INSIGHTSIAS

SIMPLIFYING IAS EXAM PREPARATION

Insights Mains 2019 Exclusive (Environment)

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Conservation

1. Eoo-Centrism

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

2. India's Water Crisis

- The **NITI Aayog report** on **Composite Water Management Index** (CWMI) said that **India is facing its 'worst' water crisis in history**. Taps in Shimla went dry in summer of 2018, posing an unprecedented water crisis in the hill town.
- India has only 4% of the planet's fresh-water for 16% of its population.
- Twenty-one cities, including Delhi, Bengaluru, Chennai and Hyderabad will run out of groundwater by 2020, affecting 100 million people.
- The rate of **groundwater extraction is so severe** that NASA's findings suggest that **India's water table is declining** alarmingly at a rate of about 0.3 metres per year.
- At this rate of depletion, India will have only 22 per cent of the present daily per capita water available in 2050, possibly forcing the country to import water.
- Dug-wells and borewells are constructed with alarming impunity to slide deeper and deeper to suck water from greater depths.
- **Water is being diverted from food-crops to cash-crops**; **livelihoods to lifestyles; rural to urban**— mismanagement is a bigger reason for the drought.
- Water shortages are hurting India's ability to produce power and **40% thermal power plants are in areas facing high water stress**, a recent World Resources Institute report says.
- Residents in the arid Thar Desert of Rajasthan were spending Rs 2,500 to buy 2,500 litres of water which they share with their cattle.
- **Measures needed to strengthen water Governance:**
    - **India's priority must be:**
        - To make our irrigation and water systems amenable to modern concepts.
        - To complete **irrigation and water sector reforms**.
        - To implement improved water management, governance and

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regulation practices.
    - **Pricing system for water:** For making people use water efficiently
  - **Decentralisation of irrigation commands**, offering higher financial flows to well-performing States through a **National Irrigation Management Fund**.
  - Groundwater extraction patterns need to be better understood through **robust data collection**.
  - **Large catchment areas need to be developed** around water bodies so that natural recharge of groundwater takes place. A good example is the **Seog catchment area** which has been denoted as a wildlife sanctuary and where no construction is allowed.
  - **Greywater recycling**, a method of recycling wastewater from kitchen sinks, showers and laundry fixtures. Greywater recycling helps reduce household water usage by about 50%.
  - Comprehensive **restructuring of India's Central Ground Water Board** and the **Central Water Commission** in order to create a new 21st Century management authority.
  - **Right to water** should mean a high priority to drinking water.
  - This year's **World Water Development Report** makes it clear that **nature-based solutions** which are also aligned with the principles and aims of the 2030 Agenda for Sustainable Development can offer answers to our most pressing water-related challenges.
  - The **water governance** ought to be made **transparent, accountable and participatory** in every sub-sector, including management of rivers, groundwater, floods, and biodiversity, among others.

3. Water Management

- **The importance of water in the 21st century is comparable to that of oil in the 20th century.**
- Oil has alternatives like natural gas, wind, solar, and nuclear energy. **The only alternative to water is water.**
- Water issues will continue to be a strategically important variable in foreign policy development.
- **Valuing Water**
  - An effective valuation supports better informed **decision-making** in the allocation and use of the resource.
  - As well as in the implementation of SDG6, i.e. to **"ensure availability and sustainable management of water and sanitation for all."**
  - Valuation of water will help in its conservation, infrastructure investment, setting of water quality standards, water pricing and water allocation.
  - Appropriately designed water tariffs will discourage or prevent waste and encourage water-saving.
- **Concerns / Challenges**
  - According to the United Nations, **water use has grown at more than twice the rate of population increase in the last century**.
  - **International water disputes** have been a contention for long. Eg Indus Water Treaty
  - Various **interstate and intercountry water disputes** between upper riparian and lower riparian regions are testimony to the growing concern viz. Cauvery

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water dispute, Krishna water dispute, Teesta river dispute etc.
    - India faces national water scarcity by 2050 if current trends continue
    - States that usually have surplus water, such as Latur and Uttarakhand, currently experience acute water scarcity.
- Appropriate and effective ICT solutions in the form of **smart-water management (SWM)** must also be adopted to address water issues.
- Long-term investment in educational programs, social awareness campaigns, improved infrastructure and facilities, and water diplomacy.
- **Rainwater harvesting** can provide the country with reliable water supplies throughout the year.
- The implementation of the **United Nations Convention to Combat Desertification (UNCCD)** has a significant role in the sustainable availability of clean, adequate and safe water.
- **River Basin Organizations (RBOs)** with institutional authority for keeping the river basin and groundwater aquifers in good condition and productivity need to be established.

4. India's Conservation Laws and Policies

- India's conservation legislation is separated into those that **protect forests** and its produce, and those that target **wildlife conservation.**
- Both the **Indian Forest Act, 1927** and the **Wildlife Protection Act, 1972** create different types and grades of protected areas, and contain provisions to restrict or outlaw local use of natural resources and landscapes.
- The **Forest Rights Act, 2006** went beyond sanctioning local usage, to conferring rights to local communities over forest land and produce.
- The Ministry of Tribal Affairs was mandated with operationalising the Act, while conservation remained under the domain of the Ministry of Environment, Forest and Climate Change.
- However, given a hostile bureaucratic environment, the legislation faltered, except in certain pockets.
- The **Third National Wildlife Action Plan**, introduced in 2017, is categorically of the view that locals hinder conservation.
- **Involving communities living in and around natural resource-rich areas in the management and use of these resources** is an effective tool of conservation that has been recognised across the world.
- This was affirmed by the **1980 World Conservation Strategy of the International Union for Conservation of Nature (IUCN)**, and the **Earth Summit's 1992 Statement of Forest Principles** and the **Convention on Biological Diversity**. India needs to **value the community-involved conservation models** like other successful countries.

5. Global Assessment Report on Biodiversity and Ecosystem Services

- The first-ever Global Assessment Report on Biodiversity and Ecosystem Services by **Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)** has been released.
- It primarily looked or analysed the **impact of economic development on nature and ecosystems.**
- **Key Findings of the report:**

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- The report identified a range of risks, from the **disappearance of insects vital for pollinating food crops**, to the **destruction of coral reefs** that support fish populations that sustain coastal communities, or the **loss of medicinal plants**.
- Productivity in 23 per cent of global land has reduced due to **land degradation.**
- Up to $577 billion in annual global crops are at risk from pollinator loss and 100-300 million people are at increased risk of floods and hurricanes because of **loss of coastal habitats and protection.**

- **Way forward:**
  - The report says there is still an opportunity for human beings to live in harmony with nature.
  - But there has to be a **change in the way how natural resources are governed**, and things are produced and consumed.
  - The findings will also add to pressure for countries to agree **bold action to protect wildlife** at a major conference on biodiversity due to take place in China towards the end of next year.

6. Biodiversity Conservation

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

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fertile soils, a balanced climate and numerous other vital ecosystem services depend upon the conservation of biological diversity.
    - Food production relies on biodiversity for a variety of food plants, pollination, pest control, nutrient provision, genetic diversity, and disease prevention and control. Both medicinal plants and manufactured pharmaceuticals rely on biodiversity.

7. Genome Sequencing

- Genomics is an interdisciplinary field of science focusing on the structure, function, evolution, mapping, and editing of genomes.
- For the first time, the **entire genome of Asiatic lion has been sequenced** by scientists from **CSIR-Centre for Cellular and Molecular Biology, Hyderabad.**
- The objective is to **understand the species at DNA level and study if there are any specific problems with regard to adaptability to environment or behaviour vis-à-vis other big cats**.
- Scientists also hope that being able to study the entire genome sequence will help them understand how the genome as a whole works—how genes work together to direct the growth, development and maintenance of an entire organism.
- The study will **enable better disease and population management** of the endangered big cat by identifying characteristics which are specific to Asiatic lions. E.g.: **21 lions reportedly died between September and October in Gir forest of Gujarat due to Canine distemper virus**, such incidents can be avoided.
- Comparative genomics between African and Asiatic lions could be undertaken once the complete genome of the African lion is sequenced.
- The study noted that the evaluation of genetic diversity placed the Asiatic lion in the lowest bracket of genomic diversity index highlighting the gravity of its conservation status.
- With the complete genome of royal Bengal tiger, African Cheetah and Jaguar available, comparative studies of all these big cats would be possible. Such researches will help in adopting a **multi-pronged approach towards conservation efforts.**

8. India's Forest Cover

- The **Global Forest Watch (GFW)** released by World Resources Institute (WRI) reveals that India has lost over 1.6 million hectare of tree cover between 2001 and 2018, about four times the geographical area of Goa.
- **Findings of the report:**
    - In India, five north-eastern states — Nagaland, Tripura, Meghalaya, Mizoram and Manipur — were responsible for over 50% of all tree cover loss in the same period.
    - The main reason for loss of tree cover in the north-eastern states is **diversion of forest land and climate change.**
    - The loss of tree cover contributed to 172 MT of **carbon emissions** in India during this period.
    - The analysis reveals the total tree cover which used to be 12% of the country's geographical area in 2000 reduced to 8.9% in 2010.
- **Challenges leading to alarming situation of declining forest cover:**
    - There have been instances of **private players displacing tribal communities**

