CIVIL SERVICES EXAMINATION
focus
RAU'S HOUSE JOURNAL

SPECIAL EDITION

EXHAUSTIVE CURATION using C3 Approach

TO THE POINT

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Practice MCQs

PRELIMS COMPASS 2022

C3 = CORE+**CURRENT AFFAIRS**+related CONCEPTS

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Since 1953

ENVIRONMENT, ECOLOGY & BIODIVERSITY

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Preface Environment, Ecology and Biodiversity

Dear Learner,

Since 2013, the weight of geography, environment, ecology and biodiversity has increased significantly. The reason is the fact that prelims of the civil services exam and the Indian Forest Services exam is clubbed together. Now in the current scheme of things around 15 to 20 questions in the prelims exam are from these topics.

There is lack of good quality and updated study material and hence, when we designed the booklet for these topics, we tried to make it as a one stop solution for all your civil services exam needs. Needless to say, that this book is written with the philosophy of Core, Current and Concept and hence, it will solve almost all of your exam related needs. It is updated with latest facts and figures and even if you have not studied anything else then this book can act as your reference as well as revision source.

In order to get the maximum benefit of these booklets, you must club these with the Quality Improvement Program conducted by Rau's IAS. This will ensure that you will give your best performance in the coming prelims exam.

All the best!!!

Rau's IAS Study Circle

Themes asked in Prelims Exam in the last Three Years

GEOGRAPHY		
PRELIMS 2021 - TOPICS	**PRELIMS 2020 - TOPICS**	**PRELIMS 2019 - TOPICS**
1. Tributaries of Indus	1. Ocean mean temperature	1. Summer Solstice
2. Saline Lakes	2. Siachen Glacier	2. Water reservoirs in news
3. Rivers that rise from Eastern ghats	3. Ground Water - Authority	3. Dewdrops
4. Ocean - Tropics Temperature Characteristics	4. Jet Streams, Cyclones	4. International Sea - bordering countries
5. Tropical Rain Forest	5. International Rivers	5. Glacier - River
6. Water on Earth		
7. Savannah Grasslands		
8. Black Cotton Soil		

ENVIRONMENT		
PRELIMS 2021 - TOPICS	**PRELIMS 2020 - TOPICS**	**PRELIMS 2019 - TOPICS**
1. R2Code - Electronics Waste	1. Benzene pollution	1. 'Extended producer responsibility'
2. Pollutants from Copper Smelting Plants	2. Desert national park	2. Compensatory Afforestation Fund Act, 2016
3. Furnace Oil	3. Largest area under critical Tiger Habitat	3. Indian Forest act 1927 , FRA 2006
4. Pioneer Species	4. Schedule 6 WPA 1972	4. Environment protection act 1986
5. Natural Mosquito Repellant - Grass	5. Social Cost of Carbon	5. Solid waste management rules 2016
6. Primary producers	6. Indian Elephants	6. Cirrus cloud thinning technique and the injection of sulphate aerosol into stratosphere
7. Animals - Behaviour - Pangolin, Hedgehog	7. Protected Areas in Cauvery River Basin	7. 'Pyrolysis and plasma gasification'
8. New York Declaration on Forests	8. Birds - Biodiversity in news - Ceylon frogmouth	8. Agasthyamala Biosphere Reserve
9. Filter Feeder - Oyesters	9. Indian Swamp deer(Bara Singha) - Found in which areas	9. Species - Herbivorous, viviparous etc

10. Bio-Geochemical Cycle	10. Steel Slag	10. Wildlife - Natural habitat - Mahseer, Dolphin etc
11. Detritivores	11. Musk Deer - Habitat	11. Microbeads
12. Common Carbon Metric	12. Environmental sustainability in rural road construction	12. National park in temperate alpine zone - valley of flowers
13. Symbiotic Relationship between organisms	13. Coal Pollution	13. Green house gases released by - cattle, soils, Poultry
14. Rare Earth Metals	14. Biochar	14. Hydrogen-enriched CNG (H-CNG) as fuel - Alternative fuels
15. Morringa, Tamarind		15. Himalayan nettle (Girardinia diversifolia)
16. Blue carbon		16. Forest Cover
		17. Methane Hydrates
		18. Pollutants by burning of crops/Biomass
		19. Carbofuran, methyl parathion, phorate and triazophos - Pesticides
		20. Ramsar Convention

BASICS OF ECOLOGY

►ECOLOGY

Branch of biology concerned with relations of organisms to one another (energy flow & mineral cycling) and to their physical surroundings (environment). Ecology encompasses study of individual, organisms, population, community, ecosystem, biome & biosphere which form the various levels of ecological organization.

►ENVIRONMENT

Environment is biotic (living organisms) & abiotic (non-living organisms) surrounding of an organism or population. It includes factors that have an influence in their survival, development and evolution. Environment is our basic life support system. It provides the air we breathe, the water we drink, the food we eat and the land where we live.

►ECOLOGICAL HIERARCHY/ LEVELS OF ORGANIZATION

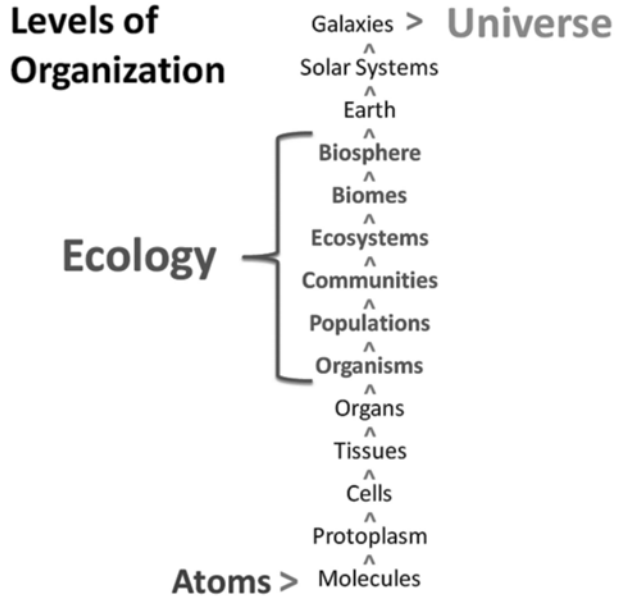
Cell is the basic unit of life in any living organism, likewise, an individual/organism is the smallest unit of interaction or existence in ecological arena.

Organism or single individual: An organism is a single individual or being. Ex. an elephant in Kaziranga.

Species: Group of single individuals having potential to inter-breed & produce fertile offspring. Ex. Entire elephant population.

Population: It is a group of individuals of a plant or an animal species inhabiting a given area. Ex. All Elephants of Kaziranga form population of elephants in that area.

Biological community: Assemblage of populations of plants, animals, microbes and all other life forms living in a particular area and interacting with each other for fulfilment of needs. Ex. Elephants+ rhino+ bacteria+ other wild animals and plants of Kaziranga. Biological community does not involve interactions of living beings with abiotic /physical environment.



Ecosystem: Composed of biological community, integrated with its physical environment through exchange of gases, energy & recycling of nutrients. Ecosystem involves interactions between living and non-living worlds or biotic and abiotic worlds.

Landscape: A unit of land with a natural boundary having a mosaic of patches representing different ecosystems. Ex. a view of river, its valley & grasslands nearby from a mountain top with three different ecosystems in one picture.

Biome: A large regional unit characterized by major vegetation types and associated fauna/animal life, found

in specific climatic zone. Ex. Tropical rain forests of Western Ghats form a typical biome with characterized vegetation of mahogany, ebony, rosewood etc. accompanied with animal life of Malabar civet, Nilgiri Tahr etc. and climatic conditions of high rainfall, high humidity and higher temperatures.

Biosphere: On a global scale, all the earth's terrestrial biomes & aquatic systems constitutes the biosphere. It includes lower atmosphere, land, oceans & rivers etc. where living organisms can be found. So, biosphere is the biologically inhabited part of earth along with its physical environment.

BIOTIC INTERACTION			
Interactions	**Species A**	**Species B**	**Examples**
Mutualism/ Symbiotic	+	+	• Leguminous plants and nitrogen fixing bacteria • Process of pollination in plants.
Commensalism	+	0	• Remoras eating leftover food of the shark without depleting shark's resources.
Amensalism	–	0	• Shading out of one plant by a taller and wider one. • Allelopathy - inhibition of one plant by the secretions of another.
Parasitism	+	–	• Mosquitoes, ticks, and the protozoan that causes malaria.
Competition	–	–	• Lion and tiger in the same niche.
Predation	+	–	• Lion and zebra, bear and fish, and fox and rabbit.

►FOOD CHAIN & FOOD WEB

- Food chain: Linear sequence of organisms through which nutrients & energy pass as one organism eats another. In a food chain, each organism occupies a different trophic level, defined by how many energy transfers separate it from the basic input of the chain.
- Food Web: Consists of many interconnected food chains & are more realistic representation of consumption relationships in ecosystems.
- Producers or autotrophs: Make their own organic molecules or food.
  - Photoautotrophs: Use energy from sunlight to make organic compounds—sugars—out of carbon dioxide in photosynthesis. Ex. Plants. There are two gateways of photosynthesis C3 and C4.
  - C3 Mechanism: Majority of plants uses C3 mechanism of photosynthesis, in which the first carbon compound produced contains 3 carbon atoms. However, loss of water vapour through stomata leaves C3 plants at a disadvantage in drought and high-temperature environments. Photorespiration in this mechanism makes the process less efficient. (Photorespiration: During photosynthesis sometimes in place CO_2, oxygen attached with Rubisco, this makes C3 photosynthesis less efficient). They do not have no bundle sheath cells. Ex. Rice.
  - C4 Mechanism: In this mechanism, a four-carbon compound is produced. There plants have a unique leaf anatomy allowing CO_2 to concentrate in 'bundle sheath' cells. This removes the possibility of photorespiration and loss of water molecule. Ex of C4 plants: Maize, Sugarcane & Sorghum.

Engineering plants for Climate Change

1. Resisting disease: For ex. Banana streak disease
2. Supercharging photosynthesis: Scientists have proposed engineered Rubisco and incorporation of C4 photosynthesis in C3 plants for making plants tolerant to dry and hotter climate.
3. Shrinking stems: shorter crops are sturdier and do not fall in the face of strong winds. For ex. shorter wheat varieties developed by Norman Borlaug & shorter corn varieties being developed.
4. Improving and increasing root formation: Roots can be elongated to make them capture more nutrients.

  - Chemoautotrophs: Use energy from chemicals to build organic compounds out of carbon dioxide or similar molecules. This is called chemosynthesis.

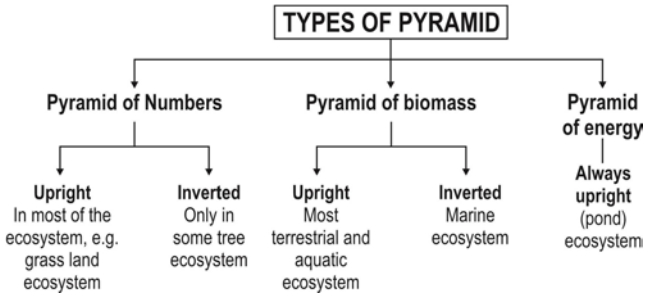
- Consumers or heterotrophs, get organic molecules by eating other organisms. They are of two types:
  - Macro Consumers (feed on plants/animals or both)
  - Micro Consumers (Saprotrophs - Decomposers)

TYPES OF FOOD CHAIN

- Grazing food chain
  - It starts from living green plants goes to grazing herbivores and on to carnivores.
  - Ecosystems with such type of food chain are directly dependent on an influx of solar radiation.
  - Most ecosystems follow this type of food chain.
  - Ex. Phytoplankton's →zooplanktons →Fish sequence or the grasses →rabbit →Fox.
- Detritus food chain
  - It goes from dead organic matter into microorganisms and then to organisms feeding on detritus and their predators.
  - Such ecosystems are less dependent on direct solar energy.
  - These depend chiefly on influx of organic matter produced in another system.
  - Ex. Food chain operating in accumulated litter in a temperate forest.
  - Ex. Earthworms, crabs, slugs or vultures.

►ECOLOGICAL PYRAMIDS

A graphical representation of the relationship between different organisms in an ecosystem.



►BIO-GEOCHEMICAL CYCLE

- A pathway by which a chemical substance moves through biotic (biosphere) & abiotic (lithosphere, atmosphere & hydrosphere) compartments of Earth.
- Type of biogeochemical cycle: Gaseous & sedimentary
- In gaseous type of biogeochemical cycle, there is a prominent gaseous phase. Cycling of carbon and nitrogen represents gaseous biogeochemical cycles.
- In sedimentary cycles, main reservoir is lithosphere from which nutrients are released largely by weathering of rocks. The sedimentary cycle is exemplified by phosphorus and sulphur.
- Biogeochemical cycles are either perfect or imperfect.
- A perfect nutrient cycle is one in which the nutrients are replaced as fast as they are used up. Most gaseous cycle's arc generally considered perfect.
- In contrast, sedimentary cycles are considered relatively imperfect, as some nutrients are lost from the cycle into soil and sediments & become unavailable for immediate cycling.

►ECOLOGICAL NICHE

- It represents the range of conditions an organism can tolerate, the resources it utilizes and its functional role in the ecological system.
- A habitat may contain many ecological niches and support a variety of species.
- Each species has a distinct niche, and no two species are believed to occupy exactly the same niche.

►EDGE EFFECT AND ECOTONE

- Edge effect is an ecological concept that describes how there is a greater diversity of life in the region where the edges two adjacent ecosystems overlap, such as land/water, or forest/grassland.
- Ecotone is a transition area between two biomes. It is where two communities meet and integrate. For ex -
- Grassland (between forest and desert)
- Estuary (between fresh water and salt water)
- Riverbank or Marshland (between dry and wet)
- Mangroves (b/w terrestrial & marine ecosystems)

►SENTINEL SPECIES

- They are organisms, often animals, used to detect risks to humans by providing advance warning of a danger. They serve as indicators of ecosystem health.
- Ex. Canaries are birds die early in odourless Carbon Monoxide environment is present in a high concentration, this gives miners time to escape.

►ECOLOGICAL SUCCESSION

- A process of directional change in vegetation on an ecological time scale. In this process, a series of communities replace one another due to large scale natural or anthropogenic destructions.

TYPES OF ECOLOGICAL SUCCESSION

- Primary Succession: When a terrestrial site is first colonised by the pioneer species.
- Secondary Succession: Sequential development of biotic communities after disturbance/destruction
- Examples of succession:

  Terrestrial: Bare rocks – Lichens -- Annual Plants -- Perennial Plants and Grasses – Shrubs – Softwood Tress, Pines – Hardwood trees
- Hydrosere: Phytoplankton – Submerged plant – Submerged free-floating plant – Reed swamp (Sedge) – Marsh meadow – Scrub - Forest

SERAL COMMUNITY (SERE)

An intermediate stage found in ecological succession in an ecosystem advancing towards its climax community.

►GLOBAL BIOMASS CENSUS

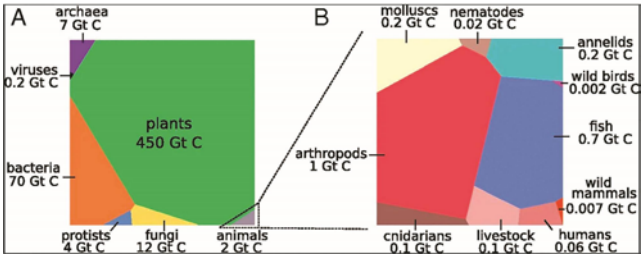
A global biomass found that there are ≈550 gigatons of carbon (Gt C) of biomass distributed among all of the kingdoms of life in the biosphere.

Plants are the dominant kingdom (≈450 Gt C) and are primarily terrestrial, whereas animals (≈2 Gt C) are mainly marine, and bacteria (≈70 Gt C) and archaea (≈7 Gt C) are predominantly located in deep subsurface environments.

Terrestrial biomass is about two orders of magnitude higher than marine biomass at approximately 6 Gt C of marine biota, although their NPP is roughly the same.

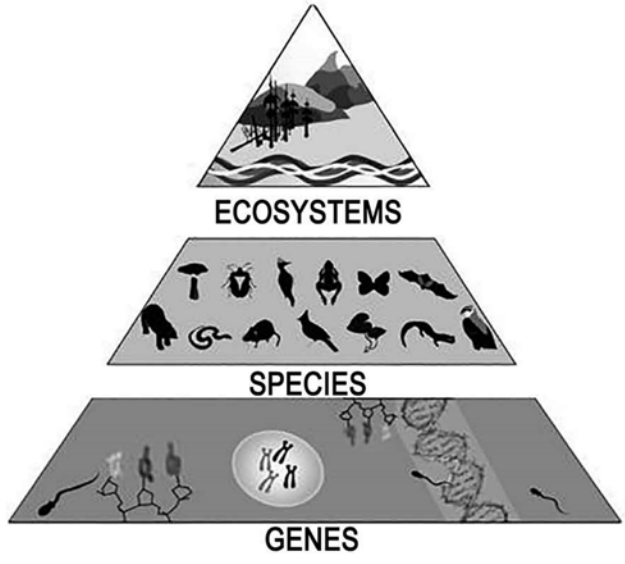
Human biomass (≈0.06 Gt C) and biomass of livestock (≈0.1 Gt C, dominated by cattle and pigs) is far greater that the biomass of wild mammals today (≈0.007 Gt C).

The same is true for wild and domesticated birds. The biomass of domesticated poultry (≈0.005 Gt C, dominated by chickens) is about threefold higher than that of wild birds (≈0.002 Gt C).



►BIODIVERSITY

- Biodiversity or Biological diversity is a term that describes the variety of living beings on earth. In short, it is described as degree of variation of life. Biological diversity encompasses microorganism, plants, animals and ecosystems such as coral reefs, forests, rainforests, deserts etc.
- Levels of Biodiversity: There are generally three levels of biodiversity: genetic, species and ecosystem. These levels are all interrelated yet distinct enough that they can be studied as three separate components.



►INVASIVE SPECIES

An alien species is a species introduced by humans – either intentionally or accidentally - outside its natural past or present distribution, however not all alien species have negative impacts. It is these species that are termed '*Invasive alien species*' (IAS).

IMPACT

- Driver of biodiversity loss
- Leads to changes in structure & composition of ecosystems leading to detrimental impact on ecosystem services and humans.

COMMON INVASIVE SPECIES OF INDIA

FLORA	FAUNA
• Prosopis juliflora • Water Hyacinth • Snowflake Corals • Lantana	• African apple snail • Papaya Mealy Bug • Amazon sailfin catfish

FLAGSHIP SPECIES	INDICATOR SPECIES	KEYSTONE SPECIES
Species chosen to represent an	Species whose presence	It is a species whose addition

environmental cause, such as an ecosystem in need of conservation.	indicates, presence of a set of other species and health of ecosystem.	or loss to an ecosystem will lead to major changes in the ecosystem.
Chosen species could be either vulnerable/ attractive/ distinct.	Ex. A species might indicate presence of environmental pollution or arrival of monsoon etc.	As certain species are considered more important in determining the presence of other species.
Ex.: Indian Tiger, African Elephant, Giant Panda of China, etc.	Ex.: Lichens (air quality), most amphibians, fishes, etc.	Ex.: Top predator tiger, lion, crocodile etc. Their removal will distort existing food chains.

CORALS

►CORAL REEFS

- They are the most biologically diverse ecosystems of the planet. They are formed when Coral polyps, the animals primarily responsible for building reefs, develop a symbiotic relationship with photosynthetic algae called zooxanthellae, which live in its tissues.
- Coral reefs begin to form when free-swimming coral larvae attach to submerged rocks or other hard surfaces along the edges of islands or continents.
- The coral provides a protected environment and the compounds zooxanthellae needs for photosynthesis.
- In return, the algae produce carbohydrates that the coral uses for food, as well as oxygen. The algae also help the coral remove waste.

FAVOURABLE CONDITIONS FOR FORMATION

- Warm tropical oceans with minimum temperature of 20 degree (30 degree north and 25^{o} south latitudes)
- Oceanic water free of sedimentation.
- Transparent parts of ocean bodies.
- Relatively low salinity ocean bodies

TYPES OF REEF FORMATIONS

- Fringing reefs: Most common, project seaward directly from the shore, forming borders along shoreline & surrounding islands.
- Barrier reefs: Grow at border shorelines, but at greater distance. They are separated from adjacent landmass by lagoon of open, often deep water.
- Atoll: If a fringing reef forms around a volcanic island that subsides completely below sea level while coral continues to grow upward, an atoll forms. Atolls are usually circular or oval, with a central lagoon.

DISTRIBUTION IN INDIA

- Gulf of Kutch: Represent northern limits of corals in Indian Ocean.
- West Coast of India
- Lakshadweep Islands: They are coral islands.
- Gulf of Mannar
- Palk Bay
- Andaman & Nicobar Islands

THREATS

Ocean Acidification, Ocean Warning, Destructive fishing practices, Overfishing, Careless tourism, Pollution, Sedimentation, Coral mining, Climate change.

IMPORTANT CORAL TYPES

- Fire corals are one of the rarest and most endangered species of corals.
- Snowflake coral is an invasive species of coral which has a capacity to dominate space and crowd out other marine organisms.
- Mesophotic corals: They are types of corals which can survive in low light environments. They can grow at greater depths. They normally grow between 30 and 40 meters and up to 150 meters in tropical and subtropical water.

►GLOBAL FUND FOR CORAL REEFS

- A $500 million blended finance instrument to mobilise action & resources to protect and restore coral reef ecosystems with two windows: (i) Grant Window & (ii) Investment Window
- It blends private and public funding and will also support businesses and finance mechanisms.
- It has a dual focus: to facilitate the uptake of innovative financing mechanisms, including private market-based investments focused on coral reef conservation and restoration. Two, to unlock financing for coral reef-related climate adaptation through the Green Climate Fund, Adaptation Fund, and multilateral development banks.
- It is a joint initiative of Private Philanthropies & UN organisations such as UNEP, UNDP, and UN Capital Development Fund etc.

►CORAL REEF PROTECTION

BIO-ROCK TECHNOLOGY

Zoological Survey of India is trying to restore coral reefs in Gulf of Kachchh by using Bio-rock process, to grow solid limestone rock structures in the sea.

Steel structures (to which coral fragments are fixed) are lowered onto the seabed → low voltage, safe electrical currents are passed to the structure using a power source → dissolved minerals crystallize on steel structures → resulting in production of calcium carbonate (CaCO3) or white limestone structures.

- Their composition is like that of natural coral reefs and tropical sand beaches.
- Strength of bio-rock is like to concrete.
- Only marine construction that grows, gets stronger with age and is self-repairing.

HOW BIOROCK HELPS IN CORAL REEF RESTORATION?

- Corals adhere to lime ($CaCO_3$) structures and grow at rapid pace as they need not spend their energy in building their own calcium carbonate skeletons.
- The technology also helps corals to counter the threats posed by global warming.

OTHER APPLICATIONS OF BIOROCK TECHNOLOGY

Marine Construction; Protection against Beach Erosion; Adaptation to sea level rise; Oyster Reef restoration; Sea Grass Restoration; Salt Marsh Restoration; Fisheries Restoration; Sustainable Aquaculture

►ANGRIA BANK

- A shallow submerged atoll island located 100 miles off western coast of India. Located off the coast of Ratnagiri & Sindhudurg districts, Maharashtra. This site has potential to be known as India's Great Barrier Reef.
- Corals reefs have been found here. The peculiarity of coral reefs present here is that it is in the middle of ocean, unlike other corals which are either coastal in nature like Gulf of Mannar or A&N island corals which are island corals.
- Angria Banks falls outside territorial waters but inside EEZ of India. Thus, it cannot be protected under Wildlife Protection Act. The area can be conserved under Maritime Zones Act.

►WETLANDS

- Transition zones between terrestrial and aquatic ecosystems. Ex. Mangroves, Lake littorals (marginal areas between highest & lowest water level of the lakes), floodplains (areas lying adjacent to the river channels beyond the natural levees and periodically flooded during high discharge in the river) & other marshy or swampy areas.
- These habitats experience periodic flooding from adjacent deep-water habitats and support biodiversity specifically adapted to such shallow flooding or water logging.
- Waterlogged soil adapted plant life (hydrophytes) and hydric soils (not enough O_2) are the chief characteristics of wetlands.

	DESCRIPTION
Wetlands in Himalayas	• Glaciated lakes, swamps & floodplain marshes spread across Leh-Ladakh, Kashmir Valley, parts of Uttarakhand, Himachal Pradesh, Sikkim, and Arunachal Pradesh & Assam. • These wetlands support flow of rivers, act as a buffer between glacial melt waters & outflows to smaller rivers and streams. (Some of them are saline Ex. Pangong Tso) • This region is often marked by inland drainage pattern, small streams feed these lakes.
Wetlands in Desert & Semi-arid zone	• Arid zone spanning Rajasthan & Gujarat has vast saline marshes & monsoon fed freshwater lakes & reservoirs. • Ex: Rann of Kachchh & salt lakes like Sambhar, Pachpadra, Didwana & Lukransar.
Wetlands in Western Ghats	• One of the biodiversity hotspots of India. They are criss-crossed by several rivers & streams giving rise to several riverine wetlands, swamps & marshes. • Myristica swamps found in the region have abundance of Myristica trees, most primitive flowering plants on earth. The evergreen, water-tolerant trees have dense stilt roots which help them to stay erect in the thick, black, wet alluvial soil. Found in Kerala and Southern Karnataka. Swamps are typically found in valleys, making them prone to inundation during monsoon. Ex. Kulathupuzha Forests in Kerala has the largest Myristica Swamps.

Wetlands in Gangetic floodplains	Alluvial plains of river Ganges & Brahmaputra have riverine wetlands as floodplains & oxbow lakes, locally known as maun, beel, chaur and jheel. These wetlands sustain highly productive agriculture & fisheries & act as flood buffers.
Wetlands in Northeast region	Located at the junction of Indian, Indo-Malayan & Indo-Chinese biogeographic regions, north-east zone is considered as the gateway of Indian floristic and faunistic diversity. The region abounds with a number of streams, lakes, ponds, waterlogged areas and oxbows.
Wetlands in Deccan peninsula	• With a few natural wetlands, Deccan Peninsula is mostly studded with constructed tanks for providing water for various human needs. • Also serves as a nesting, feeding and breeding site for a large variety of bird species.
Wetlands in Coasts & islands	Narrow plains of the east and west coast and islands harbour a range of coastal wetlands as lagoons, salt marshes, mangroves and coral reefs. Ex. Kolleru Lake between deltas of Krishna & Godavari rivers. (Largest shallow freshwater lake in Asia).

►IMPORTANCE OF WETLANDS

- Act as "nature's kidneys" by removing polluting nutrients & sediments from surface & groundwater.
- Replenish groundwater, their filtering capacity helps to protect groundwater quality. Helps in nutrients recycling and stabilization of local climate.
- Buffer shorelines against erosion & pollutants.
- Provides habitat for wildlife & fisheries, including threatened habitats. Provides recreational opportunities for birds, amphibians and mammals.
- Acts like a sponge & helps in flood control by soaking extra water from the surroundings.
- Make surroundings fertile for growth of crops. Provides ample opportunity for fishing & other commercial activities.
- Acts as a carbon sink, soils around wetlands can store carbon for many years (climate change mitigation).
- Provides opportunities for tourism and research.

PRESERVING WETLANDS HELPS IN COMBATING CLIMATE CHANGE

- Proper use & restoration of wetland is essential to protect stored carbon & reduce avoidable carbon emissions.
- Enhance climate adaptation & resilience from extreme weathers.
- Plays vital role in retaining water on the landscape, maintaining local climate, water cycles and reducing temperature extremes.
- Provides ecological, cultural & socio-economic benefits to the society.
- Wetlands contribute to human wellbeing through provision of food, energy and clean water, support to livelihoods and biodiversity.

Thus, protecting and restoring wetlands for climate mitigation and adaptation reflects a key tenet of Ramsar's Strategic Plan and represents progress towards meeting the Sustainable Development Goals and the Paris Agreement on Climate Change.

►RAMSAR CONVENTION

- Aim: Conservation & wise use of all wetland through local, national & international action, as a contribution towards achieving sustainable development throughout the world. Came into force in 1975.
- The only global environment treaty dealing with a particular ecosystem and wetlands.
- Definition of Wetlands: Wetlands include lakes, rivers, swamps, marshes, wet grasslands, peatlands, oases, estuaries, deltas, tidal flats, near-shore marine areas, mangroves, coral reefs, human-made sites such as fishponds, rice paddies, reservoirs and salt pans.
- Wise use is the maintenance of ecological character within the context of sustainable development.
- UK has highest number of wetlands recognized by Ramsar Convention. Bolivia has greatest area of listed wetlands.
- India has a total of 49 Ramsar sites.
- Three pillars of the Convention are:
  - Work towards the wise use of all their wetlands.
  - Designate suitable wetlands for the list of Wetlands of International Importance (the "Ramsar List") and ensure their effective management.

- Cooperate internationally on transboundary wetlands, shared wetland systems and shared species.

CRITERIA FOR STATUS OF WETLAND OF INTERNATIONAL IMPORTANCE

- Sites containing representative, rare or unique wetland types
- Sites of international importance for conserving biological diversity
- Criteria based on species and ecological communities
- Specific criteria based on waterbirds
- Specific criteria based on fish
- If a site supports 1% of population of a species.

MONTREUX RECORD

- A register of wetland sites on the List of Wetlands of international importance where changes in ecological character have occurred, are occurring, or are likely to occur because of technological developments, pollution or other human interference and therefore in need of priority conservation attention.
- It is maintained as part of the Ramsar List.

TWO MONTREUX RECORD SITES IN INDIA

- Loktak Lake (Manipur): Due to deforestation in catchment area, infestation of water hyacinth & pollution. Construction of a hydroelectric power plant has caused local extinction of several fish species.
- Keoladeo National Park: Water shortage and unbalanced grazing regime around it. The invasive growth of the grass and reducing its suitability for certain water-bird species, notably the Siberian Crane.

►WETLANDS (CONSERVATION & MANAGEMENT) RULES, 2017

MoEF&CC has notified Wetlands (Conservation and Management) Rules, 2017 (Wetlands Rules) under the Environment (Protection) Act, 1986 as framework for conservation & management of wetlands in India.

KEY PROVISIONS

- Decentralisation: The management of wetlands has been decentralized. The powers have been given to the State governments so that protection and conservation work can be done at the local level. Central government has mainly retained powers regarding monitoring.
- State or UT wetland authorities: States and UTs have been given the responsibility for wetland management by setting up State and UT Wetland Authorities (SWAs).
  - SWA's will be headed by environment minister and include other government officials as well as experts from the fields of wetland ecology, hydrology, fisheries, landscape planning and socioeconomics.

FUNCTIONS OF SWA's

- SWAs have to identify and notify the wetlands for protection within stipulated time.
- Develop comprehensive list of activities to be regulated and permitted within notified wetlands and their zone of influence.
- Recommend additional prohibited activities for specific wetlands, define strategies for conservation and wise use of wetlands, and undertake measures for enhancing awareness within stakeholders and local communities on values and functions of wetlands.
- The State authorities will also need to prepare a list of all wetlands of the State or union territory within three months, a list of wetlands to be notified within six months, a comprehensive digital inventory of all wetlands within one year which will be updated every ten years.

GUIDELINES FOR IMPLEMENTING WETLANDS (CONSERVATION AND MANAGEMENT) RULES, 2017

The guidelines clarified that all wetlands, irrespective of their location, size, ownership, biodiversity, or ecosystem services values, can be notified under the Wetlands Rules 2017, except –

- river channels
- paddy fields
- human-made water bodies specifically constructed for drinking water
- aquaculture
- salt production
- recreation
- irrigation purposes
- Wetlands falling within areas covered under the Indian Forest Act, 1927, Forest (Conservation) Act, 1980, Wildlife (Protection) Act, 1972 and the Coastal Regulation Zone Notification, 2011.
- Protected Areas and areas falling within the purview of Coastal Zone Regulation

NATIONAL WETLAND COMMITTEE

- NWC will be headed by the MoEFCC Secretary, to monitor implementation of these rules.
- NWC has a merely advisory role. These include -

- Advising central government on proposals received from states/UTs for omission of the prohibited activities.
- Prescribing norms & guidelines for integrated management of wetlands based on wise-use principle.
- Recommending trans-boundary wetlands for notification.
- Reviewing the progress of integrated management of Ramsar Convention sites.

PROHIBITED ACTIVITIES UNDER THE NEW RULES

- Conversion of wetland for non-wetland uses including encroachment of any kind,
- Setting up of any industry and expansion of existing industries.
- Manufacture or handling or storage or disposal of hazardous substances and construction and demolition waste.
- Solid waste dumping.
- Discharge of untreated wastes and effluents from industries, cities, towns, villages and other human settlements.

The Rules also restrict any kind of encroachment, poaching, or permanent construction, except for boat jetties within 50 metres of the mean high flood level observed in the past 10 years.

►WETLANDS INTERNATIONAL

- Wetlands International is a non-profit organization established in 1937 as 'International Wildfowl Inquiry'
- HQ in Netherlands.
- It is an independent, not-for-profit organization, supported by government and NGO membership from around the world.

►BIRD LIFE INTERNATIONAL

- World's largest nature conservation partnership. Together there are 120 Bird Life Partners worldwide.
- It strives to conserve birds, their habitats and global biodiversity, working with people towards sustainability in the use of natural resources.
- Bird Life International is the official Red List authority for birds, for the IUCN.
- Identifies sites referred to as 'Important Bird and Biodiversity Areas'.
- For India, the partner organisation is Bombay Natural History Society (BNHS).

IMPORTANT BIRD & BIODIVERSITY AREA

An area identified internationally by a set of criteria for the conservation of bird population. It was developed by Bird Life International. There are 12,000 Important Bird Areas worldwide.

GLOBAL IMPORTANT BIRD AREA CRITERIA

Based on the criteria, the Global Important Bird Areas are classified as follows:

A1 Category: Globally Threatened Species. The sites under this category holds bird population that are categorised as Critically Endangered, Endangered or Vulnerable by the IUCN Red List of Threatened Species.

A2 Category: Restricted Range species

A3: Biome Restricted Species

A4: Congregations

►NATIONAL RIVER CONSERVATION PLAN

- The river conservation program was initiated with the launching of the Ganga Action Plan (GAP) in 1985.
- The Ganga Action Plan was expanded to cover other rivers under National River Conservation Plan (NRCP) in the year 1995.
- The objective of NRCP is to improve the water quality of rivers, which are major water sources in the country, through implementation of pollution abatement works in various towns along identified polluted stretches of rivers on cost sharing basis between the Central and state governments.

►E-FLOW NORMS FOR RIVER GANGA

The Environmental Flows describe the quantity, timing, and quality of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems.

E-Flows are recognised as a key to the maintenance of ecological integrity of the rivers, their associated ecosystems, and the goods and services provided by them.

National Mission for Clean Ganga has laid down the flow specifications.

- The E-flow for the river is notified in order to restore and maintain continuous uninterrupted flow of river Ganga ('Aviralta').
- Accordingly, any dam or structure meant for diversion of river flows for the purpose of irrigation, hydro-

power and domestic or industrial use will now have to maintain the minimum flow under the notification.

- There are 784 dams, 66 barrages, 92 weirs and 45 functional lift schemes located, at present, in the Ganga river basin.
- Central Water Commission (CWC) is the designated authority to collect and monitor the flow data.
- The CWC further submits monitoring-cum-compliance reports on a quarterly basis to the NMCG.
- However, the norms do not apply to mini and micro projects.

BRISBANE DECLARATION AND GLOBAL ACTION AGENDA ON ENVIRONMENTAL FLOWS (2018)

The 2018 Declaration presents an urgent call for action to protect and restore environmental flows and aquatic ecosystems for their biodiversity, intrinsic values, and ecosystem services, as a central element of integrated water resources management.

►LOKTAK LAKE

Loktak Hydroelectric Project has disturbed the cycle of phumdis as it constantly keeps the water level in the lake high. As a result, *phumdis* are unable to feed from the nutrients on the bed, they are thinning out and even breaking away. (Keibul Lamjao National Park)

LOKTAK AND PHUMDIS

- Largest freshwater lake in northeast, located in Moirang, Manipur.
- It is famous for the floating biomass islands or phumdis: The phumdis float during the rains and sink during the dry months, sucking nutrients from the lakebed to replenish their roots and float again when the next monsoon cycle begins.
- The lake is a rich source of vegetation that has supported humans and animals for decades.
- Keibul Lamjao National Park lies in the heart of the lake.
- Loktak Lake is a 'wetland of international importance' under the Ramsar Convention.
- Ministry of Shipping has given approval for development for Loktak Inland water way project.

KEIBUL LAMJAO NATIONAL PARK

- It is the only floating national park in the world.
- The national park is home to the endangered brow-antlered deer, sangai, whose habitat is also under threat.

MANGROVES

►MANGROVES IN INDIA

- Mangroves are salt-tolerant plants, also called halophytes that are adapted to harsh coastal conditions of tropical and subtropical intertidal regions receiving rainfall between 1,000 to 3,000 mm and temperature ranging between 26-35°C.
- Since mangroves are located between the land and sea, they represent the best example of ecotone.
- About one third of the world's mangroves are found in Asia (39%), followed by Africa (21%) and North and Central America (15%).

ECOLOGICAL ADAPTATIONS

- Adaptations to low oxygen – By propping themselves above the water level with stilt roots and can then absorb air through pores in their bark (lenticels).
- Nutrient uptake – Pneumatophores (aerial roots) allow mangroves to absorb gases directly from the atmosphere.
- Limiting salt intake – mangroves exclude salt by having significantly impermeable roots.
- Limiting water loss – They can restrict the opening of their stomata (pores on the leaf surfaces, which exchange carbon dioxide gas and water vapor during photosynthesis).
- Increasing survival of offspring – Mangrove seeds are buoyant and are therefore suited to water dispersal.

IMPORTANCE OF MANGROVES

- Act as a Buffer Zone between the land and sea.
- Protect the land from erosion.
- Act as nature's shield against cyclones, ecological disasters and as protector of shorelines.
- Breeding and nursery grounds for a variety of marine animals.
- Harbours a variety of life forms like invertebrates, fish, amphibians, reptiles, birds & even mammals like tigers.
- Good source of timber, fuel and fodder.
- Main source of income generation for shoreline communities like fisher folk.
- Save the marine diversity, this is fast diminishing.
- Purify the water by absorbing impurities and harmful heavy metals and help us to breathe a clean air by absorbing pollutants in the air.
- Potential source for recreation and tourism.

DISTRIBUTION OF MANGROVES IN INDIAN SUBCONTINENT	
Sundarbans, West Bengal	Largest single block of tidal halophytic mangrove in world. Famous for Royal Bengal Tiger & saltwater crocodiles.
Bhitarkanika, Odisha	2nd largest mangrove forest in India. High concentration of typical mangrove species & high genetic diversity.
Godavari-Krishna delta, Andhra Pradesh	Mangrove swamps occur in profusion in the intertidal mudflats on both side of the creeks
Maharashtra, Goa & Karnataka	Mostly scrubby & degraded mangroves occur along intertidal region of estuaries and creeks
Kerala	Very sparse and thin.
Gulf of Kutch & Kori creek, Gujarat	Dwarf mangroves. Gujarat has India's second largest area under Mangroves after Sundarbans.
Andaman & Nicobar Islands	Small tidal estuaries, neritic inlets and lagoons support a dense & diverse undisturbed mangrove flora.

According to the State of Forest Report 2021

- Mangroves cover 0.15% of the country's total geographical area.
- There has been a net increase of 17 sq km of mangrove cover in the country as compared to 2019 assessment. Odisha has shown most gain in 8 sq km and Maharashtra 4 sq km.
- Order of States by Mangrove Cover: West Bengal (42.5%), Gujarat (23.6%).

►MANGROVES FOR FUTURE (MFF)

- A collaboration between multiple partners, including governments, NGO, research institutes etc.
- It is co-chaired by the IUCN and UNDP.
- It promotes investment in coastal ecosystems for sustainable development.
- The goal is to promote an integrated ocean-wide approach to coastal management and to building the resilience of ecosystem-dependent coastal communities.
- Mangroves are the flagship of the initiative, but MFF is inclusive of all types of coastal ecosystem, such as coral reefs, estuaries, lagoons, sandy beaches, seagrass and wetlands.
- India is a member country.

FOREST & GRASSLANDS

►SHOLA GRASSLAND

- They are patches of stunted tropical montane forest found in valleys amid rolling grassland in the higher montane regions of South India.
- Despite the huge ecological significance, they have not been historically protected because the short, stunted trees have little or no timber value.

FAUNA

Tigers, Nilgiri tahr, leopards, elephants, gaur etc.

ECOLOGICAL SIGNIFICANCE

- Undulating grassland patches.
- Thickets of stunted evergreen tree species.
- Home to host of endemic and endangered plants & animals.
- Important for keeping the water cycle alive - store the rainwater for future use.
- High concentration of lichen, mosses, ferns and orchids in these areas.

CONCERN

Timber plantations, expanding agriculture and the spread of invasive species have eaten into as much as two-thirds of natural grasslands in the Palani Hill range of the Western Ghats.

►BOTANICAL & ZOOLOGICAL SURVEY OF INDIA

- Botanical Survey of India: An institution set up by the GOI in 1890.
- Objective: Identifying the plant resources of this country.
- Zoological Survey of India: Established in 1916.
- Objective of ZSI: Explore and research the fauna.
- The history of ZSI goes back to Asiatic Society of Bengal founded by Sir William Jones in 1784 which is the mother of institutions like Indian Museum, ZSI and Geological Survey of India.

- Both are under the MOEFCC.
- Headquarters of both is in Kolkata.

►NATIONAL FOREST POLICY, 1988

- It aims to have a minimum of one third of the total land area under forests.
- Increase tree cover through massive afforestation, especially on all denuded, degraded and unproductive lands.
- To ensure environment stability and maintenance of ecological balance.
- Efficient utilization of forest products.

JOINT FOREST MANAGEMENT (JFM)

- Aimed to institutionalize participatory governance of country's forest resources.
- It was formed to recognize the importance of involving local communities
- Under JFM, both the forest department and local communities come to an agreement to form committee to manage and protect forest.
- One of the key objectives is to rehabilitate degraded forest land.
- Also, the cost and benefits are shared, this gives greater access to local communities to minor forest products.

NET PRESENT VALUE (OF FORESTS)

- The newly afforested land is expected to take no less than 50 years to start delivering comparable goods and services that the diverted forest would have provided.
- These goods and services include timber, bamboo, fuel wood, carbon sequestration, soil conservation, water recharge, and seed dispersal.
- To compensate for this loss, the Net Present Value (NPV) of the diverted forest is calculated for a period of 50 years and recovered from the user agency that is diverting the forests.

►FOREST FIRE IN INDIA

Fires in forests are not unnatural. Small and controlled fires in the form of prescribed burning are very useful and essential for good natural forest development and regeneration. As they keep forest floor free from the natural annual build-up of the litter thereby reducing risk of catastrophic forest fire, improving silvicultural opportunities, increasing forage and habitat opportunities for wildlife, enhancing biodiversity etc.

- Over 30,000 forest fires were reported in India in 2019.
- Around 95 percent of the forest fires in India are on account of human activity.

CAUSES OF FOREST FIRE FOREST FIRES ARE CAUSED BY BOTH ANTHROPOGENIC AS WELL AS NATURAL REASONS

NATURAL	ANTHROPOGENIC	
	Deliberate causes	Accidental causes
1. Lightning	**1.** Shifting Cultivation	**1.** Collection of Non-Timber Forest Produce
2. Friction of rolling stone	**2.** To flush growth *of tendu* leaves	**2.** Burning farm residues
3. Rubbing of dry bamboo clumps	**3.** To have good growth of grass and fodder	**3.** Driving away wild animals
4. Volcanic explosion	**4.** To settle score with forest department or personal rivalry	**4.** Throwing burning *bidi/* cigarettes
	5. To clear path by villagers	**5.** Campfires by picnickers
	6. To encroach upon the forest land	**6.** Sparks from vehicle - exhaust
	7. For concealing illicit felling	**7.** Sparks from transformers
	8. Tribal traditions / customs	**8.** Uncontrolled prescribed burning
		9. Resin tapping

MAIN LOSSES FROM EXTENSIVE FOREST FIRES

- Biodiversity change: In Himalayas, fires have made the situation less favorable for oaks to grow and more favorable for chir pine to grow.
- Reduced soil moisture: Creates a possibility of forest fire in future.
- Reduce water infiltration: Due to heat induced chemical and physical changes in upper layer of soil which makes it impervious.
- Enhanced global warming: Due to destruction of forest Carbon sequestration potential and addition of newer emissions such as carbon monoxide, methane hydrocarbons, nitric oxide and nitrous oxide that lead to global warming and ozone layer depletion.
- Microclimate change: Caused by removal of litter and duff, opening of the canopy by killing over storeyed shrubs and trees and darkening of the soil surface by residual soot and charcoal can increase insulation causing temperature increase.
- Soil erosion: Intense Forest fire always has a direct heating effect on the soil at the depth below 7 to 10 cm. As a result, the soil of the fire affected area loses its water holding capacity and becomes vulnerable for erosion.
- Flooding: Due to water repellent soils and cover loss give rise to higher chances of floods.

FIRE READY FORMULA

- UNEP called on global governments to adopt a new 'Fire Ready Formula,' as it warned that incidences of wildfires would rise in the future.
- The new formula envisages that 66 per cent of spending be devoted to planning, prevention, preparedness and recovery. The remaining 34 per cent can be spent on response.

POLLUTION DUE TO FOREST FIRES

Biomass burning is a locally, regionally, and globally important biospheric phenomenon, which includes burning of the world's forests (tropical, temperate, and boreal), grasslands, and agricultural fields after the harvest. It is an important global source of various environmentally significant gases and solid Transactions on Ecology and the Environment. Its combustion products include carbon dioxide (CO,) carbon monoxide (CO), methane (CH,), non-methane hydrocarbons (NMHC) nitric oxide (NO), nitrous oxide (N2O) and atmospheric particulates. CO2, CH4 and N2O are important GHG which impact global climate. CO, CH4, NMHC, and NO are chemically active gases that strongly influence the local/regional concentrations of the major atmospheric oxidants ozone (O_2) and the hydroxyl radical (OH).

- PM10 and 2.5 mm particulates, carbon dioxide, carbon monoxide, methane, non-methane hydrocarbons, ammonia, nitrous oxide, oxides of nitrogen, sulphur dioxide.
- Polycyclic aromatic hydrocarbons (PAHs) are a group of organic compounds consisting of two or more fused aromatic rings.
- PAHs originate mainly from anthropogenic processes, particularly from incomplete combustion of organic fuels.
- PAHs are distributed widely in atmosphere. Natural processes, such as volcanic eruptions and forest fires, also contribute to an ambient existence of PAHs.

►CAMPA ACT

1. To compensate the loss of forest area and to maintain the sustainability, the Government of India came up with a well-defined Act, known as CAMPA (Compensatory Afforestation Fund Management and Planning Authority).
2. The law establishes the National Compensatory Afforestation Fund under the Public Account of India, and a State Compensatory Afforestation Fund under the Public Account of each state.
3. These Funds will receive payments for: (i) compensatory afforestation, (ii) net present value of forest (NPV), and (iii) other project specific payments.
4. The National Fund will receive 10% of these funds, and the State Funds will receive the remaining 90%.
5. According to the Act's provision, a company diverting forest land must provide alternative land to take up compensatory afforestation.
6. For afforestation, the company should pay to plant new trees in the alternative land provided to the state.

►NAGAR VAN YOJANA

MOEFCC is implementing Nagar Van Yojana with an aim at developing 400 Nagar Vans and 200 Nagar Vatikas with the objective to significantly enhance the tree outside forests and green cover in cities leading to better environment, enhancement of biodiversity and ecological benefits to the urban and peri-urban areas apart from improving quality of life of city dwellers

►INITIATIVES FOR FOREST CONSERVATION

GLOBAL FOREST FINANCE PLEDGE

- Pledge by countries to collectively provide $12 billion of public finance for forest related climate finance between 2021-25.
- This fund will incentivize results in ODA eligible (Developing & Least Developed) forest countries which show concrete steps and ambition towards ending deforestation by 2030.
- Countries party to this pledge: 12 countries (Developed Countries). India is not party.

Activities supported by the fund:

- Forest & land governance, clear forest rights & land tenure of indigenous people & local communities.
- Deforestation free & sustainable agricultural supply chain.
- Deforestation free & sustainable financial markets.
- Leveraging private investment in sustainable forest management.
- Large-scale landscape restoration & forest conservation.
- Actions to reduce forest crime & forest fires.

ONE TRILLION TREES INITIATIVE

- Launched by World Economic Forum (WEF) to grow, restore & conserve 1 trillion trees around the world by 2030 to restore biodiversity & fight climate change.
- Part of WEF's work to accelerate nature-based solutions of the UN Decade on Ecosystem Restoration (2021-2030). It will act by: (a) Mobilizing Private Sector (b) Facilitating regional multi-stakeholder partnerships (Active in India as well) (c) Inspiring innovation & ecopreneurship.
- 1t.org Advisory Council is a multi-stakeholder group of influential voices from global conservation, restoration and reforestation community. It aims to provide strategic guidance & best practices.

TROPICAL FOREST ALLIANCE

- It is a multi-stakeholder partnership platform initiated to support implementation of private-sector commitments to remove deforestation from palm oil, beef, soy and pulp/paper supply chains.
- Aim: Forest Positive Collective Action for deforestation free commodities supply chain.
- Founded in 2012 at Rio+20 by World Economic Forum
- Partners include companies, governments, civil society, indigenous people & international organisations.

Initiatives:

- Collective Supply Chain Action
- Jurisdictional Exchange Network
- Demand Side

GLASGOW LEADERS' DECLARATION ON FORESTS AND LAND USE

- Declared in Glasgow summit (COP26) where leaders from 141 countries committed to halt and reverse forest loss and land degradation by 2030 by strengthening their efforts to conserve and restore forests and other terrestrial ecosystems and accelerate their restoration.
- Emphasizes critical & interdependent role of forests of all types; biodiversity & sustainable land use in enabling the world to meet its sustainable development goals; to help achieve a balance between anthropogenic greenhouse gas emissions and removal by sinks; to adapt to climate change; and to maintain other ecosystem services.
- India is not the party to this declaration as it linked trade with climate change and forest issues.
- Reaffirm respective commitments, collective and individual, to UNFCCC and Paris Agreement, the Convention on Biological Diversity, UN Convention to Combat Desertification, Sustainable Development Goals.

NEW YORK DECLARATION ON FOREST

- Spurred by the UN Secretary General's Climate Summit in September 2014
- This is a political declaration that brings together governments, companies and civil society actors including indigenous peoples organizations
- It aims at halving the loss of natural forests by 2020 and striving to end it by 2030.
- India did not join it.

LEAF COALITION

- LEAF Coalition was launched by USA, UK & Norway and leading companies aiming to mobilize at least $1 billion in finance to support tropical and subtropical forest jurisdictions (largest-ever public-private efforts to protect tropical forests) in making substantial reductions in their emissions from deforestation. It is a step towards concretising the aims and objectives of

the Reducing Emissions from Deforestation and Forest Degradation (REDD+) mechanism.

- Announced at the Leaders' Summit on Climate, 2021.
- Emergent, a US non-profit, will serve as LEAF's administrative coordinator.
- Performance will be measured against the TREES standard (The REDD+ Environmental Excellence Standard).
- TREES is a high-integrity standard building on over a decade of progress in international support for reducing deforestation and ensuring social and environmental integrity. TREES is managed by ART, a voluntary global initiative hosted by Winrock International.

►FOREST CERTIFICATION

- Forest Certification was developed at the 1992 UN Conference on Environment and Development (UNCED), (Rio Summit).
- It is an emerging voluntary, market-based instrument non-regulatory conservation tool for promotion of sustainable forestry. Regulations from developed countries have put a ban on commerce of illegally sourced plants and their products including timber and paper.
- MOEFCC has emphasized buying products made from certified wood under Green Good Deeds movement.

INDIGENOUS FOREST CERTIFICATION SYSTEM

Network for Certification & Conservation of forests has developed India's country specific and internationally benchmarked Forest Management Certification Standard. Certification Standard for Sustainable Forest Management (SFM) developed by NCCF has been endorsed by PEFC.

PROGRAM FOR ENDORSEMENT OF FOREST CERTIFICATION (PEFC)

- Founded in 1999 in response to requirements of small and family forest owners that had been unable to achieve forest certification through alternative certification systems. Today, it is largest forest certification body.
- It is global alliance of national forest certification systems. It is an international non-profit NGO.
- Network for Certification and Conservation of Forests (NCCF) is National Member from India to PEFC.

►FORESTS FOR LIFE PARTNERSHIP

Initiative launched by Global Wildlife Conservation, Rainforest Foundation Norway, UNDP, Wildlife Conservation Society and World Resources Institute.

Objectives:

1. To promote forests as a nature-based solution to climate change and biodiversity protection.
2. Halt and reverse forest degradation across one billion hectares of the most intact forests worldwide.

►STATE OF FOREST REPORT 2021

Forest Survey of India under MOEFCC has released India State of Forest Report, 2021. This report is released biannually. First State of Forest report was brought out in the year 1987.

The information being presented in latest ISFR 2021 has been derived by way of complete wall to-wall mapping of the country's forest cover using remote sensing techniques, sample plot based national forest inventory and special studies carried out at national level.

Three categories of forests are surveyed – Very Dense Forests (canopy density over 70%), Moderately Dense Forests (40-70%) and Open Forests (10-40%). Scrubs (canopy density less than 10%) are also surveyed but not categorised as forests.

NEW IN ISFR 2021

It has assessed forest cover in tiger reserves, tiger corridors, and Gir forest, which is home to Asiatic lion, for the first time.

KEY TERMS

- Tree cover: It is defined as all tree patches of size less than one hectare occurring outside recorded forest area. This covers trees in all formations including scattered trees.
- Forest area: It denotes legal status of the land as per the government records, whereas the term 'forest cover' indicates presence of trees over any land.
- Forest carbon stock: Amount of carbon that has been sequestered from atmosphere and is now stored within forest ecosystem, mainly within living biomass and soil and in dead wood and litter.
- National Forest Inventory: Knowledge of Growing Stock, or volume of all living trees is essential to understand dynamics of forest stands, their productive capacity and their sustainable management. Such information is also important in determination of quantum of biomass existing in the

forests and for further calculation of emission factors, carbon stock assessments and related information.

FINDINGS OF THE REPORT

- Forest cover changes:
  - The country's forest and tree cover has increased by 1,540 sq. km. in the last two years.
  - India's forest cover has increased to 7,13,789 sq. km., accounting for 21.71 percent of the country's land area, up from 21.67 percent in 2019.
  - Tree cover has increased by 721 sq km.
  - Performance of states:
    - Biggest increases: Telangana (3.07 percent), Andhra Pradesh (2.22 percent), and Odisha (3.07 percent) have the biggest increases in forest cover (1.04 %).
    - Deterioration: Five states in the Northeast – Arunachal Pradesh, Manipur, Meghalaya, Mizoram and Nagaland.
    - States with Highest Forest Area/Cover:
      - ✓ Area-wise: Madhya Pradesh > Arunachal Pradesh > Chhattisgarh > Odisha > Maharashtra.
      - ✓ Forest cover as percentage of total geographical area: Mizoram > Arunachal Pradesh > Meghalaya > Manipur > Nagaland.
- Carbon Stocks: The total carbon stock in the country's forests is estimated at 7,204 million tonnes, an increase of 79.4 million tonnes since 2019.
- Mangroves: Mangroves have shown an increase of 17 sq. km. India's total mangrove cover is now 4,992 sq. km.
- Forest Prone to Fires:
  - 35.46% of the forest cover is prone to forest fires. Out of this, 2.81% is extremely prone, 7.85% is very highly prone and 11.51% is highly prone.
  - By 2030, 45-64% of forests in India will experience the effects of climate change and rising temperatures.
  - Forests in all states (except Assam, Meghalaya, Tripura and Nagaland) will be highly vulnerable climate hot spots. Ladakh (forest cover 0.1-0.2%) is likely to be the most affected.
- Bamboo Forests: Bamboo forests have grown from 13,882 million culms (stems) in 2019 to 53,336 million culms in 2021.
- Forest cover in Tiger reserves:
  - The forest cover in tiger corridors has increased by 37.15 sq km (0.32%) between 2011-2021 but decreased by 22.6 sq km (0.04%) in tiger reserves.
  - Forest cover has increased in 20 tiger reserves in these 10 years and decreased in 32.
  - Pakke Tiger Reserve (Pakhui) in Arunachal Pradesh has the highest forest cover, at nearly 97%.

CONCERNS FROM THE REPORT

- The area of moderately dense woods, sometimes known as "natural forests," has shrunk by 1,582 square kilometres.
- This reduction is at the time when there is a rise of 2,621 sq. km in open forest areas which indicates that the country's forests are deteriorating.
- Also, scrub area has increased by 5,320 sq. km – indicating the complete degradation of forests in these areas.
- The forest cover in the region has decreased by 1,020 square kilometres overall. Although the Northeast states represent just 7.98 percent of total land area, they cover 23.75 percent of total forest cover.
- The decline can be linked to following factors:
  - Natural: Disasters (landslides and heavy rains)
  - Anthropogenic activities: shifting agriculture, pressure of developmental activities and felling of trees.

FOREST SURVEY OF INDIA (FSI)

- It is an organization under the MOEFCC.
- Responsible for assessment and monitoring of the forest resources of the country regularly.
- Established in 1981. Headquartered at Dehradun.
- FSI has been assessing the forest and tree resources of our country on a biennial basis since 1987.

MAIN OBJECTIVES

- To function as a nodal agency for collection, compilation, storage and dissemination of spatial database on forest resources.
- Maintain information about forest and non-forest areas and develop database on forest tree resources.

►INTEGRATED FARMING

Integrated Farming System (IFS) is a biologically integrated farming system that integrates natural

resources and regulatory mechanisms into farming activities to achieve maximum replacement of off-farm inputs, secures sustainable production of high-quality food and other products through ecologically preferred technologies, maintains farm income, eliminates, or reduces sources of current agricultural pollution, and sustains the multiple facets of agriculture.

OBJECTIVES OF INTEGRATED FARMING SYSTEM

1. Efficient recycling of farm and animal wastes
2. Minimizing the nutrient losses
3. Maximizing nutrient use efficiency
4. Complementary combination of farm enterprises.

ADVANTAGES OF INTEGRATED FARMING SYSTEM

1. Productivity: Integration of crop and allied enterprises helps to increase economic yield per unit area per unit time.
2. Profitability: Produce/waste material of one enterprise can be used for other enterprise at least for crop, thus reducing the cost of production and increasing profitability per rupee investment.
3. Sustainability: IFS provides an opportunity to sustain production through organic supplementation & effective utilization of by-product of linked components.
4. Balanced food: IFS links varied nature of enterprises to provide nutritious food viz., vitamins, proteins, carbohydrates, fat, minerals etc. from same area. This solves malnutrition problem of poor peoples.
5. Environmental Safety: In IFS waste material, by-products of one composite are effectively recycled used for other component & by-product of that component as organic manure to enrich soil. Use of bioagent or crop protection also minimizes pesticides.
6. Recycling of waste: By-product of the crop & animal husbandry can be effectively recycled for preparation of compost.
7. Saving energy: Energy crises can be served to same extent by utilizing organic waste to generate biogas which can be used for cooking, lighting etc.
8. Adoption of new technology: Big farmers are fully aware of new technologies because of using improved varieties & innovative practices. But small & marginal farmers are not able to adopt technology for want of money. In IFS, linking of cropping with dairy, mushroom, sericulture, floriculture there is a flow of money throughout the year.
9. Availability of fodder, fuel & timber: IFS utilizes every part of land.
10. Employment round the year: Crop-livestock integration increase labour requirement through the year.
11. Agro industries: Linking of various components in IFS, the production increased to commercial level. Surplus production leads to development of agro based side industry.
12. Increase input efficiency: IFS provides better scope to use available inputs more efficiently. This leads to increase cost benefit ratio.

►HYDROPONICS

Plants grown hydroponically grow faster & healthier than plants in soil as they are being provided with required nutrients directly to their roots through water.

ABOUT HYDROPONICS

Hydroponics is art of growing plants without soil as medium. The plants, mostly edible ones, are grown using nutrient rich water as well as copious amounts of sunlight. It is seen that plants grow a lot better in water provided nutrients are provided in adequate amounts.

An advanced form of hydroponics, aeroponics is the process of growing plants with only water and nutrients.

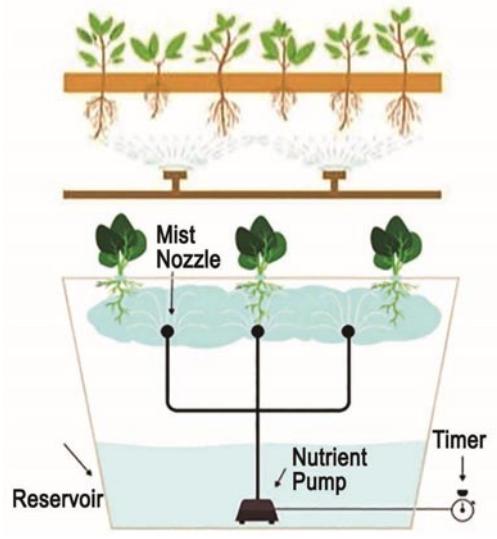
THE ADVANTAGES OF AEROPONICS

- Faster growth: Eliminating the growing medium is very freeing for plants' roots: Extra oxygen they are exposed to results in faster growth.
- Water Efficient: These closed-loop systems use 95 percent less irrigation than plants grown in soil.
- Space Efficient: Ability to grow large quantities of food in small spaces. Aeroponics is mainly employed in indoor vertical farms, which are increasingly common in cities – cutting down on environmental costs of getting food from field to plate.
- Lower Input costs: Since nutrients are held in water, they get recycled, too. The systems are fully enclosed, there is no nutrient runoff to foul nearby waterways. Rather than treating pest and disease with harsh chemicals, the growing equipment can simply

WHAT CAN YOU GROW WITH AEROPONICS?

- In theory, anything is possible. In practise, leafy greens, culinary herbs, strawberries, tomatoes, and cucumbers are grown in aeroponics systems, which are similar to hydroponics systems.

- Root crops are impractical in a hydroponic system but ideal in aeroponics because the roots have plenty of room to grow and are easily harvestable.
- Other vegetable crops are possible but have complex nutrient requirements. Fruiting shrubs & trees are impractical in aeroponics systems due to their size.



