment Programme (UNEP), a global initiative supported by the United Nations Children's Fund (UNICEF) and the World Bank under the **overarching goal of contributing to 'One World, One Health'**.

Way Forward: Need for coordination from various departments:

1. Scientists have observed that there are **more than 1.7 million viruses circulating in wildlife**, and many of them are **likely to be zoonotic**, which implies that unless there is **timely detection**, India risks facing many more pandemics in times to come.
2. To achieve targets under the **'One Health' vision**, efforts are ongoing to address challenges pertaining to veterinary manpower shortages, the lack of information sharing between human and animal health institutions, and inadequate coordination on food safety at slaughter, distribution, and retail facilities.
3. These issues can be remedied by consolidating existing animal health and disease surveillance system, the Information Network for Animal Productivity and Health, and the National Animal Disease Reporting System developing best-practice guidelines for informal market and slaughterhouse operation (e.g., inspections, disease prevalence assessments), and **creating mechanisms to operationalise 'One Health' at every stage** down to the village level.

Conclusion:

India being home to a **large portion of the world's livestock farmers**, the absence of a policy framework that ratifies the 'One Health' approach in development and health policies is a major hurdle in eliminating poverty and poverty-related diseases.

Now, as we battle yet another wave of a deadly zoonotic disease (COVID-19), awareness generation, and increased investments toward meeting **'One Health' targets is the need of the hour**.

SIMPLIFYING IAS EXAM PREPARATION