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from the forests and cutting down forests for industries.
    - A **flawed definition of "forest cover"** allows the government to claim growth in total forest cover despite largescale deforestation.
    - Rotational felling of trees by forest departments, diversion of forest lands for developmental activities, submergence of forest cover, agriculture expansion, biotic pressures and natural disasters as other reasons for the decrease in the forest cover.
    - There have been instances of **violation of forest right act,** even the CAMPA act, land acquisition rules and regulations.
- **Measures needed:**
    - India must **review the programmes** that it has been pursuing to revive forests, and **move away from monoculture plantations** that are favoured by even forest development corporations in many States.
    - The **forest policy** must be prepared by involving the stakeholders viz. people along with the state.
    - **Community-led initiatives** have successfully regenerated forests by adopting sustainable- use practices, regeneration through traditional knowledge of forests and species, guarding and penalizing poachers, among others. These must be promoted.
    - Innovative solutions like **Tree Ambulance in Tamil Nadu** must be emulated across the country.
    - **Identify and reduce the dependency**. For instance fuel wood via LPG connections and promoting fast growing timbers in forest fringes, Grazing via stall feeding or rotational grazing, controlling commercial exploitation of forests, adopt zero-tolerance to fires setting targets to reduce fires by 50%, 25% to 10% etc.
- India's diverse forests support the livelihoods of 250 million people, providing them firewood, fodder, bamboo, beedi leaves and many other products. The timber currently benefits the state treasury. There is a **need of revamping India's forest policy.**

9. Bonn Challenge and India

- India has now submitted its report titled, **'Bonn Challenge and India: Progress on Restoration Efforts Across States and Landscapes,"** a first-ever publication from any country in the world, giving detailed **progress on forest landscape restoration** under the global treaty.
- The Bonn Challenge is a global effort under which countries have committed to bringing 150 million hectares of deforested and degraded land into restoration by 2020 and 350 million hectares by 2030.
- India had pledged to restore 13 million hectares of degraded land by 2020 and an additional 8 million hectares by 2030.
- Underlying the Bonn Challenge is the **forest landscape restoration (FLR) approach**, which aims to restore ecological integrity at the same time as improving human well-being.
- The Bonn Challenge progress report acknowledged that the **government is the single largest stakeholder in forest restoration in India.**
- Thus, it is critical that "the government continues to bear the responsibility of restoring large portions of degraded areas while reaching out to different agencies

and impacted communities".

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10. Forest Survey of India

- **India is among top ten nations in the World in Terms of Forest Area.** As per the latest FAO report, India is placed 8th in the list of Top Ten nations reporting the greatest annual net gain in forest area. 24.4% of land area under forest and tree cover.
- **Forest Survey of India**, an organization under Ministry of Environment Forests & Climate Change recently published '**India State of Forest Report 2017'.**
- Survey serves as an important tool to **monitor the country's forest resources** and **plan suitable scientific and policy interventions for their management**.
- Forests play an important role in **mitigation and adaptation of climate change**.
- **Way forward:**
    - FSI should consider reporting India's green cover under more explicit categories, including plantations, orchards etc.
    - It could also help to make the GPS data for each forest unit available for public audits.
    - **Expanding forest cover should be prioritised** in the years to come and non-conventional green cover such as home gardens and urban forests should also be considered.
- **Conclusion:**
    - India's forests are critical for its ecosystem because they **absorb 11.25 percent of the country's greenhouse gases**. The value of what is technically called an "**ecosystem service**" would amount to **Rs 6 lakh crore ($120 billion) or 4.2 percent of India's gross domestic product**.
    - The increase in forests is important to **improving biodiversity** and reducing damage caused by natural disasters like floods. States that have reported damage by floods had fewer forests compared to states that had reported less damage.

11. Is planting saplings a solution to the felling of trees?

- In recent months, the idea of **Compensatory Afforestation (CA)** or plantations has sparked a huge debate.
- The debate is around, can we continue to lose the large number of trees being cut for the Goa airport, housing complexes in Delhi, highways, and the bullet train, and expect the damage to be offset through plantations.
- In India the urban population contributes over 60% to the GDP and is projected to contribute around 75% in the next few years.
- Indian cities are estimated to add 300 million new urban residents by 2050.
- Delhi is projected to become the most populous city in the world by 2028, according to the United Nations.
- With the inevitability of migration to urban areas, the **share of agriculture and allied services in GDP has shrunk to around 15%** even as the sector continues to engage around 70% of our working age population.
- Environmental pollution caused by daily hour-long traffic jams on a 10-km stretch causes more harm to the environment.
- Urban trees reduce air pollution, cool cities, and increase ground water infiltration.

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- Research shows that in Bengaluru the street trees reduce PM10 levels by 75%, reduce atmospheric temperature by 3-5°C and road asphalt temperatures by 23-25°C.
- Using the route of compensatory Afforestation, there is loss of an average of 35,000 hectares of forests annually to development projects.
- Forest and tree conservation laws have fuelled more ecological loss and destruction by relying on compensatory Afforestation.
- The **Afforestation overdrive by government departments is done in floodplains, grasslands and other ecosystems that are often not suitable for tree cover.**
- Many popular fast-growing species used for urban Afforestation, such as Eucalyptus and Acacia auriculiformis, deplete groundwater and affect soil quality.
- They cannot replace the environmental services provided by a giant native peepal, mango or tamarind.
- We have to work hard to ensure that our urban infrastructure causes least harm to the environment and has a net positive impact on our quality of life.
- Whether it is metros or elevated corridors, a **net environment impact assessment** must be conducted to justify the felling of trees and harm to water bodies.

12. India's Tiger Population

- According to the latest tiger census, **India's tiger population has doubled** in the past dozen years, a significant achievement for the country's wildlife conservation efforts.
- India was now "one of the **biggest and most secure habitats of the tiger.**" India estimates that **over 75 percent of the world's tiger population** now resides in the country.
- India is now home to **2,967 tigers**, up from **1,411 in 2006** when it conducted its **first national survey**. The last census in 2014 had counted 2,226 tigers.
- The highest number of tigers is in Madhya Pradesh in central India, which has 526.
- The Global Tiger Forum, an international collaboration of tiger-bearing countries, in 2010 at the **St.Petersburg Tiger Summit** has set a **goal of doubling the count of wild tigers by 2022**.
- **Why is a tiger census needed?**
    - The tiger sits at the **peak of the food chain**, and its conservation is important to ensure the **well-being of the forest ecosystem**.
    - The tiger estimation exercise includes **habitat assessment and prey estimation**. The numbers reflect the success or failure of conservation efforts.
    - This is an especially important indicator in a fast-growing economy like India where the **pressures of development** often run counter to the **demands of conservation.**
    - More than 80% of the world's wild tigers are in India, and it's crucial to keep track of their numbers.
- **Tiger protection in India- Concerns and challenges:**
    - **India has one of the lowest per capita forest areas in the world.** Depletion of forests is responsible for reduction of tiger habitats.
    - **Reduced food base:** As forestlands fall to development projects, habitable land for animals that make for the tiger's food base are also reduced.
    - **Poaching:** Another issue that has hindered tiger conservation in India and globally is poaching, which will persist as long as there is an illegal market for

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tiger body parts.
    - **Climate change**: Rising sea level as a result of climate change is on the verge of wiping out Sundarbans, one of the last remaining habitats of the Bengal tigers.
- **Conservation efforts:**
    - The National Tiger Conservation Authority (NTCA) has launched the **M-STrIPES (Monitoring System for Tigers – Intensive Protection and Ecological Status),** a mobile monitoring system for forest guards.
    - The **Global Tiger Initiative (GTI)** program of the World Bank, using its presence and convening ability, brought global partners together to strengthen the tiger agenda.
    - Over the years, the initiative has institutionalised itself as a separate entity in the form of the **Global Tiger Initiative Council (GTIC),** with its two arms –the Global Tiger Forum and the Global Snow Leopard Ecosystem Protection Program.
    - The **Project Tiger**, launched way back in 1973, has grown to more than 50 reserves amounting to almost 2.2% of the country's geographical area.
- **Conclusion:**
    - We have to create a healthy **balance between sustainability and development.**
    - Pench Tiger Reserve in Madhya Pradesh and Periyar Tiger Reserve in Kerala are emerged as the best managed tiger reserves in the country, out of the total 50 tiger reserves.
    - The government has taken steps for **preventing poaching activities** which includes a special strategy for monsoon patrolling etc.
    - Tigers are **terminal consumers** in the ecological food pyramid, and their conservation results in the conservation of **all trophic levels** in an ecosystem.
    - Therefore, saving tiger, ecologically is saving an entire forest and all other components of the forest ecosystems.

13. Man-Tiger Conflicts

- **The causes and impacts of the man-tiger conflicts are:**
    - A rising tiger population is forcing the animal to seek out new hunting grounds, as tigers need a **huge prey base**.
    - Continued destruction and divergence of forest lands.
    - People are **increasingly encroaching** into the country's traditional wild spaces and animal sanctuaries.
    - Tigers are used to travelling long distances, most of which fall outside the protected areas.
    - **Example**: A tiger, fitted with a tracking collar, was found to have travelled 500 km in 72 days, starting from its habitat in the 138 sq. km Bor Tiger Reserve in Wardha district. It travelled through Amravati and Nagpur before getting electrocuted on a farm in Wardha.
    - Wildlife experts' claim that **territorial animals do not have enough space within reserves** and their prey do not have enough fodder to thrive on. This is forcing the wild animals to move out and venture close to human habitation in search of food.
    - **Example:** The Pench Tiger Reserve has 30 tigers. While an adult tiger requires

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25-40 sq km of forested area to enjoy sufficient quantity of prey, now there is one tiger for every 8-10 sq km, leading to spillage.
    - There is **no mapping of the tiger corridors, or any of the well-defined routes that the tigers may be using for migration and resettlement**.
    - There is **no buffer zone between wildlife and human settlements.** The hamlets on the fringes of the jungle have expanded rapidly. **Example:** Sarati, which didn't exist before 2003, has 1,057 voters, Vihirgaon has 719 voters, and Lone, another village where Avni claimed a human life, has 417 voters near Tipeshwar Wildlife Sanctuary, Maharashtra.
    - About **16 tigers have been killed** in road and train accidents over the past five years.
    - The **'four-laning' of the national highway** running through the Pench Tiger Reserve and Kanha Tiger Reserve, and **the widening of the railway line in central India** from narrow gauge to broad gauge, for the fragmentation of the habitat.
- **Impacts of Man-Tiger conflicts:**
    - Crop Damage.
    - Animal Deaths.
    - Loss of Human Life.
    - Injuries to People.
    - Injuries to Wildlife.
    - Livestock Depredation.
- **Government Initiatives to reduce the man-tiger conflicts are:**
    - **Providing LPG to villagers**: LPG should be provided to those villagers who frequently go to the forest areas specially wildlife habitats to fetch fuel wood for their chullahs.
    - Assistance to state government for **construction of boundary walls and solar fences** around the sensitive areas to prevent the wild animal attacks.
    - Encouraging state government for creation of a network of **protected areas and wildlife corridors** for conservation of wildlife.
    - **Information technology** like radio collars, GPS, satellite uplink facilities are used by research institutions to monitor the movement of wild animals
    - Centrally sponsored schemes of project tiger, project elephant and integrated development of wildlife habitats.
- In order to be truly effective, prevention of human-wildlife conflict has to involve the full scope of society: international organizations, governments, NGOs, communities, consumers and individuals. Solutions are possible, but often they also need to have financial backing for their support and development.