►SEED BALLS

- A seed ball (or seed bomb) is a seed that has been wrapped in soil materials, usually a mixture of clay and compost, and then dried.
- Essentially, seed is 'pre-planted' and can be sown by depositing the seed ball anywhere suitable for the species, keeping the seed safely until proper germination window arises.
- Seed balls are an easy and sustainable way to cultivate plants that provides a larger window of time for sowing can occur. They are a convenient dispersal mechanism for guerrilla gardeners.

►PERMAFROST

Permafrost is any type of ground—from soil to sediment to rock—that has been frozen continuously for a minimum of two years to hundreds of thousands of years. It can extend down beneath earth's surface from a few feet to more than a mile—covering entire regions, such as the Arctic tundra, or a single, isolated spot, such as a mountaintop of alpine permafrost.

HOW DOES PERMAFROST FORM?

Just as a puddle of water freezes on a frigid winter night, water that is trapped in sediment, soil, and the cracks, crevices, and pores of rocks turns to ice when ground temperatures drop below 32°F (0°C).

When earth remains frozen for at least two consecutive years, it's called permafrost. If the ground freezes and thaws every year, it's considered "seasonally frozen."

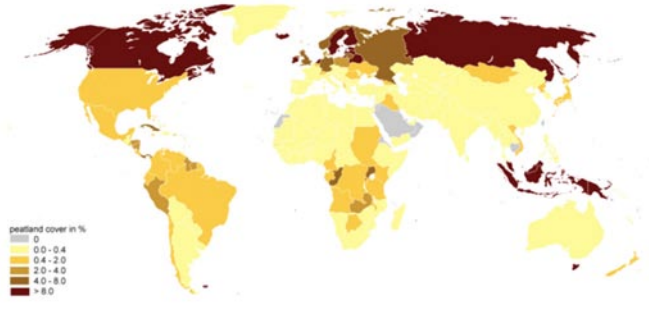
WHERE IS PERMAFROST FOUND?

About a quarter of the entire northern hemisphere is permafrost, where the ground is frozen year-round. It's widespread in the Arctic regions of Siberia, Canada, Greenland, and Alaska—where nearly 85 percent of the state sits atop a layer of permafrost. It's also found on the Tibetan plateau, in high-altitude regions like the Rocky Mountains, and on the floor of the Arctic Ocean as undersea permafrost. In the southern hemisphere, where there's far less ground to freeze, permafrost is found in mountainous regions such as the South American Andes and New Zealand's Southern Alps, as well as below Antarctica.

►PEATLANDS

- They are terrestrial wetland ecosystems in which waterlogged conditions prevent plant material from fully decomposing. Production of organic matter exceeds its decomposition, which results in a net accumulation of *peat*.
- In cool climates, peatland vegetation is mostly made up of *Sphagnum* mosses, sedges and shrubs and are the primary builder of peat.
- In warmer climates graminoids and woody vegetation provide most of the organic matter. They occur in every climatic zone & continent & cover 4.23 million km^2, which corresponds to 2.84% of Earth's terrestrial surface which include landscapes that are still actively accumulating peat (mires), others that are no longer accumulating & do not support the principal peat forming plants.

NORTHERN AND TEMPERATE PEATLANDS



Majority of world's peatlands occur in boreal and temperate parts of Northern Hemisphere, especially, Europe, North America & Russia where they have formed under high precipitation-low temperature climatic regimes.

TROPICAL PEATLANDS

In humid tropics, environmental & topographic conditions enable peat to form under conditions of high precipitation & high temperature in Southeast Asia, East Asia, Caribbean, Central America, South America, Africa, parts of Australasia & a few Pacific Islands. Most tropical peatlands are located at low altitudes where rain forest vegetation grows on a thick layer of organic matter although some are found in upland or mountainous areas where peat can exceed 30 m. Tropical peatlands may form under mangrove forests. Largest area of tropical peatland is in Southeast Asia.

WHY IS IT IMPORTANT?

- Remaining area of near natural peatland (over 3 million km^2) sequesters 0.37 gigatonnes of CO_2 a year. Peat soils contain more than 600 gigatonnes of carbon which represents up to 44% of all soil carbon, and exceeds the carbon stored in all other vegetation types including the world's forests.
- In their natural, wet state, peatlands provide indispensable Nature-based Solutions for adapting to and mitigating the effects of climate change, including regulating water flows, minimising the risk of flooding and drought, and preventing seawater intrusion.
- Wet peatlands lower ambient temperatures in surrounding areas, providing refuge from extreme heat, and are less likely to burn during wildfires. This helps to preserve air quality.
- Draining peatlands reduces the quality of drinking water as water becomes polluted with organic carbon and pollutants historically absorbed within peat.
- In many parts of the world, peatlands supply food, fibre and other local products that sustain economies. They also preserve important ecological and archaeological information such as pollen records and human artefacts.
- Damage to peatlands causes biodiversity loss. For example, the decline of the Bornean orang-utan population by 60% within 60 years is largely attributed to the loss of peat swamp habitat. The species is now listed as Critically Endangered on The IUCN Red List of Threatened Species

►GLOBAL PEATLANDS INITIATIVE

It is an international partnership formed in 2016 to save peatlands as world's largest terrestrial organic carbon stock. Four major tropical peatland countries of Indonesia, Republic of Congo, Democratic Republic of Congo and Peru along with global organisation have come together to work to improve conservation, restoration & sustainable management of peatlands globally.

Brazzaville declaration was singed to promote better management and conservation world's largest tropical peatlands-Cuvette Centrale region in Congo Basin from unregulated land use and prevent its drainage and degradation.

►SALT MARSHES

- Salt marshes are coastal wetlands that are flooded and drained by salt water brought by tides. They are marshy because soil may be composed of deep mud and peat. Peat is made of decomposing plant matter that is often several feet thick. Peat is waterlogged, root-filled, and very spongy.
- Because salt marshes are frequently submerged by tides and contain a lot of decomposing plant material, oxygen levels in peat can be extremely low—a condition called hypoxia. Hypoxia is caused by growth of bacteria which produce sulfurous rotten-egg smell that is often associated with marshes and mud flats.
- They protect shorelines from erosion by buffering wave action & trapping sediments; Reduce flooding by slowing & absorbing rainwater; Protect water quality by filtering runoff & metabolizing excess nutrients.
- Salt marshes occur worldwide, particularly in middle to high latitudes. Thriving along protected shorelines, they are a common habitat in estuaries.
- Total extent of salt marshes in India is estimated about 290 km_2^2. A total of 14 salt marsh species are found distributed along the Indian coast, belonging to 11 genera under six families. Largest extent of salt marsh in India is in Gujarat.

CONVENTIONS

►BASEL CONVENTION

Aims at protecting human health and environment against adverse effects of hazardous wastes. Its scope of application covers a wide range of wastes defined as "hazardous wastes" based on their origin and/or composition and their characteristics, as well as two types of wastes defined as "other wastes" - household waste and incinerator ash.

OBJECTIVES OF THE CONVENTION

The Convention covers hazardous wastes that are explosive, flammable, poisonous, infectious, corrosive, toxic, or eco-toxic. With respect to environmentally sound management (ESM) of hazardous waste, the Convention aims towards restricting transboundary movements of hazardous wastes except where it is perceived to be in accordance with the principle of ESM.

INDIA AND THE CONVENTION

India ratified Basel convention 1992. India has been taking measures for the effective management of hazardous wastes and thereby meeting the obligations of the Basel Convention.

Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016 was notified to ensure the safe handling, processing, treatment, storage, collection, transportation, collection, and disposal of hazardous waste.

►ROTTERDAM CONVENTION

The Rotterdam Convention on the prior informed consent procedure for certain hazardous chemicals and pesticides in international trade is a multilateral agreement. The agreement provides obligations on the import and export of certain hazardous chemicals.

Parties are empowered, through virtue of membership, to make informed decisions about the chemicals they want to receive, and to exclude those they believe they cannot manage safely. The convention's objective is to promote shared responsibility and cooperative efforts among parties in the international trade of these chemicals to protect human health and the environment and contribute to the environmentally sound use of chemicals.

PRIOR INFORMED CONSENT (PIC)

It is a mechanism for formally obtaining and disseminating the decisions of importing Parties as to whether they wish to receive future shipments of those chemicals listed in Annex III of the Convention and for ensuring compliance with these decisions by exporting Parties.

►STOCKHOLM CONVENTION ON PERSISTENT ORGANIC POLLUTANTS

It is a global treaty to protect human health and the environment from chemicals that remain intact in the environment for long periods (persistent), become widely distributed geographically (long range transport), accumulate in the fatty tissue of humans and wildlife (bioaccumulation), and have harmful impacts on human health or on the environment (toxic).

PERSISTENT ORGANIC POLLUTANTS

They are also called forever chemicals. They are resistant to environmental degradation through photolytic, chemical and biological processes. Thus, they accumulate in the environment causing adverse impacts on human health. With an intention to eliminate persistent organic pollutants completely

from the environment, the Stockholm convention on persistent organic pollutants was held in 2001. India is a signatory of the convention.

PROPOSED PERSISTENT ORGANIC POLLUTANTS

1. Methoxychlor: It is a pesticide, used as a replacement for DDT against a wide range of pests including biting flies, houseflies, mosquito larvae, cockroaches on field crops, vegetables, ornamentals, livestock & pets. It is very toxic to be invertebrates and fish, has endocrine disrupting effects, has been detected in enviros of Arctic and Antarctica and in human serum, adipose tissues, umblical cord and human breast milk.
2. UV-328: Used as an ultra-violet (UV) stabilizer in plastic products such as some personal care products, rubber and coatings. It is the first non-halogenated chemical to be considered to be added under Stockholm convention.
3. Dechlorane Plus: It is a chemical used as flame retardant in electrical wire, cable coatings, plastic roofing materials, connectors in TV and computer monitors.
4. Perfluorohexane Sulphonic Acid (PFHxS): They have high resistance to friction, heat, chemical agents, low surface energy and are used as a water, grease, oil and soil repellent They are group of industrial chemicals used in consumer products as a surfactant and sealant in carpets, leather, clothing, textiles, fire-fighting foams, papermaking, printing inks and non-stick cookware.

The Convention was adopted in 2001 and entered into force in 2004. India ratified the convention in 2006.

OBLIGATIONS UNDER THE CONVENTION

Under the convention, the chemicals can be listed for Elimination (Annex-A), Restriction (Annex-B) or Unintentional production (Annex-C).

The implementation of the convention requires its parties to take measures to eliminate or reduce the release of these POPs into the environment. Till date, 26 chemicals are listed as POPs under the Stockholm Convention. As of now, India has ratified only the 12 initially listed POPs. As a first step for implementation of Stockholm Convention in India a National Implementation Plan has been prepared. India is in process for ratification of selected newly listed POPs.

UNION CABINET APPROVES RATIFICATION OF 7 ORGANIC POLLUTANTS

Union Cabinet approved ratification of 7 Chemicals that are listed under Stockholm convention on persistent organic pollutants. Further, the cabinet delegated its powers of ratification to the union ministry of external affairs and ministry of environment forest and climate change. These Ministries are already regulating the persistent organic pollutants under the domestic regulations.

7 PERSISTENT ORGANIC POLLUTANTS

The 7 persistent organic pollutants that are currently being ratified by the government of India.

Chlordecone, Hexabromobiphenyl, Hexabromobiphenyl ether and Heptabromodiphenylether (Commercial octa BDE), Tetrabromodiphenyl ether and Pentab-romodiphenyl ether (Commercial penta-BDE), Pentachlorobenzene, Hexabromocyclododecane, Hexa-chlorobutadiene

These pollutants were listed in Stockholm convention already. In 2018, the Ministry of Environment Forest and Climate Change notified regulation of Persistent organic pollutants rules. Under these rules, the manufacture, trade, use, import and export of these seven Chemicals were prohibited. This was completely domestic and not in accordance with Stockholm Convention.

WHY IS INDIA RATIFYING NOW?

India has ratified the convention in 2006. However, India till date stays in an opt-out position following domestic rules on usage of POPs.

OPT-OUT POSITION IN STOCKHOLM CONVENTION

The convention allows its members to stay in such a position under article 25. According to the article, the amendments made to the convention shall not be enforced by its members unless an instrument of acceptance for ratification or approval is deposited with the UN.

The cabinet approval will demonstrate India's commitment towards international obligation in protecting the environment from POPs. This will in turn allow India to access the Global Environment Facility financial resources by updating National Implementation Plan.

►CONVENTION ON BIOLOGICAL DIVERSITY (UNCBD)

It provides a global legal framework for action on biodiversity. It brings together the Parties in the Conference of the Parties (COP) which is the Convention's governing body that meets every two years, or as needed, to review progress in the implementation of the Convention, to adopt programs

of work, to achieve its objectives, and provide policy guidance.

It entered into force on 29 December 1993. It has 3 main objectives:

1. Conservation of biological diversity
2. Sustainable use of components of biological diversity
3. Fair and equitable sharing of the benefits arising out of the utilization of genetic resources

The COP is assisted by the Subsidiary Body on Scientific, Technical, and Technological Advice (SBSTTA), which is made up of government representatives with expertise in relevant fields, as well as observers from non-Party governments, the scientific community, and other relevant organizations. SBSTTA is responsible for providing recommendations to the COP on the technical aspects of the implementation of the Convention.

Other subsidiary bodies have been established by the COP to deal with specific issues as they arise. These are called "ad hoc open-ended Working Groups" because they are established for a limited mandate and period of time, and because they are open to all Parties as well as the participation of observers. Current Working Groups are:

- Working Group on Access & Benefit-Sharing (ABS) is currently the forum for negotiating an international regime on access and benefit sharing.
- Working Group on Article 8(j) addresses issues related to protection of traditional knowledge.
- Working Group on Protected Areas is guiding and monitoring implementation of the program of work on protected areas.
- Subsidiary Body on Implementation (SBI) reviews progress in implementing the Convention and identifies strategic actions to enhance implementation, including how to strengthen the means of implementation. It also addresses issues associated with the operations of the convention and the Protocols.
- Open-ended Ad Hoc Intergovernmental Committee (ICNP) for the Nagoya Protocol on ABS was established as an interim governing body for the Nagoya Protocol until the first meeting of the Parties to the Protocol at which time it will cease to exist.

All living organisms, plants, animals and microbes, carry genetic material that could be potentially useful to humans. These resources can be taken from the wild, domesticated or cultivated. They are sourced from environments in which they occur naturally (in situ), or from human-made collections such as botanical gardens, gene banks, seed banks and microbial culture collections (ex situ).

What is access and benefit-sharing?

It refers to the way in which genetic resources may be accessed, and how the benefits that result from their use are shared between the people or countries using the resources (users) and the people or countries that provide them (providers).

Why is it important?

Providers of genetic resources are governments or civil society bodies, which can include private landowners and communities within a country, who are entitled to provide access to genetic resources and share the benefits resulting from their use.

The access and benefit-sharing provisions of the Convention on Biological Diversity (CBD) are designed to ensure that the physical access to genetic resources is facilitated and that the benefits obtained from their use are shared equitably with the providers.

In some cases, this also includes valuable traditional knowledge associated with genetic resources that comes from ILCs. The benefits to be shared can be monetary, such as sharing royalties when the resources are used to create a commercial product, or non-monetary, such as the development of research skills and knowledge. It is vital that both users and providers understand and respect institutional frameworks such as those outlined by the CBD and in the Bonn Guidelines. These help governments to establish their own national frameworks which ensure that access and benefit-sharing happens in a fair and equitable way.

How does it work?

Access and benefit-sharing is based on prior informed consent (PIC) being granted by a provider to a user and negotiations between both parties to develop mutually agreed terms (MAT) to ensure the fair and equitable sharing of genetic resources and associated benefits.

- Prior informed consent (PIC): is the permission given by the competent national authority of a provider country to a user prior to accessing genetic resources, in line with an appropriate national legal and institutional framework.
- Mutually agreed terms (MAT): is an agreement reached between the providers of genetic resources and users on the conditions of access and use of the resources, and the benefits to be shared between both parties.

These conditions are required under Article 15 of the CBD, which was adopted in 1992 and provides a global set of principles for access to genetic resources, as well as the fair and equitable distribution of the benefits that result from their use

In 2021, 15th meeting of the Conference of the Parties (COP) to the UNCBD was held virtually in Kunming, China. The COP 15's major goal was to create and accept a post-2020 "Global Biodiversity Framework" to replace and update the Strategic Plan for Biodiversity (SPB) 2011-2020 and the Aichi Biodiversity Targets.

For the next ten years, the framework will comprise a set of global goals, targets, and indicators that will guide biodiversity and ecosystem conservation, protection, restoration, and sustainable management.

The first draft of the GBF was released in July 2021, containing 21 targets for 2030 and 4 Goals to achieve humanity "living in harmony with nature," vision by 2050.

Parties will reconvene in 2022 for further negotiations and to come to a final agreement on the post-2020 Global Biodiversity Framework.

HIGHLIGHTING FEATURES OF THE COP

- Kunming Declaration
  - The declaration called for immediate and comprehensive action in all areas of the global economy to reflect biodiversity concerns.
  - More than a hundred countries, including India, have pledged to
    - Work together to design, adopt, and implement a viable post-2020 global biodiversity framework.
    - Reverse the current biodiversity loss.
    - Ensure that biodiversity is on the mend by 2030 at the very latest.
- China established the Kunming Biodiversity Fund with a budget of around USD 230 million to fund programs that safeguard biodiversity in underdeveloped nations.
- It also praised many countries' efforts and commitments to safeguard 30% of their land and sea regions by 2030 (30 by 30 objective), which is crucial for reversing a major cause of environmental degradation.
- The summit emphasised the importance of private sector participation, including an open letter from company CEOs to international leaders encouraging decisive action.
- Global Environment Facility, UNDP, and UNEP have pledged to expedite financial and technical assistance to developing countries to help them implement the Global Environment Facility.

►CARTAGENA PROTOCOL ON BIOSAFETY TO THE UNCBD

An international treaty governing movements of living modified organisms (LMOs) resulting from modern biotechnology from one country to another that may have adverse effects on biological diversity, taking also into account risks to human health.

Adopted in 2000 as a supplementary agreement to the Convention on Biological Diversity (UNCBD).

The Protocol seeks to protect biological diversity from the potential risks posed by living modified organisms resulting from modern biotechnology.

It establishes an advance informed agreement (AIA) procedure for ensuring that countries are provided with the information necessary to make informed decisions before agreeing to the import of such organisms into their territory. The Protocol contains reference to a precautionary approach.

It also establishes a Biosafety Clearinghouse to facilitate the exchange of information on living modified organisms and to assist countries in the implementation of the Protocol.

India has ratified this protocol.

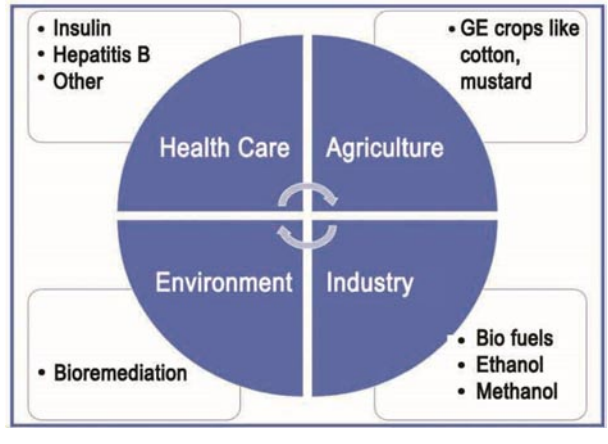
The convention does not apply to Pharmaceuticals for humans that are addressed by other international Agreements or organizations

NAGOYA — KUALA LUMPUR SUPPLEMENTARY PROTOCOL ON LIABILITY AND REDRESS TO THE CARTAGENA PROTOCOL ON BIOSAFETY

The objective of the Supplementary Protocol is to contribute to the conservation and sustainable use of biological diversity by providing international rules and procedures for liability and redress in the event of damage resulting from LMOs.

The Protocol's AIA procedure does not apply to:

1. LMOs in transit.
2. LMOs destined for contained use in the Party of import.
3. LMOs intended for direct use as food or feed or for processing (LMOs-FFP).



Under the Protocol, Advance Informed Agreement (AIA) procedure applies to the first intentional transboundary movement of an LMO for intentional introduction into the environment of the Party of import.

The advance informed agreement or AIA procedure is designed to ensure that before an LMO is imported into a country for the first time for intentional introduction into the environment, the Party of import:

a) Is notified about the proposed import

b) Receives full information about the LMO and its intended use

c) Has an opportunity to assess the risks associated with that LMO and to decide whether or not to allow the import

The AIA procedure includes (1) communication and (2) decision-making processes between the Parties:

Precautionary Principle

Proposed as a new guideline in environmental decision making. It has four central components:

- Taking preventive action in the face of uncertainty.
- Shifting burden of proof to proponents of an activity.
- Exploring a wide range of alternatives to possibly harmful actions.
- Increasing public participation in decision making.

GENETIC ENGINEERING APPRAISAL COMMITTEE

GEAC established under MoEFCC. It is the Apex body notified under Rules 1989 to accord approval of activities involving large scale use of hazardous microorganisms and recombinants in research and industrial production from the environmental angle.

COMPOSITION OF GEAC

- Chairman — Additional / Special Secretary, MoEFCC
- Co-Chairman: Representative of Department of Bio-technology Vice-Chairman —Joint Secretary, MoEFCC

CROPS	MODIFICATION	REMARKS
Bt cotton	crylAc gene	First and only GM crop approved in India India ranks first in global cotton production
Bt brinjal	Bt brinjal is created by inserting a crystal protein gene (CrylAc) from soil bacteria Bacillus thuringenisus (Bt) and it is resistant to Fruit and Shoot Borer (Leucinodes orbonalis)	In 2009, GEAC recommended the approval of commercial cultivation of Bt brinjal (eggplant) In, 2010, MoEFCC announced a moratorium on approval.
GE Mustard, DMH-11	GE Mustard, DMH-11, containing Barnase-Barstar system is under evaluation by Government of India	Technology developed by Centre for Genetic Manipulation of Crop Plants, University of Delhi.

Six Competent Authorities and their composition have been notified under this Rules which are as follows:

i. Recombinant DNA Advisory Committee (RDAC)
ii. Institutional Biosafety Committees (IBSC)
iii. Review Committee on Genetic Manipulation (RCGM)
iv. Genetic Engineering Appraisal Committee (GEAC)
v. State Biosafety Coordination Committees (SBCC)
vi. District Level Committees (DLC).

- While the RDAC is of advisory in function, the IBSC, RCGM, and GEAC are of regulatory function, SBCC and DLC are for monitoring purposes.

►ANTARCTIC TREATY

Nearly 40 years after India first signed the Antarctic Treaty, the government has brought in a draft Indian Antarctic Bill-2022 to regulate and monitor activities at its research stations in the frozen continent.

- Definition of Antarctica: All the Land and ice shelves to the south of 60-degree latitude.
- Features: 14 Million Sq.km + No Indigenous Population + Global Common + Principles of Peace, Science and Environmental protection.
- Year: 12 countries signed Antarctic Treaty'.
- Membership: 54 Countries (Including India)

Provisions:

- Antarctica should be used only for peaceful purposes. No country should build military bases.
- Freedom of scientific investigation in Antarctica.
- No country should claim sovereignty over Antarctica on the basis of setting up of Research stations.

- No Nuclear explosions or disposal of radioactive wastes
- Countries to take appropriate efforts to abide by the provisions of the treaty.

India and Antarctica

- India signed the Antarctic Treaty in 1983.
- India ratified the Convention on the Conservation of Antarctic Marine Living Resources in 1985.
- India signed Protocol on Environmental Protection to the Antarctic Treaty in 1998. (Madrid Protocol)
- India's research stations in Antarctica: Dakshin Gangotri (De-commissioned now); Maitri and Bharati. Managed by National Centre for Polar and Ocean Research (NCPOR), Goa under the Ministry of Earth Sciences.
- Nov 2021: India launched its 41st Scientific Expedition to Antarctica

INDIAN ANTARCTIC BILL, 2022

Rationale: To Give effect to Antarctic Treaty and Protocol on Environmental Protection to the Antarctic Treaty + To prevent unlawful activities such as illegal mining, pollution etc. in Research Stations

Applicability: Indian Citizen + Foreign Citizen + Company registered in India + any vessel or aircraft registered in India or outside India (provided it is part of Indian expedition to Antarctica)

Provisions:

Apex Level Committee: Committee on Antarctic Governance and Environmental Protection headed by Secretary, Ministry of Earth Sciences to monitor implement and ensure compliance of the relevant international laws for the protection of Antarctic environment.

Regulated Activities: All Indian expedition to Antarctica + Indian Station in Antarctica + Vessel and aircraft entering Antarctica + Introduction of non-native animals and plants into Antarctica.

How activities would be regulated? Permit issued by the Committee on Antarctic Governance and Environmental Protection or Written authorisation from other party to the Madrid Protocol.

Prohibited Activities: Nuclear explosion + disposal of radioactive wastes material + specified substances and products.

COMMISSION FOR THE CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES (CCAMLR)

The CCAMLR was established by the Convention on the Conservation of Antarctic Marine Living Resources. It was created to address the concern of unregulated increase in krill catches in the Southern Ocean that could be detrimental to Antarctic marine ecosystems particularly for seabirds, seals, whales and fish that depend on krill for food.

25 States and EU are members of this body. India is a member.

ABOUT KRILL

They are small crustaceans which are found in all the world's oceans. They feed on phytoplankton and zooplankton and are the main source of food for many larger animals.

In the Southern Ocean, Antarctic Krill species is one the animals with largest total biomass.

They are main prey of baleen whales.

Krills display vertical migration during the day, acting as feed for predators at surface at night and at deeper levels during the day.

►MARINE PROTECTED AREAS

India has supported the proposal of European Union for creation of two marine protected areas (MPAs) in the Antarctic for protecting the Antarctic environment. The two proposed Marine Protected areas are:

1. East Antarctic
2. Weddell Sea

ABOUT MARINE PROTECTED AREAS

A Marine Protected Area is a marine area that provides protection for all or part of the natural resources it contains. Within an MPA certain activities are limited, or entirely prohibited, to meet specific conservation, habitat protection, ecosystem monitoring or fisheries management objectives. MPAs do not necessarily exclude fishing, research or other human activities. Already two MPAs have been agreed by CCAMLR members:

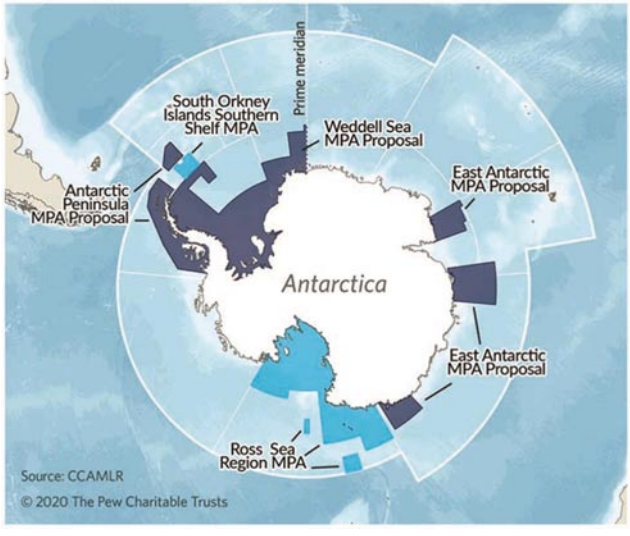
1. South Orkney Islands (World's first international MPA)
2. Ross Sea

ABOUT COMMISSION FOR THE CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES (CCAMLR)

- The CCAMLR was established by international convention in 1982 with the objective of conserving Antarctic marine life. This was in response to increasing commercial interest in Antarctic krill resources, a keystone component of the Antarctic

ecosystem and a history of over- exploitation of several other marine resources in the Southern Ocean.

- Presently, the body has 26 members (25 countries and EU). India is a member of the organisation.
- CCAMLR is a key international instrument part of the Antarctic Treaty System that as a whole for 60 years has ensured peace, freedom of science and protection of the environment in the Antarctic region. The system consists of the Antarctic Treaty and its Environmental Protocol, the Agreement on the Conservation of Albatrosses and Petrels and the Convention on the Conservation of Antarctic Seals in addition to CCAMLR.
- The CCAMLR Secretariat is located in Hobart, Australia.



►CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA (CITES), 1973

It is an international agreement between governments to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species.

NEED FOR CITES

Annually, international wildlife trade is estimated to be worth billions of dollars and to include hundreds of millions of plant and animal specimens. The trade is diverse, ranging from live animals and plants to a vast array of wildlife products derived from them, including food products, exotic leather goods, wooden musical instruments, timber, tourist curios and medicines.

Levels of exploitation of some animal and plant species are high and the trade in them, together with other factors, such as habitat loss, is capable of heavily depleting their populations and even bringing some species close to extinction. Many wildlife species in trade are not endangered, but the existence of an agreement to ensure the sustainability of the trade is important in order to safeguard these resources for the future.

Because the trade in wild animals and plants crosses borders between countries, the effort to regulate it requires international cooperation to safeguard certain species from over-exploitation. CITES was conceived in the spirit of such cooperation.

PARTIES OF THE CONVENTION

CITES is an international agreement to which States and regional economic integration organizations adhere voluntarily. States that have agreed to be bound by the Convention are known as Parties. It provides a framework to be respected by each Party, which has to adopt its own domestic legislation to ensure that CITES is implemented at the national level.

It has a membership of 183.

FUNCTIONING OF CITES

CITES works by subjecting international trade in specimens of selected species to certain controls. All import, export, re-export and introduction from the sea of species covered by the Convention has to be authorized through a licensing system.

Each Party to the Convention must designate one or more Management Authorities in charge of administering that licensing system and one or more Scientific Authorities to advise them on the effects of trade on the status of the species.

The species covered by CITES are listed in three Appendices, according to the degree of protection they need.

APPENDICES I AND II

- Appendix I includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.
- Appendix II includes species not necessarily threatened with extinction, but in which trade must

be controlled in order to avoid utilization incompatible with their survival.

- Appendix III is a list of species included at the request of a Party that already regulates trade in the species and that needs the cooperation of other countries to prevent unsustainable or illegal exploitation

►CONVENTION ON THE CONSERVATION OF MIGRATORY SPECIES OF WILD ANIMALS (CMS)

The 13th Conference of Parties to the Convention on the Conservation of Migratory Species of Wild Animals (CMS COP13) concluded in Gandhinagar with listing of total 10 migratory species of the world on Appendix I & II of the convention along with adoption of a number of resolutions and decisions to address the needs and threats facing migratory species around the globe. Three of the species listed are from India – Great Indian bustard, mainland Asian elephant and Bengal florican.

ABOUT CMS

It is an environmental treaty of UN; CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats.

WHAT IS THE MAIN TASK OF THIS CONVENTION?

- CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.
- As the only global convention specializing in the conservation of migratory species, their habitats and migration routes, CMS complements and co-operates with a number of other international organizations, NGOs and partners in the media as well as in the corporate sector.
- CMS acts as a framework Convention. The agreements may range from legally binding treaties (called Agreements) to fewer formal instruments, such as Memoranda of Understanding, and can be adapted to the requirements of particular regions.
- The development of models tailored according to the conservation needs throughout the migratory range is a unique capacity to CMS.

VARIOUS CATEGORIES INTO WHICH THE SPECIES ARE DIVIDED BY THE CONVENTION?

- Appendix I:
  - Migratory species threatened with extinction are listed on Appendix I of the Convention.
  - CMS Parties strive towards strictly protecting these animals, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them.
  - Besides establishing obligations for each State joining the Convention, CMS promotes concerted action among the Range States of many of these species.
- Appendix II:
  - Migratory species that need or would significantly benefit from international co-operation are listed in Appendix II of the Convention.
  - For this reason, the Convention encourages the Range States to conclude global or regional agreements.

MAIN TAKEAWAYS FROM COP-13

- Host
  - India hosted the CMS COP for the first time
- Presidency
  - India assumed the role of CMS Presidency for the next three years.
    - Theme:
  - The theme of the COP13 was, "Migratory species connect the planet and together we welcome them home!"
- Listings
  - Three of the species listed in the appendices are from India – Great Indian bustard, mainland Asian elephant and Bengal florican.
  - In the closing press conference of COP13, India expressed a strong resolve to recover the population of GIB which is on the brink of extinction with only around 150 birds left in the country.
- Declarations
  - CMS COP13 also adopted the Gandhinagar Declaration, which calls for migratory species and the concept of 'ecological connectivity' to be integrated and prioritized in the new Framework, which is expected to be adopted at the UN Biodiversity Conference in October.
- Reports
  - The first ever report on the Status of Migratory Species, presented to CMS COP13, shows that despite some success stories, the populations of

most migratory species covered by CMS are declining. COP13 agreed that a more comprehensive review should be undertaken to better understand the status of individual species and the main threats they face.

- Among issues that divided countries at the COP13 was a proposal moved by the CMS secretariat to put additional restrictions on countries whose financial contributions are three or more year in arrears.

►AGENDA 21

Agenda 21 is a product of the Earth Summit organized by UN that took place in Rio de Janerio, Brazil in 1992 to include stakeholders in a non-binding action plan for achieving sustainable development.

The stakeholders included local and national governments, business, international organizations, citizen groups and non-governmental organizations. The international community met again ten years later at the World Summit on Sustainable Development and reviewed developments to forge global partnerships for the implementation of Agenda 21 (World Bank, undated).

India is signatory to Agenda 21 and has sought to align various parts of its development infrastructure such as energy, transport, industry, water facilities, climate change policy, forests, biodiversity, ecosystems, marine and coastal management, land policy, agriculture, urban governance and human resource development.

ORGANZIATIONS

►IUCN

IUCN stands for International Union for Conservation of a Nature. It is a membership Union composed of both government & civil society organisations. It is the global authority on status of natural world and measures needed to safeguard it. Headquartered in Switzerland.

IUCN RED LIST

- IUCN Red List is a rich compendium of information on threats, ecological requirements, and habitats of species; and on conservation actions that can be taken to reduce or prevent extinctions.
- Based on an objective system for assessing risk of extinction of a species based on past, present, and projected threats using the rigorous IUCN Red List Categories and Criteria.
- There are eight IUCN Red List Categories based on criteria linked to population trend, size and structure, and geographic range.
- Produced by IUCN Global Species Program, Species Survival Commission & IUCN Red List Partnership.

WHAT DOES IUCN MEAN BY "THREATENED"?

Critically Endangered (CR), *Endangered* (EN) and *Vulnerable* (VU) species are considered to be threatened with global extinction.

WHAT DOES EACH CATEGORY MEAN?

In descending order of threat, the IUCN Red List threat categories are as follows:

- Extinct *or* Extinct in Wild
- Critically Endangered, Endangered *and* Vulnerable: Species threatened with global extinction.
- Near Threatened*:* Species close to the threatened thresholds or that would be threatened without ongoing conservation measures.
- Least Concern*:* Species evaluated with a lower risk of extinction.
- Data Deficient*:* No assessment because of insufficient data.

IUCN has UN observer status ensuring nature conservation a voice at highest forum of global governance.

COMMISSIONS OF IUCN

Work of IUCN's six Commissions covers a wide range of disciplines: Education & communication, Environmental, Economic & social policy, Ecosystem management, Species survival, Environmental law & Protected areas.

1. Commission on Education and Communication (CEC): to raise awareness of the importance of nature and its conservation.
2. Commission on Environmental, Economic and Social Policy (CEESP): livelihoods, human rights and responsibilities, human development, and fair and effective governance of natural resources, are some of the main aspects
3. Commission on Ecosystem Management (CEM) promotes ecosystem-based approaches for the management of landscapes and seascapes.
4. World Commission on Environmental Law (WCEL) serve as the principal source of legal technical advice on all aspects of environmental law to IUCN

5. World Commission on Protected Areas (WCPA) works to develop policy, advice and guidance on issues relating to protected areas.
6. Species Survival Commission's more than 9,000 experts work independently and with the IUCN Global Species Program to build knowledge on the status of species and threats to them.

►UNEP

UN Environment Assembly organized a special session, called UNEP@50, to commemorate the 50th anniversary of establishment of UNEP.

The theme for the special session was "Strengthening UNEP for the implementation of the environmental dimension of the 2030 Agenda for Sustainable Development."

UNEP is the leading global environmental authority that sets the global environmental agenda, promotes the coherent implementation of the environmental dimension of sustainable development within the United Nations system, and serves as an authoritative advocate for the global environment.

Headquartered in Nairobi, Kenya, it works through its divisions as well as its regional, liaison and out-posted offices and a growing network of collaborating centres of excellence. It also hosts several environmental conventions, secretariats and inter-agency coordinating bodies.

They categorize their work into seven broad thematic areas: climate change, disasters and conflicts, ecosystem management, environmental governance, chemicals and waste, resource efficiency, and environment under review.

SECRETARIATS HOSTED WITHIN UNEP

It hosts the secretariats of many critical multilateral environmental agreements and research bodies, bringing together nations and the environmental community to tackle the greatest challenges of our time. These include the following:

- Convention on Biological Diversity
- Convention on International Trade in Endangered Species of Wild Fauna and Flora
- Minamata Convention on Mercury
- Basel, Rotterdam and Stockholm Conventions
- Vienna Convention for the Protection of Ozone Layer and the Montreal Protocol
- Convention on Migratory Species
- Carpathian Convention
- Bamako Convention
- Tehran Convention

Carpathian Convention is a subregional treaty to foster the sustainable development and the protection of the Carpathian region. The Carpathians are one of Europe's largest mountain ranges, a unique natural treasure of great beauty and ecological value, and home of the headwaters of major rivers.

Bamako Convention is a treaty of African nations prohibiting the import into Africa of any hazardous (including radioactive) waste.

Tehran Convention or also known as Framework Convention for the Protection of the Marine Environment of the Caspian Sea is a regional convention signed by the official representatives of the five littoral Caspian states: Azerbaijan, Iran, Kazakhstan, Russian Federation and Turkmenistan in Tehran (Iran) on 4 November 2003.

Air	Ecosystem and Biodiversity	Extractives	Resource Efficiency
Biosafety	Education and environment	Forests	Sustainable Development Goals
Chemicals and waste	Energy	Gender	Technology
Climate change	Environment under review	Green economy	Transport
Disasters and conflicts	Environmental rights and governance	Oceans and seas	Water

COMMITTEE OF PERMANENT REPRESENTATIVES

Committee of Permanent Representatives prepares the meetings of the UN Environment Assembly and regularly reviews the implementation of its decisions.

The Committee of Permanent Representatives (CPR) is composed of all accredited Permanent Representatives to UN Environment Program (UNEP) and was formally established as a subsidiary organ of the Governing Council (now the United Nations Environment Assembly). Its functions are:

- Contribute to preparation of agenda of UNEA governing body.
- Provide advice to UNEA on policy matters.
- Prepare decisions for adoption by the UNEA and oversee their implementation.
- Convene thematic and/or programmatic debates.
- Promote effective ways and means to facilitate participation of the non-resident members of the Committee, particularly from developing countries.
- Perform any other functions delegated to it by the UNEA.

FUNDING

- Environment Fund is the core source of flexible funds.
- Earmarked funds (funds given or "earmarked" to a specific project, theme, country etc.) enable us to expand and replicate our program in more countries and with more partners. Main providers of earmarked funds include the Global Environment Facility, the Green Climate Fund and the European Commission.

►UN CONFERENCE ON HUMAN ENVIRONMENT (STOCKHOLM, 1972)

It was the first world conference to make environment a major issue.

The participants adopted a series of principles for sound management of the environment including the 'Stockholm Declaration and Action Plan for the Human Environment'.

Stockholm Declaration contained 26 principles and placed environmental issues at forefront of international concerns. It marked the start of a dialogue between industrialised and developing countries on the link between economic growth, pollution of air, water and oceans and the well-being of people around the world.

Indian Prime Minister Indira Gandhi in her seminal speech in the conference brought forward the connection between ecological management and poverty alleviation.

UNEP is celebrating 50 anniversary of Stockholm Conference this year.

►LIMITS TO GROWTH

Published 1972. It argued that earth's resources – the global system of nature in which we all live – probably cannot support present rates of economic and population growth much beyond the year 2100, if that long, even with advanced technology. In 1970, an international team of researchers at MIT began a study of the implications of continued worldwide growth.

They examined five basic factors that determine and, in their interactions, ultimately limit growth on this planet-population increase, agricultural production, nonrenewable resource depletion, industrial output and pollution generation. MIT team fed data on these five factors into a global computer model and then tested the behavior of the model under several sets of assumptions to determine alternative patterns for mankind's future. This theory has again gained prominence as some researchers believe the continuous GDP growth is not possible. A new economic movement called 'De-growth' has been developed.

►ADAPTATION GAP REPORT 2021

This report by UNEP provides an update on global status and progress of adaptation process across three elements: planning, financing, and implementation. The report assesses overall results in adaptation using a forward-looking approach and takes a thematic deep dive into COVID-19 implications on adaptation progress.

It finds that growth in climate impacts is far outpacing our efforts to adapt to them. New evidence suggests that 1.5°C aspirational target of Paris Agreement will likely be missed while some climate impacts are already irreversible, highlighting urgent need to adapt.

There is an urgent need to step up climate adaptation finance. However, finance needed to implement adaptation plans is still far short of where it should be.

►EMISSIONS GAP REPORT 2021

This report by UNEP report provides an update of global emissions pathways and progress towards achieving national mitigation pledges and Paris Agreement goals as well as resulting 'emissions gap'.

The report states that new climate pledges for 2030 have only limited impact on global emissions resulting in a reduction of projected 2030 emissions by only 7.5%. While a 30% reduction in emissions is needed to limit warming to 2° Celsius and a 55% reduction in emissions to limit warming to 1.5 degrees Celsius.

The report noted that if countries achieved their net-zero pledges, it could help in limiting warming to about 2.2° Celsius which is closer to the 2° Celsius goal of Paris Agreement. However, current 2030 commitments and lack of policies do not put G20 member countries on track of achieving even their climate pledges, let alone net-zero pledges.

EMISSIONS GAP

Difference between emissions level countries have pledged to achieve under international agreements and level consistent with limiting warming to well below 2 degrees C.

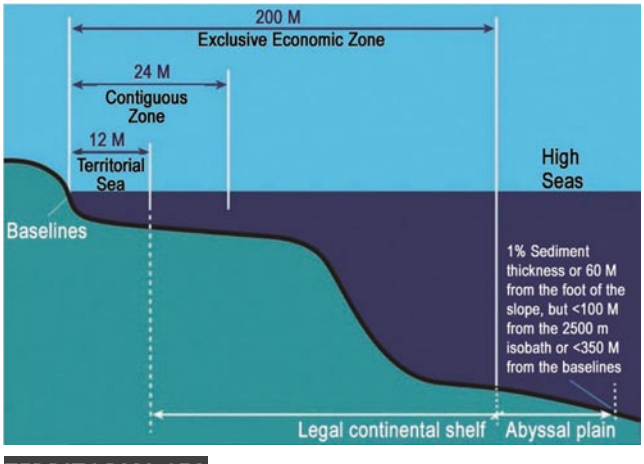
That benchmark exists because warming above 1.5-2 degrees C would bring increasingly catastrophic impacts.

►UNITED NATIONS CONVENTION ON LAW OF THE SEA (UNCLOS)

- UNCLOS lays down a comprehensive regime of law and order in the world's oceans and seas.
- 1982 convention was signed by 117 states & it establishes rules governing all uses of the ocean and its resources.
- The convention also provides the framework for the development of a specific area of law of the sea.
- The convention is a lengthy document having 446 articles group in 7 parts in 9 annexes.

BASELINE

As otherwise provided in the UNCLOS convention, the normal baseline for measuring the breadth of the territorial sea is the low-water line along the coast as marked on large-scale charts officially recognized by the coastal State.



TERRITORIAL SEA

- Every state has the right to establish the breadth of its territorial sea up to a limit not exceeding 12 nautical miles measured from the baseline determined in accordance with this convention.
- The outer limit of the territorial sea is the line every point of which is at a distance from the baseline equal to the breadth of the territorial sea.
- Where the coasts of two States are opposite or adjacent to each other, neither of the two States is entitled, failing agreement between them to the contrary, to extend its territorial sea beyond the median line every point of which is equidistant from the nearest points on the baselines from which the breadth of the territorial seas of each of the two States is measured.

CONTIGUOUS ZONE

- Contiguous zone generally extends 12 nautical miles beyond the territorial sea limit. It consists of a combination of Revenue and Public health or Quarantine jurisdiction.
- The coastal state can prejudice a foreign flag vessel beyond the territorial see if there are reasonable grounds for assuming they are about to violate Customs or Public Health Regulations

EXCLUSIVE ECONOMIC ZONE

The exclusive economic zone shall not extend beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured.

►WMO

As a specialized agency of the United Nations, WMO is dedicated to international cooperation and coordination on the state and behaviour of the Earth's atmosphere, its interaction with the land and oceans, the weather and climate it produces, and the resulting distribution of water resources.

WMO FACILITATES AND PROMOTES

- Establishment of an integrated Earth System observation network to provide weather, climate and water-related data
- Establishment and maintenance of data management centers and telecommunication systems for the provision and rapid exchange of weather, climate and water-related data
- Creation of standards for observation and monitoring in order to ensure adequate uniformity in the practices and procedures employed worldwide and, thereby, ascertain the homogeneity of data and statistics
- Provision of weather, climate and water-related services - through the application of science and technology in operational meteorology and hydrology - to reduce disaster risks and contribute to climate change adaptation, as well as for sectors such as transport (aviation, maritime and land-based), water

resource management, agriculture, health, energy and other areas

- Activities in operational hydrology as well as closer cooperation between National Meteorological and Hydrological Services in states and territories where they are separate
- Coordination of research and training in meteorology and related fields.

WMO STRATEGIC PLAN

- Disaster risk reduction
- The Global Framework for Climate Services (GFCS)
- The WMO Integrated Global Observing System (WIGOS)
- Aviation meteorological services
- Polar and high mountain regions
- Capacity development
- Governance

►THE ECONOMICS OF ECOSYSTEM & BIODIVERSITY (TEEB)

The Economics of Ecosystems and Biodiversity (TEEB) is a global initiative focused on "making nature's values visible".

Its principal objective is to mainstream the values of biodiversity and ecosystem services into decision-making at all levels. It aims to achieve this goal by following a structured approach to valuation that helps decision-makers recognize the wide range of benefits provided by ecosystems and biodiversity, demonstrate their values in economic terms and, where appropriate, capture those values in decision-making.

►NATURAL CAPITAL ACCOUNTING

GDP looks at only one part of economic performance — income — but says nothing about wealth and assets that underlie this income. For example, when a country exploits its minerals, it is actually depleting wealth. The same holds true for over-exploiting fisheries or degrading water resources. These declining assets are invisible in GDP and so, are not measured.

Wealth accounting, including natural capital accounting (NCA), is needed to sustain growth. Long-term development is a process of accumulation and sound management of a portfolio of assets — manufactured capital, natural capital, and human and social capital. As Nobel Laureate Joseph Stiglitz has noted, a private company is judged by both its income and balance sheet, but most countries only compile an income statement (GDP) and know very little about the national balance sheet.

The other major limitation of GDP is the limited representation of natural capital. The full contribution of natural capital like forests, wetlands, and agricultural land does not show up. Forestry is an example – timber resources are counted in national accounts but the other services of forests, like carbon sequestration and air filtration are ignored. So, GDP can give misleading signals about the economic performance and well-being of a country.

Partly as a result, ecosystems are deteriorating worldwide, and with them, the capacity to support human well-being and sustainable economic growth.

The concept of accounting for natural capital has been around for more than 30 years. A major step towards achieving this vision came with the adoption by the UN Statistical Commission of the System for Environmental and Economic Accounts (SEEA) in 2012. This provides an internationally agreed method to account for material natural resources like minerals, timber and fisheries.

►WORLDWIDE FUND FOR NATURE (WWF)

It is an international non-governmental organization founded in 1961 that works in the field of wilderness preservation and the reduction of human impact on the environment.

WWF is the world's largest conservation organization, with over five million supporters worldwide, working in more than 100 countries and supporting around 3,000 conservation and environmental projects.

The Worldwide Fund for Nature (WWF) is part of the Steering Group of the Foundations Platform F20, an international network of foundations and philanthropic organizations.

►LIVING PLANET REPORT 2020

Living Planet Report is published every 2 years by Worldwide Fund for Nature since 1998. It is based on the Living Planet Index and ecological footprint calculations.

LIVING PLANET INDEX (LPI) 2020

- In 2020, the LPI shows an average rate of decline in the population size of 68% between 1970 and 2016.
- The LPI now tracks the abundance of almost 21,000 populations of mammals, birds, fish, reptiles and amphibians around the world.

- The LPI includes the data for threatened and non-threatened species.
- Species and populations in the LPI are increasing, declining or stable.
- About half of the species in the LPI show an average decline in the population size.
- LPI does not show numbers of species lost or extinct.

►SEEA- ECOSYSTEM ACCOUNTING

It constitutes an integrated statistical framework for organising data about habitats and landscapes, measuring ecosystem services, tracking changes in ecosystem assets, and linking this information

UN Statistical Commission adopted the SEEA-Ecosystem Accounting in 2021.

SEEA-EA IS BUILT ON FIVE ECOSYSTEM ACCOUNTS

1. Ecosystem extent
2. Ecosystem condition
3. Ecosystem services (Physical)
4. Ecosystem services (Financial)
5. Monetary Ecosystem Asset

The aim of this exercise is to improve the economic benchmarks such as GDP which currently do not take into account the value of nature and other externalities.

►EDGAR FOOD

It is a database which can be used to assess how changes in consumer behavior or technology, may impact food system derived greenhouse gas emissions.

It incorporates land use data for over 200 countries and goes back to 1990 and spans multiple sectors, which will enable tracking of ongoing and future trends.

This database is an initiative of FAO.

►ENVIRONMENTAL DNA METABARCODING (eDNA)

It involves taking samples of soil or water and searching for fragments of DNA specific to certain species. This method eliminates the time-consuming process of sorting individual samples and enables us to identify different species present in a river system.

►GLOBAL EBA FUND

A fund established by UNEP and IUCN, which will provide grants for innovative approaches to ecosystem-based adaptation through seed capital.

OBJECTIVES

1. Build awareness and understanding of critical role of natural assets
2. Encourages catalytic initiatives to help overcome identified barriers for upscaling EbA.

ABOUT ECOSYSTEM-BASED ADAPTATION (EBA)

It is the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to adverse effects of climate change.

►NATURE-BASED RECOVERY INITIATIVE

- It aims to ensure that at least 10% of overall investments in stimulus packages are channeled to nature, nature-based solutions and interventions that add value to nature.
- It is an initiative of IUCN.

►POWERING PAST COAL ALLIANCE

It is a coalition that aims to advance the transition from unabated coal power generation to clean energy by 2030 in OECD and EU and by no later than 2050 in rest of the world. The initiative was launched by UK and Canadian government at COP23 in 2017.

AIMS

1. Secure commitment from government and industry to phase out existing coal power
2. Encourage global moratorium on construction of new coal fired power plants
3. Shift investment from coal to clean energy, restrict funding for coal and coal-based projects
4. Phase out in a sustainable and economically inclusive way.

MEMBERSHIP

- 36 National Governments (India is not a member), Subnational Governments and Organisations.
- Carbon di oxide emitted from coal combustion is responsible for a third of $1^{o}C$ increase in global average surface temperatures. Coal is single largest source of global temperature increase.

►ASIA PROTECTED AREAS PARTNERSHIP (APAP)

- India is the co-chair of the IUCN-supported Asia Protected Areas Partnership (APAP) for 3 years and it

would, in this capacity, assist other Asian countries in managing their protected areas.

- The APAP is a regional platform to help the governments and other stakeholders to collaborate for more effective management of the protected areas (PAs) in the region.
- The APAP currently consists of 21 members from 17 countries, including China, Japan, South Korea, Nepal, Bhutan, Sri Lanka and Bangladesh.
- The APAP, formally launched at the IUCN World Parks Congress in Australia in 2014, is chaired by IUCN Asia and co-chaired by an APAP country member.
- India replaced South Korea in 2020.

►BIOTRADE INITIATIVE

- UNCTAD's BioTrade Initiative aims to contribute to the conservation and sustainable use of biodiversity through the promotion of trade and investment in the BioTrade products and services.
- BioTrade is understood as activities related to the collection or production, transformation and commercialization of goods and services derived from biodiversity (genetic resources, species and ecosystems), under the environmental, social and economic sustainability criteria. These criteria, known as the BioTrade Principles and Criteria (P&C), have been the core foundation that guides the implementation of the activities of the UNCTAD BioTrade Initiative, the BioTrade programs and other related activities since their inception in 2007.

►BIODIVERSITY AND ECOSYSTEMS SERVICES INDEX

- The Biodiversity and Ecosystems Services Index is an index published by Swiss Re Institute that enables business and governments to factor in biodiversity and ecosystem issues into economic decision-making. Over half (55%) of the global GDP is dependent on high functioning biodiversity and ecosystem services.
- However, a staggering fifth of the countries globally (20%) are at a risk of their ecosystems collapsing due to a decline in biodiversity and related beneficial services, reveals a new study by Swiss Re Institute.

►GLOBAL STANDARDS ON NATURE BASED SOLUTIONS (NbS)

Nature-based Solutions (NbS) are a powerful ally to address societal challenges, such as climate change, biodiversity loss and food security

IUCN has released first ever, Global Standard for Nature-based Solutions to help users design, implement and verify NbS actions.

The Global Standard includes a self-assessment that consists of eight criteria and associated indicators, which address the pillars of sustainable development (economy, environment and society) and resilient project management.

The eight criteria are

1. Societal Challenges
2. Design of scale
3. Biodiversity net-gain
4. Adaptive management
5. Inclusive governance
6. Balance trade-offs
7. Adaptive management
8. Mainstreaming & Sustainability

The output of the self-assessment comes in the form of a percentage match compared against good practices, with a traffic light system to identify areas for further work and adherence to the IUCN Global Standard. The governing body of the IUCN Global Standard will be responsible for revising the criteria every four years, enabling improvement and engagement on NbS across sectors.

USE OF GLOBAL STANDARDS

1. Prevent misuse of NbS mislabelling
2. Help donors, investors and governments to identify projects
3. Standardisation of nature-based solutions.

►OECM STATUS

- Other effective area-based conservation measures' (OECMs) is a conservation designation for areas that are achieving the effective in-situ conservation of biodiversity outside of protected areas.
- OECM Status is conferrd by the IUCN.
- Aravalli Biodiversity Park in Gurgram, Haryana is the first site with OECM status in India.

►IUCN GREEN STATUS OF SPECIES

It aims to complement the IUCN Red List by providing a tool for assessing the recovery of species populations and measuring their conservation success. It also highlights impact of past conservation and dependence of many species on continued conservation efforts.

Note: IUCN animals with Green Status will continue to be preserved and IUCN Red List will be published.

Since 2012, IUCN has been preparing Green List of Protected & Conserved Areas.

DEFINITION OF RECOVERY UNDER GREEN LIST

A species is fully recovered if it is present in all parts of its range, even those that no longer occupied but were occupied prior to major human impact/disruption.

It is viable in all part of the range.

It is performing its ecological functions in all parts of the range.

GREEN SCORE

Recovery definition is translated in Green Score, a numeric value. Green Score calculated at the time of assessment is the Species Recovery Score.

►STATE OF CLIMATE SERVICES REPORT 2021

A multi-agency report, coordinated by WMO, on the state of climate services for assessing adaptation needs in climate-sensitive socioeconomic sectors. The 2021 edition of the WMO State of Climate Services report focuses on water.

This latest WMO report explores the progress made by WMO Members in using climate services to address water-related challenges – and highlights the gaps in user engagement, forecasting, observing networks, and data collection that still exist.

►GROSS ECOSYSTEM PRODUCT

- Ecosystem products and services are essentials for human survival and development.
- Gross Ecosystem Product (GEP) aims to specific indicators to measure the total economic value of all ecosystem products and services.
- GEP is the total value of final ecosystem goods and services supplied to human well-being in a region annually and can be measured in terms of biophysical value and monetary value.
- Ecosystems that can be measured include natural ecosystems such as forests, grassland, wetland, desert, freshwater and ocean, and artificial systems that are based on natural processes like farmland, pastures, aquaculture farms and urban green land, etc.
- IUCN is currently carrying out pilot research projects on GEP with partners.

►GREEN VOYAGE 2050 PROJECT

- It is a partnership project between Norway and IMO launched in 2019 aiming to transform the shipping industry towards a lower carbon future.
- The global partnership is supporting developing countries, including Small Islands Developing States (SIDS) and Least Developed Countries (LDCs), in meeting their commitment towards relevant climate change and energy efficiency goals, for international shipping.
- India has been selected as the first country under IMO Green Voyage 2050 project for conduct of a pilot project related to Green Shipping.
- India intends to increase share of renewable energy to 60% of total power demand of each of its major port from present share of less than 10%. This will be through solar and wind generated power.

GLOBAL INDUSTRY ALLIANCE TO SUPPORT LOW CARBON SHIPPING

Low Carbon GIA was originally established in 2017 under the GEF-UNDP-IMO GloMEEP Project. Following the completion of the GloMEEP Project in December 2019, the Low Carbon GIA was re-established and continues to operate under the framework of the IMO-Norway GreenVoyage2050 Project. The Low Carbon GIA aims to bring together maritime industry leaders to support an energy efficient and low carbon maritime transport system.

►FINANCE FOR BIODIVERSITY INITIATIVE

- Finance for Biodiversity (F4B) was established in 2019 and aims to increase the materiality of biodiversity in financial decision-making, and so better align global finance with nature conservation and restoration.
- F4B focuses on the following strategic areas:
  - Market efficiency and innovation
  - Nature markets
  - Public finance
  - Strategic liabilities
  - Citizen engagement
- F4B is a dual-purpose platform, both implementing its own activities across five work streams and making grants to support others to undertake work in these areas.
- It is supported by the MAVA Foundation as well as CIFF and its work is guided by a leadership group of experts and practitioners in the field.

►GLOBAL ASSESSMENT ON MARINE LITTER AND PLASTIC POLLUTION

- UNEP has released a global assessment of the marine pollution crisis in the lead up to the Glasgow Climate Change Conference (COP 26) and the UN Environment Assembly's meeting in 2022.
- The publication titled, 'From Pollution to Solution: A global assessment of marine litter and plastic pollution,' released on 21 October 2021, provides a scientific basis for the need to urgently act to control plastic emissions into the environment.
- The authors report that plastics are the largest, most harmful and most persistent component of marine litter, accounting for at least 85%.
- The report finds sharp growth in recent years of plastic waste emissions, or leakage, into aquatic ecosystems, which it says are on track to almost triple by 2040.

►CLYDEBANK DECLARATION

- UK has announced the launch of the Clydebank Declaration on Green Shipping Corridors at the COP26 conference in Glasgow.
- The signatories of the Declaration are to support the establishment of green shipping corridors – zero-emission maritime routes between 2 (or more) ports.
- As part of the declaration, the signatory countries will support the establishment of at least six green shipping corridors by 2050.
- Signatory countries: Around 22 countries have signed the declaration.
- India has not signed the declaration yet.

►NAIROBI DECLARATION 2021

- Nairobi Declaration, adopted by African ministers and heads of delegation 2021, underlined the need to deliver commitments on the Program of Action (PoA) for implementing the Sendai Framework in Africa.
- This included the action plans under the PoA, to implement Sendai Framework for Disaster Risk Reduction (SFDRR), 2015-2030.
- The declaration was adopted at the seventh high-level meeting on disaster risk reduction reduction.
- Theme- Towards Disaster Risk-Informed Development for a Resilient Africa in a COVID-19 Transformed World.
- It was organised by UN Office for Disaster Risk Reduction (UNDRR), in collaboration with the African Union Commission and the Intergovernmental Authority on Development.

Sendai Framework is aimed towards "substantial reduction in disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries".

Implementation of the Sendai Framework is expected to contribute to UN-mandated Sustainable Development Goals and to achieving Agenda 2063 commitment "The Africa we want".

►UNDP EQUATOR PRIZE

- The two winning organizations from India out of ten winners globally are— Aadhimalai Pazhangudiyinar Producer Company Limited (1,700-member cooperative, managed and run entirely by indigenous people from the Nilgiri Biosphere Reserve) and Snehakunja Trust.
- The UNDP gives this biennial award to recognize community efforts to reduce poverty through the conservation and sustainable use of biodiversity.

►ECO OSCARS

- Earthshot Prize (dubbed as Eco Oscars) is an award that five finalists will receive between 2021 and 2030 for developing solutions to fight climate crisis.
- Established in 2020, 2021 was the first year when awards were handed out to finalists for their contributions towards the five UN Sustainable Development Goals -- restoration and protection of nature, air cleanliness, ocean revival, waste-free living and climate action.
- The awards were established by UK's Prince William and famed natural historian David Attenborough in 2020.
- Inspired by former US President John F Kennedy's Moonshot -- when the president had set a goal of reaching the Moon in less than a decade -- the Earthshot Prize hopes to encourage and support the development of solutions for Earth's environmental problems.
- New Delhi-based 17-year-old entrepreneur Vidyut Mohan is among the five global winners for the inaugural 'Earthshot Prize'.
- Vidyut has been awarded in the Clean our Air category, for his technology called 'Takachar', a small and portable device that uses crop residue to convert it into bio-products like fuel and fertilisers to reduce smoke emissions and combat air pollution.

- Each of the five winners will receive £1 million for their project.

►ICIMOD

- ICIMOD stands for international center for integrated mountain development. A regional intergovernmental learning & knowledge sharing center for Hindu-Kush.
- It has eight regional member countries of the Hindu Kush Himalaya – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan – and based in Kathmandu, Nepal. Also called 'Third Pole'.
- ICIMOD aims to assist mountain people to understand the changes, adapt to them, and make the most of new opportunities, while addressing upstream-downstream issues.
- The ICIMOD has been facilitating the Mount Kailash Sacred Landscape Initiative, involving India, Nepal and China. These countries will collaborate on eco-restoration and bio-diversity management in their parts of the territory.

MOUNTAINS OF OPPORTUNITY INVESTMENT

It will enable investment partners – including HKH governments, mountain communities, financial institutions, private sector actors, and development partners – to identify, align and scale up investment in mountain-specific climate priorities in the near to medium term. It is an initiative of ICIMOD.

It identifies six investment priorities aligned to climate action and COVID-19 recovery that will contribute to climate-resilient, carbon-neutral mountain societies.

1. Mountain specific nature-based solutions
2. Resilient mountain infrastructure
3. Resilient mountain entrepreneurial ecosystem
4. Inclusive and climate responsive financial landscape
5. Shock responsive social protection systems
6. Resilient & inclusive labour markets.

►IPBES

IPBES stands for Intergovernmental Science Policy Platform on Biodiversity & Ecosystem Services.

It is an independent intergovernmental body established by States to strengthen the science-policy interface for biodiversity and ecosystem services for the conservation and sustainable use of biodiversity, long-term human well-being and sustainable development.

It was established in Panama City, on 21 April 2012 by 94 Governments.

It is not a United Nations body. However, at the request of the IPBES Plenary and with the authorization of the UNEP Governing Council in 2013, the UNEP provides secretariat services to IPBES.

WHY DOES IPBES MATTER?

Biodiversity and nature's benefits to people underpin almost every aspect of human development and are key to the success of the new Sustainable Development Goals. They help to produce food, clean water, regulate climate and even control disease. Yet they are being depleted and degraded faster than at any other point in human history. IPBES is unique – harnessing the best expertise from across all scientific disciplines and knowledge communities – to provide policy-relevant knowledge and to catalyze the implementation of knowledge-based policies at all levels in government, the private sector and civil society.

WHAT DOES IPBES DO?

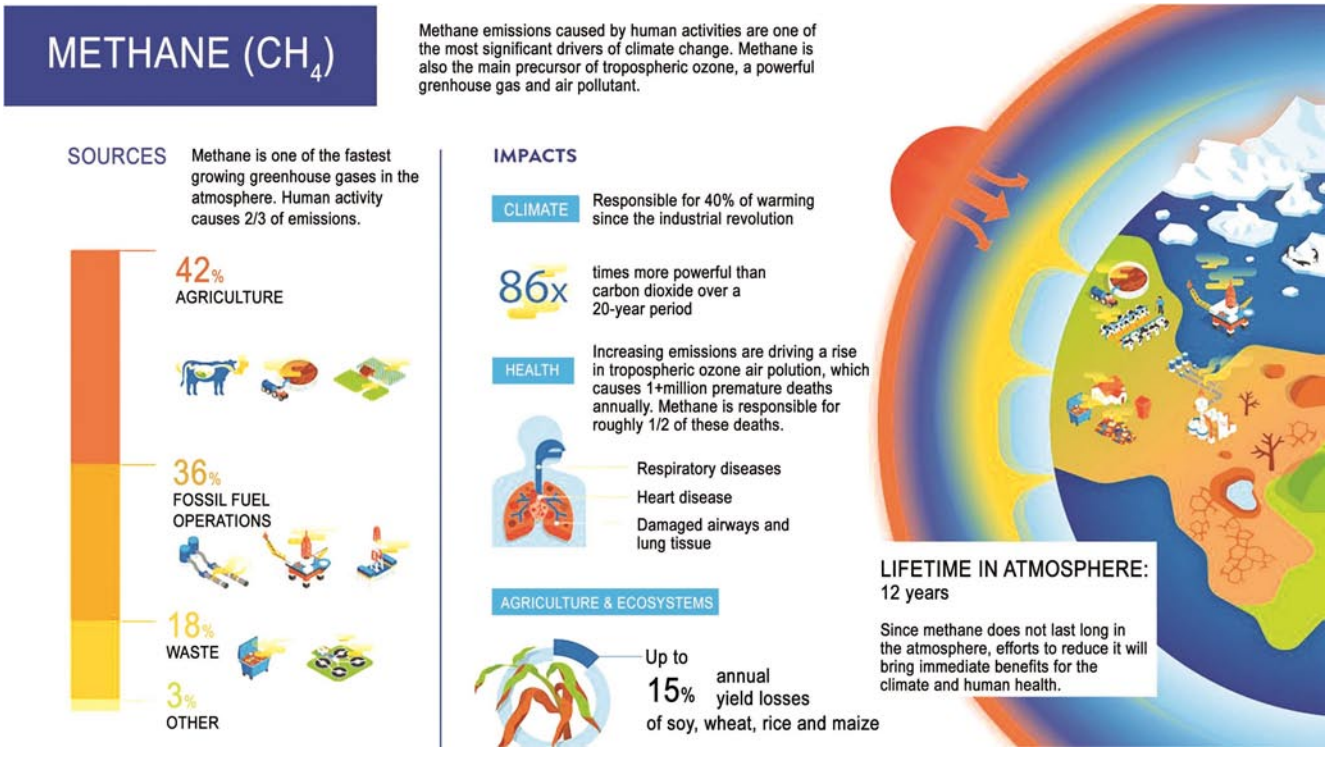
The work of IPBES can be broadly grouped into four complementary areas:

- Assessments: On specific themes (Ex. "Pollinators, Pollination and Food Production"); methodological issues (Ex. "Scenarios and Modelling); and at both the regional and global levels (Ex. "Global Assessment of Biodiversity and Ecosystem Services").
- Policy Support: Identifying policy-relevant tools and methodologies, facilitating their use, and catalyzing their further development.
- Building Capacity & Knowledge: Identifying and meeting the priority capacity, knowledge and data needs of our member States, experts and stakeholders.
- Communications & Outreach: Ensuring the widest reach and impact of our work.

►METHANE & CLIMATE CHANGE

- It is a hydrocarbon that is a primary component of natural gas.
- Methane is also a greenhouse gas (GHG), so its presence in the atmosphere affects the earth's temperature and climate system.
- Methane is emitted from a variety of anthropogenic and natural sources.
- Anthropogenic emission sources include landfills, oil and natural gas systems, agricultural activities, coal mining, stationary and mobile combustion, wastewater treatment, and certain industrial processes.
- Methane is the second most abundant anthropogenic GHG after carbon dioxide (CO_2), accounting for about 20 percent of global emissions.

- Methane is more than 25 times as potent as carbon dioxide at trapping heat in the atmosphere.
- Because methane is both a powerful greenhouse gas and short-lived compared to carbon dioxide, achieving significant reductions would have a rapid and significant effect on atmospheric warming potential.



INTERNATIONAL METHANE EMISSIONS OBSERVATORY

- The International Methane Emissions Observatory (IMEO) was launched at the G20 Summit, on the eve of the COP26 UN climate conference in Glasgow.
- It is a data-driven, action-focused initiative by the UN Environment Programme (UNEP) with support from the European Commission to catalyse dramatic reduction of methane emissions, for achieving Paris agreement goals.
- An Eye on Methane (2021) is the report by International Methane Emissions Observatory 2021

How it will be done

- IMEO will collect and integrate diverse methane emissions data streams to establish a global public record of empirically verified methane emissions at an unprecedented level of accuracy and granularity.

Emission Data from Four streams-

1. Reporting from the Oil and Gas Methane Partnership 2.0 (OGMP 2.0)
2. Oil and gas companies
3. Direct measurement data from scientific studies
4. Remote sensing data, and national inventories.

- IMEO will initially focus on methane emissions from the fossil fuel sector, and then expand to other major emitting sectors like agriculture and waste.
- This will allow IMEO to engage companies and governments around the world to utilize this data to target strategic mitigation actions and support science-based policy options.
- IMEO will provide the means to prioritize actions and monitor commitments made by state actors in the Global Methane Pledge (Launched at Glasgow, COP26) – a US and EU-led effort by over thirty countries to slash methane emissions by 30 per cent by 2030. India has not signed up for the pledge.
- Methane Fat tails: A common characteristic across the oil & gas supply chain is the presence of subset of sources or facilities with a disproportionate contribution to total emissions. These subset of super-emitters sites as the 'fat tail' of emissions distributions.

OIL AND GAS METHANE PARTNERSHIP 2.0

OGMP 2.0 launched in November 2020 is a multi-stakeholder initiative launched by UNEP and climate and clean air coalition. It is the only comprehensive, measurement-based reporting framework for the oil

and gas sector, and its 74 member companies represent many of the world's largest operators across the entire value chain, and account for over 50% of all oil and gas production.

GLOBAL METHANE INITIATIVE

- It is an international public private partnership focused on reducing barriers to the recovery and use of methane as a valuable energy source.
- GMI provides technical support to deploy methane to energy projects around the world that enable Partner Countries to launch methane recovery and use projects. GMI support has enabled Partner Countries to launch hundreds of methane recovery and use projects, with millions of tonnes of carbon di oxide equivalent emission reduction.
- GMI advances methane mitigation in 3 key sectors: Oil & Gas, Biogas (including agriculture, municipal solid waste, and wastewater) and Coal Mines.
- Methane emissions from Oil & Gas Sector: Methane emissions from oil and natural gas systems result from both normal operations and system disruptions. These emissions can be cost-effectively reduced by upgrading technologies or equipment, and by improving operations.
- Methane emissions from Biogas Sector: Biogas produced from the anaerobic digestion of organic material or emitted directly from landfills can be treated to create pipeline-quality natural gas, used as a cooking fuel, used to generate electricity, and captured on-site to provide heat and power.
- Methane emissions from Coal Mines Sector: Removing fugitive methane gas from underground coal mines and using it in profitable and practical ways can improve worker safety, enhance mine productivity, increase revenues, and reduce greenhouse gas emissions.
- Membership: GMI Partner Countries account for approximately 70% of global manmade methane emissions. India is a member of this organisation.

Through these efforts, GMI aims to:

a. Decreasing greenhouse gas emissions
b. Improving human health
c. Increasing worker safety
d. Improving air and water quality
e. Enhancing energy security
f. Expanding economic growth

LOBAL METHANE ASSESSMENT

The assessment was launched by Climate & Clean Air Coalition (CCAC) together with UNEP.

Keyfindings:

- Europe has greatest potential to curb methane emissions from farming, fossil fuel operations & waste management.
- India has greatest potential to reduce methane emissions in the waste sector.
- China's mitigation potential is best in coal production and livestock.
- Africa's mitigation potential is in livestock, followed by oil and gas.
- Up to 80% of measures in the oil and gas industry could be implemented at negative or low cost.
- Methane in the atmosphere reached record levels in 2020, which is a cause of concern as it is an extremely powerful GHG and is responsible for about 30 per cent of warming since pre-industrial times.
    - However, carbon dioxide levels have dropped during the Covid-19 pandemic due to the lockdowns and travel restrictions.

ENVIRONMENTAL LEGISLATIONS

►DAM SAFETY BILL, 2019

The Bill provides for surveillance, inspection, operation, and maintenance of all specified dams across the country. These are dams with height more than 15 metres, or height between 10 metres to 15 metres with certain design and structural conditions.

- Constitutes two national bodies: National Committee on Dam Safety, whose functions includes evolving policies and recommending regulations regarding dam safety standards; and National Dam Safety Authority, whose functions include implementing policies of National Committee, providing technical assistance to State Dam Safety Organisations (SDSOs), and resolving matters between SDSOs of states or between a SDSO and any dam owner in that state.
- Constitutes two state bodies: State Committee on Dam Safety, and State Dam Safety Organisation. These bodies will be responsible for surveillance, inspection, and monitoring operation and maintenance of dams within their jurisdiction.
- Functions of the national bodies and State Committees on Dam Safety have been provided in Schedules to the Bill. These Schedules can be amended by a government notification.
- An offence under the Bill can lead to imprisonment of up to two years, or a fine, or both.

DAM REHABILITATION AND IMPROVEMENT PROJECT (DRIP PHASE II)

This new Scheme will strengthen dam safety initiatives taken by Government of India through physical rehabilitation of selected dams by addressing various concerns to improve safety and operational performance, institutional strengthening in various ways, incidental revenue generation for sustainable operation & maintenance of dams etc. The Scheme is designed to infuse global know-how, innovative technologies in dam safety. Another major innovation envisaged under the project, that is likely to transform dam safety management in the country, is the introduction of a risk-based approach to dam asset management that will help to effectively allocate financial resources towards priority dam safety needs. Also, Scheme implementation will equip the Indian dam owners to gear up their human resources to comprehensively handle many important activities envisaged in proposed Dam Safety Legislation.

►BIOLOGICAL DIVERSITY ACT, 2002

It was born out of India's attempt to realise objectives enshrined in UNCBD, 1992 which recognizes sovereign rights of states to use their own Biological Resources.

Aims at conservation of biological resources, managing its sustainable use and enabling fair and equitable sharing benefits arising out of the use and knowledge of biological resources with the local communities.

Biodiversity: The biodiversity means the variability among living organisms from all sources and the ecological complexes of which they are part and includes diversity within species or between species and of ecosystems

Biological Resources: The biological resources means plants, animals and micro-organisms or parts thereof,

their genetic material and by-products (excluding value added products) with actual or potential use or value but does not include human genetic material.

SALIENT FEATURES

- Prohibits following activities without prior approval from National Biodiversity Authority:
  - Any person or organisation (either based in India or not) obtaining any biological resource occurring in India for its research or commercial utilisation.
  - The transfer of the results of any research relating to any biological resources occurring in, or obtained from, India.
  - The claim of any intellectual property rights on any invention based on the research made on the biological resources obtained from India.
- Three-tier structure to regulate access to biological resources:
  - National Biodiversity Authority (NBA)
  - State Biodiversity Boards (SBBs)
  - Biodiversity Management Committees (BMCs) (at local level)
- Provides these authorities with special funds and a separate budget in order to carry out any research project dealing with the biological natural resources of the country.
  - It shall supervise any use of biological resources and the sustainable use of them and shall take control over the financial investments and their return and dispose of those capitals as correct.
- Under this act, the Central Government in consultation with the NBA
  - Shall notify threatened species and prohibit or regulate their collection, rehabilitation and conservation
  - Designate institutions as repositories for different categories of biological resources
- The act stipulates all offences under it as cognizable and non-bailable.
  - Any grievances related to the determination of benefit sharing or order of the National Biodiversity Authority or a State Biodiversity Board under this Act, shall be taken to the National Green Tribunal (NGT).

EXEMPTIONS FROM THE ACT

- Excludes Indian biological resources that are normally traded as commodities.
  - Such exemption holds only so far the biological resources are used as commodities and for no other purpose.
- Excludes traditional uses of Indian biological resources and associated knowledge and when they are used in collaborative research projects between Indian and foreign institutions with the approval of the central government.
- Uses by cultivators and breeds, Ex. farmers, livestock keepers and beekeepers and traditional healers Ex. vaids and hakims are also exempted.

NATIONAL BIODIVERSITY AUTHORITY

- The National Biodiversity Authority (NBA) was established in 2003 by the Central Government to implement India's Biological Diversity Act (2002).
- It is a Statutory body that performs facilitative, regulatory and advisory functions for the Government of India on the issue of Conservation and sustainable use of biological resources.
- The NBA has its Headquarters in Chennai, Tamil Nadu, India.

STRUCTURE OF THE NBA

- The National Biodiversity Authority consists of the following members to be appointed by the central government, namely:
  - A Chairperson.
  - Three ex officio members, one representing the Ministry dealing with Tribal Affairs and two representing the Ministry dealing with Environment and Forests.

FUNCTIONS OF THE NBA

- Creating an enabling environment, as appropriate, to promote conservation and sustainable use of biodiversity.
- Advising the central government, regulating activities and issuing guidelines for access to biological resources and for fair and equitable benefit sharing in accordance with the Biological Diversity Act, 2002.
- Taking necessary measures to oppose the grant of intellectual property rights in any country outside India on any biological resource obtained from India or knowledge associated with such biological resources derived from India illegally.
- Advising the State Governments in the selection of areas of biodiversity importance to be notified as heritage sites and suggest measures for their management.

STATE BIODIVERSITY BOARDS (SBBS)

- The SBBs are established by the State Governments in accordance with Section 22 of the Act.
- Structure: The State Biodiversity Board consists of the following members:
  - A Chairperson
  - Not more than five ex officio members to represent the concerned Departments of the State Government
  - Not more than five members from amongst experts in matters relating to conservation of biological diversity, sustainable use of biological resources and equitable sharing of benefits arising out of the use of biological resources.
  - All the members of the SBB are appointed by the respective State Governments.

FUNCTIONS OF SBBS

- Advise the State Government, subject to any guidelines issued by the Central Government, on matters relating to the conservation, sustainable use or sharing equitable benefits.
- Regulate by granting approvals or otherwise requests for commercial utilisation or bio-survey and bio-utilisation of any biological resource by people.

Note

- There are no State Biodiversity Boards constituted for Union territories.
- The National Biodiversity Authority exercises the powers and performs the functions of a State Biodiversity Board for the UTs.

BIODIVERSITY MANAGEMENT COMMITTEES (BMCS)

- According to Section 41 of the Act, every local body shall constitute the BMC within its area for the purpose of promoting conservation, sustainable use and documentation of biological diversity including:
  - Preservation of habitats
  - Conservation of Landraces
  - Folk varieties and cultivars
  - Domesticated stocks And breeds of animals
  - Microorganisms And Chronicling Of Knowledge Relating To Biological Diversity

STRUCTURE

- It shall consist of a chairperson and not more than six persons nominated by the local body.
  - Out of total members of a BMC, not less than one third should be women and not less than 18% should belong to the Scheduled Castes/ Scheduled Tribes.
- The Chairperson of the Biodiversity Management Committee shall be elected from amongst the members of the committee in a meeting to be chaired by the Chairperson of the local body.
- The chairperson of the local body shall have the casting votes in case of a tie.

FUNCTIONS

- The main function of the BMC is to prepare People's Biodiversity Register in consultation with the local people.
- The register shall contain comprehensive information on availability and knowledge of local biological resources, their medicinal or any other use or any other.

PEOPLE'S BIODIVERSITY REGISTERS (PBR)

- The PBRs focus on participatory documentation of local biodiversity, traditional knowledge and practices.
  - The register shall contain comprehensive information on the availability and knowledge of local biological resources, their medicinal or any other use or any other traditional knowledge associated with them.
- They are seen as key legal documents in ascertaining the rights of local people over the biological resources and associated traditional knowledge.

BIODIVERSITY HERITAGE SITES (BHS)

- Under Section 37 of Biological Diversity Act, 2002 the State Government in consultation with local bodies may notify the areas of biodiversity importance as Biodiversity Heritage Sites.
- The Biodiversity Heritage Sites are the well-defined areas that are unique, ecologically fragile ecosystems - terrestrial, coastal and inland waters and marine having rich biodiversity comprising of any one or more of the following components:
  - richness of wild as well as domesticated species or intra-specific categories
  - high endemism
  - presence of rare and threatened species
  - keystone species
  - species of evolutionary significance
  - wild ancestors of domestic/cultivated species or their varieties
  - past pre-eminence of biological components represented by fossil beds

- having significant cultural, ethical or aesthetic values; important for the maintenance of cultural diversity (with or without a long history of human association with them)

- Areas having any of the following characteristics may qualify for inclusion as BHS.

BIODIVERSITY HERITAGE SITE (BHS)	DISTRICT/STATE
Nallur Tamarind Grove	Bangalore, Karnataka
Hogrekan	Chikmagalur, Karnataka
University of Agricultural Sciences, Bengaluru	Karnataka
Ambaraguda	Karnataka
Glory of Allapalli	Maharashtra
Tonglu BHS and Dhotrey BHS under the Darjeeling Forest Division	Darjeeling, West Bengal
Mandasaru	Odisha
Dialong Village	Manipur
Ameenpur lake	Telangana
Majuli	Assam
Gharial Rehabilitation Centre	Lucknow, Uttar Pradesh
Chilkigarh Kanak Durga	West Bengal
Purvatali Rai	Goa
Naro Hills	Madhya Pradesh
Asramam	Kerala

►BIOLOGICAL DIVERSITY (AMENDMENT) BILL, 2021

This bill proposes to amend Biological Diversity Act, 2002. The Act provides for the conservation of biological diversity, sustainable use of its components, and fair and equitable sharing of the benefits arising out of the use of biological resources. The Bill seeks to streamline research and patent applications, encourage cultivation of wild medicinal plants, and practice of indigenous medicine. Key amendments proposed by the Bill include:

ACCESS TO BIOLOGICAL RESOURCES AND INTELLECTUAL PROPERTY RIGHTS (IPR)

The Bill amends the last category to any foreign-controlled company registered in India. The Bill also provides that these four categories of applicants must obtain NBA's approval before the grant of IPR (and not before applying for IPR).

Under the Act, State Biodiversity Boards (SBBs) are set up by state governments to advise them on conservation of biodiversity. Indian citizens and organisations registered in India must give prior intimation to the concerned SBB before obtaining any biological resource for commercial utilisation. They must also get NBA's approval before applying for IPR.

- The Bill amends this to provide that anyone who does not need approval from NBA to access biological resources must give prior intimation to the concerned SBB. Further, they must: (i) register with the NBA before the grant of IPR, and (ii) get prior approval of the NBA before commercialising the granted IPR.

EXEMPTIONS

The Bill extends the exemption to registered AYUSH (Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy) practitioners, and cultivated medicinal plants and their products.

COMPOSITION OF NBA

The Bill provides for 11 additional members in the Authority. These include: (i) six ex-officio members dealing with wildlife, forestry research, and Panchayati Raj, (ii) four representatives from State Biodiversity Boards (on a rotational basis), and (iii) a Member-Secretary (must have experience in biodiversity conservation). The Member-Secretary will be the chief coordinating officer of the NBA.

THREATENED SPECIES

The Bill allows the central government to delegate this power to the state government. However, before notifying any threatened species, the state government must consult the NBA.

BIODIVERSITY MANAGEMENT COMMITTEE (BMC):

The Bill specifies that the state government will prescribe the composition of these BMCs, and they must have between seven to eleven members. Further, state governments may also constitute BMCs at the intermediate or district Panchayat level.

OFFENCES: The offences under the Act are cognizable and non-bailable. A cognizable offence is one for which a police officer may arrest an accused person without a warrant.

- The Bill deletes this provision.

►WILDLIFE PROTECTION ACT, 1972

It provides for protection to listed species of flora and fauna and establishes a network of ecologically important protected areas. The Act consists of 60 Sections and VI Schedules- divided into Eight Chapters.

The Wildlife Protection Act, 1972 empowers the central and state governments to declare any area a wildlife sanctuary, national park or closed area. There is a blanket ban on carrying out any industrial activity inside these protected areas. It provides for authorities to administer and implement the Act; regulate the hunting of wild animals; protect specified plants, sanctuaries, national parks and closed areas; restrict trade or commerce in wild animals or animal articles; and miscellaneous matters.

The Act prohibits hunting of animals except with permission of authorized officer when an animal has become dangerous to human life or property or as disabled or diseased as to be beyond recovery. The Act underwent many amendments.

1. 1982 Amendment introduced provisions permitting the capture and transportation of wild animals for the scientific management of animal population.
2. 1991 Amendment led to the insertion of the special chapters dealing with the protection of specified plants and the regulation of zoos. This also recognized the needs of tribal and forest dwellers and changes were introduced to advance their welfare. The near-total prohibition on hunting was made more effective.
3. 2002 Amendment: A new chapter has been incorporated as Chapter VI-A to deal with the forfeiture of property derived from illegal hunting and trade. Further, this amendment Act also introduced the concept of co-operative management through conservation reserve management committee and community reserve committees.
4. 2005 Amendment: Special Provisions for Tigers, Incorporation of NTCA and Statutory Status to Wildlife Crime Control Bureau (WCCB).

DEFINITION OF WILDLIFE

The Section 2(37) of the Act defines wildlife as wildlife includes any animal, bees' butterflies, crustacean, fish and moths; and aquatic or land vegetation which forms part of any habitat. So, the meaning of the wildlife in this Act is very wide and inclusive of all kinds of flora and fauna.

AUTHORITIES CONSTITUTED UNDER WILDLIFE (PROTECTION) ACT

As per the Sec. 3 of the Act, the Central Government may appoint a Director of Wildlife Preservation, Assistant Directors of Wildlife Preservation and such other officers and employees as may be necessary. As per the Sec. 4, the State Government may, for the purpose of this Act, appoint Chief Wildlife Warden, Wildlife Warden, Honorary Wildlife Wardens and other officers and employees as may be necessary. As per Sec. 6, the State Governments and the Administrators in Union Territories shall constitute a Wildlife Advisory Board.

WILDLIFE ADVISORY BOARD (SEC. 6)

Sec. 6 of this Act enforces and enables the state governments and administrators of UTs to constitute a Wildlife Advisory Board in each state and UT.

It shall consist of the Minister in charge of Forests in the State or Union territory as the Chairman. If there is no such minister, then the Chief Secretary will be the Chairman of the Board.

Wildlife Advisory Board mainly constituted to advise the state government in the following matters.

a) Selection of areas to be declared as Sanctuaries, National Parks and Closed areas and the administration thereof.

b) Formulation of policy for protection and conservation of wildlife and specified plants.

c) In any matter relating to the amendment of any schedule.

d) In relation to the measure to be taken for harmonizing the needs of the tribals and other dwellers of the forests with the protection and conservation of wildlife.

e) In any other matter connected with the protection of wildlife which may be referred to it by the state government.

HUNTING OF WILD ANIMALS (SEC. 9)

Sec. 2(16(a) (b) (c)) defines the word hunting as follows Hunting, with its grammatical variations and cognate expressions, includes; capturing, killing, poisoning, snaring, and trapping or any wild animal and every attempt to do so; driving any wild animal for any of purposes specified in sub clause; injuring or destroying or taking any part of the body of any such animal, or in the case of wild birds or reptiles, damaging the eggs of such birds or reptiles, or disturbing the eggs or nests of such birds or reptiles;

HUNTING OF WILD ANIMALS TO BE PERMITTED IN CERTAIN CASES

Chief Wildlife Warden may permit hunting of wild animals in certain situations. They are:

- Chief Wildlife Warden may, if he is satisfied that any wild animal specified in Schedule 1 has become dangerous to human life or is so disabled or diseased as to be beyond recovery, by order in writing and stating the reasons therefore, permit any person to hunt such animal or cause animal to be hunted.

- The Chief Wildlife Warden or the authorized officer may, if he is satisfied that any wild animal specified in Schedule. II or III or IV has become dangerous to human life or to property (including standing crops on any land) or is so disabled or diseased as to be beyond recovery, by order in writing and stating the reasons, therefore, permit any person to hunt such animal or cause such animal to be hunted.
- The killing or wounding in good faith of any wild animal in defense of oneself or of any other person shall not be an offence; Provided that nothing in this sub-section shall exonerate any person who, when such defense becomes necessary, was committing any act in contravention of any provision of this Act or any rule or order made there under.
- Any wild animal killed or wounded in defense of any person shall be Government property.

GRANT OF PERMISSION FOR HUNTING FOR SPECIAL PURPOSES

The Chief Wildlife Warden, permit, by an order in writing stating the reasons therefore, to any person, on payment of such fee as may be prescribed, which shall entitle the holder of such permit to hunt, subject to such conditions as may be specified therein, any wild animal specified in such permit, for the purpose of,

- Education.
- Scientific research.
- Scientific management; means and includes
  - translocation of any wild animal to an alternative suitable habitat; or
  - population management of wildlife, without killing or poisoning or destroying any wild animals.
- Collection of specimens
  - for recognised zoos subject to the permission under section 38-1 or
  - for museums and similar institutions.
- derivation, collection or preparation of snake-venom for the manufacture of life saving drugs.

PROTECTION OF SPECIFIED PLANTS

Sec. 17A of the Act prohibits picking, uprooting, etc., of specified plants or as otherwise provided in this Chapter.

The Chief Wild Life Warden may with the previous permission of the State Government, grant to any person a permit to pick, uproot, acquire or collect from a forest land or the area specified under section 17A or transport, subject to such conditions as may be specified therein, any specified plant for the purpose of education; scientific research., collection, preservation and display in a herbarium of any scientific institutions; or propagation by a person or an institution approved by the Central Government in this regard.

SANCTUARIES

Section 18 provides that the State Government may, by notification, declare its intention to constitute any area other than area comprised with any reserve forest or the territorial waters as a sanctuary if it considers that such area is of adequate ecological, faunal, floral, geomorphological, natural or zoological significance, for the purpose of protecting, propagating or developing wildlife or its environment.

For the purposes of this section, it shall be sufficient to describe the area by roads, rivers, ridges, or other well-known or readily intelligible boundaries.

Chief Wildlife Warden may, on an application, grant to any person a permit to enter or reside in a sanctuary for the following purposes.

a) Investigation or study of wildlife

b) Photography

c) Scientific research

d) Tourism

e) Transaction of lawful business with any person in the sanctuary.

Only a public servant on duty or permit holder or a person having a right over immovable property within the limits of a sanctuary, person passing through pathway in the sanctuary and dependants of the above can also enter or reside in the sanctuary.

NATIONAL PARK

The state government, for the purpose of protecting, propagating or developing wildlife may by a notification declare that an area, by reason of its ecological, faunal, floral, geomorphological or zoological association or importance, needed to be constituted as a National Park.

Once a National Park is declared, no alteration of the boundaries shall be made except on the resolution passed by the legislature of the state. In a National Park, the following activities are strictly prohibited.

a) destroying, exploring or removing any wildlife,

b) Destroying, damaging the habitat of any wild animal,

c) Deprive any wild animal of its habitat,

d) Grazing of any livestock

CENTRAL ZOO AUTHORITY

Central government shall constitute Central Zoo Authority, consisting of a chairperson, ten members and a member secretary. They shall hold office for a period of three years.

a) The Central Zoo Authority shall perform the following functions
   Specify the minimum standards for housing, upkeep and veterinary care of the animals kept in a zoo.
b) Evaluate and assess the functioning of zoos with respect to the standards or the norms as may be prescribed.
c) Recognize or derecognize zoos.
d) Identify endangered species of wild animals for purposes of captive breeding and assigning responsibility in this regard to a zoo.
e) Co-ordinate the acquisition, exchange and loaning of animals for breeding purposes.
f) Co-ordinate research in captive breeding and educational programs for the purposes of zoos.

TRADE OR COMMERCE IN WILD ANIMALS, ANIMAL ARTICLES AND TROPHIES

The term trophy means the whole or any part of any captive animal or wild animal, other than vermin, which has been kept or preserved by any means, whether artificial or natural, and includes, rugs, skins, and specimens of such animals mounted in whole or in part through a process of taxidermy, and antler, horn, rhinoceros horn, feather, nail, tooth, musk, eggs, and nests. And uncured trophy means the whole or any part of any captive animal, other than vermin, which has not undergone a process of taxidermy, and includes a [freshly killed wild animal ambergris, musk and other animal products].

Sec. 39 of the Act declares that every wild animal other than vermin, which is hunted or kept or bred in captivity or found dead or killed by mistake, shall be the property of the State Government. Likewise, animal articles, trophy or uncured trophy, meat derived from any wild animal, ivory imported to India, article made from such ivory, vehicle vessel weapon, trap or tool that has used for committing an offence and has been seized shall be the property of the state government. If any of the above is found in the sanctuary or a National Park declared by Union Government then it shall be property of the Central Government.

WILDLIFE PROTECTION ACT 1972

- It has six schedules which give varying degrees of protection.
- Schedule I and part II of Schedule II provide absolute protection - offences under these are prescribed the highest penalties.
- Species listed in Schedule III and Schedule IV are also protected, but the penalties are much lower.
- Schedule V includes the animals which may be hunted.
- The plants in Schedule VI are prohibited from cultivation and planting.

Summary: Various kinds of Protected areas and procedure of declaration.

Type of Protected Areas	Declaration of Protected Areas	Permission of Centre	Authority who regulates the Protected Area
Sanctuaries	State Government to constitute an area as sanctuary by notification *(such area should not be comprised within any reserve forest or territorial waters)*	If any part of the territorial waters is to be so included within the sanctuary, prior concurrence of the Central Government shall be obtained by the respective State Government	Chief Wildlife Warden shall be the authority who shall control, manage and maintain all sanctuaries State Government shall appoint a Collector to determine rights of persons within the sanctuary
National Parks	State Government can declare an area as National Park which is either within a sanctuary or outside it. Reasons – If the area has ecological, faunal, floral, geomorphological or zoological association or importance for the purpose of protecting, propagating or developing wildlife therein or its	If any part of the territorial waters is to be so included within the National Park, prior concurrence of the Central Government shall be obtained by the respective State Government	State Government shall appoint a Collector to determine rights of persons within the National Park Chief Wildlife Warden shall be the authority to ensure destruction, damage or diversion of wildlife does not take place Permission of National Board for Wildlife when required?

	environment		(i) Alteration of Boundaries of National Park; or (ii) removal of wildlife from the National Park; or (iii) the change the flow of water into or outside the National Park which is necessary for the improvement and better management of wildlife National Board for Wildlife is constituted by Central Government and is chaired by the Prime Minister of India
Conservation Reserve	The State Government declares any area owned by the Government after consulting with local communities particularly the areas adjacent to National Parks and sanctuaries and those areas which link one protected area with another, as a conservation reserve for protecting landscapes, seascapes, flora and fauna and their habitat.	Where the conservation reserve includes any land owned by the Central Government, its prior concurrence shall be obtained.	The State Government shall constitute a conservation reserve management committee to advise the Chief Wildlife Warden to conserve, manage and maintain the conservation reserve.
Community Reserve	The State Government may declare any private or community land not comprised within a National Park, sanctuary or a conservation reserve, as a community reserve, for protecting fauna, flora and traditional or cultural conservation values and practices.		The State Government shall constitute a Community Reserve management committee, which shall be the authority responsible for conserving, maintaining and managing the community reserve. The committee shall consist of five representatives nominated by the Village Panchayat/Gram Sabha and one representative of the State Forests or Wildlife Department under whose jurisdiction the community reserve is located.
When can Central Government notify any areas as Sanctuary or National Park? • When an area which is not already within a sanctuary or national park is transferred or leased by the state to the centre, then the Centre can notify such area as Sanctuary or			

National Park. • In relation to a sanctuary or National Park declared by the Central Government, the powers and duties of the Chief Wildlife Warden shall be exercised and discharged by the Director or by such other officer as may be authorised by the Director in this behalf			
Tiger Reserve	The State Government shall, on the recommendation of the Tiger Conservation Authority, notify an area as a tiger reserve. No State Government shall de-notify a tiger reserve, except in public interest with the approval of the Tiger Conservation Authority and the National Board for Wildlife.		The National Tiger Conservation Authority (NTCA) has been constituted by the Central Government chaired by Minister in charge of the Ministry of Environment and Forests. NTCA shall approve the Tiger Conservation Plan prepared by the State Government.

►WILDLIFE (PROTECTION) AMENDMENT BILL, 2021

Wildlife (Protection) Amendment Bill, 2021 amends the Wild Life (Protection) Act, 1972. The Act regulates the protection of wild animals, birds and plants. The Bill seeks to increase the species protected under the law and implement the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Key features of the Bill include:

CITES

- It is an international agreement between governments to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species. Under CITES, plant and animal specimens are classified into three categories (Appendices) based on the threat to their extinction. The Convention requires countries to regulate the trade of all listed specimens through permits. It also seeks to regulate the possession of live animal specimens.
- The Bill seeks to implement these provisions of CITES.

RATIONALISING SCHEDULES

The Bill reduces the total number of schedules to four by: (i) reducing the number of schedules for specially protected animals to two (one for greater protection level), (ii) removes the schedule for vermin species, and (iii) inserts a new schedule for specimens listed in the Appendices under CITES (scheduled specimens).

OBLIGATIONS UNDER CITES

The Bill prohibits any person from modifying or removing the identification mark of the specimen. Additionally, every person possessing live specimens of scheduled animals must obtain a registration certificate from the Management Authority.

INVASIVE ALIEN SPECIES

The Bills empowers the central government to regulate or prohibit the import, trade, possession or proliferation of invasive alien species.

Invasive alien species refers to plant or animal species which are not native to India and whose introduction may adversely impact wildlife or its habitat. The central government may authorise an officer to seize and dispose the invasive species.

CONTROL OF SANCTUARIES

The Bill specifies that actions of the Chief Warden must be in accordance with the management plans for the sanctuary. These plans will be prepared as per guidelines of the central government, and as approved by the Chief Warden. For sanctuaries falling under special areas, the management plan must be prepared after due consultation with the concerned Gram Sabha. Special areas include a Scheduled Area or areas where

the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 is applicable. Scheduled Areas are economically backward areas with a predominantly tribal population, notified under the Fifth Schedule to the Constitution.

CONSERVATION RESERVES

The Bill empowers the central government to also notify a conservation reserve.

SURRENDER OF CAPTIVE ANIMALS

The Bill provides for any person to voluntarily surrender any captive animals or animal products to the Chief Wildlife Warden. No compensation will be paid to the person for surrendering such items. The surrendered items become property of the state government.

PENALTIES

The Act prescribes imprisonment terms and fines for violating the provisions of the Act. The Bill increases these fines.

►FOREST RIGHTS ACT, 2006

Maharashtra Governor issued a notification modifying the Forest Rights Act (FRA), 2006 that will enable tribals and other traditional forest dwelling families to build houses in the neighbourhood forest areas.

FOREST RIGHTS ACT, 2006

- The act recognize and vest the forest rights and occupation in Forest land in Forest Dwelling Scheduled Tribes (FDST) and Other Traditional Forest Dwellers (OTFD)who have been residing in such forests for generations.
- The act also establishes the responsibilities and authority for sustainable use, conservation of biodiversity and maintenance of ecological balance of FDST and OTFD.
- It strengthens the conservation regime of the forests while ensuring livelihood and food security of the FDST and OTFD.
- It seeks to rectify colonial injustice to the FDST and OTFD who are integral to the very survival and sustainability of the forest ecosystem.

THE ACT IDENTIFY FOUR TYPES OF RIGHTS

- Title rights: Gives FDST and OTFD, the right to ownership to land farmed by tribals or forest dwellers subject to a maximum of 4 hectares. Ownership is only for land that is being cultivated by the concerned family and no new lands will be granted. It also provides for Community rights over minor forest produce and other resources.
- Use rights: The rights of the dwellers extend to extracting Minor Forest Produce, grazing areas, to pastoralist routes, etc.
- Relief and development rights: To rehabilitation in case of illegal eviction or forced displacement and to basic amenities, subject to restrictions for forest protection
- Forest management rights: It includes the right to protect, regenerate or conserve or manage any community forest resource which they have been traditionally protecting and conserving for sustainable use.

WHO CAN CLAIM THESE RIGHTS?

- Members or community of the Scheduled Tribes who primarily reside in and who depend on the forests or forest lands for bona fide livelihood needs.
- It can also be claimed by any member or community who has for at least three generations (75 years) prior to the 13th day of December 2005 primarily resided in forests land for bona fide livelihood needs.
- The Gram Sabha is the authority to initiate the process for determining the nature and extent of Individual Forest Rights (IFR) or Community Forest Rights (CFR) or both that may be given to FDST and OTFD.

CRITICAL WILDLIFE HABITAT (CWH)

Forest Rights Act, 2006 (FRA) defines CWHs as 'areas of national parks and sanctuaries where it has been specifically and clearly established, case by case, based on scientific and objective criteria, that such areas are required to be kept as inviolate for the purposes of wildlife conservation'.

To notify a CWH, the Act requires state governments to establish that the presence of right-holders is causing irreversible damage to wildlife and their habitats, and that co-existence between rights holders and wildlife was not a reasonable option.

NOTIFYING CWHS: KEY FEATURES OF GUIDELINES

- The Chief Wildlife Warden of a state will notify an Expert Committee for the purpose of identification of critical wildlife habitats (CWH) in a national park or sanctuary.
- The Expert Committee will identify areas within national parks and sanctuaries, based on scientific and objective criteria relevant to the protected area, required to be kept inviolate for the purpose of wildlife conservation.
- The Expert Committee shall issue a public notice on the intention to notify CWH. The public notice shall

include details of areas required to be kept inviolate, criteria adopted for CWH identification, implication of the notification on existing rights, and all options of resettlement and rehabilitation schemes, if applicable.

ISSUES AND CONCERNS

In the existing guidelines, CWH notification does not stand any public scrutiny once consultations have been carried out. Contrast this to the notification of Eco-Sensitive Zones (ESZ) around protected areas, where the draft notification of every ESZ is put up in public domain for at least 60 days before its finalisation. ESZ are often notified under Environment Protection Act, 1986.

FOREST DWELLERS VS. WILDLIFE

- Conservationists believe that wildlife needs absolutely "inviolate" areas — those devoid of humans and human activities.
- Many others believe human-wildlife co-existence is generally possible and must be promoted if we are to have "socially just conservation".

►ENVIRONMENT PROTECTION ACT, 1986

It was enacted under Article 253 of the Indian constitution and the expression in the say of environmental quality was taken at the United Nation Conference on the Human Environment held at Stockholm in June 1972.

SCOPE AND COMMENCEMENT OF THE ACT

The Environment Protection Act, 1986 extends to whole India.

Section 2 of the Environmental protection Act, 1986 (EPA) deals with some of the information about the definition of the Act and these definitions are as follows:

"Environment" the word environment includes water, air, land and the inter-relation between their existence. It also includes human beings and other living creatures such as plants, micro-organisms and property.

"Environmental Pollutants" means any substance in solid, liquid or gaseous form which in consideration is injurious to the health of living beings.

"Handling" means any substance which is in the relation of being manufactured, processed, collected, used, offered for sale or like of such substance.

"Environmental Pollution" includes the presence of environmental pollutants in the environment.

"Hazardous substance" includes the substance or the preparation by which the physical-chemical property is liable to harm the human beings or other living creatures such as plants, microorganisms and the property.

"Occupier" is in the relation of factory or any other premises which means a person who has control over the affairs of it.

From the above definitions given the Environmental protection Act tends to cover a wide range of matters related to the environment protection.

POWER OF CENTRAL GOVERNMENT FOR MEASURES TO PROTECT AND IMPROVE THE ENVIRONMENT

It is the power vested in the central government that they can take any reasonable and valid steps and measures for the purpose of the protection and improvement of the quality of the environment.

These measures are taken for the prevention, control and abatement of environmental Pollution.

SUCH MEASURES MAY INCLUDE MEASURES WITH RESPECT TO ALL NAMELY AS FOLLOWS

- Laying down the standards for the quality of the standards of the environment.
- Coordination of actions which are obliged to the state officers and other authorities under any law.
- Execution and proper planning of the worldwide national program for the prevention, controlling and the abatement of environmental pollution.
- Restrictions to be applied in any of the industries, process and any operation shall be carried out.
- It is the power and the duty of the government to lay down the procedure to carry forward safeguards for the prevention of many inevitable accidents which may inculcate in more environmental pollution.
- Proposal of remedies should be put forward for the protection and prevention of further incidents.
- Duty and power to lay down the procedures and safeguards to handle the hazardous substance.
- Examination of manufacturing processes should be done, materials, substances which are likely to cause environmental pollution.
- Power to inspect at various premises, equipment, material and the substances and power to direct the authorities for the prevention and control of environmental pollution.
- To collect the dissemination in the respect of information related to environmental pollution.
- Preparation of the manuals, codes, guides which are considered suitable enough for controlling environmental pollution.

- One of the most important tasks is to establish the laboratories.
- Serving other matters which are necessary for the central government to deal for the effective implementation of the Environmental Protection Act, 1986.

Under Section 3 of the following act, the central government has the power to authorize or constitute other authorities for the accurate implementation of powers and duties which are mentioned above.

Section 3 of the Environmental Protection Act holds importance due to the fact of a better regulatory mechanism.

POWER TO GIVE DIRECTION

The central government in the exercise of powers designated by the Act can issue the directions in writing to any of the person or any officer. They shall be bound to comply with these given directions.

The powers to issue directions will include the power to direct which are as follows:

- The direction of closure, prohibition or the regulation of any industry and its operational process.
- direction for the stoppage or regulation of the supply of electricity, including any other services.

PREVENTION, ABATEMENT AND CONTROL OF ENVIRONMENTAL POLLUTION

Section 7 of Environment Protection Act 1986 suggest that no person in the country shall be carrying any of the activity or operation in which there is a large emission of gases or other substances which may lead to excess environmental pollution.

The same section also provides certain standards that ought to be maintained in which it is a must that no person is allowed to damage the environment and if a person is found guilty of causing damage to the environment by polluting the pollution pay principle.

He can be asked for the 'exemplary damages' if he is found guilty of damaging the environment.

Section 8 provides that any person who is handling the hazardous substance needs to comply with the procedural safeguards.

If the emission is to a very large extent or is apprehended through an accident, the person responsible for it is obliged to mitigate from that place to reduce the environmental pollution.

He is also required to give an intimation to the higher authorities regarding the same and for that one receipt of remedies shall be required to prevent or to mitigate the environmental pollution.

In subsection (1), it is also provided that if a person wilfully delays or obstructs the person designated by the central government, he will be charged guilty under this act.

PENALTY FOR THE CONTRAVENTION OF RULES AND ORDERS OF THIS ACT

As it was stated earlier that the most important goal of the environmental protection act is to provide for the punishment of the offence of endangering the human environment, safety and health.

Section 15 states that any person who is not complying to the provisions stated in this act and its failure or contravention will make him liable and punishable as the following:

►OTHER INSTITUTIONS

Indian Institute of Forest Management (IIFM)	• A sectoral management institute, which constantly endeavors to evolve knowledge useful for the managers in Forest, Environment and Natural Resources Management and allied sectors. • Disseminates such knowledge in ways that promote its application by individuals and organizations. • Located in Bhopal.
Wildlife Institute of India (WII)	• Offers training program, academic courses and advisory in wildlife research and management. • Located in Dehradun.
CPR Environmental Education Centre	• Strives to increase awareness & knowledge of key target groups (school children, local communities, woman etc.) about various aspects of environment. • Established jointly by MoEFCC and C.P. Ramaswami Aiyar Foundation. • Located in Chennai.
Indian Plywood Industries Research and Training Institute	• Works for development & adoption of efficient technologies of wood and panel products from renewable fibers including plantation timbers and bamboo. • It was initially formed as a co-operative research laboratory under

	the Council of Scientific and Industrial Research (CSIR). • Located in Bengaluru.
Centre for Environment Education (CEE)	• The organization works towards developing programs and materials to increase awareness about the environment and sustainable development. • It was established in 1984 as a Centre of Excellence of the MoEFCC. • Located in Ahmedabad.

CENTRAL GROUND WATER AUTHORITY

A body functioning under Ministry of Jal Shakti. It was formed in 1996 by an executive order under the Environment (Protection) Act, 1986.

Functions:

1. Regulation & control of groundwater management.
2. Issues 'No Objection Certificates' for groundwater extraction.
3. Frames guidelines for sustainable groundwater in 22 States and UTs, where ground water development is not being regulated by the State or UT government.

►INDIAN FOREST ACT (IFA), 1927

MoEF&CC has started the process of "comprehensively amending" the backbone of forest governance in India—the Indian Forest Act, 1927 (IFA).

ABOUT IFA 1927

- Provides legal framework for:
  - Protection and management of forest.
  - Transit of forest produce and timber.
  - Duty leviable on timber and other forest produce.
- Provides basic architecture for management of forests in India including procedure to be followed for declaring an area to be a Reserved Forest, Protected Forest or Village Forest.
- Defines forest offence is, acts prohibited inside a Reserved Forest, and penalties leviable on violation of the provisions of the Act.

EXPECTED OUTCOME

- Currently there is no definition of forest in any Indian law pertaining to forest or its governance. Therefore, the amendments will also include definitions of terms like forests, pollution, ecological services etc.
- The legal definition of forests will have huge ramifications on the conservation of forests as well as the implementation of the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006.

The amendments will include changes to punishments and fines prescribed in the IFA, incorporate provisions related to carbon sequestering, ecological services etc.

►COMMISSION FOR AIR QUALITY IN NCR

- It establishes a Commission to improve coordination, research, identification, and resolution of air quality concerns in the National Capital Region (NCR) and surrounding areas.
- Adjoining areas are defined as locations in the states of Haryana, Punjab, Rajasthan, and Uttar Pradesh that are next to the NCR and where any source of pollution could have a negative impact on air quality of NCR.
- It dissolves the Environment Pollution Prevention and Control Authority (EPCA), which was established in NCR in 1998.

FUNCTIONS OF THE COMMISSION

- Planning and executing plans to prevent and control air pollution in the NCR region
- Providing a framework for identification of air pollutants
- Conducting research and development through networking with technical institutions Training and creating a special workforce to deal with issues related to air pollution Preparing various action plans such as increasing plantation and addressing stubble burning.

POWERS OF THE COMMISSION

- Ability to limit activities that affect air quality, investigate and conduct research related to environmental pollution that influences air quality.
- Develop codes and guidelines to prevent and control air pollution.
- Issue directives on matters such as inspections or regulations that are binding on the person or authority concerned.
- Authority to tax and collect environmental compensation from farmers who contaminate the environment by burning stubble.

COMPOSITION

- The commission will be led by a chairperson, a member-secretary and chief coordinating officer of the rank of joint secretary, a currently serving or former joint secretary from the central government as a full-time member.
- There will also be three independent technical members with expertise in air pollution, and three members from NGOs.
- The commission's chairperson and members will serve for three years, or until they reach the age of 70 whichever comes first.
- The commission will also have ex-officio members from the central government and concerned state governments, as well as technical members.

►NATIONAL GREEN TRIBUNAL (NGT)

- It is a tribunal set up to address environmental issues.
- A statutory body established by National Green Tribunal Act 2010.

COMPOSITION

- One full time Chairperson,
- Not less than ten but subject to maximum of twenty full time Judicial Members as the Central Government may, from time to time, notify.
- Not less than ten but subject to maximum of twenty full time Judicial Members as the Central Government may, from time to time, notify.

AIMS

- Effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources,
- Enforcement of any legal right relating to environment, and
- Giving relief and compensation for damages to persons and property and for matters connected therewith or incidental thereto.
- The tribunal has three courts in its principal Bench in Delhi and four zonal Benches — in the east, west, central and south to encompass all States and Union Territories.

NGT DEALS IN THE FOLLOWING ACTS

- Water (Prevention and Control of Pollution) Act, 1974.
- Water (Prevention and Control of Pollution) Cess Act, 1977.
- Forest (Conservation) Act, 1980.
- Air (Prevention and Control of Pollution) Act, 1981.
- Environment (Protection) Act, 1986.
- Public Liability Insurance Act, 1991.
- Biological Diversity Act, 2002.

➔ Does not deal with Wildlife (Protection) Act,1972

CLIMATE CHANGE

►CLIMATE CHANGE

Global climate change has already had observable effects on the environment. Glaciers have shrunk, ice on rivers and lakes is breaking up earlier, plant and animal ranges have shifted, and trees are flowering sooner.

Effects that scientists had predicted in the past would result from global climate change are now occurring loss of sea ice, accelerated sea level rise and longer, more intense heat waves.

Scientists have high confidence that global temperatures will continue to rise for decades to come, largely due to greenhouse gases produced by human activities. IPCC forecasts a temperature rise of 2.5 to 10 degrees Fahrenheit over the next century.

According to the IPCC, the extent of climate change effects on individual regions will vary over time and with the ability of different societal and environmental systems to mitigate or adapt to change.

The IPCC predicts that increases in global mean temperature of less than 1.8 to 5.4 degrees Fahrenheit (1 to 3 degrees Celsius) above 1990 levels will produce beneficial impacts in some regions and harmful ones in others. Net annual costs will increase over time as global temperatures increase.

Let's look at few evidence in support of Climate change

Sea-level river: Mean Sea level has been continuously rising since past two decades. Reasons: (a) Melting of Ice (b) Expansion of water as temperatures increase. According to NASA, sea levels have been rising by 3.3 millimetres per year.

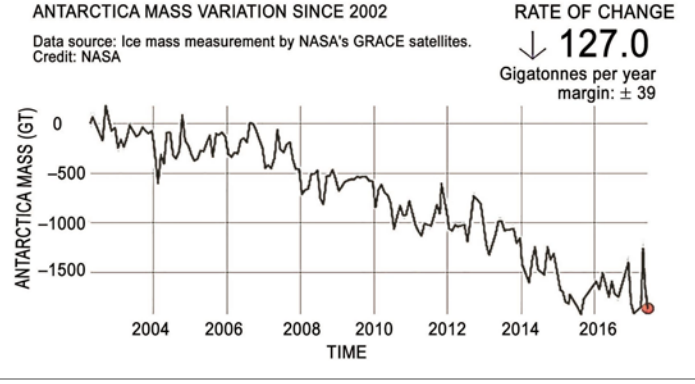
Temperature: Earth's average surface temperature has risen about 1.62 degrees Fahrenheit (0.9 degrees Celsius) since late 19th century, a change driven largely by increased CO_2 and other human-made emissions.

Warming Oceans: Ocean does an excellent job of absorbing excess heat from the atmosphere. The top few meters of the ocean stores as much heat as Earth's entire atmosphere. So, as the planet warms, it's the ocean that gets most of the extra energy.

Shrinking of Cryosphere (Areas which are permanent or temporarily under ice cover)

Shrinking of Ice sheets:

The Greenland and Antarctic ice sheets have decreased in mass.



Frost-free Season (and Growing Season) will Lengthen

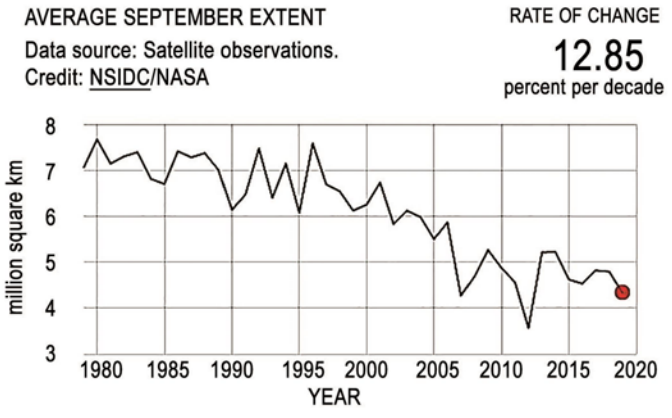
The length of the frost-free season (and the corresponding growing season) has been increasing since the 1980s.

Glacial retreat

Glaciers are retreating almost everywhere around the world — including in the Alps, Himalayas, Andes, Rockies, Alaska and Africa.

Decreased snow cover

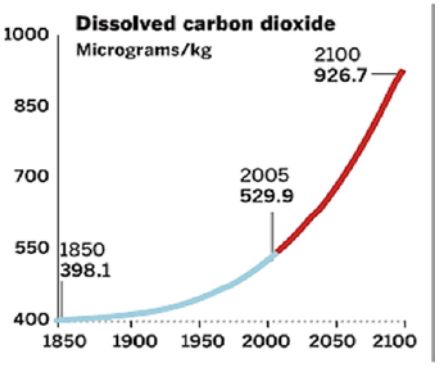
Satellite observations reveal that the amount of spring snow cover in the Northern Hemisphere has decreased over the past five decades and that the snow is melting earlier.

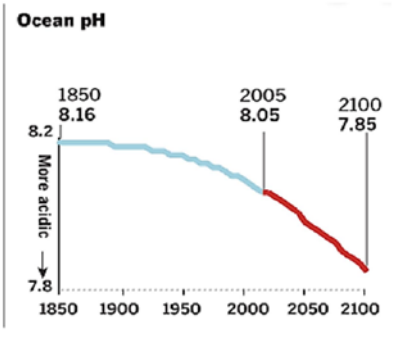


Ocean Acidification:

Since the beginning of the Industrial Revolution, the acidity of surface ocean waters has increased by about 30 percent.

This increase is the result of humans emitting more carbon dioxide into the atmosphere and hence more being absorbed into the oceans. The amount of carbon dioxide absorbed by the upper layer of the oceans is increasing by about 2 billion tons per year.





CAUSE OF CLIMATE CHANGE

- Scientists attribute the global warming trend observed since the mid-20th century to the human expansion of the "greenhouse effect" — warming those results when the atmosphere traps heat radiating from Earth toward space.
- Human activities are changing Earth's natural greenhouse effect. Burning fossil fuels like coal and oil puts more carbon dioxide into our atmosphere.

GASES CONTRIBUTING TO GREENHOUSE EFFECT

- Water vapor: Most abundant greenhouse gas, but importantly, it acts as feedback to the climate. Water vapor increases as the Earth's atmosphere warms, but so does the possibility of clouds and precipitation, making these some of the most important feedback mechanisms to the greenhouse effect.
- Carbon dioxide (CO_2): A minor but very important component of atmosphere, CO_2 is released through natural processes such as respiration and volcano eruptions and through human activities such as

deforestation, land use changes, and burning fossil fuels. Humans have increased atmospheric CO2 concentration by more than a third since the Industrial Revolution began. This is the most important long-lived "forcing" of climate change. Keeling Curve measures the concentration of Carbon dioxide in the environment.

- Methane: A hydrocarbon gas produced both through natural sources and human activities, including the decomposition of wastes in landfills, agriculture, and especially rice cultivation, as well as ruminant digestion and manure management associated with domestic livestock. On a molecule-for-molecule basis, methane is a far more active greenhouse gas than carbon dioxide, but also one which is much less abundant in the atmosphere.
- Nitrous oxide: A greenhouse gas produced by soil cultivation practices, especially use of commercial & organic fertilizers, fossil fuel combustion, nitric acid production, and biomass burning.
- Chlorofluorocarbons (CFCs): Synthetic compounds entirely of industrial origin used in several applications, but now largely regulated in production and release to the atmosphere by international agreement for their ability to contribute to destruction of the ozone layer. They are also greenhouse gases.
- Ozone: The triatomic form of oxygen, and a gaseous atmospheric constituent. In the troposphere, O_3 is created both naturally and by photochemical reactions involving gases resulting from human activities (e.g., smog). Tropospheric O_3 acts as a greenhouse gas (GHG). In the stratosphere, O_3 is created by the interaction between solar ultraviolet radiation and molecular oxygen (O_2). Stratospheric O_3 plays a dominant role in the stratospheric radiative balance. Its concentration is highest in the ozone layer.

GREENHOUSE EFFECT

The greenhouse effect is a process that occurs when gases in Earth's atmosphere trap the Sun's heat. This process makes Earth much warmer than it would be without an atmosphere. The greenhouse effect is one of the things that makes Earth a comfortable place to live. Gases in the atmosphere, such as carbon dioxide, trap heat just like the glass roof of a greenhouse. These heat-trapping gases are called greenhouse gases.

During the day, the Sun shines through the atmosphere. Earth's surface warms up in the sunlight. At night, Earth's surface cools, releasing heat back into the air. But some of the heat is trapped by the greenhouse gases in the atmosphere. That's what keeps our Earth a warm and cozy 58 degrees Fahrenheit (14 degrees Celsius), on average.

IMPACT OF VARIATION OF GREENHOUSE EFFECT

Not enough greenhouse effect: The planet Mars has a very thin atmosphere, nearly all CO_2. Because of the low atmospheric pressure, and with little to no methane or water vapor to reinforce the weak greenhouse effect, Mars has a largely frozen surface that shows no evidence of life.

Too much greenhouse effect: The atmosphere of Venus, like Mars, is nearly all CO_2. But Venus has about 154,000 times as much carbon dioxide in its atmosphere as Earth (and about 19,000 times as much as Mars does), producing a runaway greenhouse effect and a surface temperature hot enough to melt lead.

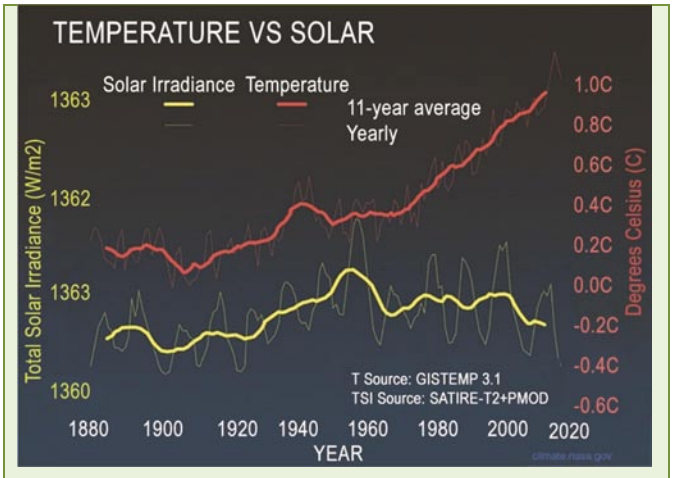
COULD SOLAR IRRADIANCE BE BEHIND RISING GLOBAL TEMPERATURE?

It's reasonable to assume that changes in the Sun's energy output would cause the climate to change, since the Sun is the fundamental source of energy that drives our climate system. Indeed, studies show that solar variability has played a role in past climate changes.

For example, a decrease in solar activity coupled with an increase in volcanic activity is thought to have helped trigger the Little Ice Age between approximately 1650 and 1850, when Greenland cooled from 1410 to the 1720s and glaciers advanced in the Alps.

But several lines of evidence show that current global warming cannot be explained by changes in energy from the Sun:

- Since 1750, the average amount of energy coming from the Sun either remained constant or increased slightly.
- If the warming were caused by a more active Sun, then scientists would expect to see warmer temperatures in all layers of the atmosphere. Instead, they have observed a cooling in the upper atmosphere, and a warming at the surface and in the lower parts of the atmosphere. That's because greenhouse gases are trapping heat in the lower atmosphere.
- Climate models that include solar irradiance changes can't reproduce the observed temperature trend over the past century or more without including a rise in greenhouse gases.



The above graph compares global surface temperature changes (red line) and the Sun's energy that Earth receives (yellow line) in watts (units of energy) per square meter since 1880. The lighter/thinner lines show the yearly levels while the heavier/thicker lines show the 11-year average trends.