14. Groundwater shortage in India

- **The problem of groundwater shortage in India:**
    - **India is the largest user of the groundwater in the world** with almost 90% being used for drinking water and almost 60-70% for irrigation. We use 25% of all groundwater extracted globally, ahead of the US and China.
    - According to the assessment of the **Central Ground Water Board (CGWB),** total 1,034 out of 6,584 assessed blocks in the country are over-exploited.
    - Current statistics also show that nearly 50% of urban water supply comes from groundwater.

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- This was not the case in the 1960s and 1970s but the need to grow more food (the Green Revolution) changed that.

- **Causes for ground water exploitation in India:**
  - Government encourages farmers to produce **water-intensive crops** like rice and sugarcane through increased **minimum support prices (MSP).** This has also led to groundwater depletion, income inequality and unsustainable agriculture.
  - **Successive droughts and erratic rainfall have led to excess extraction of groundwater**.
  - The government finance for **well digging and pump installation** with capital subsidies, massive rural electrification and pervasive energy subsidies all have enabled this process to aggravate.
  - Lack of adequate planning, crumbling infrastructure, indiscriminate drilling of borewells, large-scale consumption of water, and a false sense of entitlement in using water carelessly are causing water shortages.
  - Existing rules on groundwater access that give **landowners the right to pump on their land.**
  - **Subsidies on electricity** are thought to play a central role in the Indian groundwater crisis.
  - In the north western parts of India and southern peninsula, the early and rapid rural electrification, free or subsidised power to the farm sector, large productive farmers and attractive procurement prices for major cereals led to intensive use of groundwater.
  - Cities like Bengaluru are losing its capacity to recharge groundwater as the number of water bodies like lakes has reduced by 79%.
  - Commercial establishments like shopping malls, hotels, hospitals and high-rise apartments are using borewells in large number to meet the demand for the occupants.

- **Steps to make India water secure:**
  - **Sustainable Agricultural practices:**
    - **Growing less water-intensive crops in the dry season** and transitioning away from irrigation-intensive systems where there is little water.
    - **Restoring and enhancing groundwater recharge areas**, stopping polluted water from recharging groundwater, rainwater and roof top harvesting and the restoration of ponds, lakes and other river systems.
  - **Micro-irrigation techniques:**
    - Encouraging farmers to adopt micro-irrigation techniques such as drip irrigation and micro-sprinklers.
    - According to the NITI Aayog's CWMI report, adopting **micro-irrigation techniques can save roughly 20% of the groundwater** used annually on irrigation in India.
  - **Curbing subsidies:**
    - An analysis of panel data across 370 districts in India found that a reduction in electricity subsidy was correlated with a decrease in groundwater extraction.
  - **Technology:**
    - Technical expertise from countries which have managed their

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groundwater resources well like Israel, Japan etc.

- **Proper implementation of initiatives:**
  - 12th five-year plan proposed a policy of **participatory groundwater management (PGM)**, which involves a collaborative approach among government departments, researchers, NGOs and community members.
  - Government has come up with a Rs. 6,000-crore World Bank-aided **Atal Bhujal Yojana** with community participation to ensure sustained groundwater management in overexploited and ground water-stressed areas in seven States.
  - **World Bank's Water Scarce Cities Initiative** seeks to promote an integrated approach to managing water resources and service delivery in water-scarce cities as the basis for building resilience against climate change.
- **Awareness Generation:**
  - Behavioural changes that promote conservation and adoption of efficient water use practices to reduce ground water use for irrigation
  - Successful community-based groundwater management experiences from different states like Andhra Pradesh, Maharashtra, Gujarat and Rajasthan must also be studied.

15. Methanol Based Economy

- Methanol is the future of fuel in India.
- The methanol economy is a future economy in which **methanol and dimethyl ether replace fossil fuels** as a means of energy storage, transportation fuel, and raw material for synthetic hydrocarbons and their products.
- Across the world, methanol is emerging as a clean, sustainable transportation fuel of the future.
- **Why Methanol Based Economy:**
  - Methanol is a **clean burning drop in fuel** which can replace both petrol & diesel in transportation & LPG, Wood, Kerosene in cooking fuel.
  - Methanol Economy is the "Bridge" to the dream of a complete **"Hydrogen based fuel systems".**
  - Methanol is a scalable and sustainable fuel, that can be produced from a variety of feedstocks like Natural Gas, Coal, Bio-mass, Municipal Solid waste and CO2.
  - Methanol can be a major market in India, besides helping us **reduce oil imports by 20%.**
  - The development of methanol-based technology could **turn energy-importing India into an energy-exporting country.**
  - The gaseous version of Methanol can blended with LPG and can be excellent substitute for diesel in large buses and trucks.
  - To adopt Methanol as a transport fuel, it requires **minimal infrastructure modifications and capital.**
  - Methanol can be stored economically over a long time and command a higher value in the commodities market.
- **International Practice**
  - Methanol Economy is being actively pursued by China, Italy, Sweden, Israel,

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US, Australia, Japan and many other European countries.
    - 10% of fuel in China in transport Sector is Methanol. China alone produces 65% of world Methanol and it uses its coal to produce Methanol.
    - The Technology has acquired commercial maturity and countries like Iceland are producing in meaningful quantities already.
    - Israel, Italy have adopted the Methanol 15% blending program with Petrol.
- **India's First Methanol-based Cooking Fuel**
    - The **Namrup-based Assam Petrochemicals Limited (APL)** rolled out the **country's first methanol-based cooking fuel project**- 'Green and Clean Fuel Pilot Project on **Methanol Cooking Stove'.**
    - This is seen as India's first step towards realising the concept of "methanol economy".
    - The project has been promoted by NITI Aayog.

16. Protecting India's Wetlands

- Wetlands are defined as: "lands transitional between terrestrial and aquatic eco-systems where the water table is usually at or near the surface or the land is covered by shallow water".
- **Wetlands are important, both economically and ecologically**; providing food, water, livelihood, fisheries, birdlife, controlling floods, and acting as a natural filter for groundwater.
- Significant socio-economic values include constant water supply, fuelwood, medicinal plants, agriculture, energy resource, wildlife resource, transport, recreation and tourism.
- Wetlands are also important as a **genetic reservoir** for various species of plants including rice.
- **Threats to wetlands**
    - The world has already lost 35% of its wetlands since 1970.
    - We lose wetlands three times faster than forests.
    - India has nearly 30,000 wetlands of which we are losing 2-3% each year.
    - The Punjab State Administration was recently pulled up by the courts for allowing illegal construction near the Harike Wetlands, a designated Ramsar Site.
    - In the latest census, Ernakulam district in Kerala saw a drop of 37% in waterbirds as its wetlands face continued threats from road construction and waste dumping.
    - There is **no National Wetland Policy,** which is a requirement under the Ramsar treaty obligation by India.
    - Several water bodies of Delhi NCR have either been encroached upon or turned into garbage dumps.
    - Most of the wetlands in the urban areas are under threat.
    - The loss of wetlands leads to environmental and ecological problems, which have a direct impact on the socio-economic benefits of the associated populace.
    - Climate change and sea level rise could also affect wetlands.
- **Conservation of wetlands**
    - Showing an early commitment to protecting wetlands, India became one of the first signatories to the **Ramsar Convention** in 1981.

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- The good work in **Chilika** continues and today it is the **largest wintering ground for migratory birds** on the subcontinent.
- India has identified 115 sites as **wetlands of national importance** so far, and the maintenance of these sites is funded through the MoEFCC.
- **National Wetland Conservation Programme (NWCP),** a MoEFCC scheme under which funds are allocated to wetland site management, and asking the states to identify wetlands of importance in their state for such management.

- **Wetlands (Conservation and Management) Rules, 2017**
  - In September 2017, India adopted the Wetlands (Conservation and Management) Rules, 2017.
  - It **prohibits conversion of wetland for non-wetland uses**, setting up of industries near wetlands, and waste dumping into the water.
- **Way Forward**
  - With the level of urbanisation likely to increase from 30% to 50% in the next decade, a legal framework to protect these wetlands and their catchments are urgently needed
  - There is enough evidence, both internationally and at home, that **involving citizens**, especially those who live near wetlands—is a good way to achieve conservation success.
  - This helped in reviving the **Mangalajodi Wetland** located at the northern edge of Chilika.
  - Focussing on directing CSR funds towards protecting wetlands could also be useful.
  - The database of wetlands in India is not complete and money needs to be invested in groundwork and diligent survey of wetland areas across the country.
  - It is therefore necessary to notify the wetlands, clearly demarcating the wetland boundary and zone of influence of the wetlands.
  - The Government of India should **enact a wetland conservation act**, on the lines of the Forest Conservation Act, 1980.
  - The government ought to become a facilitator, while society should become caretaker of wetlands.

17. Natural Capital and its Preservation

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

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the year overshoots the earth's capacity to regenerate it, has advanced every year at an alarming rate.

- A recent study shows that **India will become water scarce by 2025.**
- Within a century, our **food production could see a loss of 10-40%** if these trends continue.
- **Crossing the limits of Natural Capital Stocks:**
    - Scientists have identified **nine earth system processes** which mark the safe zones, beyond which there is a risk of 'irreversible environmental change'.
    - **Four of these boundaries have now been crossed**
        - Climate change.
        - Loss of biosphere integrity.
        - Land system change.
        - Altered biogeochemical cycles, such as phosphorus and nitrogen cycles.
    - This means that **human activity has altered the balance of a few delicate equilibriums**.
    - The effects are: changing weather patterns, accelerated extinction events for both flora and fauna, and global warming.
- **Ecological collapse** can soon come, examples being the **Darfur region in Sudan and countries in the Horn of Africa**. All were subject to **rapid socio-economic decline.**
- Integrating natural capital assessment and valuation into our economic system is critical to usher in a truly sustainable future for India.
- India should seek to **publish "green GDP" figures** that take into account depreciation of natural capital stock due to economic exploitation and environmental degradation. This can follow the template provided by the **UN's System of Environmental-Economic Accounting.**

18. Fighting Forest Fires

- According to **Global Forest Watch**, India has witnessed a **125% spike in forest fires** between 2015 and 2017.
- About 70% forest fires in India occur in the tropical dry forests encompassing scrub, savannah grassland, and dry and moist deciduous forests.
- Forest fires are caused by **Natural causes** as well as **Man-made** or anthropogenic causes.
- **Human-made forest fires** in the Himalayan states of Uttarakhand and Himachal Pradesh have been a regular and historic feature.
- The Himalayan forests, particularly, Garhwal Himalayas witness major fire incidents.
- In 2017, **23 out of 33 states and union territories** reported an increase in forest fires with maximum number of forest fires were reported in Madhya Pradesh followed by Odisha and Chhattisgarh.
- Fires are a major cause of **forest degradation** and have wide ranging adverse ecological, economic and social impacts.
- Forest fires are usually seasonal. They usually start in the dry season and can be prevented by adequate precautions.
- **Government Programmes for Forest Fire Management:**
    - **National Plan for forest fire management**
    - **Forest Fire Prevention & Management Scheme (FFPMS)**

Environmental Pollution

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1. Plastic Pollution

- The **Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal** was created to protect people and the environment from the negative effects of the inappropriate management of hazardous wastes worldwide. Around 180 governments recently agreed on a new UN accord to regulate the export of plastic waste, some eight million tonnes of which ends up in the oceans each year.
- The accord is a crucial first step towards stopping the use of developing countries as a dumping ground for the world's plastic waste, especially those coming from rich nations.
- **India** has won global acclaim for its **"Beat Plastic Pollution"** resolve declared on World Environment Day last year, under which it pledged to eliminate single-use plastic by 2022.
- **India has made progress in its efforts to reduce plastic waste:**
    - The **Plastic Waste Management Rules, 2016** are clear that producers, importers and brand owners must adopt a collect-back system for the plastic they introduce into the environment.
    - **Voluntary initiatives** are having an impact in many States, as citizens reduce, reuse and sort their waste.
    - In 2016, **Sikkim banned usage of packaged drinking water** in government offices and government events. Second, it banned the use of Styrofoam and thermocol disposable plates and cutlery in the entire state.
- Waste plastic from packaging of everything from food, cosmetics and groceries to goods delivered by online platforms remains unaddressed.
- Small producers of plastics are facing the ban, while more organised entities covered by the Extended Producer Responsibility clause continue with business as usual.
- The **Solid Waste Management Rules, 2016**, mandate ULBs to set up facilities for processing sorted dry waste. However, the implementation has been rather bleak, owing to available land/space concerns.
- **Dangers posed by Plastic pollution:**
    - The recycling efforts are failing to keep pace with production.
    - Current standard water treatment systems do not filter out all of the microplastics.
    - It is creating an **environmental crisis** comparable to climate change.
    - Cattle and other animals unknowingly consume some of this plastic material which is not digested, end up with painful death. This will have an impact for the farmers and on the Indian economy.
    - Pollutants also upset primary food production in waterbodies by preventing the entry of sunlight into water.
    - Plastic pollution in beaches also impact tourism.
    - The ban on plastic carry bags below 40 microns in many states has not yielded the desired results.
- **Way forward:**
    - ULBs could a take cue from cities like Bangalore where dry waste collection centres have not only been established but also have a self-sustainable

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business model.
    - It is imperative to develop a phase-wise implementation of the EPR programme with yearly targets and a system of nationwide offsets and credit to ensure effective implementation of the rules.
    - **International examples:**
        - The success of imposing a plastic bag fee has also been established in cities like Chicago and Washington, showing that such interventions could be effective in shaping behaviour change.
        - The European Union is mulling new laws to ban some everyday single-use plastic products including straws, cutlery and plates citing plastic litter in oceans as the concern prompting the action.
    - **Encouraging plogging:**
        - Picking up litter while jogging or strolling was kick-started on a small scale in a small part of Stockholm about an year ago, it has spread across the globe and India can adopt this as well.
    - **Stop using single use plastic:**
        - The Government of the state of Maharashtra has announced an ambitious ban of plastic bags, water bottles and other disposable plastic items in the state after the state civic bodies started facing serious problems on garbage disposing and its management.
    - With a worldwide crisis due to plastic waste, India has to involve all the stakeholders take the responsibility of ensuring minimisation, reuse and recycling of plastic to the maximum.
    - **Eco-friendly substitutes** (cloth/paper/jute bags, leaves/areca leaf plates, paper straws) should be developed.
- **"Polluter pays":** Governments must start charging the producers for their waste, which will lead to recovery and recycling.
- **Developing a circular economy** of plastics requires the participation of everyone across the entire value chain and the long term commitment of businesses, governments, and communities. Example: The **Alliance to End Plastic Waste (AEPW),** comprising about 30 companies, pledged over $1 billion to eliminate plastic waste across the world.
- **Marine plastic pollution** is a "planetary crisis," and we should hope for a "Paris-style" global treaty aimed at tackling it. We cannot transform our world into a 'plastic planet'. What is needed is collective public effort to stop plastic pollution and safeguard our ecosystem/biodiversity.

2. Microplastics

- Microplastics are small plastic particles in the environment that are generally smaller than 1mm down to the micrometer range. Microplastics can be formed by **fragmentation of large plastic waste material**.
- Microfibres from washing of textiles, microbeads used in cosmetics and even paint from land run-offs can dump microplastics in the ocean. According to a 2017 International Union for Conservation of Nature (IUCN) report, microplastics are estimated to constitute up to 30% of marine litter polluting the oceans.
- **Concerns posed by Microplastics:**
    - Microplastics **escape the filtration and treatment processes** for waste water and end up in sites of nature.

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- This is resulting in significant **global impacts on wildlife** from marine environment pollution.
- Microplastics are found in the viscera of dead sea birds, reptiles like turtles, whales etc.
- It holds the potential for both **bioaccumulation and biomagnification**.
- Once the microplastics enter foodchain, they carry synthetic chemical compounds such as PCBs and PAHs, which are carcinogenic.
- Unlike POPs (Persistent Organic Pollutants) or chlorofluorocarbons (CFCs), Plastic pollution has received little attention in terms of international agreements.
- **Microplastics make up 94 percent** of an estimated 1.8 trillion pieces of plastic in the patch. But that only amounts to eight percent of the total tonnage.

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

3. Desertification

- Desertification is the degradation of land in arid, semi-arid and dry sub-humid areas. It is caused primarily by human activities and climatic variations.
- It occurs because dryland ecosystems, which cover over one-third of the world's land area, are extremely vulnerable to overexploitation and inappropriate land use.
- **United Nations Convention to Combat Desertification (UNCCD)** is the sole legally binding international agreement linking environment and development to sustainable land management.
- **UNCCD Estimate of Desertification:**
  - **Land & Drought:**
    - India has witnessed increase in the level of desertification in 26 of 29 states between 2003-05 and 2011-13, according to the State of India's Environment (SoE) 2019 in Figures.
  - **Land & Human Security:**
    - By 2045 some 135 million people may be displaced as a result of desertification.
    - Achieving **land degradation neutrality** -by rehabilitating already degraded land, scaling up sustainable land management and accelerating restoration initiatives.
  - **Land & Climate:**
    - Restoring the soils of degraded ecosystems has the potential to store up to 3 billion tons of carbon annually.
    - Its rehabilitation and sustainable management are critical to

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combating climate change.

- **UNCCD 2018-2030 Strategic Framework**: It is the most comprehensive global commitment to achieve Land Degradation Neutrality (LDN) in order to restore the productivity of vast expanses of degraded land, improve the livelihoods of more than 1.3 billion people, and reduce the impacts of drought on vulnerable populations to build.
- **Way forward:**
    - **Lessons from the world:**
        - In Africa, several countries have come together to form a 12,000 sq.km **"great green wall"** extending from Senegal to Djibouti with the participation of local communities.
        - **People's participation** is crucial in reclaiming lands. China's "great green wall" project is on a massive scale and is now starting to show results.
    - National governments could consider building large green belts, prioritise forestry programmes and launch projects of fixing and stabilising sands.