GREENHOUSE GAS	GWP	SOURCES AND CAUSES
Carbon dioxide (CO_2)	1	Burning of fossil fuels, deforestation
Methane (CH_4)	12	Growing paddy, excreta of cattle and other livestock, termites, burning of fossil fuel, wood, landfills, wetlands, fertilizer factories.
Nitrous oxides (N_2O)	265	Burning of fossil fuels, fertilizers; burning of wood and crop residue.
Per fluorocarbons (PFCs)	6500	Produced as a by-product in aluminum production and manufacturing of semi-conductors.
Hydro fluorocarbons (HFCs)	12400	Used as refrigerants, aerosol propellants, solvents and fire retardants.
Sulphur hexafluoride (SF6)	23500	Used as tracer gas for leak detection, used in electrical transmission equipment

►CONCEPTS OF CLIMATE CHANGE

Social Cost of Carbon	The net present value of aggregate climate damages (with overall harmful damages expressed as a number with positive sign) from one more tonne of carbon in the form of carbon dioxide, conditional on a global emissions trajectory over time.
Tipping Point	A level of change in system properties beyond which a system reorganises, often abruptly, and does not return to the initial state even if the drivers of change are abated. For the climate system, it refers to a critical threshold when global or regional climate changes from one stable state to another stable state.
Net Zero Emissions	Net zero emissions are achieved when anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period. Where multiple greenhouse gases are involved, the quantification of net zero emissions depends on the climate metric chosen to compare emissions of different gases (such as global warming potential, global temperature change potential, and others, as well as the chosen time horizon).
Pathways	It refers to temporal evolution of natural and/or human systems towards a future state. Pathway concepts range from sets of quantitative and qualitative scenarios or narratives of potential futures to solution-oriented decision-making processes to achieve desirable societal goals. 1.5°C pathway: A pathway of greenhouse gas emissions that provides an approximately 1/2 or 2/3rd chance of global warming either remaining below 1.5°C or returning to 1.5°C by around 2100 following an overshoot.
Biophilic urbanism	Designing cities with green roofs, green walls and green balconies to bring nature into the densest parts of cities in order to provide green infrastructure

	and human health benefits.
Coping Capacity	The ability of people, institutions, organizations, and systems, using available skills, values, beliefs, resources, and opportunities, to address, manage, and overcome adverse conditions in the short to medium term.
Decarbonisation	The process by which countries, individuals or other entities aim to achieve zero fossil carbon existence. Typically refers to a reduction of the carbon emissions associated with electricity, industry and transport.
Decoupling	Decoupling (in relation to climate change) is where economic growth is no longer strongly associated with consumption of fossil fuels. Relative decoupling is where both grow but at different rates. Absolute decoupling is where economic growth happens but fossil fuels decline.
Co-benefits	The positive effects that a policy or measure aimed at one objective might have on other objectives, thereby increasing the total benefits for society or the environment. Co-benefits are often subject to uncertainty and depend on local circumstances and implementation practices, among other factors. Co-benefits are also referred to as ancillary benefits.
Blue Carbon	Biologically driven carbon fluxes and storage in marine systems that are amenable to management. Coastal blue carbon focuses on rooted vegetation in coastal zone, such as tidal marshes, mangroves and seagrasses. These ecosystems have high carbon burial rates on a per unit area basis and accumulate carbon in their soils and sediments. They provide many non-climatic benefits and can contribute to ecosystem-based adaptation. If degraded or lost, coastal blue carbon ecosystems are likely to release most of their carbon back to atmosphere.
Total Carbon Budget	Maximum amount of cumulative net global anthropogenic CO_2 emissions that would result in limiting global warming to a given level with a given probability, considering the effect of other anthropogenic climate forcers. This is referred to as the Total Carbon Budget when expressed starting from pre-industrial period, and as the Remaining Carbon Budget when expressed from a recent specified date.
Carbon footprint	Measure of the exclusive total amount of emissions of CO_2 that is directly and indirectly caused by an activity or is accumulated over the lifecycle stages of a product. Household Carbon Footprint Carbon footprint of an individual household, inclusive of the direct and indirect CO_2 emissions associated with home energy use, transportation, food provision and consumption of other goods and services associated with household expenditures.
Carbon neutrality	It is a condition in which anthropogenic CO_2 emissions associated with a subject are balanced by anthropogenic CO_2 removals. The subject can be an entity such as a country, an organisation, a district or a commodity, or an activity such as a service and an event. Carbon neutrality is often assessed over life cycle including indirect emissions but can also be limited to the emissions and removals, over a specified period.
Fugitive emissions	The release of greenhouse gases that occur during the exploration, processing and delivery of fossil fuels to the point of final use. This excludes greenhouse gas emissions from fuel combustion to produce useful heat or power. It encompasses venting, flaring and leaks.
Offsets	The reduction, avoidance or removal of

	a unit of greenhouse gases emissions by one entity, purchased by another entity to counterbalance a unit of GHG emissions by that other entity. Offsets are commonly subject to rules and environmental integrity criteria intended to ensure that offsets achieve their stated mitigation outcome. Criteria include avoidance of double counting and leakage, used of appropriate baselines, additionality and permanence or measures to address impermanence.
Carbon Leakage & Carbon Border Adjustment Mechanism	Carbon leakage refers to the situation that may occur if, for reasons of costs related to climate policies, businesses were to transfer production to other countries with laxer emission constraints. This could lead to an increase in their total emissions. The risk of carbon leakage may be higher in certain energy-intensive industries. (Trade and Climate Change). To deal with this risk of carbon leakage, EU as part of European Green Deal is implementing Carbon Border Adjustment Mechanism, which would prevent the risk of carbon leakage and support EU's increased ambition on climate mitigation, while ensuring WTO compatibility. Functioning of CBAM: EU importers will buy carbon certificates corresponding to the carbon price that would have been paid, had the goods been produced under the EU's carbon pricing rules. Conversely, once a non-EU producer can show that they have already paid a price for the carbon used in the production of the imported goods in a third country, the corresponding cost can be fully deducted for the EU importer. The CBAM will help reduce the risk of carbon leakage by encouraging producers in non-EU countries to green their production processes.

►UNFCCC

UNFCCC entered into force in 1994. Today, it has near-universal membership. The 197 countries that have ratified the Convention are called Parties to the Convention. USA has re-joined the UNFCCC after President Biden took over.

Preventing "dangerous" human interference with the climate system is the ultimate aim of the UNFCCC.

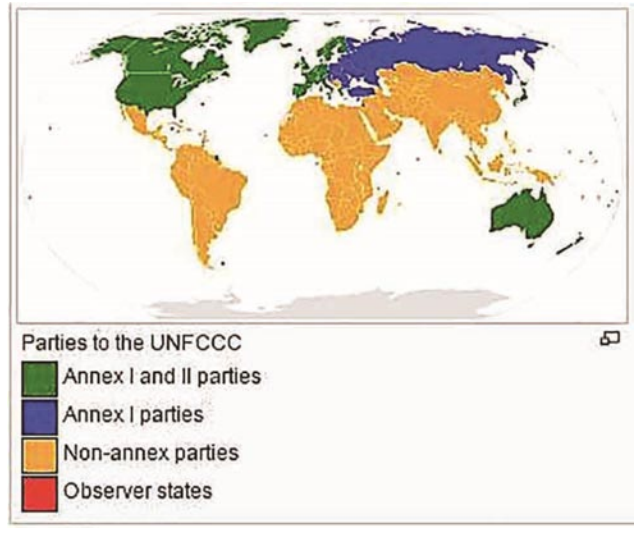
The ultimate objective of the Convention is to stabilize greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system."

PARTIES TO UNFCCC ARE CLASSIFIED AS

- Annex I countries: Industrialized countries and economies in transition
- Annex II countries: Developed countries which pay for costs of developing countries. Annex II countries are a sub-group of the Annex I countries.
- Non-Annex I countries: Developing countries are not required to reduce emission levels unless developed countries supply enough funding and technology.
- Setting no immediate restrictions under UNFCCC serves these purposes:
  i. It avoids restrictions on their development, because emissions are strongly linked to industrial capacity.
  ii. They can sell emissions credits to nations whose operators have difficulty meeting their emissions targets.
  iii. They get money and technologies for low-carbon investments from Annex II countries.
  iv. Developing countries may volunteer to become Annex I countries when they are sufficiently developed.
  v. India is non-Annex party to UNFCCC.

GOVERNING BODIES & PROCESS MANAGEMENT BODY

CONFERENCE OF THE PARTIES (COP)



The COP is the supreme decision-making body of the Convention. All States that are Parties to the Convention are represented at the COP, at which they review the implementation of the Convention and any other legal instruments that the COP adopts and take decisions necessary to promote the effective implementation of the Convention, including institutional and administrative arrangements.

CONFERENCE OF THE PARTIES SERVING AS THE MEETING OF THE PARTIES TO THE KYOTO PROTOCOL (CMP)

The Conference of the Parties, the supreme body of the Convention, shall serve as the meeting of the Parties to the Kyoto Protocol. All States that are Parties to the Kyoto Protocol are represented at the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP), while States that are not Parties participate as observers. The CMP oversees the implementation of the Kyoto Protocol and takes decisions to promote its effective implementation.

CONFERENCE OF THE PARTIES SERVING AS THE MEETING OF THE PARTIES TO THE PARIS AGREEMENT (CMA)

The Conference of the Parties, the supreme body of the Convention, shall serve as the meeting of the Parties to the Paris Agreement. All States that are Parties to the Paris Agreement are represented at the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA), while States that are not Parties participate as observers. The CMA oversees the implementation of the Paris Agreement and takes decisions to promote its effective implementation.

BUREAU OF THE COP, CMP, AND CMA

The Bureau supports the work of the governing bodies through the provision of advice and guidance regarding the ongoing work under the Convention, the Kyoto Protocol, and the Paris Agreement, the organization of their sessions and the operation of the secretariat. The Bureau serves during the sessions and between session. The Bureau consists of 11 officers, the President, seven Vice-Presidents, the Chairs of the SBSTA and the SBI and the Rapporteur, elected from representatives of Parties nominated by each of the five United Nations regional groups and Small Island Developing States.

SECRETARIAT

The UNFCCC secretariat provides organizational support and technical expertise to the UNFCCC negotiations and institutions and facilitates the flow of authoritative information on the implementation of the Convention, the Kyoto Protocol and the Paris Agreement. This includes the development and effective implementation of innovative approaches to mitigate climate change and drive sustainable development.

UNITED NATIONS INSTITUTIONAL LINKAGE

The UN serves as Depository for the Convention, the Kyoto Protocol (including its amendments) and the Paris Agreement. The secretariat is institutionally linked to the United Nations without being integrated into any program and is administered under United Nations rules and regulations.

SUBSIDIARY BODIES

Subsidiary Body for Scientific and Technological Advice (SBSTA)

Assists governing bodies through timely information and advice on scientific and technological matters as they relate to the Convention, the Kyoto Protocol and the Paris Agreement. In addition, the SBSTA cooperates with relevant international organizations on scientific, technological and methodological questions.

Subsidiary Body for Implementation (SBI)

Assists the governing bodies in the assessment and review of the implementation of the Convention, the Kyoto Protocol and the Paris Agreement. In addition, the SBI is the body that considers the biennial work programs for the secretariat, which provide the strategic direction on how the secretariat can best serve the Parties and the UNFCCC process towards greater ambition of climate change action and support that is fully commensurate with the objectives of the Convention, the Kyoto Protocol and the Paris Agreement.

CONSTITUTED BODIES

Adaptation Committee (AC)

The Adaptation Committee was established by the COP at its sixteenth session as part of the Cancun Agreements to promote the implementation of enhanced action on adaptation in a coherent manner under the Convention. The Adaptation Committee also serves the Paris Agreement.

Adaptation Fund Board (AFB)

The AFB supervises and manages the Adaptation Fund and is fully accountable to the CMP. The Adaptation Fund was established to finance concrete adaptation projects and programs in developing country Parties that are particularly vulnerable to the adverse effects of climate change. The Adaptation Fund is financed by a 2 per cent share of the proceeds from certified emission reductions issued by the Executive Board of the Clean Development Mechanism and from other sources of funding. The Adaptation Fund also serves the Paris Agreement.

Advisory Board of the Climate Technology Centre and Network (CTCN)

As the operational arm of the Technology Mechanism, the CTCN stimulates technology cooperation to enhance the development and transfer of technologies and to assist developing country Parties at their request. The Advisory Board gives guidance to the CTCN on how to prioritize requests from developing countries and, in general, it monitors, assesses and evaluates the performance of the CTCN.

CDM EB - Executive Board of the Clean Development Mechanism (CDM)

The CDM Executive Board supervises the Kyoto Protocols CDM under the authority and guidance of the CMP. The CDM Executive Board is the ultimate point of contact for CDM project participants for the registration of projects and the issuance of certified emission reductions.

CLEAN DEVELOPMENT MECHANISM

Defined in Article 12 of Kyoto Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries.

Such projects can earn saleable certified emission reduction (CER) credits, each equivalent to one ton of CO_2, which can be counted towards meeting Kyoto targets.

COMPLIANCE COMMITTEE

The functions of the Compliance Committee of the Kyoto Protocol are to provide advice and assistance to Parties in implementing the Kyoto Protocol, promote compliance by Parties with their commitments and determine cases of non-compliance and apply consequences in cases where Parties are not complying with their commitments under the Kyoto Protocol.

CONSULTATIVE GROUP OF EXPERTS (CGE)

In addition to assisting developing country Parties fulfil their reporting requirements under the Convention, the CGE will also support the implementation of the enhanced transparency framework under Article 13 of the Paris Agreement. This includes facilitating the provision of technical advice and support to developing country Parties to prepare their biennial transparency reports and providing technical advice to the secretariat on the implementation of the training of technical expert review teams.

EXECUTIVE COMMITTEE OF WARSAW INTERNATIONAL MECHANISM FOR LOSS & DAMAGE

Executive Committee of the Warsaw International Mechanism was established by the COP at tis nineteenth session by decision 2/CP.19 to guide the implementation of the functions of the Warsaw International Mechanism for Loss and Damage. The Warsaw International Mechanism is anchored in the Paris Agreement by its Article 8.

WARSAW INTERNATIONAL MECHANISM FOR LOSS AND DAMAGE

The COP established the Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts (Loss and Damage Mechanism), to address loss and damage associated with impacts of climate change, including extreme events and slow onset events, in developing countries that are particularly vulnerable to the adverse effects of climate change at COP19 (November 2013) in Warsaw, Poland.

GLOBAL ENVIRONMENT FACILITY (GEF)

It was established on the eve of the 1992 Rio Earth Summit, is a catalyst for action on the environment. Through its strategic investments, the GEF works with partners to tackle the planet's biggest environmental issues.

The GEF is a unique partnership of 18 agencies — including United Nations agencies, multilateral development banks, national entities and international NGOs — working with 183 countries to address the world's most challenging environmental issues.

The GEF has a large network of civil society organizations, works closely with the private sector around the world, and receives continuous inputs from an independent evaluation office and a world-class scientific panel.

It is a financial mechanism for five major international

environmental conventions: the Minamata Convention on Mercury, the Stockholm Convention on Persistent Organic Pollutants (POPs), the United Nations Convention on Biological Diversity (UNCBD), the United Nations Convention to Combat Desertification (UNCCD) and the United Nations Framework Convention on Climate Change (UNFCCC). GEF is also an INNOVATOR AND CATALYST that supports multi-stakeholder alliances to preserve threatened ecosystems on land and in the oceans, build greener cities, boost food security and promote clean energy for a more prosperous, climate-resilient world; leveraging $5.2 in additional financing for every $1 invested.

The GEF Trust Fund was established to help tackle our planet's most pressing environmental problems. Funds are available to developing countries and countries with economies in transition to meet the objectives of the international environmental conventions and agreements.

The World Bank serves as the GEF Trustee, administering the GEF Trust Fund (contributions by donors). The Trustee helps mobilize GEF resources; disburses funds to GEF Agencies; prepares financial reports on investments and use of resources; and monitors application of budgetary and project funds. The Trustee creates periodic reports that contain an array of fund-specific financial information.

GREEN CLIMATE FUND (GCF)

The GCF is an operating entity of the financial mechanism of the Convention and is accountable to and functions under the guidance of the COP. It is governed by a Board comprising 24 members **(with equal numbers from developed and developing country Parties)** and is intended to be the main fund for global climate change finance in the context of mobilizing USD 100 billion by 2020. The GCF, as an entity entrusted with the operation of the Financial Mechanism of the Convention, also serves the Paris Agreement.

JOINT IMPLEMENTATION SUPERVISORY COMMITTEE (JISC)

The JISC, under the authority and guidance of the CMP, supervises the verification procedure for submitted projects to confirm that the ensuing reductions of emissions by sources or enhancements of anthropogenic removals by sinks meet the relevant requirements of Article 6 of the Kyoto Protocol and the joint implementation guidelines.

KATOWICE COMMITTEE OF EXPERTS ON THE IMPACTS OF THE IMPLEMENTATION OF RESPONSE MEASURES (KCI)

It supports the work of the forum on the impacts of implementation of response measures.

LEAST DEVELOPED COUNTRIES EXPERT GROUP (LEG)

The COP established the LEG, the membership of which is to be nominated by Parties, with the objective of supporting the preparation and implementation strategies of national adaptation programs of action. The LEG also serves the Paris Agreement.

FACILITATIVE WORKING GROUP (FWG) OF THE LOCAL COMMUNITIES AND INDIGENOUS PEOPLES PLATFORM

It has the objective of further operationalizing the Local Communities and Indigenous Peoples Platform and facilitating the implementation of three functions related to knowledge, capacity for engagement, and climate change policies and actions.

STANDING COMMITTEE ON FINANCE (SCF)

The mandate of the Standing Committee on Finance is to assist the COP in exercising its functions with respect to the financial mechanism of the Convention in terms of the following: improving coherence and coordination in the delivery of climate change financing; rationalization of the financial mechanism; mobilization of financial resources; and measurement, reporting and verification of support provided to developing country Parties. The SCF also serves the Paris Agreement.

TECHNOLOGY EXECUTIVE COMMITTEE (TEC)

The COP, by its decision 1/CP.16, established a Technology Mechanism to facilitate the implementation of enhanced actions on technology development and transfer to support action on mitigation and adaptation to achieve the full implementation of the Convention. The Technology Mechanism comprises the Technology Executive Committee (TEC) and the Climate Technology Centre and Network (CTCN).

In accordance with Article 10 of the Paris Agreement, the Technology Mechanism shall also serve the Paris Agreement under the guidance of the CMA. As the policy arm of the Technology Mechanism, the TEC undertakes analysis and provides recommendations on policies that can accelerate the development and transfer of low-emission and climate resilient technologies.

PARIS COMMITTEE ON CAPACITY-BUILDING (PCCB)

Established by the Conference of the Parties (COP) in 2015 as part of the adoption of the Paris Agreement to address gaps and needs, both current and emerging, in implementing capacity-building in developing country Parties and further enhancing capacity-building efforts, including with regard to coherence and coordination in capacity-building activities under the Convention.

SPECIAL CLIMATE CHANGE FUND

It was established to finance activities, programs and measures relating to climate change, that are complementary to those supported by other funding mechanism for the implementation of the Convention. The Global Environment Facility (GEF) has been entrusted to operate the SCCF. The SCCF, administered by the GEF, also serves the Paris Agreement.

LEAST DEVELOPED COUNTRIES FUND

The COP established the Least Developed Countries Fund (LDCF) to support the Least Developed Country Parties (LDCs) work program and assist LDCs carry out, inter alia, the preparation and implementation of national adaptation programs of action (NAPAs). The Global Environment Facility (GEF) has been entrusted to operate the LDCF. The LDCF, administered by the GEF, also serves the Paris Agreement.

►PARIS AGREEMENT

The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 196 Parties at COP 21 in Paris, in 2015.

Its goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels. To achieve this long-term temperature goal, countries aim to reach global peaking of greenhouse gas emissions as soon as possible to achieve a climate neutral world by mid-century.

- The agreement aims to increase the ability of countries to deal with the impacts of climate change, and at making finance flows consistent with a low GHG emissions and climate-resilient pathway.
- To reach these ambitious goals, appropriate mobilization and provision of financial resources, a new technology framework and enhanced capacity-building is to be put in place, thus supporting action by developing countries and the most vulnerable countries, in line with their own national objectives.
- The Agreement also provides for an enhanced transparency framework for action and support.

The Paris Agreement requires all Parties to put forward their best efforts through "nationally determined contributions" (NDCs) and to strengthen these efforts in the years ahead. This includes requirements that all Parties report regularly on their emissions and on their implementation efforts. There will also be a global stocktake every 5 years to assess the collective progress towards achieving the purpose of the agreement and to inform further individual actions by Parties.

To make the Paris Agreement fully operational, a work program was launched in Paris to develop modalities, procedures and guidelines on a broad array of issues. Since 2016, Parties work together in the subsidiary bodies (APA, SBSTA and SBI) and various constituted bodies.

IMPORTANT PROVISIONS OF PARIS AGREEMENT

Long-term temperature goal (Art. 2) – limiting global temperature increase to well below 2 degrees Celsius, while pursuing efforts to limit the increase to 1.5 degrees.

Global peaking and 'climate neutrality' (Art. 4) –To achieve this temperature goal, Parties aim to reach global peaking of greenhouse gas emissions (GHGs) as soon as possible, recognizing peaking will take longer for developing country Parties, to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHGs in the second half of the century.

Mitigation (Art. 4) – The Paris Agreement establishes binding commitments by all Parties to prepare, communicate and maintain a nationally determined contribution (NDC) and to pursue domestic measures to achieve them.

- It also prescribes that Parties shall communicate their NDCs every 5 years and provide information necessary for clarity and transparency.
- To set a firm foundation for higher ambition, each successive NDC will represent a progression beyond the previous one and reflect the highest possible ambition.
- Developed countries should continue to take the lead by undertaking absolute economy-wide reduction targets, while developing countries should continue enhancing their mitigation efforts, and are encouraged to move toward economy-wide targets over time in the light of different national circumstances.

Sinks and reservoirs (Art.5) –The Paris Agreement also encourages Parties to conserve and enhance, as appropriate, sinks and reservoirs of GHGs as referred to in Article 4, paragraph 1(d) of the Convention, including forests.

Voluntary cooperation/Market- and non-market-based approaches (Art. 6) – The Paris Agreement recognizes the possibility of voluntary cooperation among Parties to

allow for higher ambition and sets out principles – including environmental integrity, transparency and robust accounting – for any cooperation that involves internationally transferal of mitigation outcomes. It establishes a mechanism to contribute to the mitigation of GHG emissions and support sustainable development and defines a framework for non-market approaches to sustainable development.

Adaptation (Art. 7) – The Paris Agreement establishes a global goal on adaptation – of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change in the context of the temperature goal of the Agreement. It aims to significantly strengthen national adaptation efforts, including through support and international cooperation. It recognizes that adaptation is a global challenge faced by all. All Parties should engage in adaptation, including by formulating and implementing National Adaptation Plans, and should submit and periodically update an adaptation communication describing their priorities, needs, plans and actions. The adaptation efforts of developing countries should be recognized.

ADAPTATION

The world is already experiencing changes in average temperature, shifts in the seasons and an increasing frequency of extreme weather events and other climate change impacts and slow onset events. The faster the climate changes, and the longer adaptation efforts are put off, the more difficult and expensive it could be.

Adaptation refers to adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change. In simple terms, countries and communities need to develop adaptation solution and implement action to respond to the impacts of climate change that are already happening, as well as prepare for future impacts.

Loss and damage (Art. 8) – The Paris Agreement recognizes the importance of averting, minimizing and addressing loss and damage associated with the adverse effects of climate change, including extreme weather events and slow onset events, and the role of sustainable development in reducing the risk of loss and damage. Parties are to enhance understanding, action and support, including through the Warsaw International Mechanism, on a cooperative and facilitative basis with respect to loss and damage associated with the adverse effects of climate change.

Finance, technology and capacity-building support (Art. 9, 10 and 11) – The Paris Agreement reaffirms the obligations of developed countries to support the efforts of developing country Parties to build clean, climate-resilient futures, while for the first time encouraging voluntary contributions by other Parties. Provision of resources should also aim to achieve a balance between adaptation and mitigation. In addition to reporting on finance already provided, developed country Parties commit to submit indicative information on future support every two years, including projected levels of public finance. The agreement also provides that the Financial Mechanism of the Convention, including the Green Climate Fund (GCF), shall serve the Agreement.

Transparency (Art. 13), implementation and compliance (Art. 15) – The Paris Agreement relies on a robust transparency and accounting system to provide clarity on action and support by Parties, with flexibility for their differing capabilities of Parties. In addition to reporting information on mitigation, adaptation and support, the Agreement requires that the information submitted by each Party undergoes international technical expert review. The Agreement also includes a mechanism that will facilitate implementation and promote compliance in a non-adversarial and non-punitive manner and will report annually to the CMA.

Global Stocktake (Art. 14) – A "global stocktake", to take place in 2023 and every 5 years thereafter, will assess collective progress toward achieving the purpose of the Agreement in a comprehensive and facilitative manner. It will be based on the best available science and its long-term global goal. Its outcome will inform Parties in updating and enhancing their actions and support and enhancing international cooperation on climate action.

COMMON BUT DIFFERENTIATED RESPONSIBILITIES (CBDR)

It is a principle of international environmental law establishing that all states are responsible for addressing global environmental destruction yet not equally responsible. The principle balances, on the one

hand, the need for all states to take responsibility for global environmental problems and, on the other hand, the need to recognize the wide differences in levels of economic development between states.

These differences in turn are linked to the states' contributions to, as well as their abilities to address, these problems. CBDR was formalized in international law at the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro.

In accordance with the principle of "common but differentiated responsibility and respective capabilities" set out in the Convention, developed country Parties are to provide financial resources to assist developing country Parties in implementing the objectives of the UNFCCC.

The Paris Agreement reaffirms the obligations of developed countries, while for the first time also encouraging voluntary contributions by other Parties.

POLLUTER PAYS

'Polluter pays' principle is the commonly accepted practice that those who produce pollution should bear the costs of managing it to prevent damage to human health or the environment. For instance, a factory that produces a potentially poisonous substance as a by-product of its activities is usually held responsible for its safe disposal. The polluter pays principle is part of a set of broader principles to guide sustainable development worldwide (formally known as the 1992 Rio Declaration).

CLIMATE CHANGE

►INDIA'S EFFORTS FOR COMBATING CLIMATE CHANGE

- Commitments under Paris Climate Deal
  - Cut greenhouse gas emissions intensity of its gross domestic product 33% to 35% by 2030,
  - Increase non-fossil fuel power capacity to 40% from 28% in 2015
  - Substantially boost forest cover to reduce Carbon Dioxide.
  - As per the BUR, the emission intensity of India's GDP has reduced by 21 per cent over the period of 2005-2014 which is the result of India's proactive and sustained actions on climate change.
- National Action Plan on Climate Change (NAPCC): It identifies several measures that simultaneously advance the country's development and climate change related objectives of adaptation and mitigation through focused National Missions.
  - National Solar Mission: Aims to increase the share of solar energy in the total energy mix. Under the total target of 100 GW, 32.5 GW of solar electric generation capacity has been installed.
  - National Water Mission: It focuses on monitoring of ground water, aquifer mapping, capacity building, water quality monitoring and other baseline studies. It seeks to increase water use efficiency by 20%.
  - National Mission for a Green India: It seeks to increase tree and forest cover by 5 mha. It also seeks to increase the quality of existing forests by additional 5 mha.
  - National Mission on Sustainable Habitat: It is being implemented through three programs: Atal Mission on Rejuvenation and Urban Transformation, Swachh Bharat Mission, and Smart Cities Mission. Energy Conservation Building Rules 2018 for commercial buildings has been made mandatory.
  - National Mission for Sustainable Agriculture: It aims at enhancing food security and protection of resources.
  - National Mission for Sustaining the Himalayan Ecosystem: It aims to evolve suitable management and policy measures for sustaining and safeguarding the Himalayan Ecosystem.
  - National Mission on Strategic Knowledge for Climate Change: It seeks to build a knowledge system that would inform and support national action for ecologically sustainable development. Key achievements include setting up of 11 Centers of Excellence and 10 State Climate Change Centers.
  - National Mission for Enhanced Energy Efficiency (NMEEE): Under it, The Perform, Achieve and Trade (PAT) scheme was designed on the concept of reduction in Specific Energy Consumption.
- Climate Change Action Program (CCAP): Central sector scheme to build and support capacity at central and state levels, strengthening scientific and analytical capacity for climate change assessment, establishing appropriate institutional framework and implementing climate actions.

- Energy Efficiency Measures: Energy Conservation Building Code (ECBC) 2017 prescribes energy performance standards for new commercial buildings to be constructed across India to achieve a 50 per cent reduction in energy use by 2030 translating to energy savings of about 300 billion Units by 2030 and peak demand reduction of over 15 GW in a year. Schemes like UJALA for LED bulb distribution has crossed 360 million whereas under streetlight national program, 10 million conventional streetlights have been replaced by LED street lights thus cumulatively saving 43 million tons of CO2 emission.
- Promotion of Electric Vehicles: National Electric Mobility Mission Plan (NEMMP) 2020, Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME India) scheme was formulated in 2015 to promote manufacturing and sustainable growth of electric and hybrid vehicle technology
- Promotion of Biofuels: The National Bio-fuels Policy 2018 targets 20 per cent blending of ethanol in petrol and 5 per cent blending of biodiesel in diesel by 2030.
- Separate Fund for Climate Change: National Adaptation Fund on Climate Change (2015) supports concrete adaptation activities for the States/UTs that are particularly vulnerable to the adverse effects of climate change and are not covered under on-going schemes. The Scheme has been taken as Central Sector Scheme with National Bank for Agriculture and Rural Development (NABARD) as the National Implementing Entity.
- Green Bonds: Green bonds are debt securities issued by financial, non-financial or public entities where the proceeds are used to finance 100 per cent green projects and assets. India has the second largest Emerging green bond market after China. Several Government agencies have contributed to issuance: Indian Renewable Energy Development Agency (IREDA) and the Indian Railway Finance Corporation (IRFC). In 2018, the SBI entered the market with an US$ 650 million Certified Climate Bond.
- International Platform on Sustainable Finance (IPSF): IPSF acknowledges the global nature of financial markets which has the potential to help finance the transition to a green, low carbon and climate resilient economy by linking financing needs to the global sources of funding. India joined the International Platform on Sustainable Finance (IPSF) in 2019.
- International Solar Alliances (ISA): Lead by India, the primary objective of the alliance is to work for efficient consumption of solar energy to reduce dependence on fossil fuels.
- FAME Scheme – for E-mobility: To promote adoption of electric/ hybrid vehicles (xEVs) in India.
- Atal Mission for Rejuvenation & Urban Transformation (AMRUT) – for Smart Cities
- Pradhan Mantri Ujjwala Yojana – for access to clean cooking fuel
- UJALA scheme - for embracing energy efficient LED bulbs
- Swachh Bharat Mission

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

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

i. Reach 500GWNon-fossil energy capacity by 2030.
ii. 50 per cent of its energy requirements from renewable energy by 2030.
iii. Reduction of total projected carbon emissions by one billion tonnes from now to 2030.
iv. Reduction of the carbon intensity of the economy by 45 per cent by 2030, over 2005 levels.
v. Achieving the target of net zero emissions by 2070.

The transfer of climate finance and low-cost climate technologies have become more important for implementation of climate actions by the developing countries. The ambitions on climate finance by developed countries cannot remain the same as they were at the time of Paris Agreement in 2015. It was emphasized that just as the UNFCCC tracks the progress made in climate mitigation, it should also track climate finance. Further, it was conveyed to the developed countries that India understands the suffering of all other developing countries, shares them, and hence raises the voice of developing countries.

The mantra of LIFE- Lifestyle for Environment to combat climate change was also shared in COP 26. It was stated that Lifestyle for Environment has to be taken forward as a campaign to make it a mass movement of Environment Conscious Lifestyles. The message conveyed by India was that the world needs mindful and deliberate utilization, instead of mindless and destructive consumption.

►CARBON MARKET

Carbon markets are one of the tools to tackle the climate change problem. The argument behind carbon trading is

that the best way to take climate action is to reduce emissions where it is least costly to do so.

Article 6 under Paris Agreement contains three separate mechanisms for "voluntary cooperation" towards climate goals: two based on markets and a third based on "non-market approaches"

CARBON MARKETS UNDER THE PARIS AGREEMENT (ARTICLE 6)

- Market Mechanism 1 (Article 6.2) – It sets up a carbon market which allows countries on voluntary direct bilateral cooperation basis to sell any extra emission reductions {called as Internationally Transferred Mitigation Outcomes (ITMO)} they have achieved compared to their Nationally Determined Contributions (NDCs) target.
- Market Mechanism 2 (Article 6.4) - A new international carbon market would be created for the trading of emissions reductions created anywhere in the world by the public or private sector. This new market referred to as the "Sustainable Development Mechanism" (SDM) seeks to replace the CDM.
- The non-Market Approach: to boost "mitigation, adaptation, finance, technology transfer and capacity building", in situations where no trade is involved. This could involve similar activities without the added element of trading. E.g., a country could support a renewable energy scheme overseas via concessional loan finance, but there would be no trading of any emissions cuts generated.

WHY IS ARTICLE 6 IMPORTANT?

Within Sustainable Development Mechanism, the notion of Overall Mitigation in Global Emissions (OMGE) has the potential to go beyond the Kyoto markets' "zero-sum game" to accomplish "global" mitigation.

Current international carbon market mechanisms operate under Kyoto Protocol's regulations, which provide that transfers between Parties result in no net decrease in global emissions.

Trading could aid in the reduction of emissions by making it easier and less expensive for governments to accomplish their climate goals, so encouraging them to set more ambitious targets.

- According to a World Bank Report, some 96 country climate pledges - about half of all NDCs - refer to the use of carbon pricing initiatives.
- According to IETA, trading could save $250bn every year by 2030. This could be invested into further emissions cuts to raise ambition.

It also includes a provision that a "share of the proceeds" earned under SDM be used to assist developing nation parties that are particularly vulnerable to the negative consequences of climate change in meeting adaptation expenses. This might become a new way for richer countries to channel climate funds to developing countries, complementing existing initiatives like the Green Climate Fund.

Article 6 might potentially be used to incorporate company climate pledges into the larger UN process. The only component of the legislation that specifically mentions private sector participation in the Paris process is Article 6.

The carbon market system must progress beyond offsets to something better. Rather than offering a cheap way out and substituting someone else's work, it should try to accelerate the change. Offsetting methods should be phased out in favor of climate programs that actually accelerate the zero-carbon transition.

CARBON PRICING

Carbon pricing is a tool that captures the external costs of greenhouse gas (GHG) emissions - costs that the public bears, such as crop damage, health care costs from heat waves and droughts, and property loss from flooding and sea level rise - and ties them to their sources through a price, usually in the form of a price on the CO_2 emitted.

TYPES OF CARBON PRICING

There are 2 major types of carbon pricing

- Emissions Trading Systems (ETS): The ETS, also known as a cap-and-trade system, sets a limit on total GHG emissions and permits low-emitting companies to sell their excess allowances to higher-emitting industries.
- Carbon Tax: It places a price on carbon by imposing a tax on greenhouse gas emissions or, more typically, the carbon content of fossil fuels. It differs from an ETS in that the carbon tax's emission reduction effect is not pre-determined, but the carbon price is.

OTHER MECHANISMS TO PRICE THE CARBON EMISSION

- Results-Based Climate Finance (RBCF) is a funding strategy in which payments are paid in response to pre-determined outputs or outcomes connected to climate change management, such as emission reductions.
  - Many RBCF programs also simultaneously aim to reduce poverty, improve access to clean energy and offer health and community benefits.

- GHG emission reductions from project- or program-based activities are referred to as offset mechanisms, and they can be traded domestically or internationally.
  - Offset programs have their own register and award carbon credits according to a system.
  - These credits can be utilised to address GHG mitigation compliance requirements under international agreements, domestic policies, or corporate citizenship goals.
- Internal carbon pricing is a tool that an organisation utilises to steer its decision-making process in relation to the impacts, risks, and opportunities of climate change.

IMPORTANCE OF CARBON PRICING

It holds the emitters responsible for the emissions, rather than deciding on who should reduce emissions where and how. It incentivizes the emitters to transform their process to lower the emissions. In this way, the overall environmental goal is achieved in the most flexible and least-cost way to society.

Placing an adequate price on GHG emissions is of fundamental relevance to internalize the external cost of climate change in the broadest possible range of economic decision making and in setting economic incentives for clean development.

It can help to mobilize the financial investments required to stimulate clean technology and market innovation, fueling new, low-carbon drivers of economic growth.

For governments, carbon pricing is one of the instruments of the climate policy package and a source of revenue needed to reduce emissions.

Businesses use internal carbon pricing to evaluate the impact of mandatory carbon prices on their operations and as a tool to identify potential climate risks and revenue opportunities.

Long-term investors use carbon pricing to analyze the potential impact of climate change policies on their investment portfolios, allowing them to reassess investment strategies and reallocate capital toward low-carbon or climate-resilient activities.

CHALLENGES TO CARBON PRICING

Ineffective use of revenues: Effectiveness of many carbon pricing initiatives depends on how these revenues are spent.

Carbon leakage: Occurs when there is an increase in greenhouse gas emissions in one country as a result of an emissions reduction by a second country with a strict climate policy

Policy overlaps or inconsistency: Policy makers must work carefully and deliberately to avoid potential overlap of and interaction between policy instruments, which could undermine the effectiveness of carbon pricing mechanisms.

►CLIMATE FINANCE

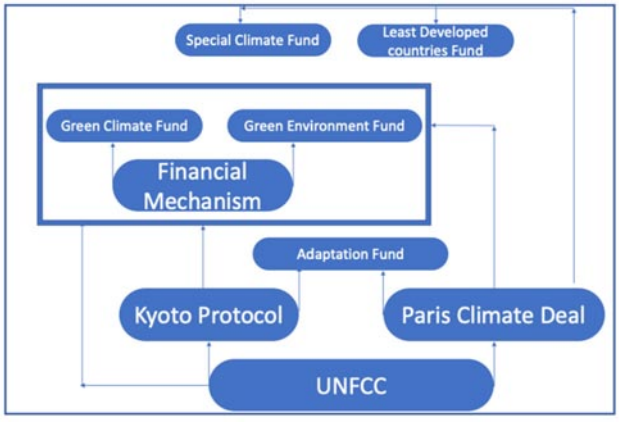
According to UNFCCC Standing Committee on Finance, climate finance is "finance that aims at reducing emissions and improving greenhouse gas sinks, as well as reducing vulnerability of, and maintaining and increasing the resilience of, human and ecological systems to negative climate change impacts."

The term has been used in a narrow sense to refer to transfers of public resources from developed to developing countries, in light of their UN Climate Convention obligations to provide "new and additional financial resources", and in a wider sense to refer to all financial flows relating to climate change mitigation and adaptation.

UNFCCC, Kyoto Protocol and Paris Agreement call for financial assistance. In accordance with the principle of “common but differentiated responsibility and respective capabilities” set out in the Convention, developed country Parties are to provide financial resources to assist developing country Parties in implementing the objectives of the UNFCCC.

The Convention has created Financial Mechanisms to offer cash to developing nation Parties to help with this.

- Since the Convention's entrance into force in 1994, the Global Environment Facility (GEF) has acted as the financial mechanism's operating institution.
- Copenhagen Accord: Parties agreed for a "goal" for the world to raise $100 billion per year by 2020, from "a wide variety of sources", to help developing countries cut carbon emissions (mitigation). New multilateral funding for adaptation will be delivered, with a governance structure.
- COP 16 (2010): Parties established the Green Climate Fund (GCF) and in 2011 (COP 17) also designated it as an operating entity of the financial mechanism.
- Establishment of special funds: Special Climate Change Fund (SCCF), the Least Developed Countries Fund (LDCF), both managed by the GEF; and the Adaptation Fund (AF) under the Kyoto Protocol in 2001. (See Diagram)



►ENVIRONMENTAL, SOCIAL AND GOVERNANCE (ESG)

- Investors are increasingly applying above non-financial factors as part of their analysis process to identify material risks and growth opportunities like climate and social unrest.
- Tragedy of the Horizon: The idea of Climate change as the Tragedy of the Horizon was first laid by Mark Carney, Governor of Bank of England in 2015. According to this idea, today's generation is not doing enough to address climate change as the don't feel the gravity of the problem. However, the next generation which will suffer the worst effects of climate change are not in decision making positions.

INITIATIVES FOR SUSTAINABILITY IN FINANCE

- International Sustainability Standards Board (ISSB): IFRS Foundation announced creation of a new standard setting board (ISSB) to create international standards with global investment portfolios for high quality, transparent, reliable & comparable reporting by companies on climate & other ESG matters.

►GLOBAL CLIMATE RISK INDEX 2021

- Environmental think tank 'Germanwatch' released the Global Climate Risk Index 2021.
- This is 16th Edition of the Index published annually.

ABOUT THE INDEX

- The Index analyses the extent to which countries and regions have been affected by the impacts of weather-related loss events (storms, floods, heat waves etc.).
- The impact is calculated in terms of fatalities and economic losses, both.
- The most recent data available for 2019 and from 2000 to 2019 were considered.
- The 2021 Index does not include data from United States of America.
- Climate Risk Index signals those consequences of climate change can no longer be ignored, on any continent or in any region.
- Impacts from extreme-weather events hit the poorest countries hardest as these are particularly vulnerable to the damaging effects of a hazard, have a lower coping capacity and may need more time to rebuild and recover.
- High-income countries are also getting severely impacted by climate change.

►CLIMATE CHANGE PERFORMANCE INDEX

- Released by New Climate Institute, Germanwatch and CAN (Climate Action Network).
- The index has been rating 60 countries and EU greenhouse emitters countries accounting over 90% of global emissions since 2005.
- Aim: Enable comparison of mitigation efforts and enhance transparency in global climate politics.
- Parameters: CCPI is based on countries performance on four parameters: GHG Emissions, Renewable Energy, Energy Use and Climate Policy.
- India remained in the top ten in the Climate Change Performance Index for the second consecutive year. China, one of the largest contributors of greenhouse gases ranked 33rd. In 2020, India slid a position to the tenth. India was at 31st rank in 2014.

►ENVIRONMENTAL PERFORMANCE INDEX

- A biennial index produced by World Economic Forum, Yale University and Columbia University.
- It offers a scorecard that highlights leaders and laggards in environmental performance and provides practical guidance for countries that aspire to move toward a sustainable future.
- This index was first published in 2002 designed to supplement the environmental targets set forth in the United Nations Millennium Development Goals.

►SUSTAINABLE MOUNTAIN DEVELOPMENT SUMMIT X

Integrated Mountain Initiative (IMI) is a civil society led network platform with the mission to mainstream

concerns of Indian Himalayan Region (IHR) and its people in the development dialogue of India.

It functions as a platform to integrate the knowledge and experiences of multiple stakeholders working across the IHR and uses this to inform and influence policy at the national and state level.

TOWARDS ONE HEALTH

Making our mountains resilient Organised by Integrated Mountain Initiative & Darjeeling Himalaya Initiative

SMDSXE OBJECTIVES

Integrated Mountain Initiative's Sustainable Mountain Development Summit (SMDS) X was organized in the Darjeeling - Kalimpong Hills for 2021 and will be hosted by the Darjeeling chapter - Darjeeling Himalaya Initiative (DHI) and Integrated Mountain Initiative (IMI). The theme of SMDSX is "Towards One Health: Making our mountains resilient"

OBJECTIVES FOR SMDS X WERE

- To advocate for resilient and sustainable policies and programs in the IHR in averting future impacts of climate change, disasters and pandemics
- To share knowledge and inform policy and decision makers about the interconnectedness of the selected themes and the importance of One Health approaches in all aspects of development in the IHR

THEMATIC AREAS

Under the broad theme of One Health, the main event of SMDSX shall discuss around these 4 sub themes that are highly relevant for the mountains.

- One Health response to zoonosis
- Sustainable Food systems
- Biodiversity and Ecosystems for human health
- Governance that promotes One Health

WHAT IS ONE HEALTH?

One Health is an approach that recognizes that the health of people is closely connected to the health of animals and our shared environment. One Health is not new, but it has become more important in recent years. This is because many factors have changed interactions between people, animals, plants, and our environment.

Human populations are growing and expanding into new geographic areas. As a result, more people live in close contact with wild and domestic animals, both livestock and pets. Animals play a key role in our lives, whether for food, fiber, livelihoods, travel, sport, education, or companionship. Close contact with animals and their environments provides more opportunities for diseases to pass between animals and people.

The earth has experienced changes in climate and land use, such as deforestation and intensive farming practices. Disruptions in environmental conditions and habitats can provide new opportunities for diseases to pass to animals.

The movement of people, animals, and animal products has increased from international travel and trade. As a result, diseases can spread quickly across borders and around the globe.

These changes have led to the spread of existing or known (endemic) and new or emerging zoonotic diseases, which are diseases that can spread between animals and people. Every year, millions of people and animals around the world are affected by zoonotic diseases. Examples of zoonotic diseases include:

- Rabies
- Salmonella infection
- West Nile virus infection
- Q Fever (Coxiella burnetii)
- Anthrax
- Brucellosis
- Lyme disease
- Ringworm
- Ebola

Animals also share our susceptibility to some diseases and environmental hazards. Because of this, they can sometimes serve as early warning signs of potential human illness. For example, birds often die of West Nile virus before people in the same area get sick with West Nile virus infection.

WHAT ARE COMMON ONE HEALTH ISSUES?

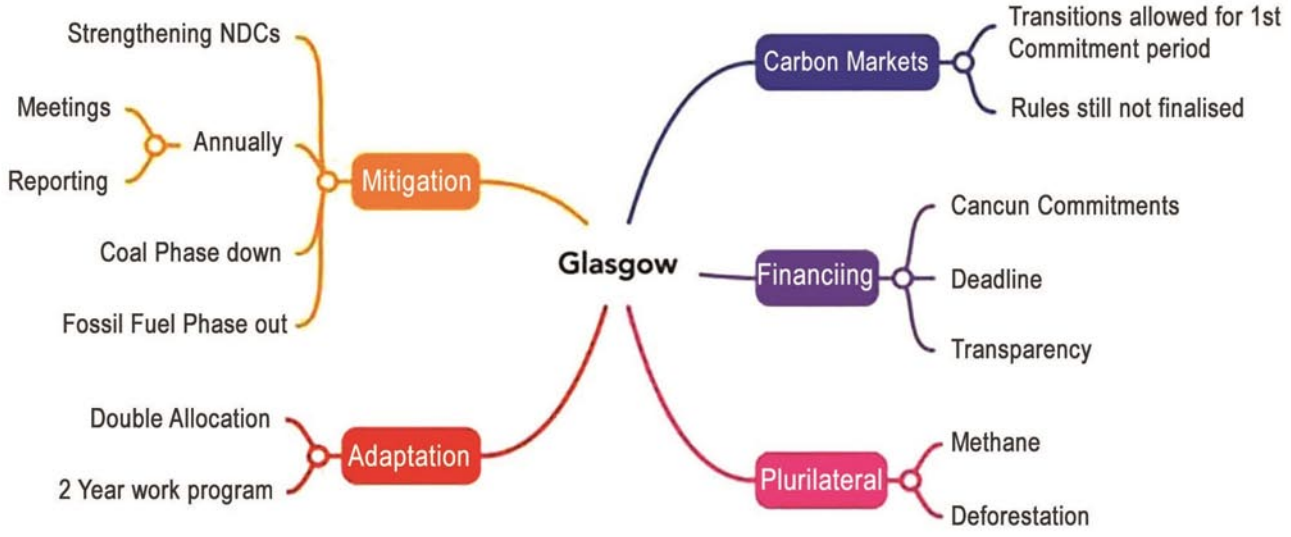
One Health issues include zoonotic diseases, antimicrobial resistance, food safety and food security, vector-borne diseases, environmental contamination, and other health threats shared by people, animals, and the environment. For example:

- Antibiotic-resistant germs can quickly spread through communities, the food supply, healthcare facilities, and the environment (soil, water), making it harder to treat certain infections in animals and people.
- Vector-borne diseases are on the rise with warmer temperatures and expanded mosquito and tick habitats.
- Diseases in food animals can threaten supplies, livelihoods, and economies.

- The human-animal bond can help improve mental well-being.
- Contamination of water used for drinking, recreation, and more can make people and animals sick.
- Even the fields of chronic disease, mental health, injury, occupational health, and non-communicable diseases can benefit from a One Health approach involving collaboration across disciplines and sectors.

►GLASGOW AGREEMENT

The Conference of Parties to the UNFCCC, or COP26, met in Glasgow for the 26th time. Every year, these meetings are convened to develop a worldwide response to climate change. Each of these sessions results in a collection of choices with various names. This has been dubbed the Glasgow Climate Pact in this edition. Previously, these sessions resulted in the Kyoto Protocol in 1997 and the Paris Agreement in 2015, both of which are treaty-like international accords.



SALIENT FEATURES OF GLASGOW ACCORD

Mitigation

- All the parties agreed that stronger action in the present decade is vital for meeting the 1.5-degree objective, according to the Glasgow Accord.
- As a result, it has requested/decided:
  - By the end of the year, they should have strengthened their 2030 climate action plans, or NDCs (nationally determined contributions).
  - Create a work plan to increase mitigation ambition and implementation as soon as possible.
  - Organize an annual summit of ministers to increase the ambition of climate action in 2030. o Annual synopsis of individual countries cations.
  - In 2023, a gathering of world leaders will be held to increase the ambition of climate action.
  - Countries should make steps to limit coal use as a source of energy and eliminate "inefficient" fossil fuel subsidies.
  - Coal will be phased down, and fossil fuels will be phased out. This is the first-time coal has been mentioned clearly in a COP decision.

Adaptation

- Adaptation is regarded as the most crucial component of climate action by most countries, particularly the smaller and poorer ones, as well as small island governments.
- They have demanded that adaptation efforts receive at least half of all climate money.
- As a result, the Glasgow Climate Pact has the following provisions:
  - Developed countries have been asked to at least double the amount of money allocated to adaptation by 2025, compared to current levels.
  - Developed a two-year work plan to create a global adaptation goal.

Finance

- Every step taken to address climate change has a monetary cost. It is now predicted that trillions of dollars will be required each year to pay all the initiatives required to meet the climate goals. • As a result of their past culpability for greenhouse gas emissions, developed countries have a responsibility.
- They must help underdeveloped countries cope with climate change by providing funds and technology.
- Developed countries committed in 2009 that by 2020, they would raise at least $100 billion annually. Even

though the 2020 deadline has passed, the $100 billion pledge has yet to be met.

- The industrialised countries have recently stated that they will raise this sum by 2023.

Carbon Markets

- Carbon markets make trading emission reductions easier.
- They are regarded as a crucial and effective tool for reducing overall emissions.
- A carbon market existed under the Kyoto Protocol; however, it has since disappeared due to the Protocol's expiration last year.
- Because many countries abandoned their emission reduction commitments, developing countries such as India, China, and Brazil have substantial amounts of carbon credits left over.
- The Glasgow Pact has provided some relief to poor countries.
- It has enabled countries to use these carbon credits to satisfy their first NDC targets.

Announcement of Parallel Processes:

- In Glasgow, a lot of important work was done in parallel procedures that were not part of the official COP debates. Prior failures in financing must be considered
- "Deep regrets" were expressed over the rich countries' failure to deliver on their $100 billion promise.
- It has requested them to put this money together as soon as possible, and to do so every year until 2025.
- Discussions on creating a new climate finance target beyond $100 billion for the period after 2025 have begun.
- The wealthy countries have been asked to offer transparent information about the funds they intend to provide.

Loss and Damage

- Climate disasters are becoming more common, and many of them have resulted in widespread devastation. There is no institutional system in place to reimburse these countries for their losses or to assist them with relief and reconstruction.
- The Paris Agreement's loss and damage provision attempts to remedy this. Substantive discussions on loss and damage could take place in Glasgow, thanks to a push from numerous countries.
- A provision for the establishment of a facility to coordinate loss and damage actions was included in one of the earlier draughts.

- India has announced a Panchamrita (a five-point plan) to combat climate change.
- Brazil's net-zero target year would be pushed back from 2060 to 2050.
- China agreed to release a clear strategy for meeting its commitment to peak emissions in 2030 and achieve net-zero emissions by 2060. Israel has set a goal of achieving net zero emissions by 2050.
- Over a hundred countries have committed to cutting methane emissions by at least 30% by 2030, compared to current levels.
- Over a hundred countries have pledged to halt and reverse deforestation by 2030.
- Over 30 countries signed a declaration vowing to work toward a transition to zero-emission vehicles by 2040, at least in the world's major car markets.

Panchamrit Strategy of India Prime Minister of India announced a heightened commitment to address the issue of climate change. This was in line with the principle of Common but Differentiated Responsibilities and Respective Capabilities (CBDR-RC), wherein it is accepted that developed nations account for most of the legacy greenhouse emissions, which are the cause of present climate change. Hence, developing nations like India which have only very low per capita carbon emissions need lesser commitment.

Also, developing countries like India need carbon space to pursue development path ensuring sustainable development of their country.

The strategy includes:

- India will get its non-fossil energy capacity to 500 GW by 2030
- India will meet 50 per cent of its energy requirements till 2030 with renewable energy
- India will reduce its projected carbon emission by one billion tonnes by 2030
- India will reduce the carbon intensity of its economy by 45 per cent by 2030
- India will achieve net zero by 2070

'Panchamrita' is a traditional method of mixing five natural foods — milk, ghee, curd, honey and jaggery. These are used in Hindu and Jain worship rituals. It is also used as a technique in Ayurveda.

►TECHNIQUES OF GEOENGINEERING

1. Solar Radiation Modification

- This refers to the intentional modification of Earth's shortwave radiative budget with the aim of reducing

warming.

- Stratospheric Aerosol Injection: Injection of a gas in the stratosphere, which then converts to aerosols
- Marine Cloud Brightening: Spraying Sea salt or other particles into marine clouds, making them more reflective.
- Cirrus Cloud Thinning: Seeding to promote nucleation, reducing optical thickness and cloud lifetime, to allow more outgoing longwave radiation to escape into space.
- Ground based Albedo Modification: Whitening roofs, changes in land use management (e.g., no-till farming), change of albedo at a larger scale (covering glaciers or deserts with reflective sheeting and changes in ocean albedo).

2. Ocean Fertilisation

Deliberate increase of nutrient supply to near-surface ocean to enhance biological production through which additional carbon dioxide from the atmosphere is sequestered. This can be achieved by the addition of micro-nutrients or macro-nutrients. Ocean fertilisation is regulated by the London Protocol.

3. Carbon dioxide removal

- Bioenergy
- Afforestation and reforestation
- Soil carbon sequestration and biochar

4. Biochar

- They are stable, carbon rich material produced by heating biomass in an oxygen-limited environment.
- They may be added to soils to improve soil functions and to reduce greenhouse gas emissions from biomass and soils and carbon sequestration.

5. Enhanced Weathering

Weathering is the natural process of rock decomposition via chemical and physical processes in which CO_2 is spontaneously consumed and converted into solid or dissolved alkaline bicarbonates and carbonates. The process is controlled by temperature, reactive surface area, interactions with biota and in particular water solution composition.

Challenges associated with Enhanced Weathering are:

- Increase in water pH
- Release of heavy metals like Nickel and Chromium and plant nutrients like K, Ca, Mg, P and Si
- Changes in hydrological soil properties

6. Ocean alkanisation

- Ocean alkanisation adds alkalinity to marine areas to locally increase CO_2 buffering capacity of the ocean.
- Direct air carbon dioxide capture and storage

►REDUCING EMISSIONS FROM DEFORESTATION AND FOREST DEGRADATION (REDD)

- A mechanism under UNFCC, since 2005, to mitigate climate change through reducing net emissions of greenhouse gases through enhanced forest management in developing countries.
- Inclusion of reducing emissions from land use change is considered essential to achieve the objectives of the UNFCCC.
- During the negotiations for Kyoto Protocol the inclusion of tropical forest management was debated but eventually dropped due to anticipated methodological difficulties in establishing – in particular – additionality and leakage (detrimental effects outside of project area attributable to project activities).
- REDD+ (Defined in Bali Action Plan, 2007, CoP13)

WHAT CONSTITUTES "+"?

1. sustainable management of forests,
2. conservation of forest carbon stocks and
3. enhancement of forest carbon stocks.

DIFFERENCE BETWEEN REDD AND REDD+?

- REDD = "reducing emissions from deforestation in developing countries"
- REDD+ (or REDD-plus) = to "reducing emissions from deforestation and forest degradation in developing countries, and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries"
- REDD+ is essentially a vehicle to financially reward developing countries for their verified efforts to reduce emissions and enhance removals of greenhouse gases through a variety of forest management option.
- India favours REDD+

UGANDA: FIRST AFRICAN COUNTRY TO SUBMIT REDD++

Uganda recently submitted its REDD++ results and has become the first African country to submit the results.

INDIA'S REDD++

India has prepared National REDD++ strategy complying with the UNFCCC decisions. It is being updated in line with the National Action Plan on Climate Change, Nationally Determined Contributions and Green India Mission. The strategy was prepared by the Indian Council of Forestry Research and Education, Dehradun.

REDD++ HIMALAYAN PROGRAM

REDD++ Himalayan Program was launched in 2016 to address deforestation and forest degradation in the Himalayan states of India. It ends in July 2020. The project was implemented in four countries namely Bhutan, Nepal, Myanmar and India.

INDIA'S PARIS AGREEMENT TARGETS

India ratified the Paris Agreement exactly one year after the submission of its Intended Nationally Determined Contribution (INDC), on 2 October 2016. Since India did not submit an NDC prior to ratification, the INDC became its first NDC. It includes the following main elements (Government of India, 2015):

- To reduce the emissions intensity of GDP by 33%–35% by 2030 below 2005 levels.
- To increase the share of non-fossil-based energy resources to 40% of installed electric power capacity by 2030, with help of transfer of technology and low-cost international finance including from Green Climate Fund (GCF).
- To create an additional (cumulative) carbon sink of 2.5–3 GtCO2e through additional forest and tree cover by 2030.

India does not specify the coverage and metrics of the emissions intensity target in its NDC.

APEX COMMITTEE FOR THE IMPLEMENTATION OF THE PARIS AGREEMENT: KEY FACTS

- The Apex Committee for the Implementation of the Paris Agreement (AIPA) was recently constituted by the Indian government to ensure coordinated response to climate change matters and to keep the country on track towards meeting its climate change obligations under the Paris Agreement, which includes Nationally Determined Contributions (NDCs).
- It will act as the national authority for regulating carbon markets within the country.
- The committee was formed under the chairmanship of Union Ministry of Environment, Forest and Climate Change secretary.

►CLIMATE SMART CITIES ASSESSMENT FRAMEWORK 2.0

Ministry of Housing and Urban Affairs has launched the Climate Smart Cities Assessment Framework (CSCAF) 2.0, along with the 'Streets for People Challenge'.

- Objective: CSCAF is to provide a roadmap for cities towards combating Climate Change while planning & implementing their actions, including investments.
- In the last decade, an increase in frequency of cyclones, floods, heat waves, water scarcity and drought-like conditions have had adverse impacts on many of our cities. Such extreme events and risks cause loss of life as well as impact on the economic growth. In this context, CSCAF initiative intends to inculcate a climate-sensitive approach to urban planning and development in India.

►DOMESTIC CARBON MARKET MECHANISM

India has two market-based trading schemes in place:

- Perform, Achieve & Trade (PAT) is a flagship progarmme of Bureau of Energy Efficiency under the National Mission for Enhanced Energy Efficiency (NMEEE) to promote energy efficiency
- Renewable Energy Certificate (REC) for promotion of clean energy.

Indian Energy Exchange (IEX) and Power Exchange of India (PXIL) are the two power bourses in the country which are engaged in trading of renewable energy certificates (RECs) and electricity.

PARAMETER	PAT	REC
Nodal Body	Bureau of Energy Efficiency (BEE), under the aegis of the Ministry of Power (MOP)	Ministry of New and Renewable Energy (MNRE)
Metric	Energy Saving Certificates (ESCert) are measured in ton of oil equivalent (TOE) value;	REC Certificates are measured in MWh value; 1 REC = 1 MWh

	1 ESCert = 1 TOE saved	
Coverage	11 energy-intensive sectors have been notified for PAT - Aluminum, Cement, Chlor-Alkali, Fertilizer, Iron & Steel, Paper & Pulp, Thermal Power Plants, Textile, Railways, Refineries and Electricity Distribution Companies.	• 2 categories of RECs: solar RECs and non-solar RECs. • The following categories are included: Electricity distributors/ suppliers such as Distribution Licensees, Captive Consumers, Open Access users
Regulatory Body	Central Electricity Regulatory Commission (CERC)	Central Electricity Regulatory Commission (CERC)
Trading Platform	Indian Energy Exchange (IEX) and Power Exchange India Limited (PXIL)	Indian Energy Exchange (IEX) and Power Exchange India Limited (PXIL)

►OZONE LAYER DEPLETION

ABOUT OZONE

- Ozone is a form of oxygen. Oxygen occurs in three different forms in the atmosphere: as oxygen atoms (O), as oxygen molecules (O2) and as zone(O3).
- Ozone's unique physical properties allow the ozone layer to act as our planet's sunscreen, providing an invisible filter to help protect all life forms from the sun's damaging UV (ultraviolet)rays. Most incoming UV radiation is absorbed by ozone and prevented from reaching the Earth's surface. Without the protective effect of ozone, life on Earth would not have evolved the way it has.

WHAT IS ULTRAVIOLET RADIATION?

- Ultraviolet radiation is the one form of radiant energy coming out from the sun. The sun emits a range of energy known as the electromagnetic spectrum. The various forms of energy, or radiation, are classified according to wavelength (measured in nanometres where one nm is a millionth of a millimetre).
- The shorter the wavelength, the more energetic the radiation. In order of decreasing energy, the principal forms of radiation are gamma rays, x-rays, UV (ultraviolet radiation), visible light, infrared radiation, microwaves, and radio waves. Ultraviolet, which is invisible, is so named because it occurs next to violet in the visible light spectrum.
- The three categories of UV radiation are:
  - UV-A between 320 and 400 nm
  - UV-B between 280 and 320 nm
  - UV-C between 200 and 280 nm

WHAT ROLE DOES OZONE PLAYS IN ABSORBING THESE RADIATIONS?

- UV-B and C being highly energetic and are dangerous to life on earth. UV-A being less energetic is not dangerous.
- Fortunately, UV-C is absorbed strongly by oxygen and by ozone in the upper atmosphere. UV-B is also absorbed by ozone layer in the Stratosphere and only 2-3% of it reaches the earth's surface. The ozone Layer, therefore, is highly beneficial to plant and animal life on earth in filtering out the dangerous part of sun's radiation and allowing only the beneficial part to reach earth. Any disturbance or depletion of this layer would result in an increase UV-B and UV-C radiation reaching the earth's surface leading to dangerous consequences.

WHAT IS OZONE DEPLETION?

- Ozone depletion occurs when the natural balance between the production and destruction of stratospheric ozone is tipped in favour of destruction.
- Although natural phenomenon can cause temporary ozone loss, chlorine and bromine released from synthetic compounds is now accepted as the main cause of a net loss of stratospheric ozone in many parts of the world since 1980.
- There is strong evidence that global ozone depletion is occurring.
- The evidence is in the observations of the Antarctic ozone "hole" and atmospheric records indicating seasonal declines in global ozone levels.

ABOUT OZONE HOLE

- Ozone layer is the common term for the high concentration of ozone that is found in the stratosphere (layer of the atmosphere between around 10- 50 km altitude).

- Atmospheric ozone absorbs ultraviolet (UV) radiation from the sun, particularly harmful UVB-type rays.

- Ozone hole refers to a region in stratosphere where concentration of ozone becomes extremely low.
  - Such holes are spotted over both the Poles.
  - Ozone depletions at North pole are much smaller in size, owing to warmer temperatures in North Pole than the South Pole.
  - Ozone depletion is directly related to the formation of Polar vortex (in stratosphere).
    - During winter, temperatures in the vortex usually drop below 195 K (-78°C), and polar stratospheric clouds (PSCs) form.
    - PSCs provide surface for ozone depleting substances such as chlorine containing CFCs, HCFCs, bromine containing halons etc. to reach stratosphere.
    - At the poles, ODSs attach to ice particles in PSCs. When the sun comes out again in the polar spring, the ice particles melt, releasing the ozone-depleting molecules from the ice particle surfaces.
    - Once released, these ozone-destroying molecules harm and breaking apart the molecular bonds in UV radiation-absorbing ozone.
  - During the Southern Hemisphere spring season (August - October) the ozone hole over the Antarctic increases in size, reaching a maximum between mid-September and mid-October.
  - Ozone depletion slows when temperatures in stratosphere start to rise, in late Southern Hemisphere spring, the polar vortex weakens and breaks down.
    - This is because in warmer temperatures fewer PSCs form and they don't persist as long, limiting the ozone- depletion process.