4. Global Environment Outlook (GEO-6)

- The sixth edition of the Global Environment Outlook (GEO-6) from the UN Environment Programme (UNEP) on the theme "**Healthy Planet, Healthy People"** was released recently.
- It painted a dire picture of a planet where environmental problems interact with each other to make things even more dangerous for people.
- The report concludes '**unsustainable human activities** globally have degraded the Earth's ecosystems, endangering the ecological foundations of society.'
- The report details climate change impacts on human health, air, water, land and biodiversity.
- **Key highlights of the report:**
    - A quarter of all premature deaths and diseases worldwide are due to manmade pollution and environmental damage.
    - There is a growing chasm between rich and poor countries as rampant overconsumption, pollution and food waste in the developed world leads to hunger, poverty and disease elsewhere.
    - The top 10% of populations globally, in terms of wealth, are responsible for 45% of GHG emissions, and the bottom 50% for only 13%.
    - Nearly 1.4 million people die each year from preventable diseases with lack of access to clean drinking supplies. For instance, diarrhoea and parasites linked to pathogen-riddled water and poor sanitation
    - **Air pollution** alone causes 6-7 million early deaths annually.
    - **Species extinction rates** also continue to increase at a pace that could compromise Earth's ability to meet human needs, the report says.
- **Way forward for India:**
    - Every other international environmental report showed that India will be the most hit due to climate change.
    - Now, the GEO report on environmental damage causing health emergencies is another thing that the country should worry due to **its burgeoning population and weak public healthcare sector.**
    - By emphasising on "synergies" between "the efforts to meet climate change

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targets and policies to reduce air pollution, this is particularly significant for India, whose Paris Climate Treaty commitments rely heavily on a shift to renewable energy (RE).
    - Steps like **India Clean Air Program (ICAP),** Ayushman Bharat should be strengthened to tackle the challenges arising.

5. India's Carbon emissions

- India emitted 2,299 million tonnes of carbon dioxide in 2018, a 4.8% rise from previous year, according to a report by the **International Energy Agency (IEA).**
- India's emissions growth this year was higher than that of the United States and China — the two biggest emitters in the world — and this was primarily due to a **rise in coal consumption**.
- **Global energy consumption** in 2018 increased at nearly twice the average rate of growth since 2010, driven by a robust global economy and higher heating and cooling needs in some parts of the world.
- **The government of India has taken the following steps to reduce the carbon emissions:**
    - India has doubled the **Clean Energy Cess on coal**, which very few countries have, and the **Clean Energy Fund** already has over 3 billion US dollars to be used for promoting clean technologies.
    - India's **National Solar Mission** is being scaled up five-fold from 20,000 megawatts to 100,000 megawatts. This will mean an additional investment of 100 billion dollars and savings of about 165 million tonnes of CO2 emissions per year.
    - India has allocated about 200 million US dollars for **the 'National Adaptation Fund',** setting-up of Ultra Mega Solar Projects, Ultra-Modern Super Critical Coal Based Thermal Power Technology, and the development of Solar Parks on canals.
    - The "**100 Smart Cities'** with integrated policies for adaptation and mitigation to reduce the vulnerability and exposure of urban areas to climate change.
    - **Crop diversification programme** under Rashtriya Krishi Vikas Yojana (RKVY), National Food Security Mission (NFSM) and Bringing Green Revolution to Eastern India (BGREI).
    - Increasing the area under **System of Rice Intensification (SRI)** as an alternative to the widely used practice of transplanted paddy.
    - India has initiated preparations to develop a National Air Quality Index and have launched a National Air Quality Scheme.
- According to a recently released **Greenpeace report**, **139 Indian cities** breached air pollution standards. **The Lancet report** in December 2018 said **1.2 million deaths of Indians in 2017 could be attributed to air pollution**.
- National Clean Air Policy proposes a framework to achieve a **national-level target of 20-30 per cent reduction of PM2.5 and PM10 concentration by between 2017 and 2024**.

6. Failure of environmental laws in India

- 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.

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- The systems of **accountability have been weakened, so** monitoring is a huge problem.
- **India is ranked 177th out of 180 countries in the 2018 Global Environment Performance Index (EPI) rankings** for being unable to improve its air quality, protect its biodiversity, and cut its greenhouse gas emissions.
- **Air pollution:-**
    - India has highest number of cities which violate the threshold of healthy air limits
    - **Coal-based power plants** continue to be the major source of air pollution in the country as more than 300 coal thermal power plants still violate emission standards.
- **Wildlife:-**
    - Despite laws to protect wildlife protection, **poaching and illegal trade** of wild animals is a common practise till date. Also rise in **man animal conflict** is an indicator of lack of proper implementation of the laws.
- More than two-thirds of the states/union territories in the country have neither bothered to comply with the orders passed by the Supreme Court, nor complied with the directions given by the Ministry of Environment, Forests and Climate Change (MoEF&CC).
- **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.
- 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".

7. E-Waste

- e- Waste is technically all waste electrical and electronic equipment (WEEE) discarded without the intent of use.
- A recent UN report titled **'A new circular vision for electronics'** warned that 'Tsunami of e-waste' was to hit the world soon. The report notes that the waste stream has already reached 48.5 million tonnes (MT) in 2018 and the figure is expected to double if nothing changes.
- In India, e-Waste accounts for 70% of the landfills. (2011 Rajya Sabha Secretariat Study).
- Globally, only up to 20% of e-waste is recycled.
- In India, e waste accounts for 4% of global e-waste and 2.5% of global GDP (2014 figures) – so it has a higher share of e-waste than its share of gross domestic product (GDP).
- The **informal sector manages about 95% of the e-Waste in India**. Due to the informal and crude processing techniques, the soil, water and air are polluted to a beyond-repairable level. Example: Moradabad and Seelampur.

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- The **poor implementation of Extended Producer Responsibility** as mandated under e-Waste Management Rules, 2016 is another challenge.
- The **export of e-Waste from developed countries** is another growing problem despite regulations under Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and Their Disposal.

8. Marine Ecological Crisis

- Across the globe, marine habitats are in a state of dramatic decline.
- **SDG14 pertains to conservation and sustainable use of oceans, seas and marine resources**.
- The world's waters have absorbed more than 93 per cent of the enhanced heating from climate change since the 1970s and drastically altering the rhythm of life in the ocean.
- According to a recent study by the Wildlife Conservation Society, **only 13 percent of the planet's oceans are untouched by human activity.**
- Marine ecologists observe that Human activity has managed to negatively affect almost the entire global ocean ecosystem.
- According to recent estimates, roughly 90 percent of the world's fish stocks are now fully fished, overfished, or depleted.
- Climate change has only made matters worse, altering water temperature and biogeochemistry, displacing fish stocks from their natural habitats. The global fishing economy is on the "verge of collapse".
- **Case of South Asia**
    - In South Asia, the **most significant damage** to natural habitats has been in the **Bay of Bengal**.
    - India's coastal regions are witnessing their most rapid expansion of plastic pollution in recent years.
    - The Indian government's fisheries subsidies program has led to **overcapacity and overfishing in India's seas**, resulting in a significant rise in illegal fishing.
    - A report warns that the Indian Ocean may be reduced to an ecological desert, given the levels of ocean warming.
- **Way Forward**
    - One remedy for shrinking habitats is the **establishment of protected spaces.**
    - The United Nations believes that **setting aside sanctuaries in the oceans** will help improve the state of fish stocks and the health of marine habitats.
    - Governments must recognize **sea life preservation as a universal developmental goal.**
    - UN and the governments must consider bringing **conventions for beating plastic pollution** at the global level like Montreal protocol for CFC.
    - It is our responsibility to ensure that our future generations live in a clean and green planet, in harmony with nature.

9. Ocean Acidification

- Ocean acidification is an emerging global problem.
- Around a third to a half of the CO2 released by human activities is absorbed into the oceans which has a direct, chemical effect on seawater, which we call ocean acidification.

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

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Climate Change

1. Climate change

- Climate change is any significant **long-term change in the expected patterns of average weather of a region** (or the whole Earth) over a significant period of time.
- Climate change is inextricably linked with society, economics, politics, and people's way of life.
- Global warming above pre-industrial levels has touched about 1 degree Celsius.
- The recent IPCC's "Special Report on Global Warming of 1.5°C" revealed that the impacts and costs of 1.5 degrees Celsius of global warming will be far greater than expected.
- The Intergovernmental Panel on Climate Change says a **1.5°C average rise may put 20-30% of species at risk of extinction**. If the planet warms by more than 2°C, most ecosystems will struggle. Coral reefs are projected to decline by a further 70-90% at 1.5°C.
- The IPCC 1.5 report basically says, at the current rates at which we are producing greenhouse gases, we are looking at a couple of decades really before what we have available is exhausted.
- IPCC said that climate change could have **"irreversible" and "catastrophic" impacts** if the global average temperatures were allowed to rise beyond 2 degrees Celsius.
- At one level, for many people climate change has become an **existential problem**, a problem that risks undermining the conditions for productive life and therefore a problem that does not override but certainly permeates all kinds of other issues.
- For many others, climate change is a distant problem that is overwhelmed by more immediate issues.
- Sea levels have risen between four and eight inches in the past 100 years. Current projections suggest that sea levels could continue to rise between 4 inches and 36 inches over the next 100 years.
- The **World Health Organization** estimates that climate change is causing tens of thousands of deaths every year.
- Experts predict that by 2030, climate change will cause an additional 250,000 deaths each year from malaria, diarrhoeal disease, heat stress and undernutrition alone.
- **Climate change lengthens the transmission season and expands the geographical range of many diseases like malaria and dengue**.
- *The **Climate Adaptation Management and Innovation Initiative** of the Word Food Programme develops climate-induced food insecurity analyses and practices to inform programming and decision-making.*
- **Climate refugees** can be found all over the world, displaced by coastal flooding in Dhaka, by hurricane Maria in Puerto Rico, or due to the desertification of Lake Chad in West Africa.
- It is estimated that the number of people seeking asylum in the European Union due to climate change would see a 28% increase by 2100.
- International Centre for Integrated Mountain Development's (ICIMOD) "**Hindu Kush Himalaya Assessment**" reveals that more than 35 per cent of the glaciers in the region could retreat by 2100, even if the global temperature rise is capped at 1.5º C.
- **Coral reefs would decline** by 70-90 percent with global warming of 1.5°C, whereas

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virtually all (> 99 percent) would be lost with 2°C.

- **Is the 1.5°C target attainable?**
  - The IPCC report suggests possible pathways to attain the 1.5°C objective.
  - It would involve much **sharper and quicker emission cuts by big emitters** like China, the US, the European Union and India.
  - These pathways are likely to be heavily dependent on the success of **carbon removal technologies.**
  - No such technology exists yet, but several possibilities are being explored.
- **Challenges in addressing climate change:**
  - **Regional Inequality:**
    - The **indifferent behaviour by the developed countries** has led to partial success of many global initiatives. Eg. Kyoto Protocol.
  - **Developed Countries not taking responsibility:**
    - Developed nations are unwilling to accept the responsibility and are moving away from global agreements. Eg. USA rejecting the Paris deal.
  - **Finance:**
    - Electric mobility, certainly is a green measure, but is actually expensive, in immediate terms, in terms of cost per vehicle kilometre.
  - **Technology:**
    - Commercialization of technology in form of Patents, evergreening has made it unaffordable.
- **Case Study:** A scientific study of wind farms in the Western Ghats, a UNESCO-listed range of mountains and forest spanning India's west coast, found that predatory raptor birds were four times rarer than in adjacent areas. Their absence cascaded down the food chain and radically altered the density and behaviour of the birds' prey. There was, in particular, an explosion in the raptors' favourite meal: fan-throated lizards.
- **Way Forward**
  - To limit ourselves to 1.5°C, global net **anthropogenic CO2 emissions should reduce** by about 45 per cent from 2010 levels by 2030, and should reach net-zero around 2050.
  - **Use of coal should reduce steeply** and its share in electricity mix should be reduced to close to 0 per cent by 2050.
  - Real emission reductions can be achieved through a combination of new and existing technologies, including **sustainable bio-based feedstocks**, product substitution, and **carbon capture, utilisation and storage (CCUS).**
  - Wealthy nations like the U.S., and those of the EU argued that emissions from developing countries are consistently rising and they need to commit to more serious emission cuts. A consensus needs to be developed at the earliest.
  - The immediate up scaling of ambition in the s**econd Commitment period of Kyoto Protocol** and its early ratification by all Kyoto Protocol parties would be a step in the right direction.
  - Concerning mitigation, distinction enshrined in the Convention between Annex I (Developed) and non-Annex I (developing) Parties must be maintained in accordance with the principles of Equity, CBDR and other provisions of the UN Conventions.
- **Concept of Green Financing in India:**
  - In India the concept of **green financing is nascent.**

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- Measures to **encourage green-bonds** could help raise finances needed **to "green" India's economy.**

2. India's risk profile due to climate change

- India ranks fifth globally for the losses it has experienced due to climate change.
- India is ranked 14th on the **Global Climate Risk Index 2019.**
- With **rain-fed agriculture** practised in **over 67% of our total crop area**, weather variability can lead to heavy costs, especially for coarse grains (which are mostly grown in rain-fed areas).
- According to one estimate, they may face a **24-58% decline in household income** and **12-33% rise in household poverty** through exacerbated droughts.
- India has over 120 million hectares suffering from some form of degradation.
- Rise in average temperatures would significantly impact our kharif crops.
- Any significant decline in summer rains would devastate Indian agriculture.
- Around 800 million people in the country live in villages and depend on agriculture and natural resources for their livelihoods. **With at least 50% of the farmlands in the country being rain-fed, changes in the pattern of the monsoons will affect their livelihoods the most.**
    - There has been a recorded decline in monsoon rainfall levels since 1950. And it is suspected that 2°C rise in world's temperature will make India's monsoon even more unpredictable.
- Due to climate change, 15% of **India's groundwater resources are damaged,** and falling water table is suspected to deal a severe blow in progress of agriculture.
- **Economic:-**
    - India will be among the worst hit countries that may face wrath of calamities like **floods and heatwaves, and reduced GDP.**
- There will be manifold increase in the **severe heatwave frequency** and population affected in India if the global mean temperature rises to or beyond 1.5 degree by the end of the century.
- Limiting global warming to 1.5 degree compared with 2 degree would reduce challenging impacts on ecosystems, human health and well-being, making it easier to achieve the United Nations Sustainable Development Goals.

3. Impact of Climate Change on Food Production

- Climate change is adversely affecting the production of key crops such as wheat and rice, with some countries faring far worse than others. This is as per research, published in the journal PLOS ONE.
- The study found that about half of all food-insecure countries are experiencing decreases in crop production — and so are some affluent industrialised countries in Western Europe.
- Crops like soybean and gram are likely to benefit from higher level of CO2 in atmosphere, which helps in CO2 fertilisation.
- A recent study of global vegetable and legume production concluded that if greenhouse gas emissions continue on their current trajectory, yields could fall by 35 percent by 2100 due to water scarcity and increased salinity and ozone.
- **Climate change will not only affect crops—it will also impact meat production, fisheries and other fundamental aspects of our food supply**.

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- **Heat waves**, which are expected to become more frequent, **make livestock less fertile and more vulnerable to disease**. Dairy cows are especially sensitive to heat, so milk production could decline.
- Aquaculture of fresh water species is also affected by sea level rise as saltwater can move upstream in rivers.
- For example, in the Mekong Delta and Irawaddy region of Vietnam and Myanmar, the booming catfish aquaculture could be affected by saltwater intrusion.
- **Groundwater:**
    - About 10 percent of the crops grown in the world's major food production regions are irrigated with groundwater that is non-renewable.
    - Aquifers are being drained faster than they're refilling—a problem which will only get worse as the world continues to heat up.
    - This is happening in major food producing regions such as the U.S. Great Plains and California's Central Valley, and in Pakistan, India, northeastern China, and parts of Iran and Iraq.
- **Impacts on India's agriculture profile due to climate change:**
    - India is fortunate to have the monsoon, but it is also uniquely vulnerable to rising temperatures.
    - With **rain-fed agriculture** practised in **over 67% of our total crop area**, weather variability can lead to heavy costs, especially for coarse grains (which are mostly grown in rain-fed areas).
    - The World Bank report warned that by the 2040s, India would see a significant reduction in crop yields because of extreme heat
    - Any significant decline in summer rains would devastate Indian agriculture. Climate change related phenomena have consequences, especially for marginal farmers.
    - They potentially face a huge decline in household income and rise in household poverty through exacerbated droughts.
    - As agriculture contributes 16 per cent to India's GDP, climate change causes about 1.5 per cent loss in GDP.
    - According to 2018 Economic Survey, India incurs losses of about $9-10 billion annually due to extreme weather events. It also noted farmers' income losses from climate change would be between 15 % and 18 % on an average
- **Way forward:**
    - **Increasing area under permaculture** could result in a total reduction of gigatons ofCO_2, from both sequestration and reduced emissions.
    - Applying Farm yard Manure, compost or by practising organic farming to improve the soil organic matter which can help in improvement of soil health.
    - Develop climate-smart agriculture practices.
    - Adoption of **Zero Budget Natural Farming (ZBNF) and Organic farming**.
    - Promoting Drought / temperature tolerant varieties and water saving paddy cultivation methods (**System of Rice Intensification (SRI)**).
    - Investment in R&D is needed to spur innovations in sustainable climate-friendly and climate-proof productivity, and the private sector can help on this.

4. Climate change and Hunger

- According to the United Nations' annual food security report 2018, World hunger has

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risen for a third consecutive year. **Climate Change is among the leading causes of rising global hunger**. 60 million people are facing a food crisis but the public has not heard about it.

- The 2015/16 'super El Niño', combined with climate change, brought severe droughts and flooding to people in the Horn of Africa, Southern Africa, Central America, Asia, the Caribbean and the Pacific.
- **Relationship between climate change and hunger:**
  - Agriculture is one of the industries most exposed and vulnerable to climate change.
  - Crops and livestock are extremely sensitive to temperature and precipitation.
  - With climate change, people face shortage of water and food, resulting in **increased competition to access these basic necessities**. This increases the chances of the intensification of existing conflicts and also creates new ones.
  - Such conflicts affect the poor the most, and further lead to an increase in poverty and displacement, pushing people into a vicious trap.
  - Frequent floods and droughts caused by climate change lead to **food shortages and rise in food prices.** This causes hunger and malnutrition, the effects of which are felt most strongly by the poor.
  - Rising sea levels, extreme weather events and prolonged drought force millions of people to move away from home every year in search of food, water and jobs.
  - Gradual changes brought on by deforestation, overgrazing and drought slowly transform pastures to dust, destroy crops and kill livestock, effectively challenging the livelihoods of millions of farmers
- **Way forward:**
  - **Curbing food loss, improving nutrition and promoting sustainable production systems** must be prioritized.
  - Food-producing nations will need creative policies and new technologies to meet these challenges successfully.
  - The efforts should include **reforestation** which would reduce the impact of extreme events fuelled by warming of the surrounding oceans and neighbouring lands.
  - To limit global warming, countries will have to **change policies in sectors like land, energy, industry, buildings, transport, and urban development**.
  - **Public funding for agricultural research and development** must be increased and the developed countries must transfer the technology to the developing and low-income nations.
  - **Precision agriculture** can leverage computers, global positioning systems, geographic information systems and sensors to provide the data necessary to give each tiny parcel of land on a field exactly the inputs it needs.
  - **Nanotechnologies** can also help improve how fertilizers and pesticides are released. By putting chemical inputs into tiny capsules or in gels, it is possible to control when and how these inputs are released to make them more effective, and at the same time reduce chemical emissions and runoff.