WHAT ARE VARIOUS IMPACTS OF OZONE LAYER DEPLETION?

- Effects on Human and Animal Health
  - Increased penetration of solar UV-B radiation is likely to have profound impact on human health with potential risks of eye diseases, skin cancer and infectious diseases.
- Effects on Terrestrial Plants
  - It is a known fact that the physiological and developmental processes of plants are affected by UV-B radiation.
  - Scientists believe that an increase in UV-B levels would necessitate using more UV-B tolerant cultivar and breeding new tolerant ones in agriculture.
  - In forests and grasslands increased UV-B radiation is likely to result in changes in species composition (mutation) thus altering the biodiversity in different ecosystems.
- Effects on Aquatic Ecosystems
  - While more than 30 percent of the world's animal protein for human consumption comes from the sea alone, it is feared that increased levels of UV exposure can have adverse impacts on the productivity of aquatic systems.
  - High levels of exposure in tropics and subtropics may affect the distribution of phytoplankton which form the foundation of aquatic food webs.
- Effects on Bio-geo-chemical Cycles
  - Increased solar UV radiation could affect terrestrial and aquatic bio-geo-chemical cycles thus altering both sources and sinks of greenhouse and important trace gases, Ex. carbon dioxide (CO_2), carbon monoxide (CO), carbonyl sulphide (COS), etc.
- Effects on Air Quality
  - Reduction of stratospheric ozone and increased penetration of UV-B radiation result in higher photodissociation rates of key trace gases that control the chemical reactivity of the troposphere.
- Effects on Materials
  - Increased levels of solar UV radiation are known to have adverse effects on synthetic polymers, naturally occurring biopolymers and some other materials of commercial interest.
  - UV-B radiation accelerates the photodegradation rates of these materials thus limiting their lifetimes.

OZONE DEPLETING SUBSTANCES

Which are the Ozone Depleting Substances (ODS) presently used in India?

- Chlorofluorocarbons (CFCs)–12 for Refrigeration, Chillers and Metered Dose Inhalers.
- Hydrochlorofluorocarbons (HCFCs) - 22 for Air Conditioners.

- Carbon Tetrachloride (CTCs) for as solvent process agent mainly in the metal cleaning and textile industries. It is also used as feedstock in the manufacture of CFCs and DV Acid Chloride.

Which ODS is no longer produced in India?

- Halons, which were earlier used in fire extinguishers. Halons continue to be used in Defence sector, which is exempt from Montreal Protocol. The production of CFCs has also been stopped from 2008.

What are the commonly used ODS alternatives?

ODS ALTERNATIVES

SUB-SECTOR	APPLICATION	ALTERNATIVE TECHNOLOGY
Domestic Refrigeration	Household Refrigerators And Freezers	HFC-134a, HFC-152a, Blends and mixtures, Hydrocarbons (for refrigerants) and HCFC-22, HCFC-22 + 142b, HCFC-141b, Hydrocarbons for foaming)
Commercial Refrigeration	Refrigerated Cabinets Water Coolers Ice-candy machines Walk-in coolers	HCFC-134a, HFC-152a, Blends and mixtures, Hydrocarbons (for refrigerants) and HCFC-22, HCFC-22 +142b, Hydrocarbons (for foaming) HCFC-22, HFC-134a HCFC-22, HFC-134a (refrigerants) and HCFC-14b (foaming)
Industrial Refrigeration	Cold Storages Process Chillers	HCFC-22, HFC-134a, Ammonia HCFC-22, HFC-134a, Ammonia
Transport Refrigeration	Perishable Transport	HCFC-22, HFC-134a, Blends and mixtures
Air Conditioning	Chillers Automotive-air conditioning	HCFC-123, HFC-134a, HCFC-22 HFC-134a, Blends and mixtures

During the last few years intense research has yielded many substitute chemicals as replacements to currently used chlorofluorocarbons (CFCs), Halons, CTC, and Methyl chloroform.

The Government of India has entrusted the work relating to ozone layer protection and implementation of the Montreal Protocol to the Ministry of Environment & Forests (MOEF). The MOEF has set up an Ozone Cell as a national unit to look after and to render necessary services to implement the Protocol and its ODS phaseout program in India.

The MOEF has also established an Empowered Steering Committee, which is supported by four Standing Committees, namely the Technology and Finance Standing Committee, Standing Committee for Small Scale, Tiny and Unorganised industries, Standing Committee on Implementation of ODS phaseout projects and Monitoring and Evaluation Committee. The Empowered Steering Committee is responsible for the implementation of the Montreal Protocol provisions, review of various policy and implementation options, project approvals and project monitoring.

REGULATORY FRAMEWORK

India has provided for protection and improvement of the environment in its Constitution. Article 51-(g) of the Constitution says that it is the duty of every citizen of India to protect and improve the natural environment including forest, lakes, river and wildlife and to have compassion for living creatures. The constitutional provisions are implemented through environment protection laws of the country.

Environment is a concurrent subject thus allowing control of both the State Government and the Central Government on policies, regulations and action plans. In the recent past, the Honorable Supreme Court of India has ordered initiatives for protection of environment and prevention of pollution. This order can be passed based on Public Interest Litigation. The Environment Protection Act, 1986 empowers the Central Government to protect and improve the

environment and prevent, control and abate environmental pollution.

The Regulations and Controls relating to Ozone Layer protection namely, Ozone Depleting Substances (Regulations and Control) Rules, 2000 have also been issued by the Central Government under the Environment Protection Act, 1986.

INTERNATIONAL TREATIES AND COOPERATION ABOUT THE PROTECTION OF THE STRATOSPHERIC OZONE LAYER

VIENNA CONVENTION

- It is a Multilateral Environmental Agreement that was agreed upon at the 1985 Vienna Conference and entered into force in 1988.
- It is one of the most successful treaties of all time.
- It has been ratified by 197 states.
- It acts as a framework for the international efforts to **protect the ozone layer**.
- These are laid out in the accompanying Montreal Protocol.
- Vienna convention is not legally binding.

MONTREAL PROTOCOL (MP)

- Montreal Protocol on Substances that Deplete the Ozone Layer is a protocol to Vienna Convention for the Protection of Ozone Layer.
- It is an international treaty and aims to protect the ozone layer by phasing out:
  - Chlorofluorocarbons (CFCs),
  - Hydro chlorofluorocarbons (HCFCs),
  - Hydrobromofluorocarbons (HBFCs),
  - Carbontetrachloride (CCl4),
  - Methylbromide (CH3Br),
  - Bromochloromethane (CH2BrCl),
  - Methyl chloroform (CH3CCl3),
  - Halons.

KIGALI AGREEMENT (2016)

- The Kigali Agreement amended the 1987 Montreal Protocol that was designed to close growing ozone hole by banning ozone-depleting substances.
- This amended Montreal Protocol which was initially conceived only to plug gases that were destroying the ozone layer, now includes HFCs responsible for global warming.
- This move will help to prevent a potential 0.5-degree Celsius rise in global temperature by the end of the century.
- All signatory countries have been divided into three groups with different timelines to go about reductions of HFCs.
- First group includes countries like US and those in European Union (EU). They will freeze production and consumption of HFCs by 2018. They will reduce them to about 15% of 2012 levels by 2036.
- Second group includes countries like China, Brazil and all of Africa which will freeze HFC use by 2024 and cut it to 20% of 2021 levels by 2045.
- Third group countries like India, Pakistan, Pakistan, Iran, Saudi Arabia etc. will be freezing HFC use by 2028 and reducing it to about 15% of 2025 levels by 2047.

OZONE POLLUTION IN DELHI

- Surface Ozone pollution in Delhi shot up during summer months in 2019.
- This was reflected in Air Quality Index.
- Surface ozone and its cause:
  - It is not a primary pollutant, and it is produced due to chemical reactions of NOx (nitrogen oxides), CO (carbon monoxide) in the presence of sunlight.
  - When temperature increases, the rate of production of ozone also increases. It can cause fatigue, breathlessness, and asthma.
- Impact of rising Ozone concentration in the atmosphere:
  - Surface ozone can lead to cough, shortness of breath, throat pain in short term and cause corrosion of linings of lungs and make lungs vulnerable to further infections in case of long-term exposure.

►INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

- It is a scientific government body under the United Nations set up at the request of the member governments, dedicated to providing the world with an objective, scientific view of climate change and its political and economic impacts on the nations.
- It was first established in 1988 by two United Nations organizations, the World Meteorological Organization

and the United Nations Environment Program and later endorsed by the United Nations General Assembly.

- Membership of the IPCC is open to all members of the WMO and the UNEP.
- IPCC produces reports that support UNFCCC, which is the main international treaty on climate change.
- Main objective of UNFCCC is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.
- IPCC reports cover the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human induced climate change, its potential impacts and options for adaptation and mitigation.

►SIXTH ASSESSMENT REPORT OF IPCC

This is the sixth cycle of global review of climate change being conducted by IPCC. This report is significant as its findings will compel countries to up their climate commitments in Glasgow climate summit of UNFCCC.

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC)

The IPCC provides regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation. IPCC reports are also a key input into international climate change negotiations.

Created in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Program. For preparing the reports, IPCC does not conduct its own research, neither does it finances climate research. It bases its climate reports on the review of already published scientific research by a panel of scientists.

SALIENT FINDINGS

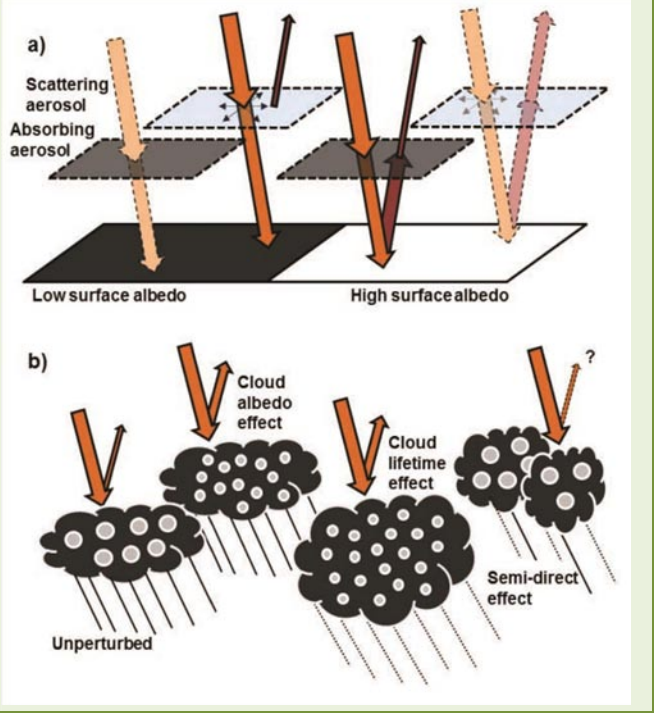
- Human induced global warming is undeniable.
- Average surface level Global Warming is 1.07 °C as compared to pre-Industrial levels.
- Current rate of warming will result into warming of at least 1.5°C to 2°C.
- CO_2 has been and will be most dominant GHG.
- GHG warming is assessed to be partially offset by aerosol cooling by almost 30%.
  - Scientists believe the cooling from sulfates and other reflective aerosols overwhelms the warming effect of black carbon and other absorbing aerosols over the planet.
- Actions:
  - Drastic reduction in GHG emissions
  - Carbon Neutrality
- Assessment for South Asian Region
  - South Asian Monsoon has weakened due to Anthropogenic Aerosol Forcing.
  - Freezing levels height is increasing and Elevation dependent warming is visible.
  - With few exceptions, mountain glaciers have retreated since the second half of 19th century.

ANTHROPOGENIC AEROSOL FORCING

All atmospheric aerosols scatter incoming solar radiation, and a few aerosol types can also absorb solar radiation. BC is the most important of the latter, but mineral dust and some OC components are also sunlight absorbers. Aerosols that mainly scatter solar radiation have a cooling effect, by enhancing the total reflected solar radiation from the Earth.

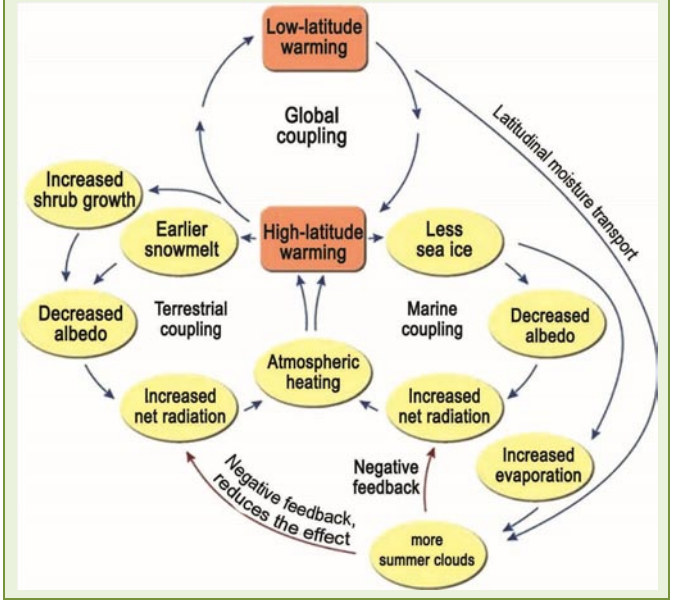
Strongly absorbing aerosols have a warming effect. In the atmosphere, there is a mixture of scattering and absorbing aerosols, and their net effect on Earth's energy budget is dependent on surface and cloud characteristics. Scattering aerosols above a dark surface and absorbing aerosols above a bright surface are most efficient (see Figure).

Scattering (absorbing) aerosol above a bright (dark) surface are less efficient because the solar radiation is reflected (absorbed) anyway. Absorbing aerosols are particularly efficient when positioned above clouds, which are a main contributor to the total reflection of solar radiation back to space.



ELEVATION DEPENDENT WARMING

The phenomenon that the warming rate of air temperature is amplified with elevation is termed elevation-dependent warming (EDW).



►WORKING GROUP II (WG2) CONTRIBUTION TO THE SIXTH ASSESSMENT REPORT (AR6) OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC)

Context: The report reaffirms India's call for equity and climate justice and stated that the Developed countries must take the lead in urgent mitigation and providing finance for adaptation, loss and damage.

A delegation from India participated in the final discussions on the Summary for Policymakers of the Report, held online from 14th February to 27th February (extending two days over its scheduled duration) and has joined other nations in approving the Summary for Policymakers of the Report.

THE FOLLOWING ARE THE KEY FINDINGS OF THE REPORT AND ITS SUMMARY FOR POLICYMAKERS

- The Report affirms that climate change due to historical emissions is leading to serious impacts which are already being felt globally including in developing countries with low contribution to cumulative emissions. These impacts will rise as warming proceeds and will rise rapidly at higher levels of warming.
- The Report emphasizes that action on adaptation is urgently needed – as urgently as action on mitigation.
- The Summary for Policymakers (SPM) underlines the need for climate action based on equity and climate justice to ensure the well-being of humanity and the planet.
- The science of climate resilience now fully acknowledges the importance of equity and climate justice that India has always championed and had brought into the Paris Agreement.
- Further, the SPM clearly acknowledges the importance of Indigenous and Local Knowledge in adaptation to climate change.

►CARBON PRICING LEADERSHIP COALITION (CPLC)

- The CPLC is a voluntary initiative that catalyses action towards the successful implementation of carbon pricing around the world.
- The CPLC brings together leaders from government, business, civil society and academia to support carbon pricing, share experiences and enhance the global, regional, national and sub-national understanding of carbon pricing implementation. The CPLC Secretariat is administered by The World Bank Group.
- As of 2019, the Coalition comprises 34 national and sub-national government, 163 private sector organizations from a range of regions and sectors, and 80 strategic partners representing NGOs, business organizations, and universities.

CARBON PRICING

A carbon price is a cost applied to carbon pollution to encourage polluters to reduce the amount of greenhouse gases they emit into the atmosphere. There are two main types of carbon pricing:

- **Emissions trading systems**
  - Sometimes referred to as a cap-and-trade system – caps the total level of greenhouse gas emissions and allows those industries with low emissions to sell their extra allowances to larger emitters. By creating supply and demand for emissions allowances, an ETS establishes a market price for greenhouse gas emissions. The cap helps ensure that the required emission reductions will take place to keep the emitters (in aggregate) within their pre-allocated carbon budget.
- **Carbon Tax**
  - A carbon tax directly sets a price on carbon by defining a tax rate on greenhouse gas emissions or

– more commonly – on the carbon content of fossil fuels. It is different from an ETS in that the emission reduction outcome of a carbon tax is not pre-defined, but the carbon price is.

►GLOBAL COMMISSION ON ADAPTATION (GCA)

- The body was launched in the Hague. It was established by the Prime Minister of Netherlands and leaders of 22 other convening countries.
- India is one of the participating countries.
- The Commission was launched with the mandate to accelerate adaptation by elevating political visibility of adaptation and focusing on concrete solutions.
- GCA published its flagship report Adapt Now: A global call for leadership on climate resilience
- The commission's mandate has come to an end at the Climate Adaptation Summit hosted by the Netherlands in 2021.
- Also launched during the Climate Adaptation Summit held in Netherlands was:

1. RACE TO RESILIENCE

- High level climate champions Race to Resilience is the sibling campaign to Race to Zero.
- By 2030, to catalyse action by non-state actors that builds the resilience of 4 billion people from groups and communities who are vulnerable to climate risks
- Through a partnership of initiatives, the campaign will focus on helping frontline communities to build resilience and adapt to impacts of climate change.
- Urban: Transform urban slums into healthy, clean and safe cities
- Rural: Equip smallholder farmers to adapt and thrive
- Coastal: Protect homes and businesses against climate shocks

2. ADAPTATION ACTION COALITION

- The Coalition's primary aim is to accelerate global action on adaption to achieve a climate resilient world by 2030.
- The Adaptation Action Coalition will deliver sector-specific, action-orientated workstreams, initially focused on health, infrastructure and water in 2021. These workstreams will:
  - demonstrate real world action that is being taken to respond to climate risks
  - build the evidence base on good adaptation
  - support the integration of climate risk into sectoral and national plans
  - ensure work is driven in partnership with others, including the Race to Resilience to being together state and non-state actors
  - integrate inclusion and the locally led principles
  - The Coalition was developed by the UK in partnership with Egypt, Bangladesh, Malawi, the Netherlands, Saint Lucia and the United Nations. The coalition is open to all UN member states (plus the European Union) who have signed the Call for Action.

►HIGH AMBITION COALITION FOR NATURE AND PEOPLE

- A coalition launched by Costa Rica and France (UK is Ocean co-chair) to create conditions for adoption of an ambitious nature protection target by the CBD COP. It's objectives are:
- Protect at least 30% of world's land & ocean by 2030
- Effective management of protected & conserved areas
- Increased public & private financing to ensure long-term management and local governance
- Clear implementation mechanisms to put nature on a path to recovery by 2030.

The 30 × 30 target is a global target which aims to halt accelerating loss of species, protect vital ecosystems.

►PREZODE INITIATIVE

- PREZODE stands for Preventing Zoonotic Disease Emergence.
- It is an initiative launched by France at the One Planet Summit.
- It aims to support international organisations and countries, particularly low-income countries to prevent emergence and spread of zoonotic diseases.
- This initiative is an attempt to initiate a framework shift to envision innovative prevention strategies, based on five pillars:

  (1) zoonotic risk assessment,

  (2) zoonotic risk reduction,

  (3) early detection and socioeconomic evaluation,

  (4) a global surveillance system of zoonotic risks, and

(5) ensuring stakeholder commitment and capacity building to strengthen One Health networks and policies.

►EARTH OVERSHOOT DAY

- It marks the date when humanity's demand for ecological resources and services each year exceeds what Earth can regenerate in that year.
- It maintains this deficit by liquidating stocks of ecological resources and accumulating waste, primarily carbon dioxide in the atmosphere.
- It is hosted and calculated by Global Footprint Network, an international research organization that provides decision-makers with a menu of tools to help the human economy operate within Earth's ecological limits.
- How is the Earth Overshoot Day calculated?
  - To determine the date of Earth Overshoot Day for each year, Global Footprint Network calculates the number of days of that year that Earth's biocapacity suffices to provide for humanity's Ecological Footprint.
  - The remainder of the year corresponds to global overshoot. Earth Overshoot Day is computed by dividing the planet's biocapacity (the amount of ecological resources Earth can generate that year), by humanity's Ecological Footprint (humanity's demand for that year), and multiplying by 365, the number of days in a year:

(Earth's Biocapacity / Humanity's Ecological Footprint) x 365 = Earth Overshoot Day

►LAND DEGRADATION

- Land degradation is a process in which the value of the biophysical environment is affected by a combination of human-induced processes acting upon the land.
- It is viewed as any change or disturbance to the land perceived to be deleterious or undesirable.
- Natural hazards are excluded as a cause; however human activities can indirectly affect phenomena such as floods and bush fires.
- This is an important topic of the 21st century due to the implications land degradation has upon agricultural productivity, the environment, and its effects on food security.
- It is estimated that up to 40% of the world's agricultural land is seriously degraded.

IMPACT OF LAND DEGRADATION

- A temporary or permanent decline in the productive capacity of the land:
  - This can be seen through a loss of biomass, a loss of actual productivity or in potential productivity, or a loss or change in vegetative cover and soil nutrients.
- Loss of biodiversity:
  - A loss of range of species or ecosystem complexity as a decline in the environmental quality.
- Shifting ecological risk:
  - increased vulnerability of the environment or people to destruction or crisis. This is measured through a base line in the form of pre-existing risk of crisis or destruction.

CAUSES OF LAND DEGRADATION

Land clearance, such as clearcutting and deforestation	Agricultural depletion of soil nutrients through poor farming practices
Livestock including overgrazing and over drafting	Urban sprawl and commercial development Vehicle off-roading
Invasive Species	Quarrying of stone, sand, ore and minerals
Soil degradation, Soil contamination, Soil acidification, Soil erosion	Exposure of naked soil after harvesting by heavy equipment
Significant land degradation from seawater inundation, particularly in river deltas and on low-lying islands, is a potential hazard that was identified in a 2007 IPCC report	Increase in field size due to economies of scale, reducing shelter for wildlife, as hedgerows and copices disappear
	Loss of soil carbon
Dumping of non-biodegradable trash, such as plastics	Monoculture, destabilizing the local ecosystem
Inappropriate irrigation and over drafting	

Leading causes of Land Degradation across world

Sensitivity and resilience

Sensitivity and resilience are measures of the

vulnerability of a landscape to degradation. These two factors combine to explain the degree of vulnerability.

Sensitivity is the degree to which a land system undergoes change due to natural forces, human intervention or a combination of both. Resilience is the ability of a landscape to absorb change, without significantly altering the relationship between the relative importance and numbers of individuals and species that compose the community. It also refers to the ability of the region to return to its original state after being changed in some way.

The **resilience** of a landscape can be increased or decreased through human interaction based upon different methods of land-use management. Land that is degraded becomes less resilient than undegraded land, which can lead to even further degradation through shocks to the landscape.

►UNCCD

Established in 1994, the United Nations Convention to Combat Desertification (UNCCD) is the sole legally binding international agreement linking environment and development to sustainable land management.

The Convention addresses specifically the arid, semi-arid and dry sub-humid areas, known as the drylands, where some of the most vulnerable ecosystems and peoples can be found.

The Convention's 197 parties work together to improve the living conditions for people in drylands, to maintain and restore land and soil productivity, and to mitigate the effects of drought.

The UNCCD is particularly committed to a bottom-up approach, encouraging the participation of local people in combating desertification and land degradation. The UNCCD secretariat facilitates cooperation between developed and developing countries, particularly around knowledge and technology transfer for sustainable land management.

As the dynamics of land, climate and biodiversity are intimately connected, UNCCD collaborates closely with the other two Rio Conventions; UNCBD and the UNFCCC, to meet these complex challenges with an integrated approach and the best possible use of natural resources.

COP 14 HELD IN DELHI

- The UNCCD COP 14 ended on 13 September 2019, after ten days of meetings, 11 high-level, 30 committee and over 170 stakeholder meetings, 44 exhibitions and 126 side events.
- The Conference adopted Delhi Declaration where parties expressed commitment for a range of issues, including gender and health, ecosystem restoration, taking action on climate change, private sector engagement, Peace Forest Initiative and recovery of 26 million hectares of degraded land in India.

MANDATE

The Global Mechanism (GM) was established under Article 21 of the United Nations Convention to Combat Desertification (UNCCD) to assist countries in the mobilization of financial resources to implement the Convention and address desertification, land degradation and drought.

►LAND DEGRADATION NEUTRALITY FUND

Land Degradation Neutrality Fund (LDN Fund) was launched at the 13th Conference of the Parties (COP13) to the United Nations Convention to Combat Desertification (UNCCD) in Ordos, China.

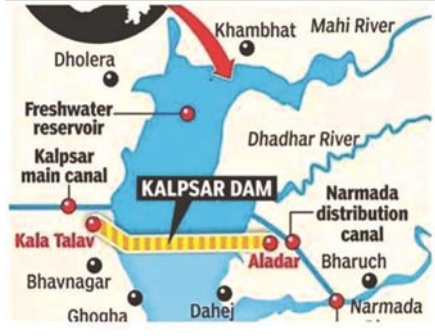
ABOUT LDN FUND

- LDN fund is a first-of-its-kind investment vehicle leveraging public money to raise private capital for sustainable land management and landscape restoration activities worldwide.
- It will be independent from the UN and will be managed by a private sector investment management firm.
- It will invest in bankable projects on land rehabilitation and sustainable land management worldwide, including
  - sustainable agriculture, sustainable livestock management,
  - agro-forestry, sustainable forestry,
  - renewable energy, infrastructure development, and eco-tourism.

ABOUT LDN

It is a state whereby the amount and quality of land resources, necessary to support ecosystem functions, services and enhance food security, remains stable or increases within specified temporal and spatial scales and ecosystems.

► SNIPPETS

Vulture Protection	Bangladesh has become the first country that has banned the painkiller ketoprofen.
GI Tag sought for Gucchi Mushroom	• They are locally called 'gucchi' in the Himalayan region and are prized for their spongy, honeycomb texture and has a unique flavor to it. • The mushrooms cannot be cultivated commercially and instead they grow wild only in some regions like the Kangara Valley, Jammu and Kashmir, Manali, and other parts of Himachal Pradesh after the snowfall period.
Omkareshwar Dam	• The Government of India is to construct the largest floating solar energy project in the world. • The project is to be constructed at Omkareshwar Dam on Narmada River. The project will begin its power generation by 2022 to 2023.
Bhashan Char Island	• It is a remote uninhabited island of Bangladesh, located in the Bay of Bengal. It is also known as Char Piya. • Around thousands of Rohingyas from Cox's Bazar refugee camp are being shifted to the newly developed facility in the island. Humanitarians oppose this move fearing poor liveable conditions in the new.
Segur Plateau	A plateau in the Nilgiri Hills of Tamil Nadu. Situated on the Moyar River. Important wildlife corridor between the Eastern and Western Ghats. Part of Nilgiri Biosphere Reserve.
BHADHUT PROJECT	• It is planned to be a 1.7-km causeway-cum-weir barrage, across the Narmada River, 5 km from Bhadbhut village, and 25 km from the mouth of the river, where it flows into the Gulf of Khambhat. • The barrage will stop most of the excess water flowing out of the Sardar Sarovar Dam from reaching the sea and thus create a "sweet water lake" of 600 mcm (million cubic metres) on the river. 
Mission Innovation (MI)	It is a global initiative of 24 countries and the European Commission (on behalf of the European Union). Find out more about our members, including annual progress reports.
Great Green Wall Initiative	Aims to transform lives of 100 million Africans by growing 8,000 kilo metre long and fifteen kilo metre wide mosaic of trees, vegetation, grasslands, plants. The project aims to restore 100 million hectares of degraded land by 2030. It is an African initiative, started in 2007 by African Union to combat desertification, land degradation, drought.
SATAT Initiative (The Sustainable alternative Towards Affordable Transportation)	The Government of India signed Memorandum of Understanding with leading oil and gas marketing companies to establish Compressed Bio-Gas Plants all over India. These plants are to generate biogas from crop wastes. The agreements were signed under the SATAT (Sustainable Alternative Towards Affordable Transportation) initiative.
SILAM and ENFUSER	IMD launched improved SILAM and ENFUSER models to monitor Air Quality in the country. SILAM is System for Integrated Modelling of Atmospheric Composition. The model has been improved by implementing Global emission inventories such as CAMS-GLOB and

	EDGAR for mineral fine anthropogenic particulate matter at 10 km resolution. The model provides information such as equality atmospheric composition and Wildfire smoke. It can solve the inverse dispersion problem. The model can take data from variety of sources such as sea salt, Pollen and blown dust. ENFUSER is Environmental information FUsion SERvice. It was operationalised to identify pollution hotspots in the national capital region. The Speciality of the model is its high utilisation of measurement data such as air quality observations, high resolution satellite images, land use information. Triple system model or evaluated with satellite measurements and operations. Both SILAM and ENFUSER were developed in technical collaboration with Finland. WRF-Chem is another air quality model that has been updated by the Indian Meteorological Department.
Kamchatka Disaster?	The mass death of sea creatures off the coast of Kamchatka in Russia's far east was caused by toxic algae and not man-made factors,
Kaleshwaram lift irrigation project	It is a multipurpose irrigation project on the Godavari River. The project begins at the meeting point of Godavari River and Pranahita river. It was initially called the pranahita Chevella project. Later it was renamed as Kaleshwaram project in 2014.
Global Initiative to reduce Land Degradation	The primary aim of the initiative is to strengthen the implementation of existing frameworks to prevent, halt, and reverse land degradation within G20 member states and globally. Implementation must be done by considering implications on the achievement of other sustainable development goals (SDGs) and adhering to the principle of doing no harm.
Pink Ice in Italian Alps	Italian scientists have found pink-coloured glaciers in the Alps. According to them, pink colour is formed due to an algae found in the ice.
Zig Zag Technology	In zigzag kilns, bricks are arranged to allow hot air to travel in a zigzag path. The length of the zigzag air path is about three times that of a straight line, and this improves the heat transfer from the fuel gases to the bricks, making the entire operation more efficient.
Global Resilience Index Initiative	It will be world's first curated, open-source reference index. This information will be open, accessible to all using shared standards and consistent metrics at local to global scales. Until now this essential information remains unavailable, inaccessible and inconsistent even in developed countries. Partners institutions of GRII: CDRI and 9 other global institutions. Goals: 1. Offer global open reference risk data using metrics built on insurance risk modelling principles. 2. Provide shared standards & facilities applicable to a wide range of uses, including corporate climate risk disclosure, national adaptation planning and reporting and planning of pre-arranged humanitarian finance.
Children's Climate Risk Index	• It provides first comprehensive view of children's exposure & vulnerability to impacts of climate change. It ranks countries based on children's exposure to climate and environmental shocks, such as cyclones and heatwaves, as well as their vulnerability to those shocks, based on their access to essential services. • It is released by UNICEF.
Orca Plant	• Orca is the world's first and largest climate positive direct air capture and storage plant, making direct air capture and storage a reality. • It has been developed by Swiss company, Climateworks AG and works on the principle

	of direct air capture, which aims to remove CO_2 from atmosphere. • The system captures CO_2 from air and deposits the gas underground. The captured carbon is then mixed with water and pumped deep underground, where it slowly turns into rock.
Amazon of Europe	• UNESCO has designated world's first biosphere reserve that spans across 5 countries – Austria, Slovenia, Croatia, Hungary & Serbia. The biosphere reserve includes floodplains of Mura, Drava and Danube River which passes through these 5 countries. • Total area of the reserve, is more than million hectares, making it the so-called 'Amazon of Europe', which makes it largest riverine protected area on the continent.
India Plastics Pact	It is an ambitious, collaborative initiative that aims to bring together businesses, government and NGOs to reduce, reuse and recycle plastics in the value chain. It aims to transform current linear plastics system into a circular plastics economy that will: • Reduce use of problematic plastics in India. • Retain valuable materials in the economy for use in other products. • Generate jobs, investment and opportunities in the plastics system in India. • It is a collaboration between WWF India and Confederation of Indian Industry (CII).
Partnership for Clean Funds and Vehicles	It is a global initiative to promote and support better air quality through the introduction of cleaner fuels and vehicles in developing and transitional countries. It is a public private partnership led by UNEP. UNEP based Partnership Clearing House provides technical, networking and financial support for improved capacity and technology transfer through regional, national and local activities related to cleaner fuels and vehicles. Objectives: 1. Phase out of leaded gasoline worldlife. 2. Reduce sulphur levels (to 50 ppm or less) 3. Introduction of cleaner fuels and introduce cleaner vehicles.
Urban Shift Initiative	• It is a program of UNEP to transform cities for people and planet through sustainable, integrated, zero-carbon urban development. • The program will support 23 cities in Argentina, Brazil, China, Costa Rica, India, Indonesia, Morocco, Rwanda and Sierra Leone (9 countries) to adopt integrated approaches to urban development. • Indian cities participating in the program are Chennai, Pune, Surat, Agra and Puducherry. Urban Shift project in India is implemented by UNEP and Asian Development Bank.
Coalition for Digital Environmental Sustainability (Codes)	• It is a global multi-stakeholder alliance of governments, companies and civil society established to harness digital transformation to become a positive and exponential force for sustainability and climate action. • Initiated by UNEP, UNDP, International Science Council, German Environment Agency, Kenyan Ministry of Environment, Future Earth and Sustainability in Digital Age. Objectives: • Offer a vision and authoritative framing of environmental sustainability and digitalisation nexus. • Establish an acceleration plan for digitalising environmental sustainability of including immediate priorities and partnerships covering a 2–3-year perspective. • Unite environmental sustainability and digitalisation tracks under a common framework and umbrella. • Mobilize scientific community and research agenda.

Mountain Green Cover Index	• The index measures changes in the area of green vegetation in mountain areas (forest, shrubs, pasture lands and crop lands). This information will help identify the status of conservation of mountain environments in order to measure progress towards SDG Target 15.4. • The index has been developed by Food and Agriculture Organisation (FAO of UN). • The index is based on satellite imagery at a 300 metres resolution.
CLEANaction	• CLEANaction stands for Coalition Linking Energy And Nature for action. It is a partnership that aims to highlight the need for new renewable energy generation projects (solar and wind) to be carefully assessed for their impacts on biodiversity. • Partners: WWF, Birdlife International, IRENA, ICLEI, The Nature Conservancy.
Alliance for Clean Air	First global corporate initiative to bring together leading businesses to tackle air pollution. They will: • Establish air pollution footprints on nitrogen oxides, sulphur oxides, particulate matter within 12 months. • Pinpoint where they are being emitted to track human exposure. • Set ambitious targets and objectives to reduce air pollution emissions, with a clear action plan. • Act as champion of clean air by raising awareness about impact of air pollution and reduce exposure of stakeholders to air pollution. • Use their assets innovatively to accelerate clean air solutions. • Members: 10 large companies like Google, Accenture, Bloomberg, IKEA etc. Mahindra & Wipro from India is also a member.
First Movers Coalition	• It is a partnership between US Office of Special Presidential Envoy for Climate John Kerry and World Economic Forum. • Participating companies will commit to buying low-carbon products by 2030 to help develop green supply chains and meet world's climate goals. • Purchasing commitments will initially target four hard to abate sectors: shipping, aviation, steel and trucking, with four additional sectors becoming the focus in 2022.
Karakoram Anomaly	• A group of scientists has postulated a theory on why glaciers in the Karakoram Range of Central-South Asia have not been as affected by climate change as others. • While glaciers have generally been losing mass and extent across the world and in the Hindu Kush-Himalayan (HKH) region, one subset of glaciers in the Karakoram has been sticking out like a sore thumb by defying this trend. • Some glaciers in and around the range, northwest of the Tibetan Plateau, have actually been showing zero or positive mass balance changes. This "Karakoram Anomaly" has been giving glaciologists sleepless nights and climate deniers a rare straw to clutch at.
India's First Cryptogamic Garden	India's first cryptogamic garden was opened at Deoban area of Dehradun in Uttarakhand. It located at a height of 2,700 m above sea level in an area of 3 acres. About Cryptogames: Cryptogame means, "hidden reproduction." This further means that the plant produces no seed or flowers. They reproduce through spores. Cryptogams are non-seed-bearing plants. The well-known cryptogams are algae, lichens, mosses, ferns, and fungi. Cryptogams need a moist environment to thrive. The groups – lichens, algae, and bryophytes (moss and liverworts) – are made of primitive species that feature a plant body that is has no distinct roots, stems, and leaves. The body is thalloid.

Yilan Crater	• It is a crescent-shaped meteorite impact crater in Northeast China's Heilongjiang Province • It is reportedly the largest meteorite impact crater on Earth in 100,000 years.
One Ocean Summit	• Organised by France in February 2022, this brought together 41 head of states (including India), members of civil society and business. • The goal of the One Ocean Summit is to raise the collective level of ambition of the international community on marine issues and to translate our shared responsibility to the ocean into tangible commitments. Commitments • Protect biodiversity and ocean resources o Aims at creation of protected areas through High Ambition coalition for nature and people o High ambition coalition on biodiversity beyond national jurisdiction is launched for sustainable use of high seas and protection of their biodiversity. o Commitment to fight against illegal fishing • Join forces with the oceans to face climate change o France and Colombia launched a global coalition for blue carbon, which will bring together national and multilateral actors in the field to contribute to financing the restoration of coastal ecosystems, using shared and rigorous methodologies • End plastic pollution of the ocean o Clean ocean initiative was launched, several European banks doubled their commitment to 4 billion euros by 2025 o India and France together launched an initiative on the elimination of single-use plastic pollution, which aims to be multilateral. • Place the ocean at the top of the global political agenda The European Union has pledged to produce a "Digital Twin of the Ocean". This "Digital Twin" initiative will inform political decisions and track their effects, enable the marine economy to develop with respect for ecosystems and fuel dialogue with stakeholders and the public.
Clean Ocean Manifesto	Clean Ocean Expert Group formed to implement UN Decade for Ocean Science for Sustainable Development 2021-30. The have released 'clean ocean manifesto'. It has essential aims: 1. Reducing marine debris by 50-90%. 2. A globe circling, high-tech systems of monitors. Objectives: • Enlarge understanding of pathways for spread and fates of pollutants. • Reduce and remove top-priority forms of pollution (Ex. Marine debris) by large amounts, as much as 50% to 90%. • Prevent recurrence, reduce source or emission of pollutants. • Improve dramatically the outcomes of control measures. • Improve monitoring (as part of Global Ocean Observing System (GOOS) for more accurate, precise and real time tracing of spills and monitoring of ocean soundspaces. • Identify and accelerate development and adoption of technologies to promote a Clean Ocean. • Improve national mechanisms (legal, regulatory) for control and prevention, better align

	financial incentives and lift compliance with international treaties.
International Monsoons Project Office (IMPO)	• Support activities of Monsoons Panel, jointly established by World Climate Research Program's CLIVAR (Climate & Ocean Variability, Predictability and Change) and GEWEX (Global Energy and Water Exchanges). • Support to World Weather Research Program's working group on tropical meteorology research. Benefits: • Understand and predict seasonal variability of monsoons. • Enhancing prediction skill of monsoons and cyclones. • Strengthening monsoon research for better support operations and services.
Cyanokhoj	• It is a pan-India map of algal blooms, caused by cyanobacteria in Indian inland water bodies. It has been created using satellite data based on Google Earth. • It will act as an early warning system and will assist water resource managers to monitor water quality and aid decision making. • Algal blooms were most severe in post-monsoon season when nutrient concentrations are highest. About Algal Bloom • Decomposition of organic waste increases the nutrient content of water bodies, this enrichment causes profuse growth of algae (algal bloom) especially blue-green algae. • The cover entire surface of water bodies and release toxins. Toxins inhabit growth of other algae and aquatic animals may die due to lack of oxygen and toxicity. • The process of nutrient enrichment and loss of biodiversity is referred to as Eutrophication.

CONCEPTS

►GROSS ENVIRONMENT PRODUCT

The Uttarakhand government recently announced it will initiate valuation of its natural resources in the form of 'Gross Environment Product' (GEP), said to be along the lines of Gross Domestic Product (GDP)

GROSS ENVIRONMENT PRODUCT (GEP)

- Ecosystem products and services are essentials for human survival and development. Gross Ecosystem Product (GEP) aims to specific indicators to measure the total economic value of all ecosystem products and services.
- GEP is the total value of final ecosystem goods and services supplied to human well-being in a region annually and can be measured in terms of biophysical value and monetary value.
- Ecosystems that can be measured include natural ecosystems such as forests, grassland, wetland, desert, freshwater and ocean, and artificial systems that are based on natural processes like farmland, pastures, aquaculture farms and urban green land, etc.
- GEP summarizes the value of ecosystem services in a single monetary metric.
- It will assess the improvement in the environment components in a year.

FASTER ADOPTION AND MANUFACTURING OF HYBRID AND ELECTRIC VEHICLES (FAME II)

- Department of Heavy Industry notified Phase-II of the Scheme in March 2019 with an outlay of Rs. 10,000 Crore for a period of 3 years commencing from 1st April 2019.
- The main objective of the scheme is to encourage Faster Adoption of Electric and Hybrid Vehicle by way of offering upfront incentive on purchase of Electric vehicles and by way of establishing a necessary charging Infrastructure for electric vehicles.
- The scheme will help in addressing the issue of environmental pollution and fuel security. Emphasis is on electrification of the public transportation that includes shared transport.
- The scheme proposes for establishment of charging infrastructure, whereby about 2700 charging stations so that there will be availability of at least one charging station in a grid of 3 km x 3 km.
- Establishment of Charging stations are also proposed on major highways connecting major city clusters.

RECENT CHANGES

- Capped incentives for electric two-wheelers at 40% of the cost of vehicle, up from 20% earlier.
- Increased the demand incentive for electric two wheelers to Rs. 15,000 per KWh from an earlier uniform subsidy of Rs. 10,000 per KWh for all EVs, including plug-in hybrids and strong hybrids except buses.

►ECO-BRIDGES OR ECO-DUCTS

The Ramnagar Forest Division in the Nainital district of Uttarakhand built the first eco-bridges for smaller mammals and reptiles.

ABOUT ECO-BRIDGES

The Eco-Bridges or Eco-Ducts are constructed to enhance the wildlife connectivity that are usually disrupted due to logging or highways. It includes

concrete underpasses, canopy bridges or overpass tunnels, amphibian tunnels. These bridges are usually overlaid with planting from the area to give a contiguous look with the landscape. The eco-bridges also include overpasses, fish ladders, green roofs, tunnels, canopy bridges.

NEED FOR ECO-BRIDGES

1. Due to construction of multilane highways, there is a fragmentation of habitat of wildlife.
2. Many animals get killed every year in accidents on these highways.

Therefore, it is essential to build these animal pathways to prevent from disrupting their natural co-habitation.

ABOUT ECO-BRIDGES

The two main aspects considered in building the eco bridges are size and location. These bridges should be built based on the animal movement patterns.

Canopy bridges for Nilgiri Langurs (IUCN status: Vulnerable) and lion-tailed Macaques (IUCN status: Endangered) have been built in Western Ghats.

FIRST FIVE ANIMAL BRIDGES IN INDIA

The bridges have been planned to avoid disturbances in Ranthambore Wildlife Corridor. The first five animal bridges are planned on the Delhi-Mumbai Expressway. These animal bridges will help avoid man-animal conflict. Ranthambore National Park is in Rajasthan. It was declared as the Project Tiger Reserve in 1973.

►SOUTHWEST MONSOON

This year, Southwest Monsoon withdraw from the entire country by October 28 and subsequently, the Northeast Monsoon commenced over the southern peninsula.

ONSET & ADVANCE OF MONSOON

The guidelines to be followed for declaring the onset of monsoon over Kerala and its further advance over the country are enlisted below:

a) Rainfall

- If after 10th May, 60% of the available 14 stations enlisted*, viz. Minicoy, Amini, Thiruvananthapuram, Punalur, Kollam, Allapuzha, Kottayam, Kochi, Thrissur, Kozhikode, Thalassery, Kannur, Kudulu and Mangalore report rainfall of 2.5 mm or more for two consecutive days, the onset over Kerala be declared on the 2nd day, provided the following criteria are also in concurrence.

b) Wind field

- Depth of westerlies should be maintained up to 600 hPa, in the box equator to Lat. 10ºN and Long. 55ºE to 80ºE. The zonal wind speed over the area bounded by Lat. 5-10ºN, Long. 70-80ºE should be of the order of 15 – 20 Kts. at 925 hPa.

c) Outgoing Longwave Radiation (OLR)

- INSAT derived OLR value should be below 200 wm-2 in the box confined by Lat. 5-10ºN and Long. 70-75ºE.

NORTHERN LIMIT OF MONSOON (NLM)

Southwest monsoon normally sets in over Kerala around 1st June. It advances northwards, usually in surges, and covers the entire country around 15th July. The NLM is the northern most limit of monsoon up to which it has advanced on any given day.

WITHDRAWAL OF SW MONSOON

- Withdrawal from extreme north-western parts of the country is not attempted before 1st September.
- After 1st September:

The following major synoptic features are considered for the first withdrawal from the western parts of NW India.

1. Cessation of rainfall activity over the area for continuous 5 days.
2. Establishment of anticyclone in the lower troposphere (850 hPa and below)
3. Considerable reduction in moisture content as inferred from satellite water vapour imageries and tephigrams.

FURTHER WITHDRAWAL FROM THE COUNTRY

1. Further withdrawal from the country is declared, keeping the spatial continuity, reduction in moisture as seen in the water vapour imageries and prevalence of dry weather for 5 days.
2. Withdrawal of SW monsoon is from the southern peninsula and hence from the entire country only after 1st October, when the circulation pattern indicates a change over from the southwesterly wind regime.

►MT. EVEREST 'GROWS' TALLER

The world's highest mountain Mount Everest is 0.86m higher than had been previously officially calculated. Until now the countries differed over whether to add the snow cap on top. The new height is 8,848.86m (29,032 ft). China's previous official measurement of 8,844.43m had put the mountain nearly four metres lower than Nepal's. Everest stands on the border between China and Nepal and mountaineers climb it from both sides.

WHY THE DIFFERENCE OVER OFFICIAL HEIGHT?

Chinese authorities had said previously Mount Everest should be measured to its rock height, while Nepalese authorities argued the snow on top of the summit should be included.

The 8,848m height Nepal had been using for Mount Everest was determined by the Survey of India in 1954, but for the first time the country has now conducted its own measurement of the summit.

WHY ELSE HAS THE HEIGHT BEEN QUESTIONED?

Some geologists have suggested a major earthquake in 2015 may have had an impact on Mount Everest's height. The 7.8 magnitude earthquake killed around 9,000 people in Nepal and caused an avalanche which buried parts of the base camp at the mountain. At least 18 climbers were killed.

Some geologists said the earthquake may have caused Everest's snow cap to shrink. Scientists had found that some other Himalayan peaks such as Langtang Himal, mostly to the north of Kathmandu and close to the epicentre, had reduced in height by approximately a metre after the earthquake.

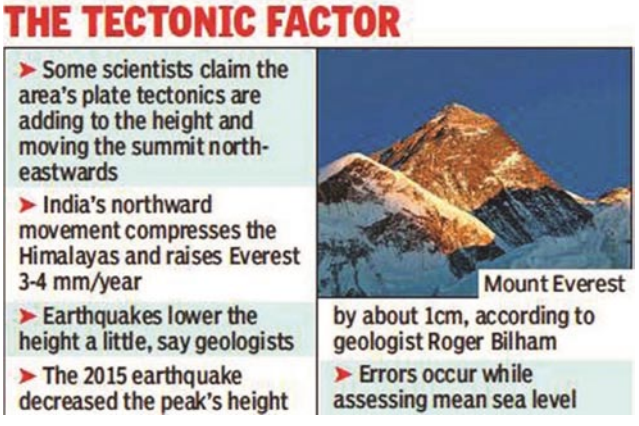


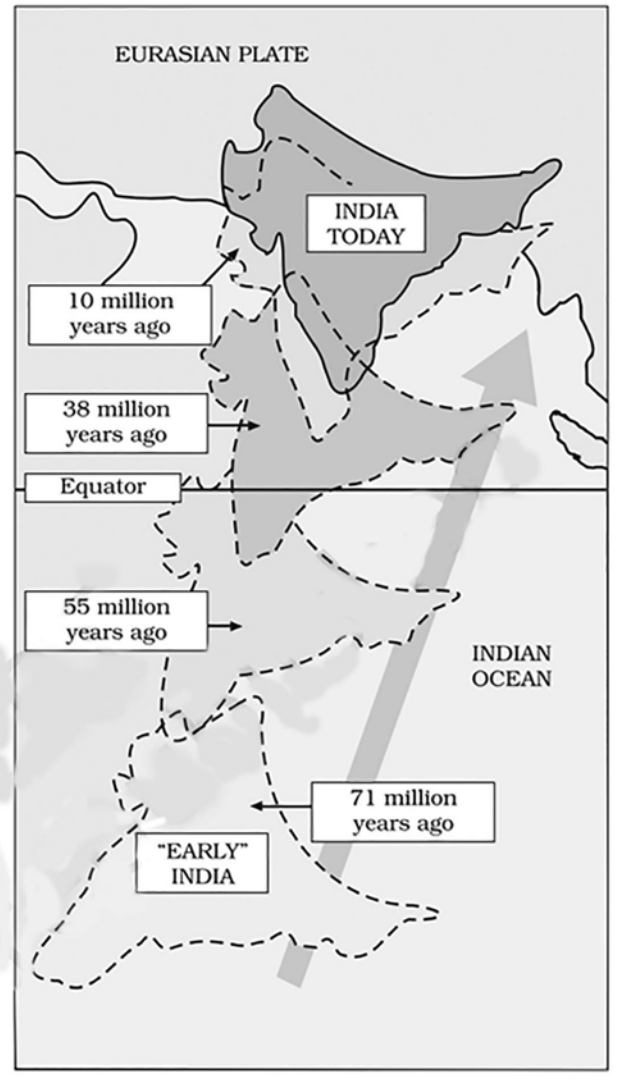
PLATE TECTONICS BEHIND HIMALAYAS

The Indian plate includes Peninsular India and the Australian continental portions. The subduction zone along the Himalayas forms the northern plate boundary in the form of continent— continent convergence.

India was a large island situated off the Australian coast, in a vast ocean. The Tethys Sea separated it from the Asian continent till about 225 million years ago. India is supposed to have started her northward journey about 200 million years ago at the time when Pangaea broke.

India collided with Asia about 40-50 million years ago causing rapid uplift of the Himalayas. About 140 million years before the present, the subcontinent was located as south as 50-degree South. latitude.

The two major plates were separated by the Tethys Sea and the Tibetan block was closer to the Asiatic landmass. From 40 million years ago and thereafter, the event of formation of the Himalayas took place. Scientists believe that the process is still continuing, and the height of the Himalayas is rising even to this date.



►REGENERATIVE AGRICULTURE

"Regenerative Agriculture" describes farming and grazing practices that reverse climate change by rebuilding soil organic matter and restoring degraded soil biodiversity – resulting in both carbon drawdown and improving the water cycle.

The key to regenerative agriculture is that it not only "does no harm" to the land but improves it, using technologies that regenerate and revitalize the soil and the environment.

Regenerative agriculture leads to healthy soil, capable of producing high quality, nutrient dense food while simultaneously improving, rather than degrading land, and ultimately leading to productive farms and healthy communities and economies.

It is dynamic and holistic, incorporating permaculture (sustainable and self-sufficient agricultural ecosystems) and organic farming practices, including conservation tillage, cover crops, crop rotation, composting, mobile

animal shelters and pasture cropping, to increase food production, farmers' income and especially, topsoil.

It has been promoted to counter loss of the world's fertile soil and biodiversity, along with the loss of indigenous seeds and knowledge.

►GLOBAL ACTION AGENDA FOR INNOVATION IN AGRICULTURE

- Global Action Agenda for Innovation in Agriculture, also known as ClimateShot, aims to close the 'innovation gap' in agriculture and food systems. This innovation gap holds
- It was launched at UN COP 26 of UNFCCC by CGIAR Research Program on Climate Change, Agriculture and Food Security (CGIAR-CCAFS).

Objectives:

- Increase investment in agricultural research and innovation to create more climate-resilient, low-emission technologies.
- Focus at least a third of agricultural research and innovation investments deliver demand-driven solutions across food systems, to protect nature and limit climate change.
- Showcase successful business models and promote public-private partnerships that deploy these innovations on the scale needed to meet the climate and food security challenge.
- Forge consensus on the evidence of what works and facilitate inclusive dialogue among food and climate champions around the world.

►RED SNOW

It is a phenomenon caused by Chlamydomonas Nivalis, a species of green algae containing a secondary red carotenoid pigment (astaxanthin) in addition to chlorophyll.

- Unlike most species of fresh-water algae, it is cryophilic (cold-loving) and thrives in freezing water
- This alga species, Chlamydomonas Nivalis, exists in snow in the polar and glacial regions, and carries a red pigment to keep itself warm.

WHAT WATERMELON SNOW SIGNALS?

The more the algae packed together, the redder the snow. And the darker the tinge, the more the heat absorbed by the snow. Subsequently, the ice melts faster.

While the melt is good for the microbes that need the liquid water to survive and thrive, it's bad for glaciers that are already melting from a myriad of other causes.

These algae change the snow's albedo — which refers to the amount of light or radiation the snow surface can reflect back. Changes in albedo lead to more melting. In the melting of snow in the Arctic, key drivers have been snow and ice-albedo.

►TARBALLS

Tarballs are dark-coloured, sticky balls of oil that form when crude oil floats on the ocean surface. Tarballs are formed by weathering of crude oil in marine environments. They are transported from the open sea to the shores by sea currents and waves.

Tarballs are usually coin-sized and are found strewn on the beaches. However, over the years, they have become as big as basketballs and can weigh as high as 6-7 kgs.

DO TARBALLS INDICATE AN OIL SPILL?

Most of the times, the presence of several tarballs indicate an oil spill. However, its annual occurrence on the west coast during the monsoon has led marine biologists and experts to demand an investigation in the matter.

Experts have urged authorities to take stricter vigil and check if ships are dumping burnt oil waste off the western coast of India.

ARE TARBALLS HARMFUL?

Tarballs that travel towards the coast can get stuck to the fishing nets installed in the sea, making it difficult for fishermen to clean.

In addition, it could affect marine life, especially filter feeders like clams and oysters.

Tarball pollution is a major concern to global marine ecosystem. Microbes such as bacteria and fungi are known to be associated with tarballs. They presumably play an important role in tarball degradation and some are potential human and animal pathogens.

NIO is currently fingerprinting the oil to determine its source and study the impact.

►BLACK CARBON LEVEL

It has been reported that Black Carbon concentration near the Gangotri glacier rose 400 times in summer due to forest fires and stubble burning from agriculture waste. According to Wadia institute of Himalayan Geology (WIHG), this also triggered glacial melt.

Black carbon is the second largest contributor to climate change after CO2.India is the second largest contributor of black carbon in the world.

WHAT IS BLACK CARBON?

Black Carbon is produced both naturally and by human activities as a result of the incomplete combustion of fossil fuels, biofuels, and biomass. It is black in colour as its particles strongly absorb sunlight and give soot its black colour.

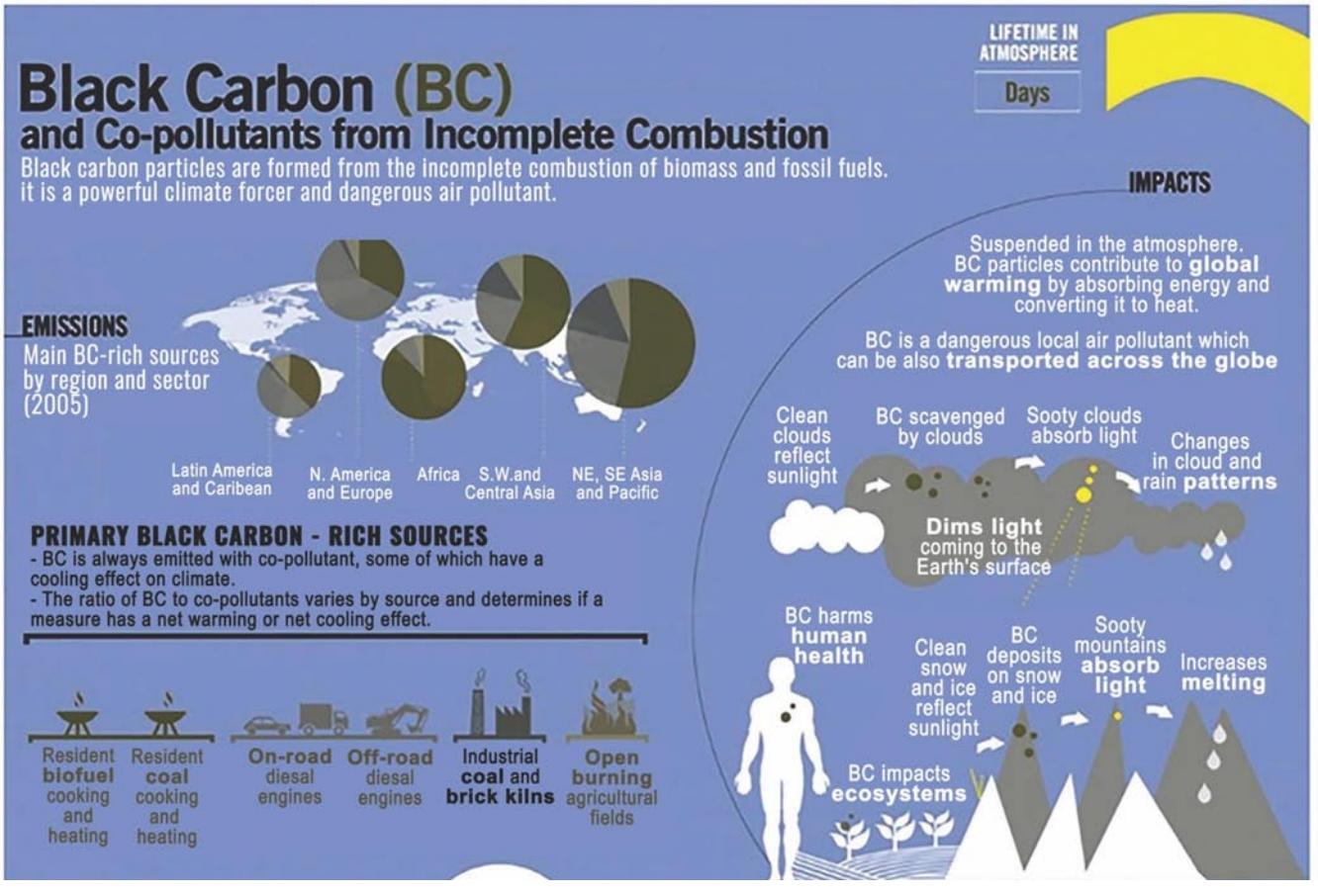
Black Carbon (BC) has recently emerged as a major contributor to global climate change, possibly second only to CO_2 as the main driver of change.

Primary sources include emissions from diesel engines, cook stoves, wood burning and forest fires.

DIFFERENCE BETWEEN CARBON DIOXIDE AND BLACK CARBON

Reducing CO_2 emissions is essential to avert the worst impacts of future climate change, but CO_2 has such a long atmospheric lifetime that it will take several decades for CO_2 concentrations to begin to stabilize after emissions reductions begin.

In contrast, BC remains in the atmosphere for only a few weeks, so cutting its emissions would immediately reduce the rate of warming, particularly in those areas which have witnessed fast changes in the level of Black Carbon.



►FLY ASH

Fly ash is a coal combustion product that is composed of the particulates (fine particles of burned fuel) that are driven out of coal-fired boilers together with the flue gases.

IMPORTANT TERMS RELATED TO FLY ASH

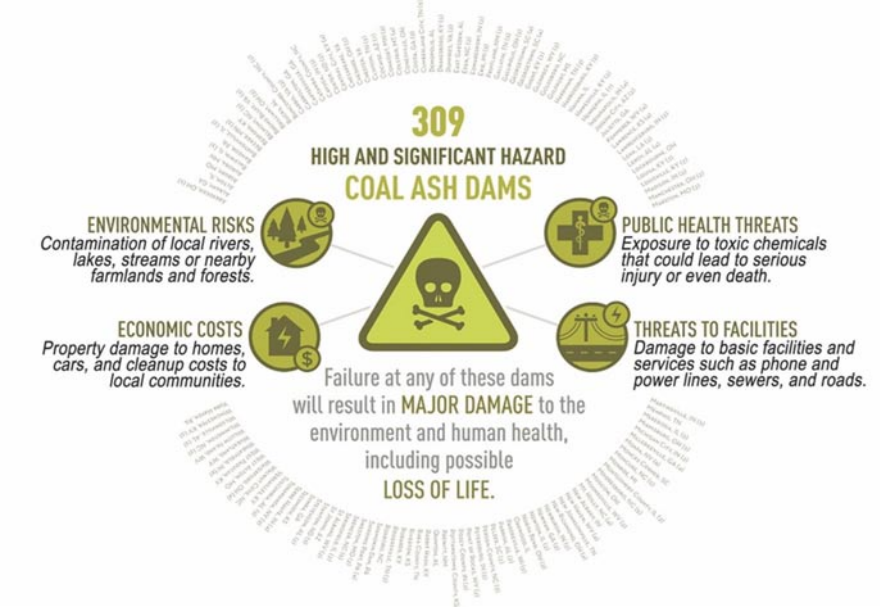
- Bottom Ash: Ash that falls to the bottom of the boiler's combustion chamber is called bottom ash.
- Ash Capture: Fly ash is generally captured by electrostatic precipitators or other particle filtration equipment before the flue gases reach the chimneys.
- Coal Ash: Together with bottom ash removed from the bottom of the boiler, it is known as coal ash.
- Composition: Depending upon the source and composition of the coal being burned, the components of fly ash vary considerably, but all fly ash includes substantial amounts of –
  - Silicon dioxide (SiO_2)

- Aluminum oxide (Al_2O_3) and
- Calcium oxide (CaO), the main mineral compounds in coal-bearing rock strata.

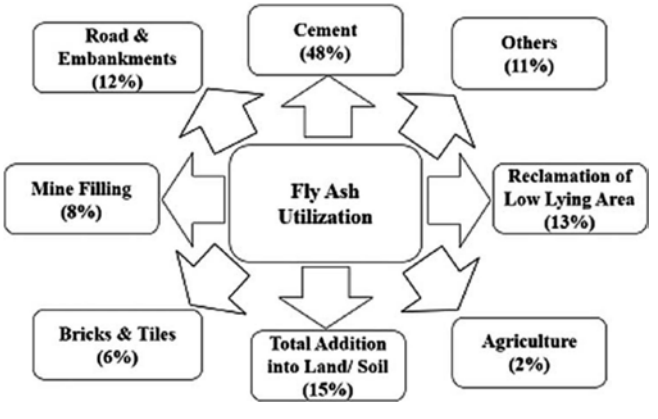
The minor constituents of fly ash depend upon the specific coal bed composition but may include one or more of the following elements or compounds found in trace concentrations - arsenic, beryllium, boron, cadmium, chromium, hexavalent chromium, cobalt, lead, manganese, mercury, molybdenum, selenium, strontium, thallium, and vanadium, along with very small concentrations of dioxins and PAH compounds.

ENVIRONMENTAL HARM CAUSED BY FLY ASH

- Fly ash is a major source of PM 2.5 and black carbon. It becomes air borne and gets transported to a radius of 10 to 20 kms.
- It can settle on water and other surfaces. It will contaminate water and soil systems.
- Fly ash contains heavy metals from coal. The wet disposal of Fly ash results in leaching of toxic heavy metals in ground water system.
- *The destruction of mangroves, drastic reduction in crop yields, and the pollution of groundwater in the Rann of Kutch from the ash sludge of adjoining Coal power plants has been well documented.*



USES OF FLY ASH



FLY ASH USAGE AND DISPOSAL NORMS BY MOEFCC

- Mandatory for power plants to give fly ash free of cost to users within 300-kilometre-radius.
- Mandatory for cement industries, within radius of 300 kilometres of a coal or lignite based thermal power plant, to use fly ash for manufacture of the cement as per the specifications of Bureau of Indian Standards (BIS).
- The cost of transportation of fly ash is to be borne collectively by the thermal power plant and the industry concerned.
- Construction agency engaged in construction of roads within a radius of 300 kilometers from a coal or lignite based thermal power plant would be bound to use fly ash in accordance with the guidelines or specifications issued by the Indian Road Congress.
- Mandatory for use of fly ash bricks in construction activities happening 500 km around thermal power plants.
- Fly ash will be used to make bricks, blocks, tiles, wall panels, cement and other construction materials.

RECENT MEASURES TAKEN BY THE GOVERNMENT

- The pricing of fly ash is increasingly becoming a contentious issue that is hampering its gainful utilization. GST rates on fly ash and its products have been reduced to 5%.
- To facilitate 100% ash utilization by all coal based thermal power plants, a web portal for monitoring of fly ash generation and utilization data of Thermal Power Plants and a mobile based application titled

"ASHTRACK" has been launched by the Government that will help to establish a link between fly ash users and power plants executives for obtaining fly ash for its use in various areas.

►GREEN BUILDING

A 'green' building is a building that, in its design, construction or operation, reduces or eliminates negative impacts, and can create positive impacts, on our climate and natural environment. Green buildings preserve precious natural resources and improve our quality of life.

THERE ARE A NUMBER OF FEATURES WHICH CAN MAKE A BUILDING 'GREEN.' THESE INCLUDE

- Efficient use of energy, water and other resources
- Use of renewable energy, such as solar energy
- Pollution and waste reduction measures, and the enabling of re-use and recycling
- Good indoor environmental air quality
- Use of materials that are non-toxic, ethical and sustainable
- Consideration of the environment in design, construction and operation
- Consideration of the quality of life of occupants in design, construction and operation
- A design that enables adaptation to a changing environment

STEPS TAKEN TOWARDS GREEN BUILDINGS PROMOTION IN INDIA

Energy Conservation Building Code (ECBC) was launched in 2007 by the Bureau of Energy Efficiency (BEE). Its main objective is to establish minimum requirements for energy efficient design and construction of buildings.

- It was revised in 2017 (ECBC 2017) that prescribes the energy performance standards for new commercial buildings to be constructed across India.
- Adoption of ECBC 2017 for new commercial building construction throughout the country is estimated to achieve a 50% reduction in energy use by 2030.
- Niwas Samhita 2018 (Energy Conservation–New Indian Way for Affordable & Sustainable homes) Eco-: It is Energy Conservation Building Code for Residential Buildings launched by Ministry of Power.
- BEE developed Star Rating Program for commercial buildings that rates buildings on a five-star scale based on actual performance in terms of energy usage.
- Two rating systems are operating for rating green buildings in India:
- Green Rating for Integrated Habitat Assessment (GRIHA): It is rating tool evaluates the environmental performance of a building holistically over its entire life cycle, thereby providing a definitive standard for what constitutes a 'green building.' It is jointly developed by The Energy and Resources Institute (TERI) and the Ministry of New and Renewable Energy.
- Leadership in Energy & Environmental Design (LEED): It is an international recognized certification system for the green buildings developed by the U.S. Green Building Council.
- Indian Green Building Council, part of the Confederation of Indian Industry (CII) formed in the year 2001, offers services like developing new green building rating programs, certification services and green building training programs.

SHUNYA LABELLING FOR NET ZERO BUILDINGS

- The buildings having 10 < EPI < 0 kWh/m2/year will be awarded by Shunya Label. Building having EPI < 0 kWh/m2/year will be awarded by Shunya+ label. It is a star rating for existing for buildings.
- The program will encourage building owners and promoters to make energy efficient buildings and further making improvements to make it net zero or net positive energy buildings. It is a program of BEE under Ministry of Power.
- Under this following commercial buildings will be rated: Day use Office buildings, BPOs, shopping malls, Hospitals.
- Energy Performance Index (EPI): EPI of a building is its annual energy consumption in kilo-watt hours per square meter of the building.

►GREEN TAX

MORTH has decided to impose additional taxes on old vehicles that are no more fit on the road. This additional tax is being called the "Green Tax".

WHAT IS THIS TAX?

- The Ministry of Road Transport and Highways will levy a green tax on transport vehicles older than eight years at the time of renewal of fitness certificate at the rate of 10% to 25% of road tax.
- The revenue collected through the green tax will be kept in a different account and will only be utilised for tackling pollution.

EXEMPTIONS

Vehicles like strong hybrids, electric vehicles and those running on alternate fuels like CNG, ethanol and LPG and vehicles used in farming, such as tractor, harvesters and tillers will be exempted.

DIFFERENTIAL TAXATION

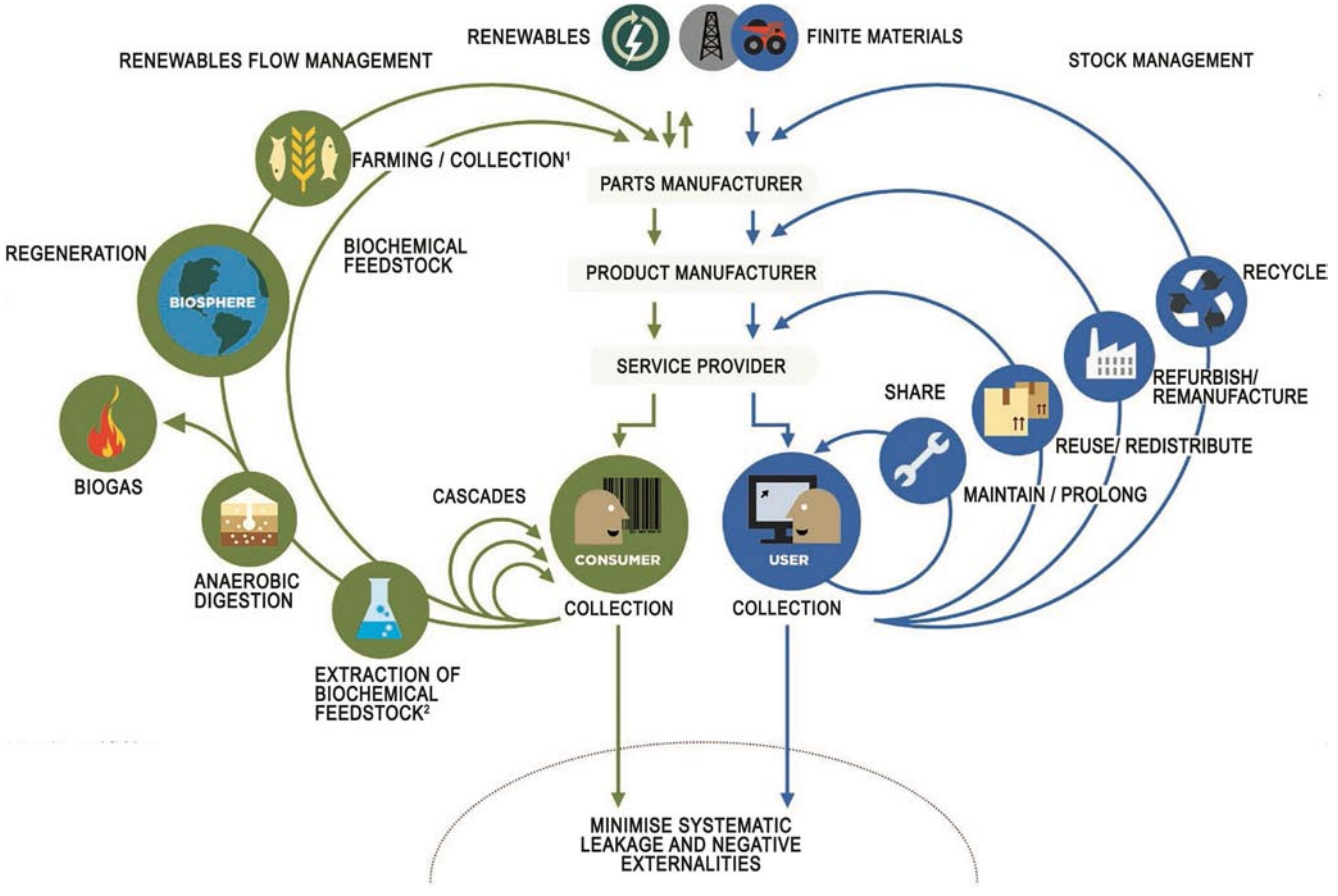
- Personal vehicles are proposed to be charged green tax at the time of renewal of registration certification after 15 years.

- Public transport vehicles, such as city buses, will be charged lower green tax.
- Higher green tax (50% of road tax) will be levied on vehicles being registered in highly polluted cities.
- Differential tax will also be charged depending on fuel (petrol/ diesel) and the type of vehicle.

BENEFITS OF GREEN TAX

- Combat Health Hazards by Vehicular Pollution
- Follows "Polluter Pays Principle"
- Initiates Carbon Pricing in India: India along with the U.S, China and Japan are some of the countries that are hardest hit by climate impacts. In order to mitigate the condition and reduce the GHG emissions, one smart approach is pricing Carbon such as introduction of green tax.

►CIRCULAR ECONOMY



WHAT IS IT?

In the linear economy, raw natural resources are taken, transformed into products and get disposed of. On the opposite, a circular economy model aims to close the gap between the production and the natural ecosystems' cycles – on which humans ultimately depend upon.

This means, on one hand, eliminating waste – composting biodegradable waste or, if it's a transformed and non-biodegradable waste, reusing, remanufacturing and finally recycling it. On the other hand, it also means cutting off the use of chemical substances (a way to help regenerate natural systems) and betting on renewable energy.

PRINCIPLES OF CIRCULAR ECONOMY

Circular economy model makes a distinction between technical and biological cycles. Consumption happens only in biological cycles, where biologically based

materials (such as food, linen or cork) are designed to feed back into the system through processes like anaerobic digestion and composting.

These cycles regenerate living systems, such as soil or the oceans, which provide renewable resources for the economy. By their turn, technical cycles recover and restore products (Ex. washing machines), components (Ex. motherboards), and materials (Ex. limestone) through strategies like reuse, repair, remanufacture or recycling.

Ultimately, one of the purposes of the circular economy is to optimize resource yields by circulating products, components, and the materials in use at the highest utility at all times in both technical and biological cycles.

BENEFITS OF THE CIRCULAR ECONOMY MODEL

- Fewer Greenhouse Gas Emissions – Environmental Benefits of The Circular Economy
- Healthy And Resilient Soils – Environmental Benefits of The Circular Economy
- Fewer Negative Externalities – Environmental Benefits of The Circular Economy
- Increased Potential for Economic Growth – Economic Benefits of The Circular Economy
- More Resources Saved – Economic Benefits of The Circular Economy
- Employment Growth – Economic Benefits of The Circular Economy
- New Profit Opportunities – Benefits of The Circular Economy on Businesses
- Volatility Reduction and Safeguarded Supplies – Benefits of The Circular Economy On Businesses

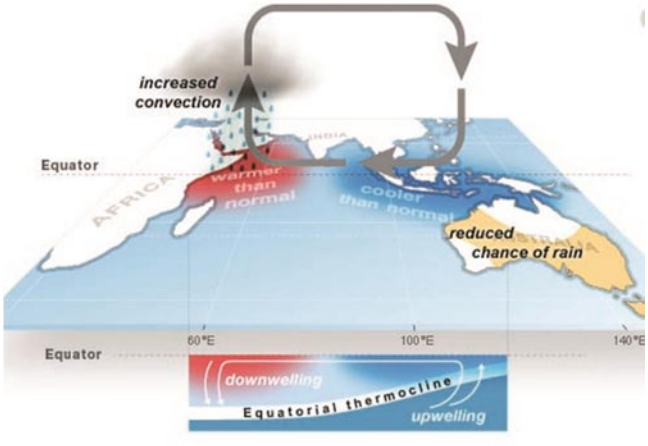
►INDIAN OCEAN DIPOLE

- IOD measures differences in sea surface temperatures between the western and eastern parts of the Indian Ocean. Sustained changes in the difference between sea surface temperatures of the tropical western and eastern Indian Ocean are known as the Indian Ocean Dipole or IOD.
- IOD is basically similar to the El Nino weather system that develops in the Pacific Ocean.
- Indian Ocean Sea surface temperatures impact rainfall and temperature patterns over Australia. Warmer than average sea surface temperatures can provide more moisture for frontal systems and lows crossing Australia.
- The IOD is one of the key drivers of Australia's climate and can have a significant impact on agriculture. This is because events generally coincide with the winter crop growing season.
- The IOD has three phases: neutral, positive and negative. Events usually start around May or June, peak between August and October and then rapidly decay when the monsoon arrives in the southern hemisphere around the end of spring.

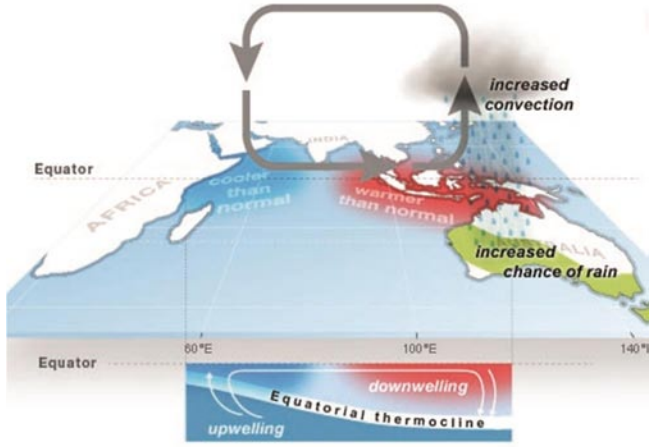
PHASES OF IOD AND THEIR IMPACT ON INDIAN OCEAN REGION

Neutral IOD phase	Positive IOD phase	Negative IOD phase
Water from the Pacific flows between the islands of Indonesia, keeping seas to Australia's northwest warm. Air rises above this area and falls over the western half of the Indian Ocean basin, blowing westerly winds along the equator. Temperatures are close to normal across the tropical Indian Ocean, and hence the neutral IOD results in little change to Australia's climate.	Westerly winds weaken along the equator allowing warm water to shift towards Africa. Changes in the winds also allow cool water to rise up from the deep ocean in the east. This sets up a temperature difference across the tropical Indian Ocean with cooler than normal water in the east and warmer than normal water in the west. During positive phase of Indian Ocean dipole, the water over western Indian Ocean is warmer than normal leading to formation of troughs (low pressure regions) and thus enhanced rainfall On the other hand, cooler waters develop off Indonesia resulting in less rainfall and high temperatures in	Westerly winds intensify along the equator, allowing warmer waters to concentrate near Australia. This sets up a temperature difference across the tropical Indian Ocean, with warmer than normal water in the east and cooler than normal water in the west. A negative IOD typically results in above-average winter–spring rainfall over parts of Australia as the warmer waters off northwest Australia provide more available moisture to weather systems crossing the country.

	Australia. 2019 witnessed the record level of positive phase of Indian Ocean Dipole It has been found that in 2019 the IOD event peaked in mid-October when the waters around east Africa were about 2 degrees Celsius warmer than those near Australia.	



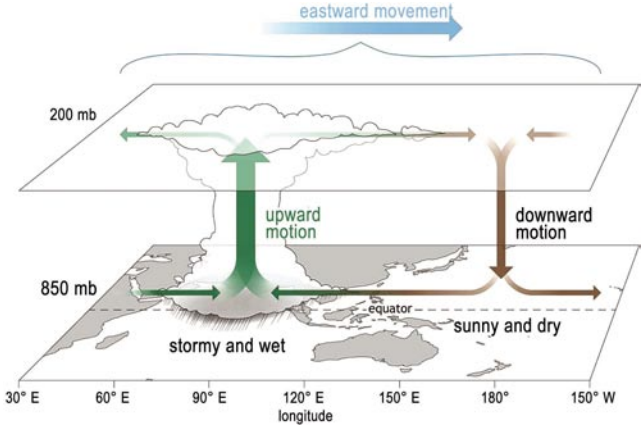
Indian Ocean Dipole (IOD): **Positive phase**



Indian Ocean Dipole (IOD): **Negative phase**

►MADDEN JULIAN OSCILLATION

Distinct patterns of lower-level and upper-level atmospheric circulation anomalies accompany the MJO-related pattern of enhanced or decreased tropical rainfall across the tropics. These circulation features extend around the globe and are not confined to only the eastern hemisphere.



The Madden–Julian oscillation moves eastward at between 4 m/s (14 km/h, 9 mph) and 8 m/s (29 km/h, 18 mph) across the tropics, crossing the Earth's tropics in 30 to 60 days—with the active phase of the MJO tracked by the degree of outgoing long wave radiation, which is measured by infrared-sensing geostationary weather satellites. The lower the amount of outgoing long waves radiation, the stronger the thunderstorm complexes, or convection, is within that region.

Enhanced surface (upper level) westerly winds occur near the west (east) side of the active convection.

Ocean currents, up to 100 metres (330 ft) in depth from the ocean surface, follow in phase with the east-wind component of the surface winds. In advance, or to the east, of the MJO enhanced activity, winds aloft are westerly. In its wake, or to the west of the enhanced rainfall area, winds aloft are easterly.

These wind changes aloft are due to the divergence present over the active thunderstorms during the enhanced phase. Its direct influence can be tracked poleward as far as 30 degrees latitude from the equator in both northern and southern hemispheres, propagating outward from its origin near the equator at around 1 degree latitude, or 111 kilometers (69 mi), per day.

IMPACT OF MJO

- Effect of Global Warming
  - Due to global warming: Change in the residence time of MJO clouds has altered the weather across the world
- Impact over global climate

- The MJO clouds are altering the residence time in Indian and Pacific Ocean.
- This has implications for global climate:
  - Increased the rainfall over Northern Australia
  - Declining rainfall in Central Pacific and along west coast of Africa.

- Impact over Indian Climate
  - When MJO appears in the Indian Ocean during the monsoon months, it can increase rains over India.
  - India was expected to receive below normal rainfall this monsoon but ended up receiving more rainfall due to MJO.

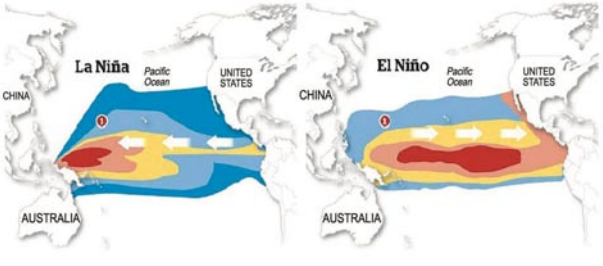
► EL NINO AND LA NINA

NORMAL CIRCULATION

During normal conditions in the Pacific Ocean, trade winds blow west along the equator, taking warm water from South America towards Asia. To replace that warm water, cold water rises from the depths — a process called upwelling.

EL NINO AND LA NINA

These are two opposing climate patterns that break these normal conditions. Scientists call these phenomena the El Nino-Southern Oscillation (ENSO) cycle. El Nino and La Nina can both have global impacts on weather, wildfires, ecosystems, and economies. Episodes of El Nino and La Nina typically last nine to 12 months but can sometimes last for years. El Nino and La Nina events occur every two to seven years, on average, but they don't occur on a regular schedule. Generally, El Nino occurs more frequently than La Nina.



EL NINO

- During El Nino, trade winds weaken. Warm water is pushed back east, toward the west coast of the Americas.
- El Nino means Little Boy, or Christ Child in Spanish. South American fishermen first noticed periods of unusually warm water in the Pacific Ocean in the 1600s. The full name they used was El Nino de Navidad because El Nino typically peaks around December.

LA NINA

- La Nina means Little Girl in Spanish. La Nina is also sometimes called El Viejo, anti-El Nino, or simply "a cold event." La Nina has the opposite effect of El Nino.
- During La Nina events, trade winds are even stronger than usual, pushing more warm water toward Asia. Off the west coast of the Americas, upwelling increases, bringing cold, nutrient-rich water to the surface.

EL NINO & LA NINA YEARS

El Nino year

An irregular event of abnormal warming of eastern Pacific waters. Occurs at intervals of two to seven years

How It Hits Indian Monsoon Area of rising warm air/rain shifts towards central/east Pacific. This warm air current subsides over Indian Ocean/India's mainland, creating high pressure that keeps rain away

La Nina year

A cold episode that usually follows the warm El Nino phenomenon. The warm equatorial ridge cools, between coasts of South America and Oceania

How It Helps Indian Monsoon Warm air/high rainfall region in west Pacific reinforces monsoon winds, invigorating rains over India

►OCEAN DEOXYGENATION

Ocean deoxygenation is the expansion of oxygen minimum zones in the world's oceans as a consequence of anthropogenic emissions of carbon dioxide. Climate change is accelerating loss of life sustaining oxygen from the ocean. Ocean Deoxygenating will adversely impact food security and human populations the world over.

REASONS FOR OCEAN DEOXYGENATION

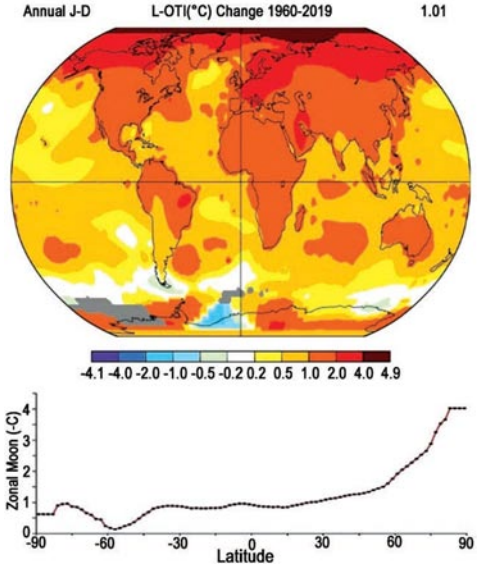
- Ocean warming-driven deoxygenation: Warmer ocean water holds less oxygen and is more buoyant than cooler water. This leads to reduced mixing of oxygenated water near the surface with deeper waters, which naturally contain less oxygen. Warmer

water also raises oxygen demand from living organisms. As a result, less oxygen is available for marine life.

- Excessive growth of algae: Fertilizer run-off, sewage, animal waste, aquaculture and deposition of nitrogen from the burning of fossil fuels are promoting excessive growth of plant life – a process known as eutrophication, which mostly affects coastal areas. Warming of ocean waters is expected to cause further oxygen loss in nutrient-rich coastal areas, exacerbating the situation.
- As a result of these processes, ocean regions with historically extremely low oxygen concentrations are expanding and new regions are exhibiting low oxygen conditions.

►ARCTIC AMPLIFICATION

Over the past 30 years, the Arctic has warmed at roughly twice the rate as the entire globe, a phenomenon known as Arctic amplification. Most scientists agree that this rapid warming is a signal of human-caused climate change.



This map shows trends in mean surface air temperature over the period 1960 to 2019. Notice that the Arctic is red, indicating that the trend over this 60-year period is for an increase in air temperature of nearly 4° C (7.2° F) across much of the Arctic, which is larger than for other parts of the globe.

REASONS BEHIND ARCTIC AMPLIFICATION

Change in Albedo:

- Albedo is a measure of how much light that hits a surface is reflected without being absorbed.
- When bright and reflective ice (with more albedo) melts, it gives way to a darker ocean (lowering albedo); this amplifies the warming trend because the ocean surface absorbs more heat from the Sun than the surface of snow and ice.

Changing Ocean currents:

- Ocean currents normally bring in warmer water from the Pacific, and colder water exits out of the Arctic into the Atlantic.
- But those currents may be changing because more melting ice is injecting the Arctic Ocean with freshwater. The missing ice also exposes the surface waters to more wind. This mixes up colder freshwater at the surface and warmer saltwater below, raising surface temperatures and further melting ice.

Changing Weather

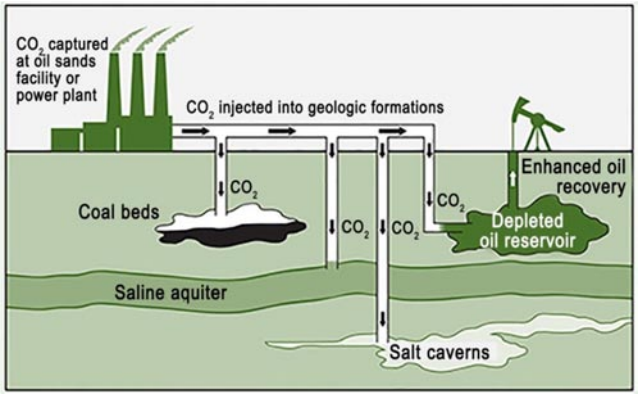
- Ocean currents drive the powerful polar jet stream, which moves hot and cold air masses around the Northern Hemisphere. This is a product of the temperature differences between the Arctic and the tropics.
- But as the Arctic warms, the jet stream now undulates wildly north and south. This has been injecting the Arctic with warm air.
- Thunderstorms are also much more likely to occur in the tropics than the higher latitudes. The storms transport heat from the surface to higher levels of the atmosphere, where global wind patterns sweep it toward higher latitudes.
- The abundance of thunderstorms in tropics creates a near-constant flow of heat away from the tropics towards the Arctic.

Change in nature of Ice Cover

- Quality of ice cover in the Arctic region is changing. New ice is replacing old ice.
- Old ice is more resilient than new ice, which melts faster. New ice contains more salty water and is more subject to melting, whereas old ice has a higher share of water coming from snow precipitations and is a source of freshwater.

►CARBON CAPTURE & STORAGE

Carbon capture and storage (CCS), or carbon capture and sequestration and carbon control and sequestration, is the process of capturing waste carbon dioxide (CO_2), transporting it to a storage site, and depositing it where it will not enter the atmosphere. Usually, the CO_2 is captured from large point sources, such as a cement factory or biomass power plant, and normally it is stored in an underground geological formation. The aim is to prevent the release of large quantities of CO_2 into the atmosphere from heavy industry, and so help to limit climate change.

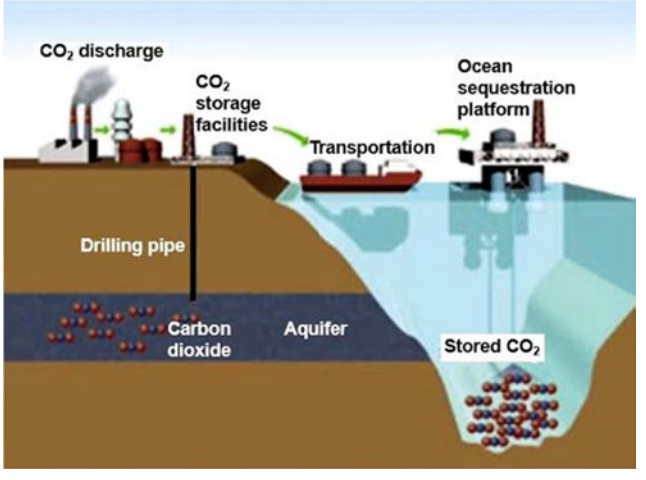


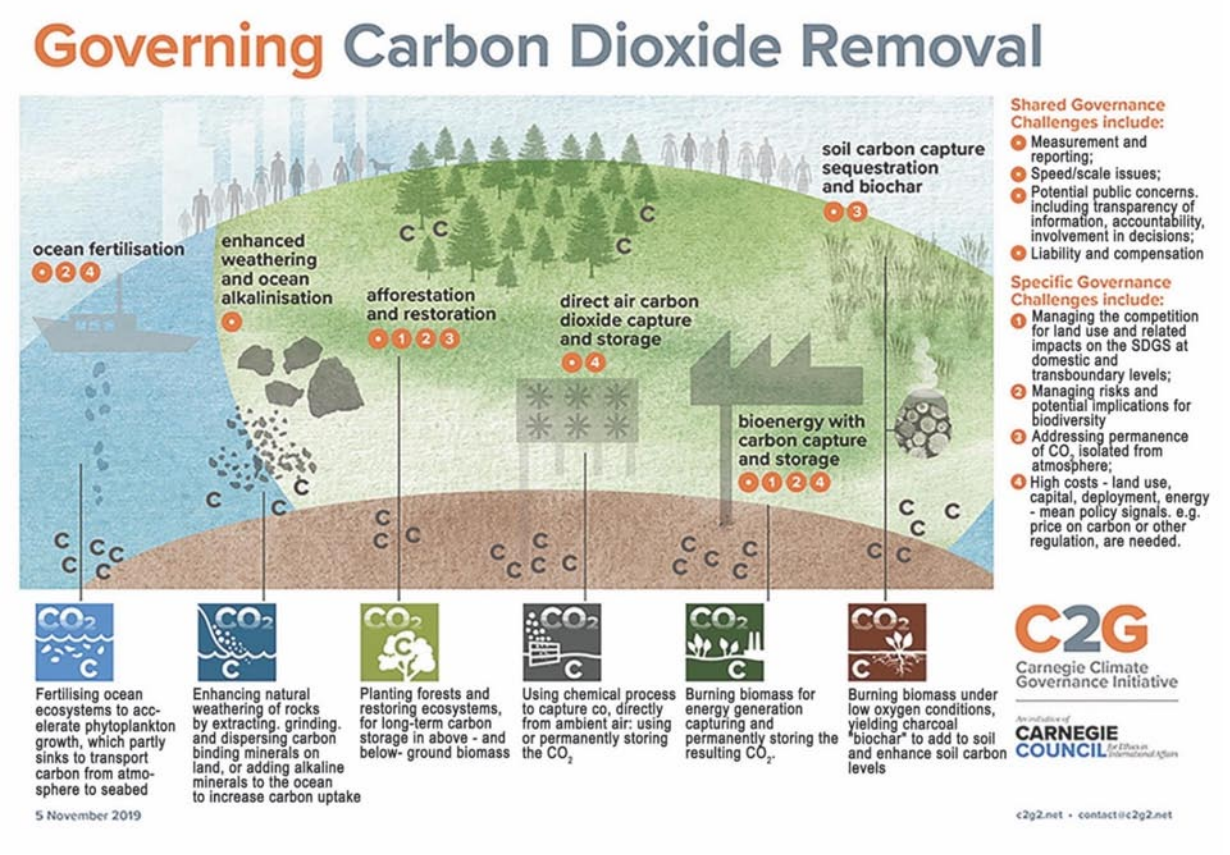
Although CO_2 has been injected into geological formations for several decades for various purposes, including enhanced oil recovery, the long-term storage of CO_2 is a relatively new concept.

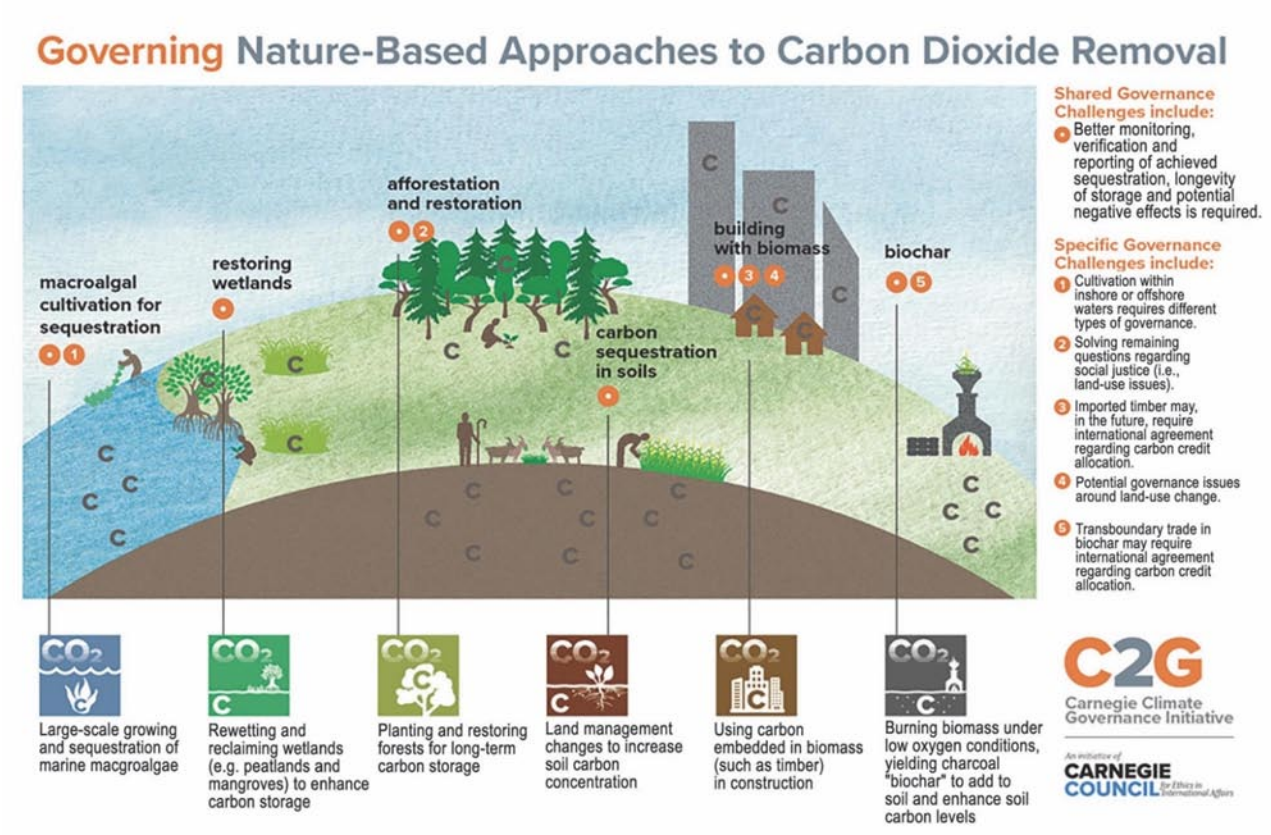
Carbon dioxide can be captured directly from an industrial source, such as a cement kiln, by using a variety of technologies, including absorption, adsorption, chemical looping, membrane gas separation or gas hydrate technologies. As of 2019 there are 17 operating CCS projects in the world, capturing 31.5Mt of CO_2 per year, of which 3.7 is stored geologically. Most are industrial not power plants: industries such as cement, steelmaking and fertiliser production are hard to decarbonize.

Storage of the CO_2 is envisaged either in deep geological formations, or in the form of mineral carbonates. Pyrogenic carbon capture and storage (PyCCS) is also being researched.

Deep ocean storage is not used, because it could acidify the ocean. Geological formations are currently considered the most promising sequestration sites. The US National Energy Technology Laboratory (NETL) reported that North America has enough storage capacity for more than 900 years' worth of carbon dioxide at current production rates. A general problem is that long term predictions about submarine or underground storage security are very difficult and uncertain, and there is still the risk that some CO_2 might leak into the atmosphere







►BLUE JET LIGHTENING

The International Space Station's Atmosphere-Space Interactions Monitor- ASIM observatory recently caught a single blue 'jet'. It is upward-shooting lightning from a thunderstorm cell, along with four elves, (optical and ultraviolet emissions from the bottom of the ionosphere).

ABOUT BLUE JET LIGHTENING

- The blue jets can generally not be seen from the ground but for under rarest circumstances. This happens because they are brief and are typically hidden due to clouds.
- It was only in 2019, the instruments on the International Space Station (ISS) recorded five blue flashes and a blue jet that shot into space from a storm cloud. It was recorded from near the island of Nauru in the Pacific Ocean.
- Each of the flashes recorded lasted between 10 and 20 milliseconds. The blue jet crossed an altitude of almost 32 miles above sea level.

WHAT CAUSES BLUE JETS?

The blue jets occur when some positively charged upper part of any cloud interacts with a negatively charged layer present immediately above it. This then briefly equalizes both opposing charges which result in a bright blue discharge of static electricity. This is called blue lighting.

►SUDDEN STRATOSPHERIC WARMING

STRATOSPHERIC POLAR VORTEX (SPV)

The stratosphere is the layer of the atmosphere from about 10-50 kilometres up. In the winter hemisphere, the pole is tilted away from the sun and is dark 24 hours. At the equator, the stratosphere receives incoming sunlight.

There is, therefore, a large difference in temperature between the high latitude stratosphere and the stratosphere at lower latitudes (a strong temperature gradient). This sets up strong winds blowing in a westerly direction around the cold air over the pole.

This arrangement is known as the Stratospheric Polar Vortex (SPV). This forms every winter. On occasions, this vortex can become disturbed. The temperature can rise by up to 50 degrees Celsius in a few days (although it is still cold) and the winds can weaken, or even reverse.

IF THE WINDS REVERSE, THEN A SUDDEN STRATOSPHERIC WARMING (SSW) IS SAID TO HAVE HAPPENED.

The SSWs happen around six times a decade in the northern hemisphere, but only one has ever been observed in the southern hemisphere.

This is because of the different arrangement of land and sea in the two hemispheres. In the northern hemisphere, there are more regions of land-sea

temperature contrast, which can set up atmospheric waves that can disturb the vortex. In the southern hemisphere, there is much more sea, which is continuous around Antarctica.

Sudden stratospheric warming (SSW)

It is an event in which the polar stratospheric temperature rises by several tens of kelvins (up to increases of about 50°C (90°F)) over the course of a few days. The warming is preceded by a slowing then reversal of the westerly winds in the stratospheric polar vortex. In the northern hemisphere SSWs occur about 6 times per decade, and only two SSWs have been observed in the southern hemisphere

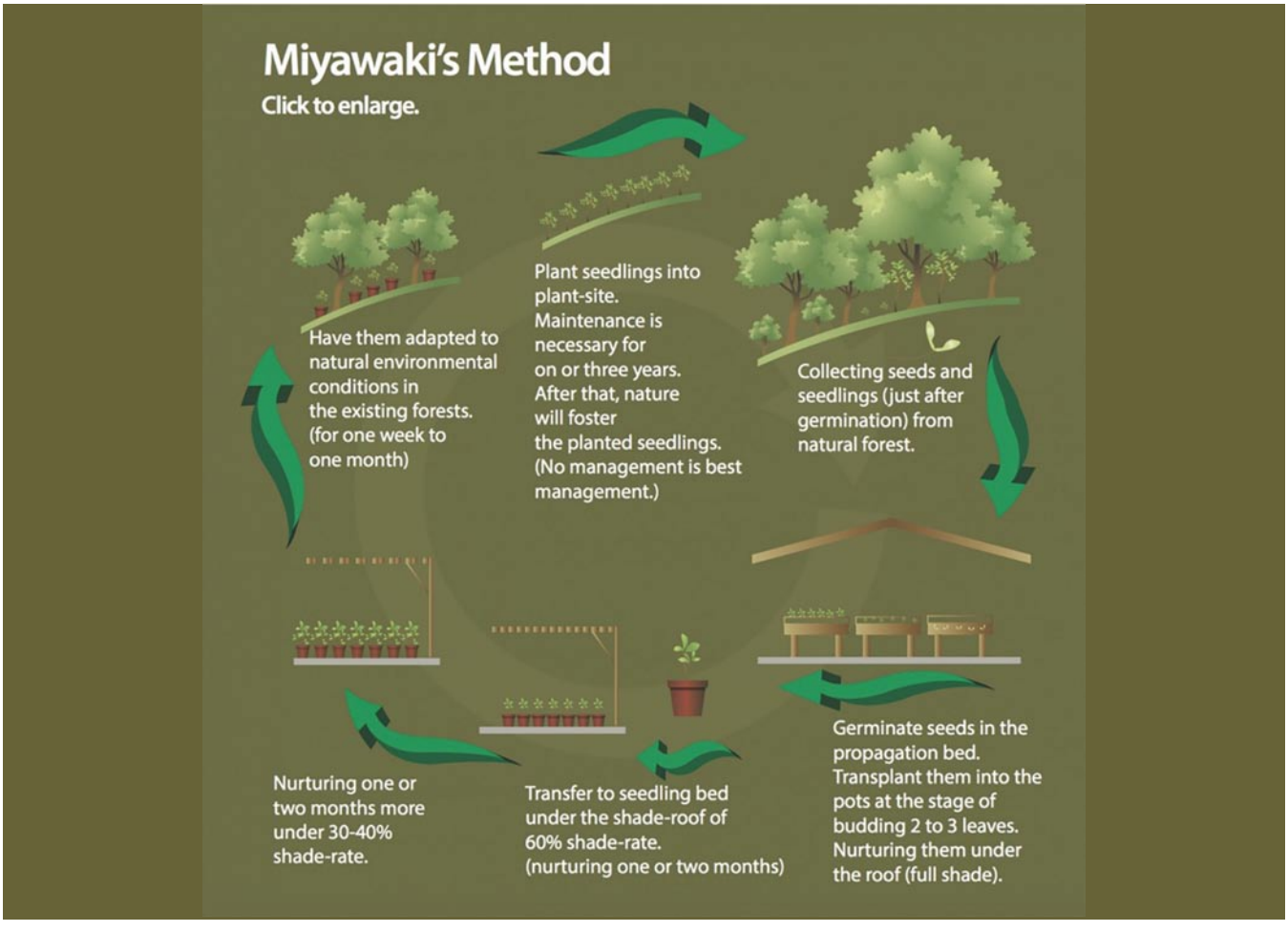
There is no consensus about this. SSWs are natural fluctuations in the atmosphere and are not caused by climate change.

Some models predict an increase with climate change, while others predict a decrease, so there is no clear direction. Models are getting better at representing the stratosphere, although there are still deficiencies.

►MIYAWAKI METHOD

Kerala has started using Miyawaki Method to promote urban forestry. The Mansa unit of Punjab state Police is developing Miyawaki forests. Also, the Bengaluru Hennagara Lake is to get a new life with Miyawaki Forests.

"Miyawaki method" is a method of ecological engineering, to restore and build dense native forests from seeds of native trees on very degraded soils which were deforested and without humus. It is a unique methodology proven to work worldwide, irrespective of soil and climate conditions.



BENEFITS

- Plant growth 10 times faster
- Resultant plantation 30 times denser than usual.
- Minimum of 300% more species in the same area as compared to conventional plantation species. A substantial 3000% increase in noise and dust isolation.
- Up to 30 times or more carbon di oxide absorption as compared to conventional forests.
- Guaranteed growth of at least 1 meter every year, in tree height.

- No maintenance-free after the first three years.

HOW TREES ARE PLANTED IN MIYAWAKI METHOD

- Soil and Water testing for selected sites
- Identification of tree species for site
- Procurement of material and saplings
- Soil preparation as per Miyawaki methodology
- Miyawaki method cluster plantation
- Maintenance and growth monitoring
- 100% Organic Materials used - Vermicompost, Cocopeat, Rice Husk, Mulching

►BLUE TIDES

Observed in several stretches of Maharashtra coast – such as in Juhu Beach. The phenomenon is due to bioluminescence, which is the emission of light by microscopic marine plants called phytoplanktons. E.g.: dinoflagellates. The blue light stems from chemical reactions of proteins inside the organism.

WHAT ARE DINOFLAGELLATES?

It is the marine plankton. The population of Dinoflagellates thrives in water based on the sea temperature. Dinoflagellates is one of the largest groups of marine eukaryotes in species. These species are photosynthetic.

WHAT IS BIO-LUMINESCENCE?

The sparkling light appearing in the sea from the microorganisms is called bioluminescence. The Bioluminescence is usually higher in deep living organisms than the shallow species. Bioluminescence is controlled by a circadian clock and only occurs at night. Luminescent and non-luminescent strains can occur in the same species. During nighttime the number of species is high. The smaller blooms are not harmful.

Basically, it is an anti-predatory response. Also, bioluminescence helps the microorganisms to gather together easily and form colonies.

HOW IS THE BLUE LIGHT RELATED TO CLIMATE CHANGE?

According to the marine experts, the blue light is the sign of climatic changes. It also reveals the low oxygen and high nitrogen content in the sea water. Also, heavy rain causes Bioluminescence.

IS BLUE TIDE HARMFUL?

The smaller blooms of microorganisms are not harmful. On the other hand, the slow-moving larger blooms have impact on deep sea fishing. Their colonies become larger only when the nitrogen presence is higher and dissolved oxygen content is lower. This environment is highly dangerous for fish as they mainly survive on oxygen. This happens due to fertilizer run off and discharge of untreated sewage into the oceans. Therefore, larger blue tide indicate deteriorating ocean ecosystem.

IS BIO-LUMINESCENCE COMMON IN INDIA?

No, Bioluminescence is not common in India. In India we can find Bioluminescence in Lakshadweep, Goa, Mumbai, kannada(udupi).

WHY DO MARINE ORGANISMS GLOW?

Species in the sea glows because of the chemicals in their body or bacteria in the skin. The oxygen reacts to produce substrate called luciferin that creates blue light in the waves.

►GREGARIOUS FLOWERING

Gregarious flowering of bamboo' inside the Wayanad Wildlife Sanctuary (WWS) and the nearby Mudumalai Tiger Reserve and Gudalur forest division in Tamil Nadu may pose a threat to wildlife in the Nilgiri biosphere, a major tiger and elephant habitat.

There are over 1500 different bamboo species known to date which all have different flowering habits and flowering intervals. There does not exist much scientific evidence and study about why and when bamboo flowers, mainly because the flowering intervals of bamboo can be several decades apart.

While the vast majority of herbaceous bamboos flower annually, most of the woody bamboos flower very infrequently. In fact, many bamboos only flower once every 20 to 120 years and may die in part or completely due to some possible causes.

There exist 3 types of flowering in bamboo which largely depend on species and circumstances:

1. Continuous Flowering
2. Sporadic Flowering
3. Gregarious Flowering

Continuous or annual flowering happens with most herbaceous bamboos and in some cases also with woody bamboos. Some species keep flowering year after year without any effect on the plant itself, although the produced seeds are rarely viable.

Sporadic flowering bamboo only occurs on individual stems (culms) of the same clump in a forest. As the name suggests, there is very little pattern to this type of flowering, and it seems that it may be induced by environmental factors such as drought or cold instead of genetics.

It has been noted that severe attacks of pests or disease, injury, malnutrition, or long periods of prolonged droughts and floods coincide with the presence of flowering in grooves that were under these circumstances.

These adverse causes inevitably produce reactions and mechanisms in the plants which leads them to flower with the objective to preserve the species. The seeds are then utilized as a unique system of self-perpetuation. Sporadic flowering can also occur when bamboo forests or plantations are heavily exploited.

Most woody bamboo species are subject to gregarious flowering which means that all plants of a particular species flower at the same time, regardless of differences in geographic locations or climate conditions, and then die a few years later. Intervals in the gregarious flowering cycle varies depending on the species, but in general bamboo flowering intervals can be as long as 20-120 years.

In other words, when a certain bamboo species starts to flower gregariously, they do this all over the world for a several year periods until the entire forest has died.

WHAT CAUSES GREGARIOUS FLOWERING?

Unlike sporadic flowering, gregarious flowering isn't triggered by environmental aspects, which leads us to believe that there must exist some sort of genetic alarm clock in each bamboo cell that signals the diversion of all energy to flower production and the cessation of vegetative growth. This mechanism, as well as the evolutionary cause behind it, is still largely a mystery.

WHY BAMBOO DIES AFTER FLOWERING?

The 2 most probable explanations for why bamboo dies after flowering (there exist many theories) is that:

i. seed production requires an enormous amount of energy which stresses the bamboo plant to such an extent that it will actually die.

ii. A second explanation could be that the mother plant is creating an optimal environment for its seedlings to survive. In other words when the mother plant dies, the bamboo seedlings will have full access to water, nutrients and sunlight that would otherwise be used by the mother plant.

Profuse natural regeneration occurs from seeds after gregarious flowering. Seeds have no dormancy, and it helps germination under favourable conditions soon after seed fall.

But protection from fire and grazing is essential for proper establishment of seedlings.

Fire incidents have been comparatively low in the sanctuary for the past five years owing to summer rain and conservation measures implemented by the Forest Department.

CONSEQUENCES OF GREGARIOUS FLOWERING

The mass flowering of bamboos and consequential seed setting also have economic and ecological consequences. The huge number of seeds in forests attract large populations of rats and other rodents which may consume all available food crops and may cause severe spread of diseases in surrounding villages. Furthermore, when bamboo stems die, local people lose access to a vital building material for their homes and agricultural activities.

►AERIAL SEEDING

Indian Navy & Greater Vishakhapatnam Municipal Corporation undertook Aerial Seeding in Vishakhapatnam for increasing green cover.

WHAT IS AERIAL SEEDING?

It is a plantation technique where seed balls are sprayed using helicopters, drones or planes. The seed balls are dispersed with coating. This coating provides the desired weight for the seeds to airdrop in a predetermined location. The seeds sprout when it receives enough rain with nutrient present within them providing them the initial growth.

The aerial seeding rates should be 25% to 50% greater than drilled rates to achieve same stand. This increases seed cost. However, more acres can be seeded in less time when rains are to occur within 7 to 10 days.

BENEFITS OF AERIAL SEEDING

The technique is best suited for steep slopes. It requires no attention after dispersing as they are already surrounded by nutrients, soil and microorganisms. The clay shell around the seeds also protects them from ants, birds and rats.

The aerial seeding also provides work opportunities to the local communities in preparation of seed balls. Seed balls consists of variety of different seeds that are rolled within a ball of clay. The additives included in seed ball are humus or compost. The additives are placed around the seed ball and at the centre to provide microbial inoculant.

SPECIES USED FOR AERIAL SEEDING

Only those species of plants that are native to the area are selected for aerial seeding. The seeds should be of larger size. Large-seeded legumes are better as they develop good seed-to-soil contact.

►ZOMBIE FIRES

Zombie Fires in the Arctic region are becoming frequent. This says that the fire regimes in the Arctic are changing rapidly. These regions were once-frozen Tundra.

ABOUT ZOMBIE FIRES

A Zombie fire is a fire from a previous growing season. It can smolder (burn slowly with smoke and no flame) under the ground that is made of carbon rich peat. The fire reignites when the weather warms.

WHAT IS THE ISSUE?

The fires in the Arctics are spreading to areas which were formerly fire-resistant. The north of Arctic Circle (the Tundra) is drying up. Vegetation in the region such as grass, moss, dwarf shrubs are catching fire. The wildfires in the permafrost region of Siberia in the Arctic are not uncommon. However, lately in 2019 and 2020, the burning occurred well above Arctic Circle.

The Wet landscapes such as grass, sedges, moss, and surface peats are also starting to catch fire. The region is not usually known to support large wildfires. Also, the temperatures in Siberia this year had gone up. The region also recorded severe heat waves. Half of these regions burnt on ancient carbon-rich peat soils

These fires have the potential of turning carbon sink into carbon source which in turn increases Global Warming.

PERMAFROST

Permafrost locks in enormous amount of carbon from ancient biomass. Thus, melting of these permafrosts will emit more and more carbon into the atmosphere.

HOW IS IT HAZARDOUS TO RUSSIA?

Russia is warming 2.5 times faster than the rest of the world due these Arctic territories. This is a huge hazard for the country's infrastructure. This is because, Russia is built on permafrost. In June 2020, the oil leak in the Ambarnaya river was due to melting of permafrost. The incident forced the Russian Government to impose emergency in the region. On the other hand, this is opening up transportation routes and energy resources to Russia.

►RED MUD

- Produced during Bayer Process for alumina production. It is insoluble product after bauxite digestion with sodium hydroxide at elevated temperature and pressure.
- It is a mixture of compounds originally present in the parent mineral, bauxite, and of compounds formed or introduced during the Bayer cycle.
- It is disposed as a slurry having a solid concentration in the range of 10-30%, pH in the range of 13 and high ionic strength.

USES

- Metallurgical uses (Iron and Steel production etc.)
- Production of building materials (constructional brick, light weight aggregates, bricks roofing and flooring tiles, cements etc.).
- Ceramics (pottery, sanitary ware, special tiles and glasses, glazes, ferrites)
- pH neutralization - for use in acidic soils as a substitute of limestone, as a treatment for iron deficient soils, in sandy soils to increase phosphorous retention.

POLLUTION & RENEWABLE ENERGY

►CHEMICALS OF ENVIRONMENTAL CONCERN

CHEMICAL	DESCRIPTION
Arsenic	• Naturally occurring element that is widely distributed in the Earth's crust. • Used in wood preservatives, pesticides, insecticides, herbicides, batteries and semiconductors. • Primary route of arsenic exposure is via ingestion of contaminated food and water. • Highly toxic in its inorganic form and a Carcinogenic. • Associated with cardiovascular disease, diabetes. • Adverse effects on nervous, respiratory, immune and endocrine systems. • Early childhood exposure effects cognitive development. • Toxic effects in wildlife.
Bisphenol a	• Belongs to group of synthetic organic compounds primarily used as a building block in production of polycarbonate plastics and epoxy resins, which are used in a wide variety of products including water bottles, sports equipment, medical devices, household electronics, thermal paper receipts, and food and beverage cans. • Polymers degradation is the dominant mechanism responsible for bisphenol releases from products. • Primary source of exposure to BPA for most people is through food and beverages, by migration from containers. • Endocrine disruptor. • May also be linked to cardiovascular diseases, diabetes, metabolic disorders, prostate cancer, and immune system alterations.
Cadmium	• A soft, silver-white metal naturally found in Earth's crust. • Largest use is in batteries, predominantly rechargeable nickel-cadmium batteries. • Also widely used in pigments, coatings, electroplating and solar cells. • Exposure is through ingestion of contaminated food. • Presence in plastic toys and exposure through cadmium wastes have also been noted. • Carcinogenic to humans • Exposure affects kidney function and has been linked to reduced lung function as well as damage to bones, with children particularly at risk.

	• Adverse effects on animals and plants.
Glyphosate	• Active ingredient in herbicide formulations that are widely used for agricultural, forestry, and residential weed control. • Researchers could not establish any serious threat to human health or environment. • Related to mild skin and eye irritation.
Lead	• Naturally occurring heavy metal found in Earth's crust. • Lead and its compounds are used in gasoline, pipes, paints, toys, ammunition and batteries etc. • Exposure is mainly through inhalation of lead particles in air, drinking water, eating foods or swallowing dust or dirt. • Health effects of exposure to lead include hypertension, renal failure, cardiovascular disease and stroke, especially among workers, while neurodevelopmental toxicity constitutes the most important consequence of lead toxicity in children.
Microbeads	• A type of primary microplastics (particles less than 5 mm in length). • Used in personal care products, other consumer applications and various industrial applications (Ex. scrubs, toothpastes) • Majority of microplastics released to the oceans are secondary microplastics originating from degradation of larger plastic items, in particular textiles and tyres, while microbeads from personal care products and cosmetics represent a relatively small source of microplastics in environment. • Aquatic organisms may be exposed to microplastics through direct ingestion or consumption of prey that have ingested the plastics. • Humans can be exposed to microplastics through ingestion of contaminated food and water. • Adverse effects on aquatic organisms, continuous release of microbeads may result in long-term effect on biological diversity and ecosystems. • Potential risks of microplastics to human health are largely unknown.
Neonicotinoids	• A class of neuroactive insecticides chemically related to nicotine. • Used as insecticides and biocides. • Adverse impact on pollinators health and numbers, especially bees. • Impact on human health has not been established yet.
Organotins	• Organic compounds that contain at least one tin-carbon bond. There are four main groups of organotin compounds. • Used in various applications such as biocidal agents in wood preservatives and disinfectants, catalysts, sealants, stabilizers and as antifouling paints on ships. • In addition to occupational exposure, people can be exposed organotins through ingestion of food and contact with household products containing organotin compounds. • The organotin compound tributyltin (TBT) is considered among the most hazardous substances released into marine environment. • Exposure to organotins can cause skin, eye and respiratory irritation, neurological problems, and effects on immune system. • Adverse effects on animals like endocrine disruption.
Phthalates	• A group of plasticizers with softening and elastic effects. • Used in products such as vinyl flooring, adhesives, detergents, lubricating oils, automotive plastics, plastic clothing and personal care products. • Main human exposure pathway is oral via food. Other pathways include direct mouthing (toys), house dust ingestion and dermal gaseous absorption. • Linked to developmental toxicity and adverse effects on reproductive function in humans and aquatic invertebrates, fish and birds. • While a number of phthalates have so far been found to present a limited risk of harm to human health and environment, others have been shown to be plausible endocrine disruptors.
Polycyclic aromatic	• A group of 100 different chemicals that occur naturally in coal and crude oil but are also formed as a by-product during incomplete burning of coal, oil, gas, wood, garbage and other organic

hydrocarbons (pahs)	substances. • Carcinogenic, mutagenic and toxic for reproduction. • Persistent, bioaccumulative and toxic for humans and other organisms.
Triclosan	• An antibacterial and anti-fungal agent widely used in a variety of products, including cosmetics and toiletries (e.g., toothpaste and soaps). • Can be released to the environment via various pathways and has been detected in surface, ground and drinking water. • Exposure to triclosan occurs primarily through the skin or mouth during the use of triclosan containing products, with only a minor contribution via environmental exposures. • Toxic to aquatic organisms and is an endocrine disruptor in mammals.
Benzene	• A hydrocarbon formed due to natural processes and human activities. • Used to make chemicals for other industries like plastics, resins, and nylon and synthetic fibers. • Also used to make some types of lubricants, rubbers, dyes, detergents, drugs, and pesticides. • Exposure can occur occupationally and domestically due to ubiquitous use of benzene-containing petroleum products, including motor fuels and solvents. • Active and passive exposure to tobacco smoke is also a significant source of exposure. • May cause narcosis: headache, dizziness, drowsiness, confusion, tremors and loss of consciousness. • Moderate eye irritant and a skin irritant. • Associated with long-term adverse health effects and diseases, like cancer and haematological effects
Asbestos	• Groups of naturally occurring fibrous minerals that are resistant to heat and corrosion. • Used as fireproofing and insulation material. • Exposure to asbestos occurs through inhalation of fibres in air. • All types of asbestos cause lung cancer, mesothelioma, cancer of the larynx and ovary, and asbestosis (fibrosis of the lungs).
Dioxins	• Belong to the so-called "dirty dozen" - a group of dangerous chemicals known as persistent organic pollutants (POPs), covered by the Stockholm Convention. • Found throughout the world in the environment and they accumulate in the food chain, mainly in the fatty tissue of animals. • Mainly by-products of combustion and industrial processes but can also result from natural processes, such as volcanic eruptions and forest fires. • These are unwanted by-products of a wide range of manufacturing processes including smelting, chlorine bleaching of paper pulp and the manufacturing of some herbicides and pesticides. • More than 90% of human exposure is through food, mainly meat and dairy products, fish and shellfish. • Has been associated with a range of toxic effects, including chloracne; reproductive, developmental and neurodevelopmental effects; immunotoxicity; and effects on thyroid hormones, liver and tooth development. • They are also carcinogenic.
Mercury	• Naturally occurring element which is found in Air, Water and Soil. • Released to environment from volcanic activity, weathering of rocks and as a result of human activity. • Human activity is the main cause of mercury releases, particularly coal-fired power stations, residential coal burning for heating and cooking, industrial processes, waste incinerators and as a result of mining for mercury, gold and other metals. • Exposure mainly occurs through consumption of fish and shellfish contaminated with methylmercury and through worker inhalation of elemental mercury vapours during industrial processes. Cooking does not eliminate mercury. • Methylmercury is very different to ethylmercury. Ethylmercury is used as a preservative in some

	vaccines and does not pose a health risk • Exposure, even small amounts, may cause serious health problems. • Threat to development of child in utero and early in life. • Toxic effects on nervous, digestive and immune system on lungs, kidneys, skin and eyes.
Polybrominated Diphenyl Ethers (PBDE) & Polybrominated Biphenyls (PBB)	Used as fire retardants in furniture foam padding, wire insulation, rugs, draperies and upholstery; plastic cabinets of electronic devices.
Acrylamide	• Formed when carbohydrates rich starchy food is cooked at very high temperatures. • Found in tobacco smoke. • Used to make chemicals to purify water, treat sewage, make paper and cosmetics.
Parabens	• A man-made chemical found in cosmetics such as makeup, moisturisers, haircare products etc; pharmaceuticals, food and beverages. • It can get absorbed through the skin.

►FROTHING IN RIVER YAMUNA

The primary reason for froth formation are:

1. High phosphate content in the water. It is believed that phosphates from detergent find their way into river water leading to froth formation.
2. Release of surfactants in river water.
3. Release of untreated effluents
4. As the water rich in surfactants, phosphates and other untreated wastes falls down from the barrages, the turbulence of water results in frothing.

CHEMICALS IN DETERGENTS

PHOSPHATES

Phosphates are used in detergents for

1. Softening hard water by bonding with calcium ions.
2. Stabilise alkalinity of surfactants
3. Keep dissolved dirt in water and prevent it from depositing on clothes.

Issues with phosphates:

1. Results in algal bloom and lead to eutrophication.
2. Inhibits biodegradation of organic substances.

NONYLPHENOL

A hazardous chemical which has tendency to bioaccumulate and enter the food chain.

It is a hormone disruptor, can cause many health issues.

Used as a surfactant in detergents, personal hygiene products, automotive & latex paints, lawn care products.

►PESTICIDE MANAGEMENT BILL, 2020

It seeks to regulate the manufacture, import, sale, storage, distribution, use, and disposal of pesticides, to ensure the availability of safe pesticides and minimise the risk to humans, animals, and environment. The Bill seeks to replace the Insecticides Act, 1968.