5. Declaring Climate change as International security

- The idea of declaring Climate change as International security issue is based on the rationale that the effects of climate change will lead to violence in near future. The

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conflicts over water, food or energy will become more common and many people will be forced from their homes. The UNSC believes that the move will help heighten public awareness and even help in surmounting opposition. However, India has questioned the rush at the UN to declare climate change an international security issue, potentially giving the Security Council the right to take action on it.

- India supports cooperation and action that are consistent with the principle of common but differentiated responsibilities to prevent and address serious disasters linked to climate. **The idea of designating climate change effects as security issue needs to deliberated and well-thought out to ensure climate equity and climate justice to all.**

6. Green New Deal

- Green New Deal (GND) is a set of proposed economic stimulus programs in the United States that aim to address climate change and economic inequality.
- The GND "is a four-part programme for moving America quickly out of crisis into a secure, sustainable future".
- The Green New Deal combines Roosevelt's economic approach with modern ideas such as renewable energy and resource efficiency.
- The Green New Deal is an acknowledgement by politicians that **economic growth, the environment and social well-being go together.** It acknowledges the responsibility of the U.S. for its historical emissions and pushes to work for the climate equity and climate justice.

7. Heatwaves

- Heat wave is a period of abnormally high temperatures, more than the normal maximum temperature that occurs during the pre-monsoon (April to June) summer season.
- According to Indian Meteorological Department, Heat wave is considered if maximum temperature of a station reaches at least 40°C or more for Plains, 37°C or more for coastal stations and at least 30°C or more for Hilly regions.
- **Effects:**
    - India lost nearly 75 billion hours of labour in 2017 as a result of rising temperatures. This made sustained work increasingly difficult and negatively affecting workers' output.
    - The **agriculture sector experienced the largest increase in labour loss**.
    - Since 1990, every region of the globe has become steadily more vulnerable to extreme increases of heat.
- **State actions towards Heat waves:**
    - **Andhra Pradesh** has strong inter-agency coordination across multiple departments.
    - **Telangana** developed one of the first **state-wide heat action plans** in 2016. The state is now integrating the heat action plan with its action plan on climate change.
    - **Odisha** has declared heat waves as a state specific disaster.
    - Ahmedabad, Nagpur and Odisha have made pioneering efforts with respect to **heat-health warning systems (HHWS).**
    - **Ahmedabad Municipal Corporation (AMC)** has adopted a heat action plan which necessitates measures such as building heat shelters, ensuring

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availability of water and removing neonatal ICU from the top floor of hospitals.

- **Way forward:**
  - In 2016, the National Disaster Management Agency prepared guidelines for state governments to formulate action plans for the prevention and management of heat waves, outlining four key strategies:
    - Forecasting heat waves and enabling an early warning system
    - Building capacity of healthcare professionals to deal with heat wave-related emergencies
    - Community outreach through various media
    - Inter-agency cooperation as well as engagement with other civil society organizations in the region.
  - **Scientific Approach:**
    - Climate data from the last 15-20 years can be correlated with the mortality and morbidity data to prepare a heat stress index and city-specific threshold.
    - Vulnerable areas and population could be identified by using GIS and satellite imagery for targeted actions.
  - Advance implementation of **local Heat Action Plans**, plus effective inter-agency coordination is a vital response which the government can deploy in order to protect vulnerable groups.
  - This will require identification of "**heat hot spots**", analysis of meteorological data and allocation of resources to crisis-prone areas.
  - The **India Cooling Action Plan** must emphasize the urgency and need for better planning, zoning and building regulations to prevent Urban Heat Islands.

8. A New Weapon in the Carbon Fight

- There has been a renewed interest in understanding how **soils can serve as a sink for carbon dioxide** since atmospheric concentrations of carbon dioxide have crossed 410 parts per million and oceans are already turning acidic.
- Increasing soil carbon offers a range of co-benefits and this would buy us time before other technologies can help us transition to a zero-carbon lifestyle.
- **Storing the carbon contained in organic matter within the soil is seen as one way to mitigate climate change** by reducing greenhouse gas emissions (in this case carbon dioxide).
- **What is soil organic carbon?**
  - Soil organic carbon (SOC) comes from plants, animals, microbes, leaves and wood, mostly found in the first metre or so.
  - In the presence of climate change, land degradation and biodiversity loss, **soils have become one of the most vulnerable resources** in the world.
  - Soils are a major carbon reservoir containing more carbon than the atmosphere and terrestrial vegetation combined.
  - The Intergovernmental Panel on Climate Change (IPCC) provides guidelines for measuring, reporting and verifying national SOC stock inventories.
- As an indicator for soil health, SOC is important for its contributions to food production, mitigation and adaptation to climate change.
- Maintaining SOC storage at equilibrium or increasing SOC content towards the

optimal level for the local environment can contribute to achieving the SDGs.

- If managed wisely, they have the potential to **sequester large amounts of carbon** in their soils, thus contributing to climate change mitigation and adaptation.

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9. Ecological perils of discounting the future

- Once the wettest place on Earth, **Cherrapunji,** a town in northeastern India, has **faced a drought each winter** for the past few years.
- Kerala, a state in the southwest, **flooded devastatingly** in 2018, but saw its wells run dry soon after.
- **Chennai,** a growing south-Indian metropolis, was **inundated by rains in 2015**—but this summer, **three of its four reservoirs run dry**.
- Meanwhile, across India, the groundwater that provides an invaluable buffer between monsoons is severely depleted and in danger of **being irreversibly lost**.
- In a report last year, the **Comptroller and Auditor General of India (CAG)** called the **Chennai floods of 2015 a "man made disaster",** a pointer to how the encroachment of lakes and river floodplains has driven India's sixth largest city to this ineluctable situation.
- The Chennai floods are a **symbol of consistent human failings and poor urban design** which are common to most urban centres in India if not urban centres across the world. Now, Chennai is in the midst of another crisis, one of water scarcity.
- In Chennai, **more than 30 waterbodies** of significance have **disappeared** in the past century.
- **Concretisation** or the increase in paved surfaces has **affected the percolation of rainwater into the soil**, thereby depleting groundwater levels to a point of no return.
- Urbanisation at the **cost of reclaiming water bodies** is a pan-India if not worldwide phenomenon.
- **The Telangana example:**
    - The government of Telangana launched a **massive rejuvenation movement** in form of **"Mission Kakatiya"** which involves the **restoration of irrigation tanks and lakes/minor irrigation sources** built by the **Kakatiya dynasty**.
    - From the perspective of inter-generational justice, this is a move towards giving future generations in the State their **rightful share of water** and, therefore, **a life of dignity.**
    - The city of Hyderabad is now moving towards a **sustainable hydraulic model** with some of the best minds in the country working on it.
    - This model **integrates six sources of water** in a way that even the most underdeveloped areas of the city can **have equitable access** to water resources and the **groundwater levels restored** in order to avoid a calamity of the kind that has gripped Chennai now.
- **Learning the Success models to protect our Ecology:**
    - Why should other urban centres shy away from **adopting, remodelling and implementing** some of the best water management practices to avoid disaster?
    - The answer perhaps lies in the **tendency of policymakers** to discount the future and of their obsession of focussing on the here and now.
    - **Mexico City** created a new executive position of a **"resilience officer"** to save its sinking urban sprawls.

- **Bengaluru** can **reclaim Kundalahalli lake** (once a landfill) through **corporate social responsibility funds** in a Public Private Partnership model.
- Hyderabad and the larger state of Telangana **rebuild its resilience** through a combination of political will and well-designed policies such as the Kaleshwaram Lift Irrigation Scheme and Mission.

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Miscellaneous

1. India Cooling Action Plan

- **India is the first country in world to develop India Cooling Action Plan** which addresses cooling requirement across sectors and lists out actions which can help reduce the cooling demand.
- The overarching goal is to provide sustainable cooling and thermal comfort for all while securing environmental and socio-economic benefits for the society.
- **Environmental and Socio-Economic benefits:**
    - **Thermal comfort for all** – provision for cooling for Economically Weaker Section (EWS) and Low Income Group (LIG) housing
    - **Sustainable cooling** – low GHG emissions related to cooling
    - **Doubling Farmers Income** – better cold chain infrastructure – better value of produce to farmers, less wastage of produce
    - **Make in India** – domestic manufacturing of air-conditioning and related cooling equipment.
    - **Robust R&D on alternative cooling technologies** – to provide a push to innovation in the cooling sector.
- ICAP is about improving the quality of life and productivity of the people of India, and achieving many of the Sustainable Development Goals (SDGs) — thus accelerating the country's growth trajectory.

2. Global Coalition for clean cooling

- The first-ever global coalition on clean and efficient cooling was launched at the recently held First Global Conference on Synergies between the 2030 Agenda and Paris Agreement in Copenhagen, Denmark.
- Clean, efficient cooling appliances and equipment can save up to $2.9 trillion in energy use by 2050, and help avoid 0.4° Celsius warming of the planet.
- The **global demand for cooling is growing** at a rapid pace as unprecedented temperatures peaks have been increasing every year.
- Throughout the world, 2018 was the fourth hottest year, preceded by 2017, 2015 and 2016.
- Already, the world's 30 percent of the population face potentially dangerous temperatures for more than 20 days in a year. Heatwaves cause 12,000 deaths annually.
- Millions of people are at risk today from extreme heat and need equal protection from both increasing temperature and increased carbon emissions due to the increasing use of cooling units, irrespective of their economic status.
- In the upcoming next 20 years, India's cooling requirement will increase by around 8 times, with AC alone consuming more than half of the total energy required for cooling in the country by 2037-38.
- **Global efforts for clean cooling:**
    - **The Global Cool Coalition**
        - The Global Cool Coalition is a unified front that links action across the Kigali Amendment, Paris Agreement and Sustainable Development Goals. It is expected to inspire ambition, identify solutions and

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mobilise action to accelerate progress towards clean and efficient cooling.

- **Kigali Amendments:**
  - The Kigali Amendment introduced in 2016, was the first modification to the Montreal Protocol (now ratified by 197 countries) to monitor substances that did not contribute to ozone depletion.
  - In January 2019, the Kigali Amendment to the Montreal Protocol started phasing down these gases, known as hydrofluorocarbons (HFCs).
- **Montreal Protocol:**
  - In 1987, the **Montreal Protocol on Substances that Deplete the Ozone Layer** was introduced, the first international policy effort to protect the ozone.
  - This treaty called for the **phase out of ozone-depleting compounds** like chlorofluorocarbons and hydrochlorofluorocarbons (HCFCs).
  - This proved to be a major success for the restoration for the ozone layer, which is expected to return to 1980 coverage around 2050.

- **Indian efforts:**
  - **National Cooling Action Plan:**
    - India has already developed a national cooling action plan that was launched by the Union environment ministry in March this year.
    - The plan acknowledges that "there is an immense potential to rationalize the rise in the requirement for active refrigerant-based cooling in the country by the adoption of passive cooling design strategies across sectors."
  - **International Solar Alliance:**
    - The ISA's major objectives include global deployment of over 1,000GW of solar generation capacity and mobilisation of investment of over US$ 1000 billion into solar energy by 2030.
    - This will help reduce the carbon emissions from Thermal power plants.
  - **Green India mission:**
    - GIM is one of the eight missions launched under the National Action Plan on Climate Change (NAPCC).
    - The objective of the mission is to increase green cover to the extent of 5 million hectares (mha) and improve quality of existing green cover on another 5 mha, improve eco-system services like carbon sequestration, hydrological services and biodiversity.

3. Electric vehicles and sustainable mobility

- The vision for the future of mobility in India is based on **7 Cs: common, connected, convenient, congestion-free, charged, clean, and cutting-edge.**
- Electric vehicles are the future of India's transportation system and could save billions of dollars in fuel cost while also reducing pollution, a report released by NITI Aayog said.
- It is anticipated that the 2020s will be the decade of the electric car and a step forward towards a clean environment for the next generation.
- Electric vehicles are cleaner than petroleum-fuelled vehicles and are seen as a promising solution to global warming.

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- According to a research, 90 per cent of India's car owners would willingly switch to electric cars, with proper infrastructural support.
- The government aims for 30 per cent electric mobility by 2030
- **Pros of Electric Vehicles:**
    - Adoption of electric and shared vehicles could help country save $60 billion in diesel and petrol along with cutting down as much as 1 gigatonne (GT) of carbon emissions by 2030. It will help in achieving the target of "Paris climate agreement".
    - Electric cars are entirely charged by the electricity, meaning there is no need to buy any fuel ever again.
    - Electric cars are 100 percent eco-friendly as they run on electrically powered engines
    - **Reducing the carbon footprint** and positively affecting the economy.
    - Electric cars put **curb on noise pollution** as they are much quieter.
- **Cons of Electric Vehicles:**
    - Lack of attention on building charging infrastructure.
    - An electric car takes about 4-6 hours to get fully charged. Therefore there is a need for dedicated power stations as the time taken to recharge them is quite long.
    - Cities already facing acute power shortage are not suitable for electric cars.
    - The consumption of more power would hamper their daily power needs.
    - The primary reason for the current high prices of EVs is the expensive battery.
- **International Practice**
    - In Norway one in three vehicles (33.1%) registered is plug-in electric.
    - China and US account for more than half of electric cars in the world.
    - China's auto industry is rapidly turning all-electric.
    - China plans to have 500,000 public charging piles in place by the end of 2020.
    - UK and France are targeting towards 100% electric cars by 2040.
- **Way forward:**
    - For EVs to contribute effectively, we need commensurate efforts in developing an entire ecosystem.
    - Need to shift the focus from subsidizing vehicles to **subsidizing batteries** because batteries make up 50% of EV costs.
    - Increasing focus on incentivizing electric two-wheelers because two-wheelers account for 76% of the vehicles in the country and consume most of the fuel.
    - A wide network of charging stations is imminent for attracting investment.
    - Work places in tech parks, Public bus depots, and Multiplexes are the potential places where charging points could be installed. In Bangalore, some malls have charging points in parking
    - Corporates could invest in charging stations as **Corporate Social Responsibility** compliances.
    - Addressing technical concerns like AC versus DC charging stations, handling of peak demand, grid stability etc.
    - **Private investment in battery manufacturing plants** and developing low cost production technology is needed.
    - India is highly dependent on thermal sources, which account for about 65% of current capacity. As EV adoption increases, so should the contribution of renewables.

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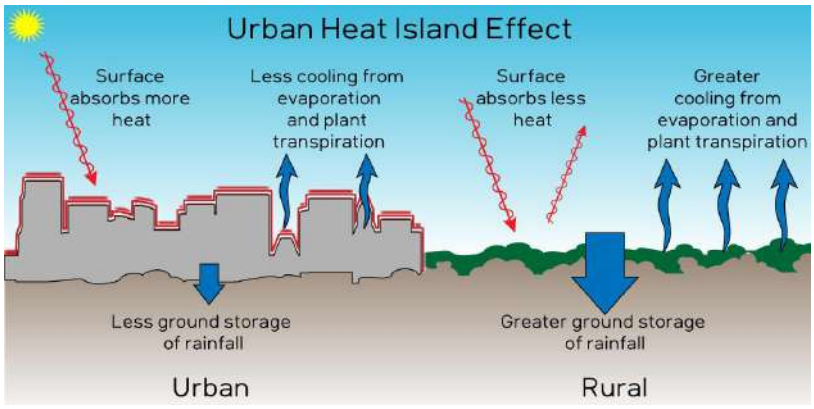
- Need for a **policy roadmap on electric vehicles** so that investments can be planned.
- **Acquiring lithium fields** in Bolivia, Australia, and Chile could become as important as buying oil fields as India needs raw material to make batteries for electric vehicles.
- Providing waiver of road tax and registration fees, GST refunds and free parking spaces for EVs.

4. The Urban Heat Island Effect



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

5. Economic Growth and its Impact on Environment

- Economic growth has **positive impacts** like increase in wealth/reduction in poverty, improved standards of living, health, education and infrastructure and technology.
- However there are **negative effects** like health challenges, increase in income inequality, increased pollution and a depletion of natural resources.
- Economists concerned about sustainable development advocate low levels of economic growth since large expansions in national income may have negative environmental consequences such as pollution.
- Large economic growth adversely affects the environmental quality and economic welfare of individuals and households.
- **Environmental Kuznets Curve (EKC):**

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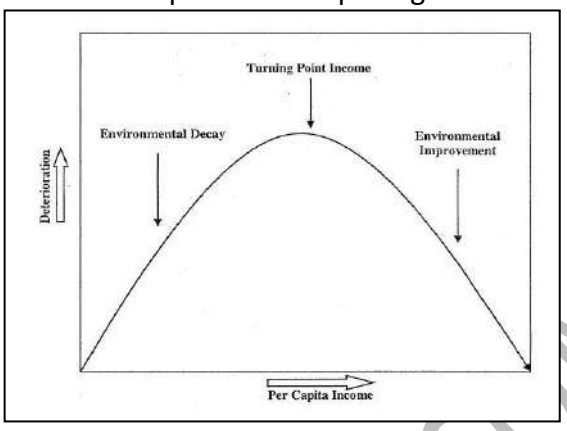
- The EKC hypothesis is shown in an inverted U-shaped curve depicting the relationship between per capita income and environmental deterioration.
- In reality, the EKC is a near myth since an increase in per capita income does not bring desirable levels of improvement to the environment.
- Empirical evidence across countries reveals that various attempts to increase per capita income cause more environmental deterioration.



- A 2013 World Bank study highlighted that in India, a higher level of economic growth maintained in the past imposed ₹3.75 trillion worth of environmental damage cost.
- Another study by the World Bank has found that India's air pollution alone caused welfare loss equivalent to 7.69% of its GDP in 2013.
- Development policies give more priority to income and employment generation, implementation of pollution control policies is very poor.
- Ex: pollution control measures implemented in the bleaching and dying units in Tiruppur, Tamil Nadu, for more than 25 years did not achieve any pollution reduction.
- Increased output and demand increases the value of GDP, but the corresponding environmental damage cost is not adjusted in the GDP estimation.
- **Our policy should not be based on the "pollute-first; clean-up-later" approach.**
- A large number of poor people are dependent on the environment for their day-to-day activities and therefore more focus on improved environmental quality can push income growth on a sustainable basis.
- The future "wars" to protect our environment require a new **"coalition of the willing"** as the problem we face is as much local as it is global.
- The time has indeed come to add "swachh paani" and "hawa" to "roti-kapada-makaan-aur-bijli", to begin our journey towards sustainable growth.