Pest and pesticide: The Bill defines a pest as any species of animal, plant, or pathogenic agent that is unwanted, or injurious to plants, humans, animals, and the environment. A pesticide is any substance of chemical or biological origin intended for preventing or destroying any pest in agriculture, industry, public health, pest control operations, or for ordinary use.

Central Pesticides Board: The central government will constitute the Central Pesticides Board to advise the central and state governments on scientific and technical matters arising under the Act. It will also advise the central government in formulating standards and best practices for: (i) pesticide manufacturers, laboratories, and pest control operators, (ii) working conditions and training of workers, and (iii) recall and disposal of pesticides. The Board will also frame model protocols to deal with poisoning cases due to pesticides.

Registration of pesticides: Persons seeking to import or manufacture a pesticide for ordinary use, agriculture, industry, pest control, or public health, are required to obtain a certificate of registration for the pesticide from the Registration Committee. The Committee will be constituted by the central government, and will: (i) specify the conditions for granting a certificate and issue certificates, (ii) periodically review the safety and efficacy of registered pesticides, and amend or cancel their certificates, and (iii) notify substances which cause the same chemical or biological action as a pesticide.

Registration criteria: The Committee will evaluate the information submitted in the application about the pesticide on factors such as safety, efficacy, necessity,

end-use, risks, and availability of safer alternatives. It will not register a pesticide if the applicant submits false or misleading information, or if the maximum limits for the residue of the pesticide on crops and commodities are not specified under the Food Safety and Standards Act, 2006. It may also not register the pesticide if there is scientific uncertainty regarding its risks and benefits, and threats of serious and irreversible damage to human health, other living organisms, or the environment.

Licences: A person seeking to manufacture, distribute, exhibit for sale, sell, or stock pesticides, or undertake pest control operations is required to obtain a licence from the Licensing Officer, who may be appointed by the state government. Once the registration certificate for a pesticide is issued, the applicant must obtain a licence within the specified period, failing which the certificate will be cancelled. Licence is not required for selling or storing ordinary use pesticides (intended for use only in households, offices, and similar premises), which may be notified by the central government.

A person's licence will be revoked if he is convicted of an offence under the Act. It can also be revoked if he: (i) violates the conditions under which the licence was granted, (ii) contravenes the provisions of the Act or the rules made under the Act, or (iii) had submitted false or misleading information to obtain the licence.

Prices: If the central government considers it necessary or expedient to secure the distribution and availability of pesticides at fair prices, it may constitute an authority to regulate their price in a manner as it may prescribe.

Prohibition on certain pesticides: The central and state governments may, by notification, prohibit the distribution, sale, or use of a pesticide or a specified batch in an area, up to a period of one year. Pesticides can be prohibited if: (i) they pose a risk to, or can adversely impact human health, other living organisms, or the environment, or (ii) they pose a barrier in international trade of agriculture commodities.

Pesticide inspector: The central and state governments may, by notification, appoint pesticide inspectors for certain areas. A pesticide inspector can: (i) enter and search a premises or vehicle if he suspects commission of an offence or wants to check compliance, (ii) seize any document, material, or stock of pesticides, (iii) send samples of pesticides for test and analysis, and (iv) with the Executive Magistrate's approval, stop the sale, use, distribution, or disposal of pesticides for a period of up to 60 days or until the receipt of the sample test reports.

Offences: Under the Bill, manufacturing, importing, distributing, selling, exhibiting for sale, transporting, storing, or undertaking pest control operations, without a licence or certificate is punishable with imprisonment of up to three years, or a fine of up to Rs 40 lakh, or both. Persons using pesticides in their own household, kitchen-garden, or land under their own cultivation are not liable for prosecution for any offence under the Bill.

AIR POLLUTION

►PARTICULATE MATTER

- Particulate matter is a term for a mixture of solid particles and liquid droplets found in the air.
- Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen with the naked eye. Others are so small they can only be detected using an electron microscope.

PARTICLE POLLUTION INCLUDES

- PM10 : inhalable particles, with diameters that are generally 10 micrometers and smaller; and
- PM2.5: fine inhalable particles, with diameters that are generally 2.5 micrometers and smaller. These are more harmful for health as they move freely with air current and block the tiny pores in our lungs.
- Major source of SPM (suspended particulate matter) are vehicles, power plants, construction activities, oil refinery, railway yard, market place, industries, etc.
- According to Central Pollution Control Board (CPCB), particulate size 2.5 µm or less in diameter (PM 2.5) are responsible for causing the greatest harm to human health. These fine particulates can be inhaled deep into the lungs and can cause breathing and respiratory symptoms, irritation, inflammations and pneumoconiosis (a disease of the lungs due to inhalation of dust, characterized by inflammation, coughing, and fibrosis).

FUGITIVE PARTICULATE MATTER

- Fugitive particulate matter is particulate matter that has not passed through a stack (such as a chimneys, pipe, vent, or duct) before being released to the air. It is released into the air by wind or other similar forces.
- The source of which is primarily the Earth's soil.
- High levels of particulate matter in the air can affect human health. It can reach deep into the lungs and cause respiratory problems. Particulate matter is linked to aggravated asthma, chronic bronchitis, and premature death.

SOURCES OF PM

- These particles come in many sizes and shapes and can be made up of hundreds of different chemicals.
- Some are emitted directly from a source, such as construction sites, unpaved roads, fields, smokestacks or fires.
- Most particles form in the atmosphere as a result of complex reactions of chemicals such as sulphur dioxide and nitrogen oxides, which are pollutants emitted from power plants, industries and automobiles.
- Natural sources include volcanic ash, pollen, yellow sand (Asian Dust), sea salt, etc. Anthropogenic sources include soot, smog, fly ash, chemical mist, etc.

►BLACK CARBON

A Study has found increased concentration of black carbon in Gangotri region even in winter months.

FINDINGS

- The high concentration of black carbon in January and February is not originating from local sources because life remains near standstill as almost the entire population in these areas migrates to the plains for the winter.
- Thus, the study has deduced that black carbon is travelling from Mediterranean countries during the western disturbances and wind trajectories and it may be one of the contributing factors leading to pollution and receding snowline in the Himalayas.

ABOUT BLACK CARBON

- Black carbon is a potent climate-warming component of particulate matter
- It is formed by the incomplete combustion of fossil fuels, wood and other fuels.
- It is a short-lived climate pollutant with a lifetime of only days to weeks after release in the atmosphere.
- During this short period of time, black carbon can have significant direct and indirect impacts on the climate, glacial regions, agriculture and human health.

→BLACK CARBON	→BROWN CARBON
• Black carbon is inorganic in nature consisting of soot particles that directly come out of combustion process, exhaust fumes that form part of particulate matter present in the air. • Black carbon absorbs sunlight and in turn warms the atmosphere. When inhaled it causes severe health problems. • Black carbon absorbs light in the visible spectrum. • It absorbs both incoming and terrestrial radiations.	• Brown carbon or organic carbon, unlike black carbon, comes from complex organic reactions in the airborne atmospheric particles. • This includes tar material from smoldering fires or coal combustion, breakdown products from biomass burning, a mixture of organic compounds given off by vegetation. Brown carbon is light brown in colour and absorbs light in the ultraviolet region. • Brown carbon leads to the formation of ground level ozone in the atmosphere.

►FOG

It is one of the major weather hazards, impacting road, aviation transportation, economy and public life.

- Fog is a visible mass consisting of cloud water droplets suspended in the air or near the Earth's surface.
- Fog usually appears over a region of high pressure where humidity is greater than 75%. Moisture in the atmosphere could condense around particulate matter of diameter in the range of nanometres, to cause fog.
- Land use changes and increasing pollution are responsible for growing fog occurrence.

►SMOG

- The word smog is derived from smoke and fog. This is the most common example of air pollution that occurs in many cities throughout the world.
- Classical smog occurs in cool humid climate. It is a mixture of smoke, fog and sulphur dioxide. Chemically, it is a reducing mixture and so it is also called as reducing smog.
- Photochemical smog occurs in warm, dry and sunny climate. The main components of the photochemical smog result from the action of sunlight on unsaturated hydrocarbons and nitrogen oxides produced by automobiles and factories. Photochemical smog has high concentration of oxidising agents and is, therefore, called as oxidising smog.

EFFECTS OF PHOTOCHEMICAL SMOG

- The common components of photochemical smog are ozone, nitric oxide, acrolein, formaldehyde and Peroxyacetyl nitrate (PAN).
- Photochemical smog causes serious health problems. Both ozone and PAN act as powerful eye irritants.
- Ozone and nitric oxide irritate the nose and throat and their high concentration causes headache, chest pain, dryness of the throat, cough, and difficulty in breathing.
- Photochemical smog leads to cracking of rubber and extensive damage to plant life.
- It also causes corrosion of metals, stones, building materials, rubber and painted surfaces.

►SULPHUR DIOXIDE POLLUTION

In order to curb emissions from power sector, Ministry of Power has proposed incentives worth Rs. 835 billion to step up infrastructure aimed at **cutting sulphur emissions.**

TROPOSPHERIC AIR POLLUTION

- Atmospheric pollution is can be divided as tropospheric and stratospheric pollution.
- Tropospheric pollution occurs due to the presence of undesirable solid or gaseous particles in the air.
- The following are the major gaseous and particulate pollutants present in the troposphere
- Gaseous air pollutants: Oxides of sulphur, nitrogen and carbon, hydrogen sulphide, hydrocarbons, ozone and other oxidants.
- In India, thermal power plant account for 80% of all industrial emissions of particulate matter, sulphur and nitrous oxides in India.
- Particulate pollutants: Dust, mist, fumes, smoke, smog etc.

SULPHUR DIOXIDE POLLUTION

- Oxides of sulphur are produced when sulphur containing fossil fuel is burnt.
- Most common oxide of sulphur is sulphur dioxide, SO_2.
- Particulate matter in the air accelerates formation of oxides of sulphur catalyses the process of oxidation.

SOURCES OF SO_2 POLLUTION

- Burning of fossil fuels such as coal, oil and natural gas are the main source of SO_2 emissions.
- Volcanic eruptions are also a major source of SO_2 emissions.
- Hydrogen sulphide, released from biological decay, reacts with O_2 in the atmosphere to produce SO_2.

HARMFUL EFFECTS OF SO_2

- SO_2 is a poisonous gas known to cause respiratory diseases such as asthma, bronchitis, emphysema in human beings, irritation to the eyes.
- High concentration of SO_2 leads to stiffness of flower buds.
- SO_2 is responsible for acid rain.
- SO_2 is the main cause of discoloration of marble in Taj Mahal.

►BHARAT STAGE NORMS (BS NORMS)

- Bharat stage norms are rules which determine the maximum limit of pollutants vehicles (Including motor vehicles) can emit.
- The standards, based on European regulations were first introduced in the year 2000.
- **2020 - BS-VI has been introduced directly bypassing BS-V**

→ BS VI is expected to be same as that of the Euro VI norms and will be declared by CPCB (Central Pollution Control Board) under the Ministry of Environment & Forests and climate change.

a) The coming BS VI norms will cut down the presence of sulphur (in comparison to BS IV) from 50 ppm to 10 ppm (80%)

b) Implementation of BS VI will ensure cutting down of the harmful NOx (nitrogen oxides) from diesel cars by nearly 70%. In the petrol cars, they can be reduced by 25%.

c) Particulate matter like PM 2.5 and PM 10 are the most harmful components and the BS VI will bring down the cancer-causing particulate matter in diesel cars by a phenomenal 80%.

►AIR QUALITY INDEX (AQI)

- AQI is an initiative of the Ministry of Environment Forest and Climate Change under Swachh Bharat Abhiyan.
- The index is constituted as a part of Government's mission to improve the culture of cleanliness and helps public to judge air quality within their vicinity. It is a colour coded index.
- There are six AQI categories, namely Good, Satisfactory, Moderately polluted, Poor, Very Poor, and Severe.

- The index will measure eight major pollutants, namely, particulate matter (PM 10 and PM 2.5), nitrogen dioxide, sulphur dioxide, ozone, carbon monoxide, ammonia and lead.

►NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

- Central Pollution Control Board (CPCB) has notified these standards under powers given to it under Air (Prevention and Control of Pollution) Act, 1981.
- It covers 12 pollutants: Sulphur Dioxide, Nitrogen Dioxide, PM-10, PM-2.5, Ozone, Lead, Carbon Monoxide, Ammonia, Benzene, Benzopyrene, Arsenic, Nickel.
- Whenever monitoring results on two consecutive days of monitoring exceed the limits specified in NAAQS above for the respective category, it is considered adequate reason to institute regular or continuous monitoring and further investigation.

►URBAN AIR ACTION PLATFORM

- UNEP together with UN Habitat and IQAir, a Swiss air quality technology company launched the world's largest air quality data platform.
- It will bring together real-time air pollution data from over 4,000 contributors including citizens, communities, governments and the private sector to work towards healthier and sustainable cities.
- It was launched at the Tenth World Urban Forum in Abu Dhabi, UAE.

►AIR QUALITY EARLY WARNING SYSTEM

- The initiative comes under the Ministry of Earth Sciences and Environment.
- Air Quality Early Warning System for Delhi has been announced by the Central government that can alert, three days in advance, about the likelihood of extreme pollution events & dust storms.
- The air pollution system has been developed jointly by Indian Institute of Tropical Meteorology (IITM), India Meteorological Department, National Centre for Medium Range Weather Forecasting (NCMRWF).
- It intends for real time observations with 72-hour lead time of air quality over Delhi region.
- It provides details about natural aerosols like dust from dust storms and particulate matter using different satellite data sets.
- It will provide warning messages and Alerts to take necessary steps as per Graded Response Action Plan (GRAP).

►GRADED RESPONSE ACTION PLAN (GRAP)

It specifies actions required for controlling particulate matter (PM) emissions from various pollution sources and prevents PM10 and PM2.5 levels to go beyond 'moderate' national Air Quality Index (AQI) category.

These measures were earlier implemented in Delhi only. However recently GRAP has been extended to the NCR towns also.

- It was planned by Environment Pollution (Prevention and Control) Authority (EPCA) and approved by the Supreme Court in 2016.
- GRAP works only as an emergency measure. As such, the plan does not include action by various state governments to be taken throughout the year to tackle industrial, vehicular and combustion emissions.
- If air quality reaches the severe+ stage, GRAP suggests shutting down schools and implementing the odd-even road-space rationing scheme.
- GRAP comprises measures such as prohibition on entry of trucks into Delhi; ban on construction activities, introduction of odd and even scheme for private vehicles, shutting of schools, closure of brick kilns, hot mix plants and stone crushers; shutting down of Badarpur power plant, ban on diesel generator sets, garbage burning in landfills and plying of visibly polluting vehicles etc.

►CORPORATE AVERAGE FUEL EFFICIENCY/ECONOMY (CAFE)

CAFE regulations are in force in many advanced as well as developing nations, including India.

The move is targeted at reducing the carbon footprint of the automobile industry.

- It aims at lowering fuel consumption (or improving fuel efficiency) of vehicles by lowering carbon dioxide (CO2) emissions.
- Corporate Average refers to sales-volume weighted average for every auto manufacturer. The norms are applicable for petrol, diesel, LPG and CNG passenger vehicles.
- In India, CAFE regulations come into force into 2017, under which, average corporate CO2 emission from vehicle must be less than 130 gm per km till 2022 and below 113 gm per km thereafter.

- CAFE norms require cars to be 30% or more fuel efficient from 2022 and 10% or more between 2017 and 2021.

►ACTION PLAN FOR CLEANER INDUSTRY

Prepared by a Task Force led by both NITI Aayog and the Confederation of Indian Industry (CII). The report identifies sources of Industrial Pollution in Delhi NCR and recommend action plan for clean Industry.

►CLEAN AIR FUND

- It is a philanthropic initiative which aims to tackle air pollution around the world. It brings together funders, researchers, policy makers and campaigners.
- It will fund and support a multinational portfolio of clean air programs to deliver impactful and scalable improvements to air quality. It is already supporting projects in India, Poland, Bulgaria and the UK, as well as a global program involving projects in China and Brazil.
- It aims to raise $100 million in funding for projects around the world.

►HAPPY SEEDER

A machine called the 'Happy Seeder' has been developed in the last few years that can plant the wheat seed without getting jammed by the rice straw.

ABOUT "HAPPY SEEDER"

- Burning of crop residue in the field by farmers in Punjab, Haryana and western Uttar Pradesh is considered as major source of pollution in Delhi in winters.
- Farmers harvest the rice crop by combine harvesters. This machine leaves rice straw strewn all over the fields.
- Farmers do not use rice straw as animal-feed or for non-feed use.
- The straws clogs the seeder machines that plant the next crop, which is wheat, so farmers need to dispose of the residue before attempting to plant wheat. They do this by burning the residue.
- The Happy Seeder is a tractor-mounted machine that cuts and lifts rice straw, sows wheat into the bare soil, and deposits the straw over the sown area as mulch.

►SMOG TOWERS

- A smog tower is a large vertical structure designed as large-scale air purifier to reduce air pollution particles.
- It is fitted with exhaust fans that will help in sucking polluted air.
- The device takes in air from all 360-degree angles and generates high volume of clean air at high rate.
- It uses Highly Effective Particulate Arrestance (HEPA) which can clean up to 99.99 per cent of the particulate matter present in the air in conjunction with a pre-filter and activated carbon.

►ANTI-SMOG GUNS

- In India water cannons have been used recently in an attempt to wash out particles.
- The anti-smog gun is a cannon shaped device that sprays atomized water droplets in the air.
- The gun is attached to a water tank built on a movable vehicle, which can be taken to various parts of the city.

►TAJ TRAPEZIUM ZONE

- Recently the white marble structure was found to be developing greenish-black patches as a result of the release of faeces and dirt by an insect identified as Goeldichironomus.
- The Central Government constituted the Taj Trapezium Zone Pollution (Prevention and Control) authority in 1998, under the Environment (Protection) Act, 1986, to protect Taj Mahal from pollution.
- The geographical limit of the Taj Trapezium Zone is in the shape of a trapezium an area that includes the towns of Agra, Firozabad, Mathura and Bharatpur. It comprises monuments including three World Heritage Sites the Taj Mahal, Agra Fort and Fatehpur Sikri.
- Under this plan more than 2000 polluting industries lying inside the trapezium would switch over to the use of natural gas or liquefied petroleum gas instead of coal or oil.

►CLIMATE & CLEAN AIR COALITION (CCAC)

- It is a voluntary partnership of governments, intergovernmental organisations, businesses,

scientific institutions and civil society organisations committed to protecting the climate and improve air quality through actions to reduce Short lived climate pollutants.

- India became a member of this coalition in 2019.

CURRENTLY IT IS FOCUSED ON 4 SHORT LIVED CLIMATE POLLUTANTS (SLCPS)

- Black Carbon
- Methane
- Hydroflurocarbons
- Tropospheric Ozone

WHAT ARE SHORT LIVED CLIMATE POLLUTANTS (SLCPS)

- These are powerful climate forcers that remain in the atmosphere for a much shorter period of time than carbon dioxide, yet their potential to warn the atmosphere can be many times.
- The SLCPs – Black Carbon, Methane, Hydroflorocarbons, Tropospheric Ozone are responsible for 45% of current global warming.

►DEVICE WAYU (WIND AUGMENTATIONPURIFYING UNIT)

- Developed by Council of Scientific and Industrial Research – National Environmental Engineering Research Institute (CSIR-NEERI)
- Developed as a part of *Technology Development Project*, funded by Department of Science and Technology.
- The device has filters for Particulate Matter removal and activated carbon (charcoal) and UV lamps for poisonous gases removal such as VOCs and Carbon Monoxide.

►CLEAN AIR INITIATIVE

- It is initiative launched by the United Nations, WHO, UNEP and Climate and Clean Air Coalition.
- It calls on national and subnational governments to commit to achieving air quality that is safe for citizens, and to align climate change and air pollution policies by 2030.
- Initiative will be led by the WHO with the support of the Clean Air and Climate Coalition (CCAC).

AIM OF THE INITIATIVE

- Implement air quality and climate change policies that will achieve the WHO Ambient Air Quality Guideline values.
- Implement e-mobility and sustainable mobility policies and actions to contribute to the reduction of road transport emissions.
- Assess the number of saved lives, health gains in children and other vulnerable groups, and avoided financial costs to health systems from implementing policies.
- Track progress and share experiences and best practices through an international network supported by the BreatheLife campaign.

►COALITION OF FINANCE MINISTERS FOR CLIMATE ACTION

- Finland and Chile created a coalition of finance ministers to agree to a set of principles to systematically study environmental impacts of their portfolios.
- It will continue to work towards the finalization and adoption of the Action Plan and the work through the operationalization of the "*Helsinki Principles*."
- It is supported by World Bank.

►COOL COALITION

- It is a global effort led by UN Environment, the Climate and Clean Air Coalition, the Kigali Cooling Efficiency Program, and Sustainable Energy for All (SEforALL).
- It was launched at the first Global Conference on Synergies between the 2030 Agenda and Paris Agreement in 2019.
- It is unified front that links action across the Kigali Amendment, Paris Agreement and Sustainable Development Goals
- It aims to inspire ambition and accelerate action on the transition to clean and efficient cooling.

►THE THREE PERCENT CLUB FOR ENERGY EFFICIENCY

- 15 countries are signatories, including India.
- Core partners are the International Energy Agency, Sustainable Energy for All, SEforAll Energy Efficiency Accelerators and Hub, UNEP, European Bank for Reconstruction and Development, Global Environment Facility, and EE Global Alliance.
- The aim is to increase energy efficiency improvements and deliver on average 3% per year until 2030 in alignment with SDG 7.3.

►ACTION TOWARDS CLIMATE ('ACT') FRIENDLY TRANSPORT

- Committed to accelerate the decarbonization of the transport sector.
- Its members are national governments (such as Germany, The Netherlands, Costa Rica), private sector leaders.
- Implementation of this initiative will be led by UN Habitat.

►CHAMPIONS OF EARTH

- Highest environmental award by the UNEP.
- It was awarded jointly to PM Modi and French president for launching international solar alliance.

►SOUTH ASIAN CLIMATE OUTLOOK FORUM

- It was established in 2010, by the South Asian Members of the World Meteorological Organization, as a platform where meteorologists from South Asian Association of Regional Cooperation (SAARC) countries along with Myanmar, could discuss some of the common weather and climate related matters.
- Countries under SASCOF — Afghanistan, Pakistan, India, Sri Lanka, Nepal, Bhutan, Myanmar and Maldives. [NO BANGLADESH]
- The forecast is helpful for India's neighbouring nations, which don't have advanced facilities to issue forecasts and make predictions.

►GREEN GOOD DEEDS CAMPAIGN

It was launched by the MOEFCC Ministry to sensitize the people and students, in particular, about climate change and global warming. It is a people-oriented campaign. The plan is to broad base it with the involvement of teachers, students and other voluntary organizations.

►SUSTAINABLE MOBILITY FOR ALL (SUM4ALL)

- Itis a growing global coalition of over 50 leading actors in the transport and mobility space with a shared vision to transform the future of mobility.
- World Bank will perform the secretariat functions of SuM4All initiative.

AIMS

1. Universal access so no one is excluded from its benefits
2. Efficiency so scarce resources are well utilized
3. Safety so transport does not claim lives
4. Green mobility helps check climate change & pollution

WATER POLLUTION

►BIOCHEMICAL OXYGEN DEMAND

- It is the amount of dissolved oxygen needed by aerobic biological organisms to break down organic material present.
- It can be used as a gauge of the effectiveness of wastewater treatment plants.
- The more organic matter there is (e.g., in sewage and polluted bodies of water), the greater the BOD; and the greater the BOD, the lower the amount of dissolved oxygen available for higher animals such as fishes.

►NATIONAL PLAN FOR CONSERVATION OF AQUATIC ECO-SYSTEMS (NPCA)

- National Wetlands Conservation Program (NWCP) and 'National Lake Conservation Plan' (NLCP)have been merged into one integrated scheme, National Plan for Conservation of Aquatic Eco-systems (NPCA).
- The scheme aims at holistic conservation and restoration of lakes and wetlands for achieving the desired water quality enhancement, besides improvement in biodiversity and ecosystem through an integrated and multidisciplinary approach and a common regulatory framework.
- The scheme would contribute to reduction of pollution loads in lakes and wise use of wetland resources and their services. NPCA is presently operational on cost sharing between Central and respective state governments.

►NATIONAL WATER MISSION

- For conservation of water, minimizing wastage and ensuring its more equitable distribution both across and within States through integrated water resources development and management".
- The five identified goals are:

(a) comprehensive water data base in public domain and assessment of impact of climate change on water resource.

(b) promotion of citizen and state action for water conservation, augmentation and preservation.

(c) focused attention to vulnerable areas including over-exploited areas.

(d) increasing water use efficiency by 20 per cent, and

(e) promotion of basin level integrated water resources management.

►NATIONAL MISSION FOR CLEAN GANGA

- The National Mission of Clean Ganga (NMCG) has taken up the initiative under Namami Ganga Project to conserve wetlands of the Ganges basin.
- The primary aim of Namami Ganga project is on pollution abatement and by 2020, the gap in treatment capacity for priority towns located along Ganga will be addressed
- It includes recharging aquifers and conservation of wetlands.
- 100 per cent funded by the Central Govt.
- The primary focus of the program is on pollution abatement and by 2020, the gap in treatment capacity for priority towns located along Ganga will be addressed.
- Identified grossly polluting industries have been directed to move towards implementing zero liquid discharge and installing real time effluent monitoring stations.
- Comprehensive river surface and ghat cleaning program has been initiated for major urban centers of Haridwar, Rishikesh, Gharmukteshwar, Mathura-Vrindavan, Kanpur, Allahabad, Varanasi, Patna, Sahibganj, Kolkata and Nabadwip.
- This program will include solid waste management and environmental monitoring/ surveillance of drains.
- Intensive afforestation drive has also been initiated along the banks of the river with focus on regeneration of native/medicinal species and providing comprehensive intervention that leads to the overall objective of cleaning river Ganga by reducing sediment load, recharging ground water and reducing non-point source pollution.

►NATIONAL ACTION PLAN FOR CLIMATE CHANGE (NAPCC)

- National Action Plan on Climate Change (NAPCC) is a comprehensive action plan which outlines measures on climate change related adaptation and mitigation while simultaneously advancing development.
- The 8 missions are:

1. National Solar Mission
2. National Mission for Enhanced Energy Efficiency
3. National Mission on Sustainable Habitat
4. National Water Mission
5. National Mission for Sustaining the Himalayan Ecosystem
6. National Mission for Green India
7. National Mission for Sustainable Agriculture
8. National Mission on Strategic Knowledge on Climate Change

►PAR-TAPI-NARMADA INTER-STATE RIVER LINK PROJECT

Gujarat government has expressed its inability to divert water for Maharashtra in Tapi basin as requested by Maharashtra as part of the Par-Tapi-Narmada inter-state river link project.

ABOUT RIVER LINK PROJECT

- Envisages transfer of surplus water of rivers in Maharashtra and south Gujarat to feed the command area of the Miyagam branch of Narmada canal.
- It will save water in Narmada dam, which will be taken to Saurashtra and Kutch.
- The project is aimed at diverting "surplus" water from parts of west flowing rivers like the Par, the Nar, the Ambika and the Auranga basins in Maharashtra.
- The project of Par-Tapi-Narmada link generally falls in the state of Gujarat except Jheri reservoir which falls in Maharashtra state.
- Jheri dam is located in Nasik district of Maharashtra
- While remaining dams viz. Mohankavchali, Paikhed, Chasmandva, Chikkar, Dabdar and Kelwan dams are located in Valsad and Dang districts of Gujarat.

SIGNIFICANCE OF PROJECT

- Providing irrigation benefits to the enroute command and Narmada command,
- Generating hydropower of the order of 93.00 Mkwh
- Providing flood relief to the people residing in downstream areas.

►MAHADAYI/MANDOVI RIVER

The dispute over Mahadayi River has resurfaced again and tensions have been rife between Goa and Karnataka. The

bone of contention is Kalasa-Banduri Nala project in the Mahadayi basin. Only a section of the project is nearing completion, with work on both reservoirs yet to be taken up owing to forest clearance. So, what is the dispute all about?

ABOUT THE RIVER

- The Mandovi and the Zuari are the two primary rivers in the state of Goa.
- Mandovi originates in the Western Ghats in the Belagavi district of Karnataka.
- Mandovi joins with the Zuari at a common creek at Cabo Aguada, forming the Mormugao harbour. Panaji, the state capital and Old Goa, the former capital of Goa, are both situated on the left bank of the Mandovi.
- The Mandovi is important for Goa also because it is one of the few sweet-water sources at the state's disposal. Most of Goa's 11 rivers contain salt water and Mandovi ensures water security as well as being an important place to source fish for the state.

KALASA-BANDURINALA PROJECT

- Goa is opposing Karnataka's move to divert water from tributaries of the river through the Kalasa-BhanduriNala project towards the parched Malaprabha river basin. While the demand for drawing water from the Mahadayi is four decades old, it was in 2002 that Karnataka drew up the Kalasa-Bhanduri project to supply drinking water to four parched districts of north Karnataka.
- While Goa fears the project will cause deficit of water, Karnataka claims the river is water-surplus. Goa has also raised concerns over the potential ecological disaster that would be likely created if the tributaries are diverted.
- The northern districts of Karnataka, Belagavi, Dharwad, Gadag and Bagalkot, are pressing for an out-of-court settlement with Goa and a speedy implementation of the project that could solve their drinking water crisis.

Mahadayi Water Dispute Tribunal final award: The tribunal in its final award in Auguest 2018 allocated 13.45 tmc feet of water (including 5.40 tmc for consumptive) to Karnataka, 24 tmc to Goa and 1.33 tmc to Maharashtra.

►COMPOSITE WATER MANAGEMENT INDEX

NITI Aayog released Composite Water Management Index (CWMI).

Aim: To assess and improve the performance in efficient management of water resources.

FINDINGS

- Index evaluates states on nine broad sectors and 28 indicators.
- 14 of the 24 states analysed, scored below 50% on water management and have been classified as "low performers".
- 21 Indian cities including Delhi, Bengaluru, Chennai and Hyderabad will run out of groundwater by 2020, affecting 100 million people.

SIGNIFICANCE

It will ensure that the principle of competitive and cooperative federalism is actualised in India's water management system

►CONFERENCE ON SUSTAINABLE WATER MANAGEMENT

The first International Conference under the aegis of National Hydrology Project, Union Ministry of Water Resources, River Development and Ganga Rejuvenation was organized by Bhakra Beas Management Board (BBMB).

AIM

- To foster the participation of and dialogue between various stakeholders, including governments, the scientific and academic communities, so as to promote sustainable policies for water management,
- To create awareness of water-related problems, motivate commitment at the highest level for their solution and thus promote better management of water resources at local, regional, national and international levels.
- The main aim is to bring advancement in water management system to further reduce flood and draughts all over the Globe.

►FORMALIN (METHANAL) CONTAMINATION

- Formalin is the aqueous solution of formaldehyde.
- Pure formaldehyde is a colourless, flammable gas with a strong pungent odour. It is extremely irritating to the mucous membranes and is associated with certain types of cancer in humans and other animals.
- It is mainly used in the production of industrial resins, e.g., for particle board and coatings.
- The Food Safety and Standards Authority of India (FSSAI) has banned formaldehyde in fresh fish, while the International Agency for Research on Cancer labelled the chemical a carcinogen.

►SOLID WASTE MANAGEMENT, 2016 RULES

- Mandatory Segregation- All waste generators will have to segregate and store the waste generated by them under three separate categories - bio-degradable, non-bio-degradable and domestic hazardous waste - in suitable bins before handing it over to authorised rag pickers or waste collectors.
- Concept of Extended Producer Responsibility: Local bodies can charge a fee from generator of wastes. The new rules have asked all such brand owners who sell products in non-biodegradable packaging material to put in place a system to collect back the packaging waste generated due to their production (ET).
- Burning of Solid Waste has been prohibited
- Social Dimension has been adequately considered. Rag pickers are to be integrated in the formal system.
- Increasing Coverage: The new rules will now apply much beyond the municipal areas, extending to urban agglomerations, census towns, notified industrial townships, areas under the control of Indian Railways, airports, airbase, port and harbour, defence establishments, special economic zones, State and Central State and Central government organizations, places of pilgrims, religious & historical importance. Event organizers, and new townships and group housing societies have been brought under the system.
- Waste-processing facilities to be set up by all local bodies having a population of 1 million or more.

►BIO-MEDICAL WASTE MANAGEMENT RULES, 2016

- Bio-medical waste has been classified in to 4 categories instead 10 to improve the segregation of waste at source and these 4 categories have colour-code.
  - Red Bin for plastic waste such as bottles, syringes, etc.
  - Yellow Bin for infectious wastes such as cotton, bandage, placenta, etc.
  - Blue Bin for glass bottles like discarded medicines
  - Black Bin for needles without syringes, metal articles, etc.
- Phase-out the use of chlorinated plastic bags, gloves and blood bags within two years.
- The ambit of the rules has been expanded to include vaccination camps, blood donation camps, surgical camps or any other healthcare activity.
- Pre-treatment of the laboratory waste, microbiological waste, blood samples and blood bags through disinfection or sterilisation on-site in the manner as prescribed by WHO or NACO.
- State Government to provide land for setting up common bio-medical waste treatment and disposal facility.
- No occupier shall establish on-site treatment and disposal facility, if a service of `common bio-medical waste treatment facility is available at a distance of seventy-five kilometers.
- The new rules prescribe more stringent standards for incinerator to reduce the emission of pollutants in environment.
- Inclusion of emissions limits for Dioxin and furans.
- Establish a Bar-Code System for bags or containers containing bio-medical waste for disposal.
- Provide training to all its health care workers and immunise all health workers regularly.

►E-WASTE (MANAGEMENT) AMENDMENT RULES, 2018

- Amendment in 2016 rules has been done with the objective of channelizing the E-waste generated in the country towards authorized dismantlers and recyclers in order to formalize the e-waste recycling sector.
- Collection targets under the provision of Extended Producer Responsibility (EPR) in the Rules have been revised and targets have been introduced for new producers who have started their sales operations recently.
- Some of the salient features of the E-waste (Management) Amendment Rules, 2018 are as follows:

1. The e-waste collection targets under EPR have been revised and will be applicable from 1 October 2017. The phase-wise collection targets for e-waste in weight shall be 10% of the quantity of waste generation as indicated in the EPR Plan during 2017-18, with a 10% increase every year until 2023. After 2023 onwards, the target has been made 70% of the quantity of waste generation as indicated in the EPR Plan.
2. The quantity of e-waste collected by producers from the 1 October 2016 to 30 September 2017 shall be

accounted for in the revised EPR targets until March 2018.

3. Separate e-waste collection targets have been drafted for new producers, i.e., those producers whose number of years of sales operation is less than the average lives of their products. The average lives of the products will be as per the guidelines issued by CPCB from time to time.
4. Producer Responsibility Organizations (PROs) shall apply to the Central Pollution Control board (CPCB) for registration to undertake activities prescribed in the Rules.
5. Under the Reduction of Hazardous Substances (RoHS) provisions, cost for sampling and testing shall be borne by the government for conducting the RoHS test. If the product does not comply with RoHS provisions, then the cost of the test will be borne by the Producers.

- Bhopal Municipal Corporation (BMC) and the Central Pollution Control Board (CPCB) have signed an agreement to set up the country's first e-waste clinic in Bhopal, Madhya Pradesh.

►HAZARDOUS AND OTHER WASTES (MANAGEMENT AND TRANS-BOUNDARY MOVEMENT) AMENDMENT RULES, 2019

- Solid plastic waste has been prohibited from import into the country including in Special Economic Zones (SEZ) and by Export Oriented Units (EOU).
- Exporters of silk waste have now been given exemption from requiring permission from the MOEFCC.
- Electrical and electronic assemblies and components manufactured in and exported from India, if found defective can now be imported back into the country, within a year of export, without obtaining permission from the MOEFCC.
- Industries which do not require consent under Water Act 1974 and Air Act 1981, are now exempted from requiring authorization also under the Hazardous and Other Wastes (Management & Trans-boundary Movement) Rules, 2016 provided that hazardous and other wastes generated by such industries are handed over to the authorized actual users, waste collectors or disposal facilities.

►WASTELAND ATLAS OF INDIA 2019

- It has been released by Department of Land Resources under the Ministry of Rural Development in collaboration with National Remote Sensing Centre (NRSC), Department of Space.
- The new wastelands mapping exercise, carried out by NRSC using the Indian Remote Sensing Satellite data is brought out as the fifth edition of Wastelands Atlas – 2019.
- India with 2.4% of total land area of the World is supporting 18% of the World's population. The per capita availability of agriculture land in India is 0.12 ha whereas World per capita agriculture land is 0.29 ha. Unprecedented pressure on the land beyond its carrying capacity is resulting into degradation of lands in the Country.

►MANDATORY PACKAGING IN JUTE MATERIALS

- The Cabinet Committee on Economic Affairs has mandated that 100% of the food grains and 20% of the sugar shall be mandatorily packed in diversified jute bags for the Jute Year 2019-20.
- Government has retained the scope of mandatory packaging norms under the Jute Packaging Material (JPM) Act, 1987.
- The act was enacted to protect the jute industry from the plastic packaging segment.

►SHIPPING INDUSTRY

The International Maritime Organization (IMO), the United Nations agency tasked with regulating shipping, had mandated that merchant ships should not burn fuel with sulphur content greater than 0.5%.

►BUNKER CONVENTION

- International Convention on Civil Liability for Bunker Oil Pollution Damage (BUNKER) is an international treaty listed and administered by the International Maritime Organization, enforced from November 2008.
- The purpose is to adopt uniform international rules and procedures for determining questions of liability and providing adequate compensation.
- The convention covers leakage of that oil and requires signatories to the convention to have their ships appropriately insured against such leakages.

- *India is yet to ratify International Convention on Civil Liability for Bunker Oil Pollution Damage* (BUNKER)

►OIL SPILL

An oil spill is the release of a liquid petroleum hydrocarbon into the environment, especially the marine ecosystem, due to human activity, and is a form of pollution.

HUMAN IMPACT

- Oil spill represents an immediate fire hazard.
- Spilled oil can also contaminate drinking water supplies.
- Contamination can have an economic impact on tourism and marine resource extraction industries.

ENVIRONMENT IMPACT

- Oil penetrates into the structure of the plumage of birds and the fur of mammals, reducing their insulating ability and their ability to fly.
- Animals who rely on scent to find their babies or mothers cannot survive due to strong scent of oil.
- Oil can also blind an animal, leaving it defenseless.
- Oil spills can also harm air quality. The chemicals in crude oil are mostly hydrocarbons that contains toxic chemicals that can introduce adverse health effects when being inhaled into human body.

OIL ZAPPING

- It is a bio-remediation technique of using the bacteria to get rid of oil spill. Oil zapper is essentially a cocktail of five different bacterial strains. Oil zapper's uniqueness lies in the bio-friendly manner in which it detoxifies oily sludges and cleans up oil slicks.
- OiliVorous is more efficient than oilzapper to degrade oily wastes. As it has an additional bacterial strain that makes the former more effective.

►REGIONAL OIL SPILL CONTINGENCY PLAN

- The SACEP jointly with the International Maritime Organization (IMO) developed a "Regional Oil Spill Contingency Plan".
- To facilitate international cooperation and mutual assistance in preparing and responding to major oil pollution incidents in the seas around Bangladesh, India, Maldives, Pakistan and Sri Lanka.

►HONG KONG CONVENTION

- Adopted by the International Maritime Organization (IMO) in 2009 for Safe and Environmentally Sound Recycling of Ships.
- India is the leader in the global ship recycling industry, with a share of over 30% of the market.
- Indian Parliament passed the Recycling of Ships Bill to enforce this convention.

NOTE: Alang in Bhavnagar district of Gujarat, has become a major worldwide centre for ship breaking.

►DECARBONIZING SHIPPING: GETTING TO ZERO COALITION

- Aim of the Coalition is to have commercially viable zero emission vessels (ZEVs) operating along deep-sea trade routes by 2030.
- Members across the maritime value chain commit to making this ambitious target a reality and thereby deliver on the target of reducing emissions from shipping by at least 50 percent by 2050.
- Alliance of more than 90 companies within the maritime, energy, infrastructure and finance sectors, supported by key governments and IGOs.
- The Coalition is committed to getting commercially viable deep sea zero emission vessels powered by zero emission fuels into operation by 2030 – maritime shipping's moon-shot ambition.

POLLUTION AUTHORITIES

►CENTRAL POLLUTION CONTROL BOARD (CPCB)

- It is a statutory organisation that was constituted in 1974 under the Water (Prevention and Control of Pollution) Act, 1974.
- It also provides technical services to the Ministry of Environment and Forests of the provisions of the Environment (Protection) Act, 1986.
- Further, CPCB is entrusted with the powers and functions under the Air (Prevention and Control of Pollution) Act, 1981.

AIM

- To promote cleanliness of streams and wells in different areas.
- To improve the quality of air and to prevent, control or abate air pollution in the country.

►SYSTEM OF AIR QUALITY AND WEATHER FORECASTING AND RESEARCH (SAFAR)

- Introduced by the Ministry of Earth Sciences (MoES), GOI.
- SAFAR for greater metropolitan cities of India is to provide location specific information on air quality in near real time and its forecast 1-3 days in advance for the first time in India.
- It has been combined with the early warning system on weather parameters.
- The implementation of SAFAR is made possible with an active collaboration with local municipal corporations and various local educational institutions and governmental agencies in that Metro city.
- The ultimate objective of the project is to increase awareness among general public regarding the air quality in their city well in advance so that appropriate mitigation measures and systematic action can be taken up for betterment of air quality and related health issues.

COMPONENTS OF SAFAR

- The development of emission inventory of air pollutants for NCR and defining air quality index for India.
- network of eleven Air Quality Monitoring Stations (AQMS) equipped with 11 automatic weather stations to provide near real time air quality information.
- 3-D atmospheric chemistry transport forecasting modelling coupled with weather forecasting model to provide 24-hour advance forecast of air pollutant levels.
- display on LED and LCD screens located at 20 different locations in Delhi in a public friendly format and displaying the online detailed information through the Web portal.
    - **Pollutants monitored:** PM1, PM2.5, PM10, Ozone, CO, NOx (NO, NO2), SO2, BC, Methane (CH4), Non-methane, hydrocarbons (NMHC), VOC's, Benzene, Mercury.
    - **Monitored Meteorological Parameters:** UV Radiation, Rainfall, Temperature, Humidity, Wind speed, Wind direction, and solar radiation.

POLLUTION RELATED CONVENTIONS

►MINAMATA CONVENTION

- It is an international treaty that aims to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds.
- The Convention is named after the Japanese city Minamata.
- This naming is of symbolic importance as the city went through devastating incident of mercury poisoning.

►NITROGEN POLLUTION

18 research institutions in India are among a group of 50 institutions — called the South Asian Nitrogen Hub (SANH) that have secured about ₹200 crores from the U.K. government to assess and study the quantum and impact of "nitrogen pollution" in South Asia.

FORMS OF NITROGEN

- Nitrogen is one of the five major chemical elements that are necessary for life.
- While nitrogen is the most abundant of these, more than 99% of it occurs as molecular nitrogen, or N2, which cannot be used by most organisms.
- This is because breaking the triple bond holding the two nitrogen atoms together requires a large amount of energy, which can be mustered only through high-temperature processes or by a small number of nitrogen-fixing microbes.
- Most living organisms can only make use of reactive nitrogen, which includes inorganic forms of nitrogen like ammonia, ammonium, nitrogen oxide, nitric acid, nitrous oxide, and nitrate, and organic compounds like urea, amines, proteins, and nucleic acids.
- It includes any nitrogen compound that is radioactively, chemically or biological active and stratospheric ozone depletion.

N_2	Un-reactive di-nitrogen; forms 78% of the air we breathe
NR	Reactive nitrogen; fixed in soil by microbes; reacts to form different compounds with various impacts
NH_3	Ammonia; used for making fertilizers; can escape into the air as a pollutant.
NH_4NO_3	Ammonium nitrate, acts as fertilizer; when synthesized in the atmosphere, contributes to particulate matter, water pollution and

	results in eutrophication.
N_2O	Nitrous oxide, a greenhouse gas; depletes ozone layer
NOx	Mixture of NO and NO2; a major air pollutant.
NO_3	Nitrate: the form in which nitrogen gets fixed in soil; can pollute water sources; forms ozone, which adds to particulate matter load.

►INTERNATIONAL NITROGEN INITIATIVE

- It is an international program, set up in 2003 under the sponsorship of Scientific Committee on Problems of the Environment (SCOPE) and the International Geosphere-Biosphere Program (IGBP).
- Aim of INI are
  - Optimize nitrogen's beneficial in sustainable food production
  - Minimize nitrogen's negative effects on human health and environment.
- The program is currently a sustained partner of Future Earth.
- INI holds conferences every three years.
- Indian scientist Nandula Raghuram has been elected as the chair of INI. He is the first Indian and Asian to be elected.

WHAT IS CAUSING NITROGEN POLLUTION?

In the pre-human world, a small amount of usable reactive nitrogen was created from N_2 by lightning and biological nitrogen fixation, but the spread of reactive nitrogen was held in check by denitrification, a process that converts reactive N back to N_2.

This is no longer the case. Human beings have dramatically altered the nitrogen balance. We have done so by cultivating legumes, rice, and other crops that promote nitrogen fixation, by burning fossil fuels, and by transforming nonreactive atmospheric nitrogen to ammonia to sustain food production and some industrial processes.

- Nitrogen is a dominant gas in the atmosphere and is inert and doesn't react.
- However, when it is released as part of compounds from agriculture, sewage and biological waste, nitrogen is considered "reactive", and it may be polluting and even exert a potent greenhouse gas effect.
- Indian NO x emissions grew at 52 % from 1991 to 2001 and 69% from 2001 to 2011.
- Nitrogen particles make up the largest fraction of PM2.5, the class of pollutants closely linked to cardiovascular and respiratory illness.

The recent global increase of reactive nitrogen by all human sources has far outstripped production from all natural terrestrial systems, and since the 1960s, the rate of increase has accelerated sharply.

►INDIAN NITROGEN ASSESSMENT

- INI, is a book, is the first-ever quantitative assessment of nitrogen pollution in India.

KEY FINDINGS OF INDIAN NITROGEN ASSESSMENT:

(a) Nitrogen particles make up the largest fraction of PM2.5 (it is related to that class of pollutants which is related to cardiovascular and respiratory illness).

(b) Agriculture remains the largest contributor to nitrogen emissions. However, the non-agricultural emissions of nitrogen oxides and nitrous oxide are growing rapidly, with sewage and fossil-fuel burning — for power, transport and industry — leading the trend.

(c) Annual NOx emissions from coal, diesel and other fuel combustion sources are growing at 6.5% a year.

(d) Since 2002, N2O has replaced methane as the second largest Greenhouse Gas (GHG) from Indian agriculture.

(e) Chemical fertilizers (over 82% of it is urea) account for over 77% of all agricultural N2O emissions in India.

►NOISE POLLUTION

- UNEP Reports on Frontiers 2022 has highlighted the need for regulation of Noise Pollution.
- The report compiles studies about noise levels in several cities around the world and illustrates a subset of 61 cities and the range of dB (decibel) levels that have been measured.
- Delhi, Jaipur, Kolkata, Asansol & Moradabad are the five Indian cities mentioned in this list.
- Moradabad, Uttar Pradesh is the second noisiest city in the list. Dhaka was the most noise polluted city with 119 dB.

- World Health Organization (WHO) guidelines established a health protective recommendation for road traffic noise levels of 53 dB.

PERMISSIBLE NOISE LEVEL IN INDIA

- CPCB has laid down permissible noise levels in India for different areas. Noise pollution rules have defined acceptable level of noise in different zones for both daytime and night-time.
- In industrial areas, the permissible limit is 75 dB for daytime and 70 dB at night.
- In commercial areas, it is 65 dB and 55 dB, while in residential areas it is 55 dB and 45 dB during daytime and night respectively.

Category of Area / Zone	Limits in L_{eq} dB(A)	
	Day Time*	Night Time**
Industrial area	75	70
Commercial area	65	55
Residential area	55	45
Silence/Sensitive Zone	50	40
*Daytime shall mean 6:00 A.M. to 10:00 P.M. **Night time shall mean 10:00 P.M. to 6:00 A.M.		

REGULATIONS FOR NOISE POLLUTION

- Earlier, noise pollution & its sources were addressed under Air (Prevention and Control of Pollution) Act, 1981.
- Noise pollution is currently regulated under Noise Pollution (Regulation and Control) Rules, 2000.
- Additionally, noise standards for motor vehicles, air-conditioners, refrigerators, diesel generators and certain types of construction equipment are prescribed under Environment (Protection) Rules, 1986.
- Noise emanating from industry is regulated by State Pollution Control Boards/Pollution Control Committees (SPCBs /PCCs) for state/UTs under Air (Prevention and Control of Pollution) Act, 1981.

ABOUT NOISE POLLUTION

- Any unwanted sound that causes annoyance, irritation and pain to human ear is termed noise. It is measured in A-weighted decibels (dB (A)) that indicate loudness of sound.
- Noise level refers to decibel levels of noise produced by any appliance or machine. In general, human ear can tolerate noise levels up to 85 db. Anything beyond that can affect human productivity & quality of life.
- Decibel levels of common sounds above 80 dB are considered loud, while decibel levels of common sounds between 100-125 dB are termed uncomfortable.
- All machines operating in an area should produce noise within acceptable level to maintain well-being of people around.

IMPACTS OF NOISE POLLUTION

- Sleep disturbance
- Physiological and psychological stress
- Hormonal imbalance
- Cardiovascular & metabolic disorders such as elevated blood pressure, arterial hypertension, coronary heart disease and diabetes.
- Premature deaths and congestive heart failure
- Increased incidence of Type 2 diabetes & hypertension.

MAKE LISTENING SAFE INITIATIVE

An initiative of WHO to protect people from hearing damage due to unsafe recreational listening practices.

►WHO GLOBAL AIR QUALITY GUIDELINES – 2021

World Health Organisation has released new guidelines for Global Air Quality Guidelines. Earlier WHO guidelines were released in 2005.

OBJECTIVES

- Provide evidence-based recommendations for air quality guideline levels for 6 pollutants PM 2.5, PM 10, Nitrogen dioxide, Ozone, sulfur dioxide and carbon monoxide.
- These guidelines are not legally binding standards, however, they do provide countries standards to follow while maintaining ambient air quality.
- Guidelines offer additional AQG levels, such as for peak season O_3 and 24-hour NO_2 and CO, as well as some new interim targets.
- Ultrafine Particles: They are particulates with a diameter less than or equal to 0.1 micrometers or 100 nanometers. Main sources of Ultrafine particles include vehicles and other forms of transportation (aviation or shipping), industrial and power plants and residential heating.
- Black carbon/Elemental carbon: It is a measure of airborne soot like carbon that is determined with optical measures. It is closely related to mass concentration of elemental carbon. BC/EC is typically formed through incomplete combustion of fossil fuels, biomass and biofuel. It consists of pure carbon in several forms. Black carbon has adverse health

effects and can be even cancerous. Black carbon is a powerful climate-warming agent that acts by absorbing heat in the atmosphere and by reducing albedo (the ability to reflect sunlight) when deposited on snow and ice.

- Sand & Dust Storms: Desert dust is usually composed of mineral particles that originate from arid and semi-arid land surfaces, but "sometimes, after having travelled great distances, they may be observed over areas where no dust or sand covers the ground".
- **INITIATIVES FOR AIR POLLUTION**
- WHO Global Ambient Air Quality Database: It provides information on the annual average concentrations of PM 2.5 and PM 10 for specific cities based on available measurements (including averages from multiple monitors within a single city, where these are available).
- OpenAQ: A non-profit making effort to maintain an open-source database of aggregated current and archived air quality data gathered in real time from government agencies.

►PRANA PORTAL

- PRANA Portal will be used to track the progress of the National Clean Air Program (NCAP) to comply with India's commitment to ensure clean air and blue skies to everybody.
- It will help in tracking physical and financial status of city air action plan implementation.
- It will also disseminate information on air quality to the public. This portal was launched on 'International Day of Clean Air for Blue Skies' in nonattainment cities (NAC). Non-attainment cities are those cities that failed to meet the National air quality standards in a five-year period. With India's efforts, 86 cities showed a better air quality in 2019 and it increased to 104 cities in 2020.
- NCAP TARGETS Central Pollution Control Board (CPCB) seeks to achieve 20-30 percent reduction in particulate matter (PM10 as well as PM2.5) concentrations in India by 2024 under the program. To achieve the target, India has prepared and is implementing city-specific action plans to improve air quality in 132 NACs/Million Plus Cities. It targets city-specific air polluting sources like soil & road dust, vehicles, MSW burning, domestic fuel, construction material and industries.

►COMMON POLLUTANTS

POLLUTANTS	SOURCES	HEALTH EFFECTS	OTHER RELATED INFORMATION
Mercury	Coal Combustion, small scale gold mining	Minamata disease (Affects nerves) Mercury reacts inside the body to form Methyl mercury which is fatal for human health	Minamata Convention signed by UN in 2015 and entered into force in 2017. It has imposed ban on new mercury mines and declared phasing out of new mines. Kodaikanal mercury poisoning case that caused poisoning of kodaikanal lake and led to closure of factory in 2001.
Cadmium	Used in Ni-Cd batteries, colouration of plastics and various discarded electronic products	Itaiitai Disease (Softening of bones and causes kidney stones)	Western U.P is most affected by Cadmium poisoning in India.
Lead	Vehicular emissions, ore and metal processing, lead acid battery manufacturers, paints	Affects Liver and Kidney, mental retardation and abnormality in fertility and pregnancy	MoEFCC has prohibited manufacture, trade, import and export of household and decorative paints containing lead.
Fluorine	Fluoride in air, soil and water	Knock knee syndrome that causes outward bending of knees, stiffness of joints, humped back.	Rajasthan, Gujarat and A.P are amongst the worst affected states in India
Coal Dust	Coal mines, heavy	Pneumoconiosis also	Chhattisgarh, Odisha, Jharkhand, West

	industry	known as black lung disease.	Bengal
Silica	Sand blasting, ship breaking industry	Silico - tuberculosis	Alang in Gujarat is worst affected, Rajasthan, U.P, Bihar, Chhattisgarh, Jharkhand, Odisha, West Bengal
Nitrate	Nitrate contamination of Ground Water due to pesticide in agriculture and vehicular emissions	Blue baby syndrome (Decreased oxygen carrying capacity of haemoglobin)	Rae Bareli district of U.P is worst affected by Nitrate pollution
Arsenic	Ground water contamination	Causes skin cancer, cancer of lungs, affects kidney and in rare cases is linked to diabetes	Ganga Brahmaputra fluvial plains
Hexavalent Chromium	Naturally occurring heavy metal, used in leather and tanneries industry	Respiratory and Gastro-intestinal problems and Carcinogenic	Kanpur is the most affected area along with certain regions of West Bengal. CSIR has recently developed waterless chrome tanning technology.
Dioxins	Production and disposal of Poly Vinyl Chloride, also production of chlorinated paper and biomedical waste is a source for Dioxins	Causes Cardiovascular diseases, diabetes, cancer, early menopause, etc.	
Dichlorine Diphenyl Tricholoroethane	Pesticide usage	It causes vomiting, shakiness and seizures. It is considered as carcinogenic	DDT is to be banned under Stockholm convention from 2020 but India has strongly opposed the move
Brominated Flame Retardents	Used in mattresses and electronic component to reduce fire related injury	Carcinogenic, development retardant	It has tendency to stay for long in environment. It is banned under Stockholm Convention on Persistent Organic Pollutant
Aflatoxins	Produced by moulds (fungi) where cereals and oilseeds are mishandled.	Carcinogenic & poisonous	ICRISAT has made peanuts free of aflatoxins
Radon	Naturally occurring radioactive gas	Lung cancer	It has spread across few areas of Bangalore
PM 2.5	Vehicular emission	Affects functioning of lung, chronic cough, asthma and heart disease	
PM 10	Vehicular emission	Affects functioning of lung, chronic cough, asthma and heart disease	
Polychlorinated Biphenyl (PCB)	Illegal or improper dumping of PCB waste	It causes rashes in skin and affects liver. It is a Carcinogenic compound of chlorine.	
Endosulphan	Sprayed as a pesticide on crop such as tea, paddy, cashew, etc	Causes dysfunctioning of endocrine glands and affects DNA	Kerala farmers have faced severe toxicity from Endosulphan pollution sprayed on cashew plants.

		strands in human beings. It causes mental and physical and physical disorders.	It is banned under Stockholm Convention on Persistent Organic Pollutant
Radioactive Pollution	It is caused by exposure to Radioactive substances Uranium, Thorium, Radium, etc.	Unsafe exposure to radiation leads to various health problems such as cancer, mutation etc.	Rem is the unit of biological damage caused to human beings. It is equivalent to the injury caused by given amount of X-ray. ATOMIC ENERGY REGULATORY BOARD regulates radioactive substances in India.

ENERGY EFFICIENCY IN INDIA

►ENERGY CONSERVATION ACT, 2001

- The Act provides for the legal framework, institutional arrangement and a regulatory mechanism at the Central and State level for energy efficiency in the country.
- It called for the creation of Bureau of Energy Efficiency (BEE) at the central level to facilitate the implementation of the EC Act.
- The Act provides regulatory mandate for: standards & labelling of equipment and appliances; energy conservation building codes for commercial buildings; energy consumption norms for energy intensive industries; and Establishment of Energy Conservation Fund (both at center and state).

►BUREAU OF ENERGY EFFICIENCY (BEE)

- It is a statutory body established in 2002, under the Energy Conservation Act, 2001.
- It functions under the Ministry of Power. Minister of power shall be the ex-officio chairman of the bureau.
- Mandate: It facilitates the implementation of the EC Act by developing policies and strategies which focus on the primary objective of reducing energy intensity of the Indian economy.
- It is responsible for spearheading the improvement of energy efficiency of the economy through various regulatory and promotional instruments
- It coordinates with State level agencies.
- The members of the governing council of the bureau are appointed by the central government.

►SCHEMES TO PROMOTE ENERGY CONSERVATION AND ENERGY EFFICIENCY

The Ministry of Power, through Bureau of Energy Efficiency (BEE), has initiated several energy efficiency initiatives. Some major of them are:

STANDARDS AND LABELING (FOR EQUIPMENT AND APPLIANCES)

- Started in 2006, the energy efficiency labeling programs under BEE are intended to reduce the energy consumption of appliance without diminishing the services it provides to consumers.
- The scheme targets display of energy performance labels on high-energy end-use equipment &appliances and lays down minimum energy performance standards, to provide the consumer an informed choice about the energy and cost saving potential.
- Under the scheme the following are the mandatory appliances - Room Air Conditioners, Fluorescent Tube Lights, Frost Free Refrigerators, Distribution Transformers, Induction Motors, Direct Cool Refrigerator, electric storage type geyser, LEDs lamp, Variable Capacity Inverter Air conditioners and Colour TVs.

ENERGY CONSERVATION BUILDING CODES (ECBC)

- The Energy Conservation Building Code (ECBC) was developed by Govt. of India for new commercial buildings in May 2007.
- ECBC sets minimum energy standards for new commercial buildings having a connected load of 100kW or contract demand of 120 KVA and above.
- While the Central Government has powers under the EC Act 2001, the state governments have the flexibility

to modify the code to suit local or regional needs and notify them.

- In 2017 ECBC was revised to incorporate advanced technologies.
- Additional parameters included are:
  - Technology neutrality, it grants engineers artistic and technical freedom.
  - Mandatory installation of renewable energy generation systems
  - Mandatory use of Passive designs strategies like daylight and shading.
- Such that-
  - Energy neutrality is achieved in commercial buildings.
  - Energy savings is optimized within the comfort levels for occupants.

LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN (LEED)

- LEED is the most widely used rating system for the design, construction and operation of high-performance green buildings in the world.
- Available for virtually all building, community and home project types.
- LEED certification is a globally recognized symbol of sustainability achievement.
- To strengthen the global consistency of the LEED rating system, from 2014, GBCI (Green Business Certification Inc.) began managing the certification process for all LEED rating systems in India, including the LEED India rating system, which was previously managed by the Indian Green Building Council (IGBC).

GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT (GRIHA)

- GRIHA is a green building design evaluation system.
- It is a rating tool that helps people assesses the environmental performance of their building holistically against certain nationally acceptable benchmarks of accepted energy and environmental principles. Thereby providing a definitive standard for what constitutes a 'green building'.
- Internationally, GRIHA has been recognized as an innovative tool for sustainable development by the United Nations.

DEMAND SIDE MANAGEMENT (DSM) SCHEME

In order to tap the energy saving potential, Agriculture Demand Side Management (AgDSM) program was initiated by Bureau of Energy Efficiency with an objective to induce energy efficiency in agriculture sector by creating market-based framework for implementation of few pilot projects and create awareness among end users & other stakeholders for adoption of energy efficient pump sets (EEPS).

KUSUM

- The Cabinet Committee on Economic Affairs (CCEA) has approved the launch of KUSUM, Kisan Urja Suraksha evam Utthaan Mahabhiyan scheme which inter-alia aims to promote use of solar energy among the farmers. The proposed scheme provides for:
  - Setting up of grid-connected renewable power plants each of 500KW to 2 MW in the rural area.
  - Installation of standalone off-grid solar water pumps to fulfil irrigation needs of farmers not connected to grid; and
  - Solarization of existing grid-connected agriculture pumps to make farmers independent of grid supply and sell surplus solar power generated to Discom and get extra income.
  - This scheme will be implemented by Ministry of Ministry of New and Renewable Energy.

ENERGY EFFICIENCY IN SMALL AND MEDIUM ENTERPRISES (SMES) SECTOR

To encourage the energy efficient technologies and operational practices in SME sectors in India, BEE has initiated the energy efficiency interventions in selected 25 SMEs clusters.

- Bureau of Energy Efficiency, in collaboration with United Nations Industrial Development Organization (UNIDO), is implementing the Global Environmental Facility (GEF) funded national project "Promoting energy efficiency and renewable energy in selected micro, small and medium enterprises (MSME) clusters in India"
- The project aims to develop and promote market environment for introducing energy efficient technologies and enhancing the use of renewable energy technologies in process applications in energy intensive MSMEs in 5 sectors (brass, ceramics, dairy, foundry and hand tools)

►NATIONAL MISSION FOR ENHANCED ENERGY EFFICIENCY (NMEEE)

- The National Mission for Enhanced Energy Efficiency (NMEEE) is one of the eight national missions under the National Action Plan on Climate Change.

- NMEEE aims to strengthen the market for energy efficiency by creating conducive regulatory and policy regime and has envisaged fostering innovative and sustainable business models to the energy efficiency sector.
- It is being jointly implemented by Bureau of Energy Efficiency and Energy Efficiency Services Limited EESL.

→ COMPONENTS OF NMEEE

1. Perform, achieve and trade (PAT)
2. Market transformation for energy efficiency (MTEE)

- It aims to make the market shift to energy efficient appliances in certain sectors by using incentives and innovative business models.
- Under MTEE, two programs have been developed i.e., Bachat Lamp Yojana (BLY) and Super-Efficient Equipment Program (SEEP).

3. Bachat Lamp Yojana (BLY)

- It is a public-private partnership program comprising of BEE, Distribution Companies (DISCOMs) and private investors to accelerate market transformation in energy efficient lighting.
- Under this program, over 29 million incandescent bulbs have been replaced by CFLs under this program.
- In the next phase of BLY, BEE will promote use of LED lights using the institutional structure of BLY Program.

4. Super-Efficient Equipment Program (SEEP)

- SEEP is a program designed to bring accelerated market transformation for super-efficient appliances by providing financial stimulus innovatively at critical point/s of intervention.
- Under this program, ceiling fan has been identified as the first appliance to be adopted.

5. Energy Efficiency Financing Platform (EEFP)

- Under this, MoUs have been signed with financial institutions to work together for the development of energy efficiency market and for the identification of issues related to this market development.
- Facilitating Financial Institutions to invest in Energy Efficiency Projects and Programs

6. ENERGY SERVICE COMPANIES (ESCOs)

- These are companies that offer energy services, usually design, retrofitting and implementation of energy efficiency projects after identifying energy saving opportunities through energy audit of existing facilities.
- It helps in arranging finances for energy efficiency projects by providing a savings guarantee, risk management in the implementation of the energy efficiency projects and perform measurement and verification(M&V) activities to quantify actual energy savings post implementation of energy efficiency projects

►ENERGY EFFICIENCY SERVICES LIMITED (EESL)

- It is Joint Venture of NTPC Limited, PFC, REC and POWERGRID to facilitate implementation of energy efficiency projects.
- It will be the first such company exclusively for implementation of energy efficiency in South Asia and amongst a very few such instances in the world.
- EESL will also lead the market-related actions of the NMEEE.

►UJALA SCHEME: UNNAT JYOTI BY AFFORDABLE LEDS FOR ALL

- The program is based on demand aggregation, mass awareness, bulk procurement, designed to attract the support of utility companies, state governments, and the price conscious Indian public.
- EESL procures the appliances and provides them to consumers at a rate of Rs 70/LED bulb, Rs 220/LED tube light and Rs 1110/Fan respectively.
- The scheme involves no subsidies.

►LIGHTING A BILLION LIVES (LABL)

- It is a campaign started by TERI which promotes and encourages people to use solar lanterns.
- The high-quality and cost-effective solar lanterns are provided on a decentralized basis (through micro solar-enterprises set-up in un-electrified or poorly electrified villages).
- LaBL engages private sector through Corporate Social Responsibility and is a great example of how public-private -people partnership can support rural development.

►ECO MARK

- Eco mark is a certification mark issued by the Bureau of Indian Standards (BEE)to products conforming to a set of standards aimed at the least impact on the ecosystem.
- Under this initiative, all those households and other consumer products which meet certain

environmental criteria are labelled with an environment friendly mark.

►STATE ENERGY EFFICIENCY PREPAREDNESS INDEX

The Alliance for an Energy Efficient Economy (AEEE) under the leadership of the Bureau of Energy Efficiency (BEE) and NITI Aayog has released the first Nationwide 'State Energy Efficiency Preparedness Index'

This year's Index has 97 indicators covering all demand sectors – buildings, industry, municipalities, transport, agriculture – and DISCOMs.

►BIO-JET FUEL FLIGHT

India's first ever bio-jet fuel flight taken off by using the fuel developed by the CSIR-Indian Institute of Petroleum (IIP).

ABOUT THE INITIATIVE

- Aircraft was powered with a blend of 75% air turbine fuel (ATF) and **25% bio-jet fuel made from jatropha crop.**
- The bio-jet fuel developed by CSIR-IIP was **recognised by American Standard** for Testing and Material and received a patent by 2011.
- International standards permit a blend rate of up-to 50% biofuel with ATF.

ABOUT BIO JET FUEL

- It is a type of Biofuel which is produced from biomass resources and used in place of or blended with ATF.
- Bio jet fuel can be produced from animal fat, used cooking oil, waste dairy fat, sewage sludge, etc.
- The oil needs to have a freezing point below -47 degrees so it doesn't freeze at altitudes at which planes fly.
- It should not catch fire on ground when being transferred into a plane.
- It must have the same density as ATF, have a certain calorific value and should not choke the filters.
- It has lower sulphur content which causes less wear and tear.

►NATIONAL POLICY ON BIOFUELS – 2018

The Union Cabinet approved National Policy on Biofuels – 2018 to encourage the generation and use of biofuels.

FEATURES

- Categorisation of biofuels to enable extension of appropriate financial and fiscal incentives under each category. The two main categories are:
- Basic Biofuels- First Generation (1G) bioethanol & biodiesel
- Advanced Biofuels - Second Generation (2G) ethanol, Municipal Solid Waste (MSW) to drop-in fuels, third Generation (3G) biofuels, bio-CNG etc.
- Expands the scope of raw material for ethanol production by allowing use of Sugarcane Juice, Sugar containing materials like Sugar Beet, Sweet Sorghum, Starch containing materials like Corn, Cassava, Damaged food grains like wheat, broken rice, Rotten Potatoes, unfit for human consumption for ethanol production.
- Allows use of surplus food grains for production of ethanol for blending with petrol to ensure appropriate price to farmers during surplus.
- Encourages setting up of supply chain mechanisms for biodiesel production from non-edible oilseeds, used Cooking Oil, short gestation crops.

ABOUT BIOFUEL

- Biofuel is any hydrocarbon fuel that is produced from organic matter in a short period of time.
- This is in contrast with fossil fuels, which take millions of years to form.
- Biofuels are considered renewable form of energy as it emits less than fossil fuels.

DIFFERENT GENERATION BIOFUELS

- First Generation Biofuels: It uses the food crops like wheat and sugar for making ethanol and oil seeds for bio diesel by conventional method of fermentation.
- Second Generation Biofuels: It uses non-food crops and feedstock such as Wood, grass, seed crops, organic waste are used in fuel preparation.
- Third Generation Biofuels: It uses specially engineered Algae whose biomass is used to convert into biofuels. The greenhouse gas emission here will be low in comparison to others.
- Fourth Generation biofuel: It aimed at not only producing sustainable energy but also a way of capturing and storing CO_2.

►METHANOL FUEL

- Namrup-based Assam Petrochemicals Limited (APL) has rolled out the country's first methanol-based cooking fuel project- 'Green and Clean Fuel Pilot Project on Methanol Cooking Stove'.

- The project has been promoted by NITI Aayog.

ABOUT METHANOL

- Methanol is a clean-burning fuel that produces fewer smog-causing emissions — such as sulphur oxides (SOx), nitrogen oxides (NOx) and particulate matter — and can improve air quality and related human health issues.
- Methanol is most produced on a commercial scale from natural gas.
- It can also be produced from renewable sources such as biomass and recycled carbon dioxide.
- As a high-octane vehicle fuel, methanol offers excellent acceleration and power. It also improves vehicle efficiency.

►RENEWABLE ENERGY

Prime Minister announced at the United Nations Climate Action Summit that India's renewable energy target will be increased to 450 GW.

India would spend approximately $50 billion "in the next few years" on the Jal Jeevan Mission to conserve water, harvest rainwater and develop water resources.

PM ANNOUNCED TWO INTERNATIONAL INITIATIVES

- First, a platform with Sweden and other countries, for governments and the private sector to work together to develop low carbon pathways for industry.
- Second, a Coalition for Disaster Resilient Infrastructure. It is an international coalition of Countries, United Nations (UN) agencies, multilateral development banks, the private sector, and academic institutions, which aims to promote disaster-resilient infrastructure.

OCEAN ENERGY IS NOW RENEWABLE ENERGY

Recently, the Ministry of New and Renewable Energy has declared Ocean Energy as renewable energy.

PROJECT SUNRISE

Project Sunrise is collaboration between India and UK to deliver low-cost photovoltaics to rural India.

►CLEAN ENERGY

COAL GASIFICATION BASED FERTILISER PLANT

- India's first coal gasification-based fertiliser plant to be set up in Talcher, Odisha.
- It will produce Neem coated urea using coal and pet-coke as feedstock.

COAL GASIFICATION TECHNOLOGY

- It is one of the clean coal technologies and involves the process of converting coal into synthesis gas (also called syngas).
- Syngas is a mixture of hydrogen (H_2), carbon monoxide (CO) and carbon dioxide (CO_2).
- The by-products of coal gasification include coke, coal tar, sulfur, ammonia and fly ash, all having their own potential uses.
- CO_2 and ammonia are further reacted to produce urea.
- Syngas can also be used in a variety of other applications such as in the production of electricity, fuel for IC engines, making plastics, cement etc.

ENERGY STORAGE INITIATIVE

- Current main donors: UK, Germany, Norway.
- Donor countries together with World Bank Group/ESMAP in collaboration with the Climate Investment Funds (CIFs), including African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank launched Energy Storage Initiative with initially $500 million in funding.
- India is one of the recipient countries.

CLEAN COOKING FUND

The World Bank/ESMAP launched a planned $500 million Clean Cooking Fund (CCF) to scale up public and private investment in the clean cooking sector at the Climate Action Summit 2019.

►VEHICLE SCRAPPAGE POLICY

The vehicle scrappage policy is a government program to replace old vehicles from Indian roads. The policy is expected to reduce pollution, create job opportunities and boost demand for new vehicles. The policy has been proposed by Ministry of Road Transport and Highways.

PROPOSED INCENTIVES, DISINCENTIVES AND EXEMPTIONS

- Incentives for scrapping old vehicles and buying new ones:
  - Vehicle manufacturers can give up to 5% discount for buying new vehicles
  - Zero new registration fee
  - Scrap value equivalent of 4-6% of ex-showroom price of new vehicles
  - States can give up to 25% and 15% rebate on road tax for personal and commercial vehicles, respectively

- Reduced maintenance cost and increased savings from fuel Disincentives for keeping old vehicles:
  - States can levy an additional 'Green Tax'
  - Hike in renewal of registration fee for private vehicles
  - Increase in renewal of fitness certification for commercial vehicles
- Automatic deregistration of unfit vehicles Vehicles to be exempted:
  - Strong hybrids and electric vehicles
  - Vehicles using alternative fuels such as CNG, ethanol and LPG
  - Farm and agricultural equipment such as tractors, tillers and harvesters

►PLASTIC WASTE MANAGEMENT RULES AMENDMENT, 2021

- MOEFCC notified the Plastic Waste Management Amendment Rules, 2021, prohibiting identified single-use plastic items by 2022.
- Pollution due to single use plastic items has become an important environmental challenge confronting all countries.
- In the 4th United Nations Environment Assembly held in 2019, India had piloted a resolution on addressing single-use plastic products pollution, recognizing the urgent need for the global community to focus on this very important issue.

SALIENT FEATURES OF AMENDMENT TO PLASTIC WASTE RULES

- Prohibition: The manufacture, import, stocking, distribution, sale and use of following single-use plastic, including polystyrene and expanded polystyrene, commodities shall be prohibited with effect from the 1st July, 2022.
- Compostable plastic: The provisions will not apply to commodities made of compostable plastic.
- Timeline: The government has given industry ten years from the date of notification to comply with any future bans on plastic commodities other than those included in this notification.
- Thickness of plastic bags: The allowable thickness of plastic bags will be increased from 50 mm to 75 microns on September 30, 2021, and to 120 microns on December 31, 2022.
- Monitoring agency: The Central Pollution Control Board, along with state pollution bodies, will monitor the ban, identify violations, and impose penalties already prescribed under the Environmental Protection Act, 1986.
- Extended Producer Responsibility (EPR): According to the Plastic Waste Management Rules, 2016, the plastic packaging waste that is not covered under the phase out of identified single-use plastic items must be collected and managed in an environmentally sustainable manner through the Extended Producer Responsibility (EPR) of the Producer, Importer, and Brand Owner (PIBO).

►NATIONAL NATURAL RESOURCES MANAGEMENT SYSTEM (NNRMS)

The Scheme "National Natural Resources Management System (NNRMS)" of the Ministry is a Central Sector Scheme. The prime objective of NNRMS scheme is utilization of Remote Sensing Technology for Inventorization, Assessment and Monitoring of the country's natural resources.

MAJOR ACHIEVEMENTS OF THE SCHEME INTER ALIA INCLUDES

1. Development of knowledge-based decision tool to simulate mechanism of vegetation change due to climatic change in Western Himalayan Ecoregion;
2. Monitoring of Snow and Glaciers of Himalayan Region.
3. Desertification Status Mapping of India.
4. Soil and Water quality appraisal in the Salt Affected Landforms of Nagapattinam District, Tamil Nadu using Remote Sensing (RS) and Geographic Information System (GIS) techniques;
5. Application of Remote Sensing for Integrated Land use, Water and Energy Management in Rural Areas: Exploring Energy Plantation Opportunities, Public Systems Group.
6. Land use dynamics and its impact on microelements, structure, composition and diversity of Achanakumar - Amarkantak Biosphere Reserve using satellite remote sensing and GIS techniques; and
7. Natural Resources Assessment of selected Eco-Tourism sites of Gujarat and its associated environments using remote sensing and GIS.

►LEGACY WASTE

- Legacy wastes are the wastes that have been collected and kept for years at some barren land or a place dedicated for Landfill (an area to dump solid waste).
- They are more dangerous because –

  - They occupy large spaces and make the land unproductive. It is estimated that in India more than 10000 ha of land is a dump site.
  - They become breeding ground for pathogens and flies
  - They also lead to water pollution via ground water contamination.
  - They also contribute to generation of greenhouse gases and pose risk of uncontrollable fire.
- Bio mining (Bio- leaching): It is a process of using microorganisms (microbes) to extract metals of economic interest from rock ores or mine waste. Metals extracted from bio leaching includes gold, silver, uranium, Nickle, Copper, cobalt and zinc. Bio-mining techniques may also be used to clean up sites that have been polluted with metals.
- Bioremediation is a branch of biotechnology that employs the use of living organisms, like microbes and bacteria, in the removal of contaminants, pollutants, and toxins from soil, water, and other environments. Bioremediation is used to clean up oil spills or contaminated groundwater.

►EXTENDED PRODUCERS' RESPONSIBILITY (EPR)

- It is a policy approach under which producers are given a significant responsibility – financial and/or physical – for the treatment or disposal of postconsumer products.
- Assigning such responsibility could in principle provide incentives to prevent wastes at the source, promote product design for the environment and support the achievement of public recycling and materials management goals.
- In essence, EPR requires the manufacturer of a product, or the party that introduces the product into the community, to take responsibility for its life cycle.
- For example: An FMCG company should not only account for the costs of making, packing and distributing a packet of chips, but also for the collection and recycling/reuse of the packet.

REGULATIONS ON EXTENDED PRODUCERS' RESPONSIBILITY

In October 2021, the Environment Ministry published draft regulations on Extended Producer Responsibility (EPR), set to come into effect by the end of this year. The draft however has missed out on several important issues.

ABOUT EXTENDED PRODUCERS' RESPONSIBILITY (EPR)

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ACHIEVEMENTS OF THE DRAFT EPR POLICY

- Brand owners and e-commerce players have been brought under the ambit of EPR.
- EPR is now applicable to both pre-consumer and postconsumer plastic packaging waste.
- Producers and brand owners (PIBO) have finally been assigned targets for collection of plastic waste that they put out in the market.
- Provisions and targets for collection, re-use (by brand owners), recycling (by PBOs) and use of recycled plastic (by PIBOs) have been laid out.
- Bi-annual plastic characterisation studies.

SINGLE-USE PLASTIC

- SUP is plastic produced and designed to be thrown away after being used only once. By that definition, many products fall in the category. These include everything from a disposable straw to a disposable syringe.
- India has defined SUP as "a plastic commodity intended to be used once for the same purpose before being disposed of or recycled" in its Plastic Waste Management Amendment Rules, 2021.
- The SUP items to be phased out have been identified with the help of a report of an expert committee that was constituted by the Department of Chemicals and Petrochemicals. This committee was formed following the government's pledge to eliminate SUP by 2022 to examine, among other things, categories of SUP and to recommend which of them could be phased out.
- The assessment of SUP was conducted by comparing two pillars — the utility index of a particular type of SUP and the environmental impact of the same.
- The product that scores low on utility and high on environmental impact should be considered for immediate phase out.

►GREEN SOHRA DEVELOPMENT PROGRAM

- Union Minister of Home Affairs launched the 'Green Sohra Afforestation Program' under which multi-level farming will be adopted for the afforestation of Cherrapunji region. Sohra is the name of Cherrapunji region in Meghalaya. Cherrapunji region once used to receive rainfall all year round however due to deforestation this situation has changed.
- Under the program, Assam Rifles will lead efforts of afforestation in the region. 80% of land area will be planted with traditional and long lifespan trees while the remaining 20% will be used for animal feed, ornamental plants and nursery which will meet the needs of people and help reduce felling of long lifespan trees.

►e-FUEL

The Porsche has joined with Siemens Energy to produce eFuel by 2022. The project of eFuel production is called Haru Oni project.

WHAT ARE e-FUELS?

- eFuels are produced with the help of electricity from renewable energy sources, water and CO2 from the air.
- In contrast to conventional fuels, they do not release additional CO2 but are climate neutral.
- With their compatibility with today's internal combustion engines, eFuels can also power vehicles, airplanes and ships, thus allowing them to continue to operate but in a climate-friendly manner.
- The same applies to all heating systems that use liquid fuels. Existing transport, distribution and fuel infrastructures (especially filling stations) can also continue to be used.

PRODUCTION

- eFuel production is based on the extraction of hydrogen. This happens by means of an electrolysis process that breaks down water (Ex. seawater from desalination plants) into its components of hydrogen and oxygen. For this process and further production steps, electricity is required.
- In a second step, with the aid of Fischer-Tropsch synthesis, the hydrogen is combined with CO2 extracted from the air and converted into a liquid energy carrier:
  - Under high pressure using a catalyst, the hydrogen binds with the CO2. Because electricity is used to produce eFuels, the procedure is known as a power-to-liquid (PtL) process: electricity is converted into a synthetic liquid that is easy to store and simple to transport.

►E-AMRIT PORTAL

- It is a web portal on electric vehicles (EVs), was launched by India at the COP26 Summit in United Kingdom's Glasgow.
- It is a one-stop destination for all information on electric vehicles—busting myths around the adoption of Evs, their purchase, investment opportunities, policies and subsidies.
- The portal has been developed and hosted by NITI Aayog under a collaborative knowledge exchange program with the UK government and as part of the UK-India Joint Roadmap 2030.

►AMMONIA POLLUTION

- It is a pollution by the chemical ammonia (NH3) – a compound of nitrogen and hydrogen.
- Ammonia is a colourless gas and is used as an industrial chemical in the production of fertilisers, plastics, synthetic fibres, dyes and other products.
- It occurs naturally in the environment from the breakdown of organic waste matter, and may also find its way to ground and surface water sources through industrial effluents or through contamination by sewage.
- If the concentration of ammonia in water is above 1 ppm it is toxic to fishes. In humans, long term ingestion of water having ammonia levels of 1 ppm or above may cause damage to internal organs. It decreases the biodiversity of terrestrial and aquatic ecosystems and forms aerosols in the atmosphere which can cause human health complications if inhaled.

►ZERO LIQUID DISCHARGE (ZLD)

- An engineering approach to water treatment where all water is recovered and contaminants are reduced to solid waste.
- While many water treatment processes attempt to maximize recovery of freshwater and minimize waste, ZLD is the most demanding target since the cost and challenges of recovery increase as the wastewater gets more concentrated.
- Salinity, scaling compounds, and organics all increase in concentration, which adds costs associated with managing these increases.

- ZLD is achieved by stringing together water treatment technology that can treat wastewater as the contaminants are concentrated.

►MICROPLASTICS

Microplastics are small plastic particles less than 0.2 inches (5 millimeters) long, according to the National Oceanic and Atmospheric Administration (NOAA).

WHERE DO MICROPLASTICS COME FROM?

Microplastics often originate from macroplastics that have broken apart in the ocean. Plastic may break apart due to weathering from the sun, wind, or other causes. The microbeads in many personal care products such as toothpaste and facial scrubs also count as microplastics.

IMPACT OF MICROPLASTICS ON ENVIRONMENT

Though they are small, these bits of plastic bring similar issues that macroplastics do — plus their own set of harms. These small particles serve as carriers for bacteria and persistent organic pollutants (POPs).

- POPs are toxic organic compounds that take years to degrade. They consist of chemicals like pesticides and dioxins, which are hazardous to human and animal health in high concentrations. POPs biomagnify as they move up the food chain, meaning that larger animals accumulate more of these toxic substances within their fat and tissues than smaller organisms. POPs aren't very water-soluble.

WORLD HERITAGE FORESTS

- Published by: UNESCO, World Resources Institute & IUCN.
- Purpose: Provides first global scientific assessment of greenhouse gas emissions and sequestration by forests in UNESCO World Heritage sites.

RENEWABLE ENERGY

►BIO-GAS

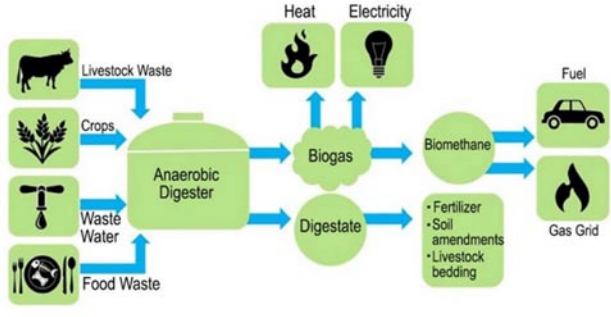
Biogas is produced when bio-degradable organic materials/wastes such as cattle-dung, biomass from farms, gardens, kitchens, industry, poultry droppings, night soil and municipals wastes are subjected to a scientific process, called Anaerobic Digestion (A.D.) in a Biogas Plants. Biogas Plant designs depend upon several factors and the feed stock to be processed is of paramount importance. Biogas is the mixture of gases (primarily methane (CH_4) and Carbon di-oxide (CO_2) and traces of Hydrogen Sulfide (H_2S), Moisture) produced by the decomposition/breakdown of bio-degradable organic matter in the absence of oxygen from raw materials such as agricultural waste, cattle dung, poultry droppings, municipal waste, plant material, sewage, green waste or food/kitchen waste.

Biogas has a calorific value of about 5000 kcal per m3. The digested slurry produced from Biogas Plants as a by-product is a better source of nutrient enriched organic manure for use in Agriculture. It not only helps in improving the crop yield but also maintain soil health.

There is ample potential of setting up biogas plants considering the livestock population of 512.06 million, which includes about 300 million (299.98 million) total population of bovines (comprising of cattle, buffalo, mithun and yak). The livestock sector contributes about significantly to India's GDP and will continue to increase. The dissemination of biogas technology is a boon for Indian farmers with its direct and collateral benefits.

Municipal solid waste comprises organic and inorganic wastes including recyclables which could be sorted out and reused as raw materials. The organic fraction of municipal solid waste can be converted into useful product like organic manure or Methane gas etc. which could be used for cooking, heating and production of energy.

- Bio-degradable (organic matter) - 30-55%
- Inert matter - (40-55%)
- Recyclable matter - (5-15%)



Biogas contains about 55-65 % of methane, 35- 44 % of carbon dioxide and traces of other gases, such as Hydrogen Sulphide, Nitrogen and Ammonia. Biogas, in its raw form, that is without any purification, can be used as clean cooking fuel like LPG, lighting, motive power and generation of electricity. It can be used in diesel engines to substitute diesel up to 80% and up to 100% replacement of diesel by using 100% Biogas Engines. Further, Biogas can be purified and upgraded up to 98% purity of methane content to make it suitable to be used as a green and clean fuel for transportation or filling in cylinders at high pressure of 250 bar or so and called as Compressed Bio-Gas (CBG).

The Ministry of New and Renewable Energy promoted installation of biogas plants by implementing 2 Central Sector Schemes under Off-Grid/distributed and decentralized Renewable Power. The following schemes were valid upto 31/03/2021:

1. National Biogas and Organic Manure Program (NNBOMP), for Biogas Plant size ranging from 1 cu.m. to 25 cu.m. per day.
2. Biogas Power Generation (Off-grid) and Thermal energy application Program (BPGTP), for setting up biogas plants in the size range of 30 m3 to 2500 m3 per day, for corresponding power generation capacity range of 3 kW to 250 kW from biogas or raw biogas for thermal energy /cooling applications.

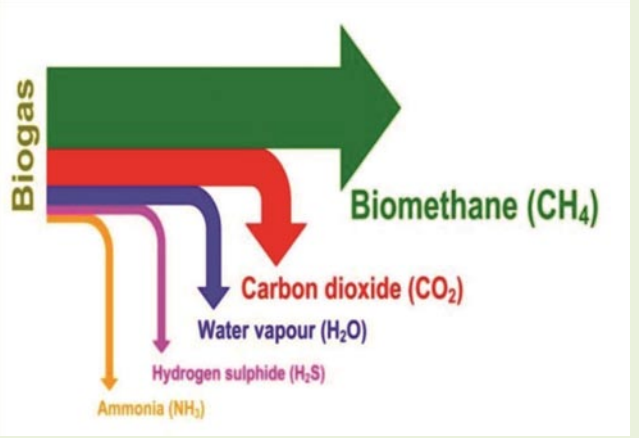
SATAT (SUSTAINABLE ALTERNATIVE TOWARDS AFFORDABLE TRANSPORTATION) SCHEME)

The SATAT scheme aims to set up Compressed Bio-Gas production plants and make CBG available in the market for use as a green fuel. 'SATAT', launched on 1.10.2018, envisages to target production of 15 MMT of CBG from 5000 plants by 2023. Besides the potential to boost availability of more affordable transport fuels, better use of agricultural residue, cattle dung and municipal solid waste, the 5000 CBG plants will provide an investment of 1.75 lakh crore, an additional revenue source to farmers, and 75,000 direct job opportunities and lakhs of indirect jobs.

►BIO CNG

- CNG stands for 'compressed natural gas'. Bio-CNG is a renewable fuel obtained by purifying biogas – in contrast to CNG, a non-renewable source of energy.
- Biogas is produced when microbes break down organic matter like food, crop residue, waste water, etc.
- Waste / Bio-mass sources like agricultural residue, cattle dung, sugarcane press mud, municipal solid waste and sewage treatment plant waste, etc. produce bio-gas through the process of anaerobic decomposition. The biogas is purified to remove hydrogen sulfide (H2S), carbon dioxide (CO2), water vapor and compressed as Compressed Bio Gas (CBG), which has methane (CH4) content of more than 90%.
- CBG has calorific value and other properties like CNG and hence can be utilized as green renewable automotive fuel. Thus it can replace CNG in automotive, industrial and commercial areas, given the abundance biomass availability within the country.

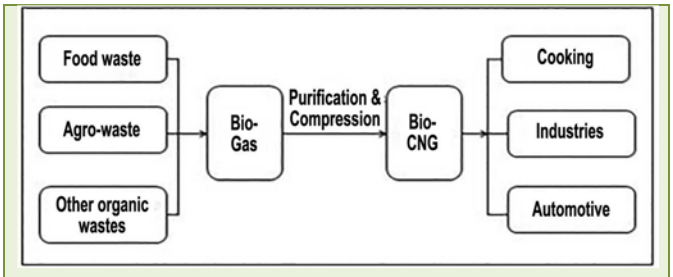
BIO-GAS TO BIO-CNG



Biogas consists mainly of methane (CH_4, 55-65%) and carbon dioxide (CO2, 35-45%) and the calorific value of biogas is 19500 KJ/Kg. Methane is a valuable form of gas, as it is an efficient energy carrier with a wide range of uses. The amount of CO_2 that is produced corresponds to the amount of CO2 captured when the biomass was created, making biogas carbon neutral.

Aside from methane and CO2, biogas also contains trace components like water vapor, hydrogen sulfide (H2S), siloxanes, hydrocarbons, ammonia, oxygen, carbon monoxide, and nitrogen. The proportion of these trace components depends on the source of the biomass. The presence of water vapor, H2S, and CO2 make biogas very corrosive and unsuitable to be used as fuel. If this biogas is used as fuel in automobiles it can cause erosion of the metal parts, which in turn increases the maintenance cost of the vehicles. In order to tackle this problem the solution that is available is to upgrade biogas.

Biogas upgrading or purification is the process by which contaminants in the raw biogas stream are absorbed or scrubbed, leaving more methane per unit volume of gas. This final product is called biomethane. The most widely used technologies for biogas upgrading are water scrubbing, Pressure Swing Adsorption, membrane, and chemical scrubbing. Of these technologies, water scrubbing and Pressure Swing Adsorption are considered to be most appropriate on a small scale due to low cost and easy maintenance. Biomethane can also be compressed and bottled into cylinders and it is called Bio-Compressed Natural Gas (Bio-CNG) or simply Compressed Bio-Gas (CBG).



Flow diagram of Bio-CNG

►WASTE TO ENERGY

The increasing industrialization, urbanization and changes in the pattern of life, which accompany the process of economic growth, give rise to generation of increasing quantities of wastes leading to increased threats to the environment. In recent years, technologies have been developed that not only help in generating substantial quantity of decentralized energy but also in reducing the quantity of waste for its safe disposal.

The Ministry is promoting all the technology options available for setting up projects for recovery of energy in the form of Biogas/BioCNG/Electricity from agricultural, Industrial and urban wastes of renewable nature such as municipal solid wastes, vegetable and other market wastes, slaughterhouse waste, agricultural residues and industrial/STP wastes & effluents.

TYPES OF WASTE

- There are different types of waste which are generated from our daily or industrial activities such as organic waste, e-waste, hazardous waste, inert waste etc.
- Organic waste refers to waste which degrades or brok en down by microorganisms over tIme. All organic wa stesare essentially carbon based compounds; though they may be diverse in nature and have different degr adation rate.
- Organic waste has significant portion in overall waste generation in industrial/urban/ agricultural sector and therefore it can be used for energy generation.

The organic fraction of waste can be further classified as non-biodegradable and biodegradable organic waste

Biodegradable waste consists of organics that can be utilized for food by naturally occurring micro- organisms within a reasonable length of time. The biodegradable organic comprise of agro residue, food pr ocessing rejections, municipal solid waste (food waste, leaves from garden waste, paper, cloths/ rags etc.), waste from poultry farms, cattle farm slaughter houses, dairy, sugar, distillery, paper, oil extraction plant, starch processing and leather industries.

Non-Biodegradable organic materials are organics resistant to biological degradation or have a very low degradation rate. This primarily includes woody plants, Cardboard, cartons, containers, wrappings, pouches, discarded clothing, wooden furniture, agricultural dry waste, bagasse, rice husk etc.

TECHNOLOGIES AVAILABLE

Waste-to-Energy (WTE) technologies to recover the energy from the waste in the form of Electricity and Biogas/Syngas are given as below:

BIOMETHANATION

Biomethanation is anaerobic digestion of organic materials which is converted into biogas. Anaerobic digestion (AD) is a bacterial fermentation process that operates without free oxygen and results in a biogas containing mostly methane (~60%), carbon dioxide (~40%) and other gases. Biomethanation has dual benefits. It gives biogas as well as manure as end product.

This technology can be conveniently employed in a decentralized manner for biodegradation of segregated organic wet wastes such as wastes from kitchens, canteens, institutions, hotels, and slaughter houses and vegetables markets.

The biogas generated from Biomethanation process can be burned directly in a gas boiler/burner to produce heat for thermal application industries and cooking or burnt in a gas engine to produce electricity. Alternatively, the biogas can be cleaned to remove the carbon dioxide and other substances, to produce BioCNG. This can be injected into the national gas grid to be used in the same way as natural gas, or used as a vehicle fuel.

By using Biomethanation process, 20-25kgs of Cattle dung can generate about 1m3 of biogas and further 1m3 of Biogas has potential to generate 2 units of electricity or 0.4kgs of BioCNG.

INCINERATION

Incineration technology is complete combustion of waste (Municipal Solid Waste or Refuse derived fuel) with the recovery of heat to produce steam that in turn produces power through steam turbines.

The flue gases produced in the boilers have to be treated by an elaborate air pollution control system. The resultant ash from incineration of solid waste can be used as construction material after necessary processing while the residue can be safely disposed of in a landfill.

This technology is well established technology and has been deployed in many projects successfully at commercial level in India to treat solid wastes

like Municipal Solid Waste and Industrial solid Waste etc. and generate electricity.

GASIFICATION

Gasification is a process that uses high temperatures (500-1800o C) in the presence of limited amounts of oxygen to decompose materials to produce synthetic gas (a mixture of carbon monoxide (CO) and hydrogen (H2)). Biomass, agro-residues, Segregated MSW and RDF pellets are used in the gasifier to produce Syngas. This gas further can be used for thermal or power generation purposes

The purpose of gasification of waste is to generate power more efficiently at lower power level (< 2MW) and also to minimize emissions and hence it is an attractive alternative for the thermal treatment of solid waste.

PYROLYSIS

Pyrolysis uses heat to break down combustible materials in the absence of oxygen, producing a mixture of combustible gases (primarily methane, complex hydrocarbons, hydrogen, and carbon monoxide), liquids and solid residues. The products of pyrolysis process are: (i) a gas mixture; (ii) a liquid (bio-oil/tar); (iii) a solid residue (carbon black). The gas generated by either of these processes can be used in boilers to provide heat, or it can be cleaned up and used in combustion turbine generators. The purpose of pyrolysis of waste is to minimize emissions and to maximize the gain.

PROGRAM ON ENERGY FROM URBAN, INDUSTRIAL, AGRICULTURAL WASTES/ RESIDUES AND MUNICIPAL SOLID WASTE

- To promote setting up of projects for recovery of energy in the form of Biogas / BioCNG / Power from Urban, Industrial and Agricultural Waste and Captive Power and Thermal use through Gasification in Industries.
- To promote setting up of projects for recovery of energy from Municipal Solid Waste (MSW) for feeding power into the grid and for meeting captive power, thermal and vehicular fuel requirements.
- To promote Biomass Gasifier for feeding power into the grid or meeting captive power and thermal needs of rice mills/other industries and villages

►HYDROGEN ENERGY

Hydrogen and ammonia are expected to replace fossil fuels in the future. One of the primary criteria for the nation's ecologically sustainable energy security is the production of these fuels using renewable energy. These fuels are known as green hydrogen and green ammonia.

'Green Hydrogen & Ammonia' policy announced by government incentivises producers of these.

According to International Renewable Energy Agency (IRENA), hydrogen will make up 12% of the energy mix by 2050 in its 'World Energy Transitions Outlook' Report & suggested that 66% of this hydrogen used must come from water instead of natural gas.

HYDROGEN AS AN ENERGY-RICH SOURCE

- An abundant element, but it's not found in pure form which is required to be used as fuel.
- Energy density almost three times that of diesel.
- Hydrogen has the potential to be the key renewable target in supporting infrastructure as well.
- Green Hydrogen can act as an energy storage option, which would be essential to meet intermittencies (of renewable energy) in the future.

GREEN HYDROGEN/ GREEN AMMONIA POLICY

HOW IS THE POLICY SET TO BOOST DOMESTIC PRODUCTION OF GREEN HYDROGEN PRODUCTION?

- Policy was released by Ministry of Power.
- Any new renewable energy facilities built to produce power for green hydrogen generation before July 2025 will receive 25 years of free power transmission under the new policy.
  - This means that a green hydrogen producer in Rajasthan may build a solar power plant to send renewable energy to a green hydrogen plant in Assam without having to pay any inter-state transmission fees.
- The move is likely going to make it more economical for key users of hydrogen and ammonia such as the oil refining, fertiliser and steel sectors to produce green hydrogen for their own use. These sectors currently use grey hydrogen or grey ammonia produced using natural gas or naphtha.

WHAT ARE THE INCENTIVES?

- The government plans to create a single gateway for all green hydrogen production clearances, as well as a mechanism for producers to bank any excess renewable energy created with discoms for up to 30 days and utilise it as needed.
- The requirement of time bound clearances for these projects would spur investment while grid connectivity on priority will ease operational

processes.

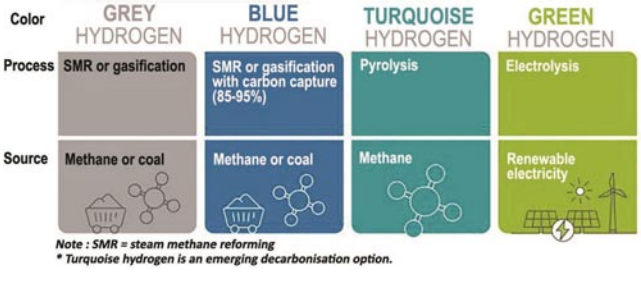
- The power ministry has also said that energy plants set up to produce green hydrogen/ammonia would be given connectivity to the grid on a priority basis.
- Power distribution companies may also procure renewable energy to supply green hydrogen producers but will be required to do so at a concessional rate which will only include the cost of procurement, wheeling charges and a small margin as determined by the state commission, under the new policy.
- Such procurement would also count towards a state's Renewable Purchase Obligation (RPO) under which it is required to procure a certain proportion of its requirements from renewable energy sources.

FACILITIES TO BOOST EXPORT OF GREEN HYDROGEN AND AMMONIA

- Under the policy port authorities will also provide land at applicable charges to green hydrogen and green ammonia producers to set up bunkers near ports for storage prior to export.
- Germany and Japan could be key markets for green hydrogen produced in India.

TYPES OF HYDROGEN

The production techniques of this 'Energy-Carrier' vary depending upon its applications — designated with different colours such as black hydrogen, brown hydrogen, blue hydrogen, green hydrogen, etc.



- Black hydrogen is produced by use of fossil fuel, whereas pink hydrogen is produced through electrolysis, but using energy from nuclear power sources.
- Brown hydrogen is produced using coal where the emissions are released to the air.
- Grey hydrogen is produced from natural gas where the associated emissions are released to the air.
- Blue hydrogen is produced from natural gas, where the emissions are captured using carbon capture and storage.
- Green hydrogen
  - is a zero-carbon fuel made by electrolysis using renewable power from wind and solar to split water into hydrogen and oxygen.
  - 'Green hydrogen' can be utilised for the generation of power from natural sources — wind or solar systems — and will be a major step forward in achieving the target of 'net zero' emission.
  - Green hydrogen accounts for less than 1% of hydrogen produced, currently.
  - Industries using hydrogen: Oil refining, ammonia production, methanol production, steel production.

BENEFITS OF USING GREEN HYDROGEN FOR INDIA

- Meet high Energy demand
- Transition to Clean Energy: Green hydrogen can drive India's transition to clean energy.
- Reduction in Import dependency: Reduce import dependency on fossil fuels.
- Indigenization of Technology: Localisation of electrolyser production & development of green hydrogen projects can create a new green technologies market in India.

ABOUT GREEN AMMONIA

Ammonia is a pungent gas used to make agricultural fertilisers, refrigerants and Adblue (mixture of ammonia and water), a diesel exhaust fluid used to reduce air pollution from diesel engines.

Green ammonia production is where process of making ammonia is 100% renewable and carbon-free. One way of making green ammonia is by using hydrogen from water electrolysis and nitrogen separated from air. These are then fed into Haber process (also known as Haber-Bosch), powered by green electricity. Hydrogen and nitrogen are reacted together at high temperatures and pressures to produce ammonia, NH_3.

Ammonia is currently produced using Haber-Bosch Process, an artificial nitrogen fixation process where atmospheric nitrogen is converted to ammonia by reaction to hydrogen using a metal catalyst under high temperatures & pressures. Haber Process is a highly energy intensive, consuming around 1.8% of global energy consumption. Ammonia synthesis is significantly the largest CO_2 emitting chemical industry process.

►NATIONAL HYDROGEN MISSION

The Mission aims to make India a green hydrogen hub. This will help in meeting target of production of 5 million tonnes of Green hydrogen by 2030 and the related development of renewable energy capacity.

INDIA'S FIRST GREEN HYDROGEN MOBILITY PROJECT IN LADAKH

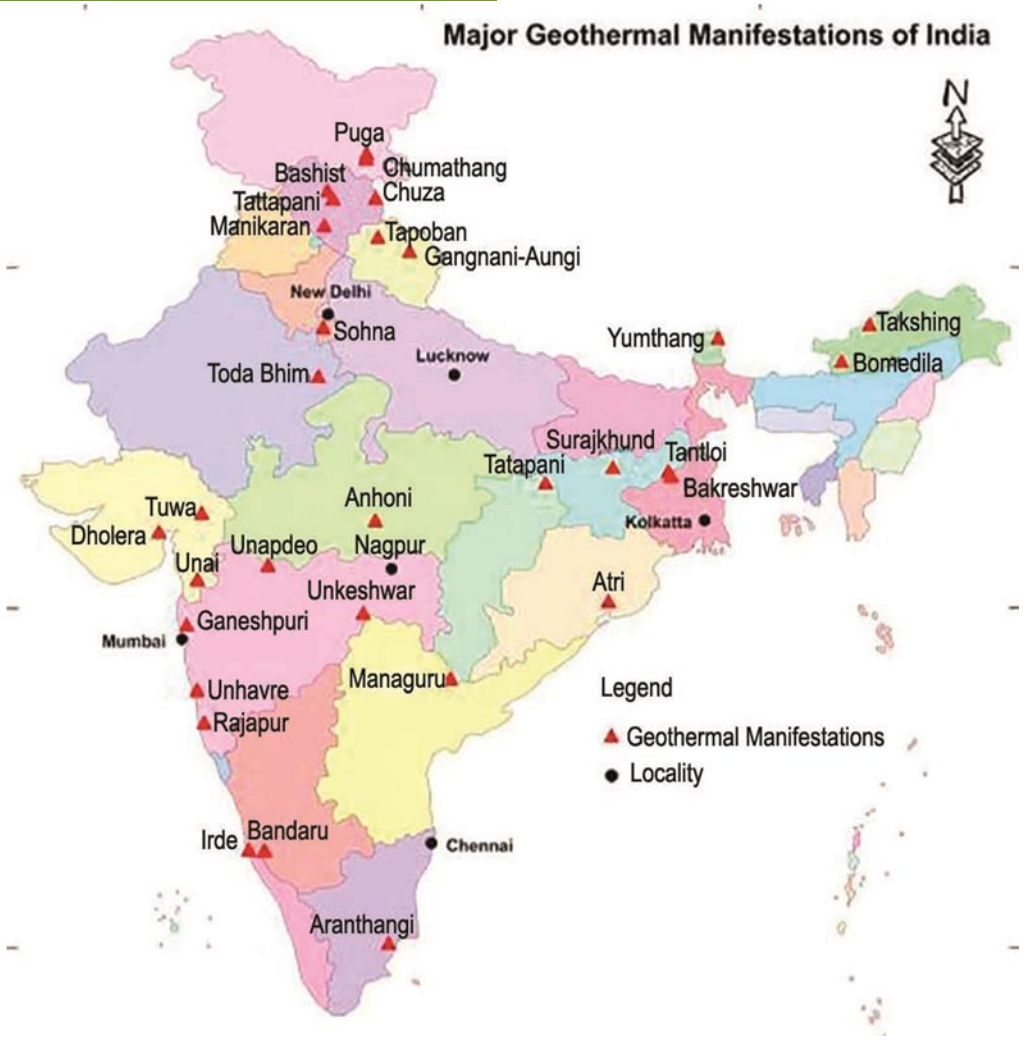
NTPC REL, will set up the country's first green Hydrogen Mobility project in Ladakh. NTPC REL, a 100 per cent subsidiary of NTPC, signed a MoU with the Union Territory of Ladakh, to set up the country's first green Hydrogen Mobility project in the region

BRICS GREEN HYDROGEN SUMMIT

BRICS countries shared their insights and professional views on subject and latest developments of their countries in the field of green hydrogen.

►INDIA'S FIRST GEOTHERMAL ENERGY PROJECT

ONGC will implement India's first Geothermal energy development project in Ladakh in Puga valley. The development will be done in three phases. Puga and Chumathang in Eastern Ladakh are the most promising geothermal fields in India.



Benefits of Geothermal Energy:

1. Round the clock renewable power supplies.
2. Hot water from spring could be used for space heating.
3. Hot swimming pools can be established in the region for attracting tourists.

GEOTHERMAL ENERGY

To produce power from geothermal energy, wells are dug a mile deep into underground reservoirs to access the steam and hot water there, which can then be used to drive turbines connected to electricity generators. There are three types of geothermal power plants; dry steam, flash and binary.

Dry steam is the oldest form of geothermal technology and takes steam out of the ground and uses it to directly

drive a turbine. Flash plants use high-pressure hot water into cool, low-pressure water whilst binary plants pass hot water through a secondary liquid with a lower boiling point, which turns to vapour to drive the turbine.

►SEAWEEDS

Seaweeds are macrophytic algae, a primitive type of plants lacking true roots, stems and leaves. The word seaweed gives the wrong impression that it is a useless plant. Seaweeds are wonder plants of the sea and highly useful plants. Seaweeds grow in the shallow waters. Root system and conducting tissues like land plants are absent in seaweeds. Most of them have hold-fast for attachment and some drift loose in the sea.

Four groups of seaweeds are recognized according to their pigments that absorb light of particular wave lengths and give them their colours of green, blue, brown and red. Most seaweed belongs to one of three divisions – the Chlorophyta (green algae), the Phaeophyta (brown algae) and the Rhodophyta (red algae). The greatest variety of red seaweeds is found in subtropical and tropical waters, while brown seaweeds are more common in cooler, temperate waters.

Seaweeds new renewable source of food, energy, chemicals and medicines. Provides valuable source of raw material for industries like health food, medicines, pharmaceuticals, textiles, fertilizers, animal feed etc.

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Seaweeds grow abundantly along the Tamil Nadu and Gujarat coasts and around Lakshadweep and Andaman and Nicobar Islands. There are also rich seaweed beds around Mumbai, Ratnagiri, Goa, Karwar, Varkala, Vizhinjam and Pulicat inTamil Nadu and Chilka in Orissa. Agar yielding red seaweeds such as Gelidiella acerosa and Gracilaria sp. are collected throughout the year while algin yielding brown algae such as Sargassum and Turbinaria are collected seasonally from August to January on Southern coast. On the West Coast, especially in the state of Gujarat, abundant seaweed resources are present on the intertidal and sub tidal regions. These resources have great potential for the development of seaweed-based industries in India.

PROTECTED AREAS & WILDLIFE

►RAMSAR WETLANDS SITES IN INDIA

	RAMSAR SITE	DESCRIPTION
1	**Chandratal Lake** Himachal Pradesh Natural Freshwater	• Situated in Spiti area of Lahaul & Spiti at Samudra Tapu Plateau. Source of Chandra River (One of the headwaters of Chenab River, Chenab is confluence of Chandra and Bhaga rivers). • High altitude lake on the upper Chandra valley near the Kunzam pass joining Himalayan and Pir Panjal ranges. • Supports Snow Leopard, Red Fox, Himalayan Ibex, Blue Sheep/Bharal.
2	**Pong Dam Lake** Himachal Pradesh Freshwater Manmade reservoir	• A water storage reservoir created in 1975 on the Beas River in the low foothills of the Himalaya on the northern edge of the Indo-Gangetic plain. • It is located at the trans-Himalayan flyway.
3	**Renuka Wetland** Himachal Pradesh Natural Freshwater	• It is a wetland with springs and inland subterranean karst formations, fed by a small stream flowing from the lower Himalayan out to the Giri river. • The lake has high religious significance and is named after the mother of Hindu sage Parshuram, and is thus visited by thousands of pilgrims and tourists.
4	**Chilika Lake** Odisha Natural Lagoon, Brackish Water	• Though added in Montreaux Record in 1993, was removed in 2002. • It is brackish lake separated from the Bay of Bengal by a long sandy ridge. • It has seasonal fluctuations in salinity in different sections of the lake and saline areas support aquatic algae. • One of the only two lagoons with population of Irrawady dolphins
5	**Bhitarkanika Wetlands** Odisha Natural mangrove swamps	• One of the finest remaining patches of mangrove forests along the Indian coast. The site's Gahirmatha beach is said to host the largest known Olive Ridley sea turtle nesting beach in the world, with half a million nesting annually, and the site has the highest density of saltwater crocodile in the country. • Salt water crocodiles, Gahirmatha beach (largest known Olive Ridley sea turtle nesting in the world)
6	**Deepor Beel**	• A permanent freshwater lake in a former channel of the Brahmaputra River.

	Assam Natural Freshwater	• It is only major storm water storage basin for the city of Guwahati. It is a staging site on migratory flyways. • Some threatened birds include pot billed Pelican Lesser and Greater Adjutant Stork and Baer's Pochard
7	**East Calcutta Wetlands** West Bengal	• World-renowned as a model of a multiple use wetland. • The wetland forms an urban facility for treating the city's wastewater & utilizing the treated water for pisciculture and agriculture • The system is described as one of the rare examples of environmental protection and development management where a complex ecological process has been adopted by the local farmers for mastering the resource recovery activities.
8	**Sundarbans Wetland** West Bengal Natural	• Sundarbans Wetland is located within the largest mangrove forest in the world, the Sundarbans, that encompasses hundreds of islands and a maze of rivers, rivulets, and creeks, in the delta of the Rivers Ganges and Brahmaputra on the Bay of Bengal in India and Bangladesh. • The Sundarbans Tiger Reserve is situated within the Site and part of it has been declared a "critical tiger habitat" under national law and also a "Tiger Conservation Landscape" of global importance. • The Sundarbans are the only mangrove habitat which supports a significant population of tigers, and they have unique aquatic hunting skills. • The Site is also home to a large number of rare and globally threatened species such as the critically endangered northern river terrapin (*Batagurbaska*), the endangered Irrawaddy dolphin (*Orcaellabrevirostris*), and the vulnerable fishing cat (*Prionailurusviverrinus*). • It is listed as World Heritage Site and also in UNESCO Biosphere Reserve
9	**Harike Lake** Punjab Manmade Freshwater	• Harike Lake is a shallow water reservoir with thirteen islands, at the confluence of two rivers, i.e., Beas and Sutlej. • Indira Gandhi Canal starts from this place.
10	**Kanjli** Punjab Man-Made reservoir, Freshwater	• It is a man-made wetland, with a permanent stream, the Kali Bein, a tributary of Beas River converted by construction of a small barrage in 1870 into a water storage area for irrigation purposes. • The stream is considered to be the most significant in the state from the religious point of view, as it is associated with the first guru of the Sikhs, Shri Guru Nanak Dev Ji
11	**Ropar Lake** Punjab Manmade Freshwater	• A wetland of lake and river formed by the 1952 construction of a barrage for diversion of water from the Sutlej River for drinking and irrigation supplies. • The site is an important breeding place for the nationally protected Smooth Indian Otter, Hog Deer, Sambar, and several reptiles, and the endangered Indian Pangolin is thought to be present.
12	**Keoladeo National Park** Rajasthan Manmade Freshwater Swamps	• It is in MONTREAUX RECORD since 1990 due to "water shortage and an unbalanced grazing regime". • Included in world heritage site. A complex of ten artificial, seasonal lagoons, varying in size, situated in a densely populated region. • The invasive growth of the grass Paspalum distichum has changed the ecological character of large areas of the site. • Siberian Crane is found here. • It is the only protected by a surrounding wall on all sides.
13	**Sambhar Lake** Rajasthan Natural Saline	• A large lake fed by four streams set in a shallow wetland and subject to seasonal fluctuations. (Inland drainage) • The site is important for a variety of wintering waterbirds, including second largest

		breeding ground for flamingos in India.
14	**Kolleru Lake** Andhra Pradesh Natural Freshwater	• A eutrophic lake, situated between the two major river basins of Godavari and Krishna, fed by two seasonal rivers and a number of drains and channels, which functions as a natural flood balancing reservoir between the deltas of the two rivers. • Known for its spot-billed pelicans sighting.
15	**Loktak Lake** Manipur Natural Freshwater	• This lake was added to MONTREUX RECORD since June 1993 as a result of ecological problems such as deforestation in the catchment area, infestation of water hyacinth, and pollution. Thick, floating mats of weeds covered with soil (phumids') are a characteristic feature • The lake is used extensively by local people as a source of water for irrigation and also plays an important role in flood control.
16	**Nalsarovar** Gujarat Natural Freshwater	• The largest natural wetland in the Thar Desert Biogeographic Province and represents a dynamic environment with salinity and depth varying depending on rainfall. • It is an important stopover site within the Central Asia Flyway, with globally threatened species such as the critically endangered Sociable Lapwing (Vanellusgregarius). • The wetland is also a lifeline for a satellite population of the endangered Indian Wild Ass.
17	**Point Calimere Wildlife Sanctuary** Tamil Nadu Coastal Swamps & salt pans	• Illegal collection of firewood and forest produce such as fruits (gathered by lopping off tree branches), • The spread of Prosopischilensis (Chilean mesquite), increasingly brackish groundwater caused by expansion of the historical salt works and decreasing inflow of freshwater are all seen as potential causes for concern. • Visitors come to the site both for recreation and for pilgrimage, as it is associated with Lord Rama.
18	**Sasthamkotta Lake** Kerala Natural Freshwater Lake	• The largest freshwater lake in Kerala. • The water contains no common salts or other minerals and supports no water plants; a larva called "cavaborus" abounds and eliminates bacteria in the water, thus contributing to its exceptional purity. • The ancient Sastha temple is an important pilgrimage centre. • Source of drinking water for Kollam.
19	**Vembanad-Kol Wetland** Kerala Natural Brackish water	• The largest brackish, humid tropical wetland ecosystem on the southwest coast of India • Famous for backwater tourism and sub-fossil clam deposits. • Longest lake in India • Thaneermukkom Salt water barrier constructed divides the lake into parts – one with perennial brackish water and other with fresh water from rivers draining into the lake.
20	**Ashtamudi Wetland** Kerala Natural Brackish	An extensive estuarine system, the second largest in Kerala State. The site supports a number of mangrove species.
21	**Surinsar-Mansar Lakes** Jammu & Kashmir Natural Freshwater	• It is a composite lake in semi-arid Panjab Plains, adjoining the Jhelum Basin with catchment of sandy conglomeratic soil, boulders and pebbles. • Important for religious reasons.
22	**Wular Lake** Jammu & Kashmir	• Largest freshwater lake in India with extensive marshes of emergent and floating vegetation, particularly water chestnut, that provide an important source of revenue

	Natural Freshwater	for the State Government and fodder for domestic livestock. • Fed by Jhelum River.
23	**Hokera Wetland** Jammu & Kashmir Natural Freshwater	• Located at the northwest Himalayan biogeopgraphic province of Kashmir, back of the snow-draped Pir Panchal.
24	**Tsomoriri** Jammu & Kashmir Natural Freshwater to brackish	• A freshwater to brackish lake lying at 4,595m above sea level, with wet meadows and borax-laden wetlands along the shores. • The site is said to represent the only breeding ground outside of China for one of the most endangered cranes, the Black-necked crane (Grus nigricollis), and the only breeding ground for Bar-headed geese in India.
25	**Bhoj Wetland** Madhya Pradesh Manmade Freshwater	Two contiguous human-made reservoirs - the "Upper Lake" was created in the 11th century by construction of an earthen dam across the Kolans River, and the lower was constructed nearly 200 years ago, largely from leakage from the Upper, and is surrounded by the city of Bhopal
26	Upper Ganga River Uttar Pradesh River stretch Freshwater	• A shallow river stretch of the great Ganges with intermittent small stretches of deep-water pools and reservoirs upstream from barrages. • The river provides habitat for Ganges River Dolphin, Gharial, Crocodile, 6 species of turtles, otters, 82 species of fish and more than hundred species of birds.
27	**Rudra Sagar Lake** Tripura Natural Freshwater	A lowland sedimentation reservoir in the northeast hills, fed by three perennial streams discharging to the River Gomti.
28	**Nandur Madhameshwar** Maharashtra Manmade Freshwater	• First Ramsar site in Maharashtra • Developed by making a low dam at the confluence of the Godavari and Kadwa Rivers. • Habitat of critically endangered species including Deolali minnow (a fish), Indian vulture and white-rumped vulture.
29	**Saman Bird Sanctuary** Uttar Pradesh Natural Freshwater	• Seasonal oxbow lake on the Ganges floodplain. • Host over 1% of the South Asian population of graylag goose during winter.
30	**Nawabganj Bird Sanctuary** Uttar Pradesh Natural Freshwater	• Shallow wetland fed by monsoon rain and Sarda canal. • Known to host Siberian cranes during winter.
31	**Samaspur Bird Sanctuary** Uttar Pradesh Natural Freshwater	• Perennial lowland marsh typical of the Indo-Gangetic Plains • Harbours threatened species such as the endangered Egyptian vulture, Pallas's fish eagle and vulnerable common Pochard. • A tall grass called Sarpat is also found in bunches at every spot.
32	**Sandi Bird Sanctuary** Uttar Pradesh Natural Freshwater	• It is a freshwater marsh. • Important Bird Area, declared by Birdlife International. • River Garra passes near the sanctuary. • It hosts common teal, red-crested pochard and ferruginous duck while vulnerable sarus crane. • The Sanctuary dried out leading to a subsequent collapse in Waterbird populations from 2014 to 2015.

33	**Parvati Arga Bird Sanctuary** Uttar Pradesh Natural Freshwater	• Permanent freshwater environment consisting of two oxbow lakes. • It is rainfed has deep natural depression. • Species: critically endangered whiterumped vulture and Indian vulture and the endangered Egyptian vulture.
34	**Sarsai Nawar Jheel** Uttar Pradesh Natural Freshwater	• Fed by precipitation run-off from the South West monsoon rains. • It is an example of co-habitation of humans and wildlife: farming practices across most of the Site play important roles in sustaining the Waterbird habitats. • Recognized as Important Bird Area by Birdlife International. • Species: vulnerable sarus crane, critically endangered whiterumped vulture and endangered woolly-necked stork.
35	**Beas Conservation Reserve** Punjab Natural Freshwater	• It is a 185-kilometre stretch of the Beas River majorly in Punjab. • Hosts the only known population in India of the endangered Indus river dolphin. • Other Important species: endangered mahseer and hog deer as well as the vulnerable smooth coated otter. • Here a program was initiated to re-introduce the critically endangered gharial.
36	**Nangal Wildlife Sanctuary** Punjab Manmade Freshwater	• Located in the Shiwalik foothills of Punjab • It occupies a human-made reservoir constructed as part of the Bhakra-Nangal Project on Sutlej River in 1961. • Historic importance - Indian and Chinese Prime Ministers formalized the "Five Principles of Peaceful Coexistence" there in 1954.
37	**Keshopur-Miani Community Reserve** Punjab Natural Freshwater	• Mosaic of natural marshes, aquaculture ponds and agricultural wetlands maintained by the annual rainfall runoff. • It has series of managed fishponds and cultivated crops such as lotus and chestnut. • The Site is an example of wise use of a community-managed wetland, which provides food for people and supports local biodiversity • Species: vulnerable common pochard and the endangered spotted pond turtle
38	**Tso Kar Wetland Complex** UT of Ladakh Natural; One lake saline & one freshwater	• Tso Kar Basin is located in a high-altitude wetland complex. It consists of two main waterbodies Startsapuk Tso and Tso Kar. The Startsapuk Tso is a freshwater lake of 438 hectares to the south. Tso Kar lake is a hypersaline lake of 1800 hectares. • Most important breeding areas of the Black necked Cranes in India.
39	**Lonar Lake** Maharashra Created by meteorite impact (Natural) Saline	• Scientists in the 1970s, confirmed the presence of Maskelynite—a naturally occurring glass that is only formed by extremely high-velocity impacts. • Formed 35,000 to 50,000 years ago, Lonar is the only "fresh" impact structure in basalt on Earth, making it an important analog for impact craters on the surface of the Moon.
40	**Sur Sarovar** Uttar Pradesh Manmade Freshwater	• Also known as Keetham Lake, created by British to supply water to Agra city. • Migratory birds flock to the site as it is located on Central Asian Flyway. Important for Greater spotted eagle, sarus crane and catfish Wallago attu. Over 1% population of graylag goose is present here.
41	**Asan Conservation reserve** Uttarakhand Natural Freshwater	• It is stretch of Asan river running down to its confluence with Yamuna River in Dehradun district of Uttarakhand. Barrage on Asan River created it. • Birds spotted: Red-headed vulture (IUCN status: Critically Endangered), White-rumped vulture, Baer's pochard. • Red crested pochard, ruddy shelduck and Putitor mahseer (IUCN status: Endangered) are also found here.

42	**Kabartal Wetland** Bihar Natural Freshwater	• Also known as Kanwar Jheel, located in Indo-gangetic plains. Plays important role in absorbing surplus waters in monsoons, preventing floods. • Five critically endangered species inhabit the site, including three vultures – the red-headed vulture, white-rumped vulture and Indian vulture – and two waterbirds, the sociable lapwing and Baer's pochard.
43	**Wadhvana Wetland** Gujarat Manmade Freshwater	• This reservoir was created in 1910 by former Baroda State (King Gaikwad). • Located in a semi-arid agricultural landscape and surrounded by wheat and paddy fields and villages. • River Orsang (which joins with the Narmada River at Chandod) flows into the lake. It also provides irrigation to 25 villages.
44	**Thol Lake** Gujarat Manmade Freshwater	• Located in Mehsana district of Gujarat. • It is a shallow freshwater reservoir and a predominantly open water area. It is a man-made wetland, was originally constructed for irrigation in 1912.
45	**Bhindawas Wildlife Sanctuary** Haryana Manmade Freshwater	• Located in Jhajjar district, Haryana. • Largest wetland in Haryana. It is a bird sanctuary by Govt. of India. • It was constructed to store the excess waters of the Jawaharlal Nehru canal at the time of power failure of the Lift Canal System. It is an important part of the ecological corridor along the route of Sahibi River which traverses from Aravalli hills in Rajasthan to the Yamuna.
46	**Sultanpur National Park** Haryana Natural Freshwater	• Located in Gurgaon district of Haryana close to National capital and Aravalli range. • Discovered by IUCN official and bird lover Peter Jackson. • Famous site for stay of winter migratory birds.
47	**Khijadiya Bird Sanctuary** Gujarat	• A bird sanctuary located in Jamnagar district. About 300 species of migratory birds have been recorded here. • The sanctuary is unique having freshwater lakes, salt and freshwater marshlands.
48	**Haiderpur Wetland** Uttar Pradesh Manmade Freshwater	Manmade wetland formed in 1984 due to construction of Madhya Ganga Barrage on a floodplain of the Ganga River.
49	**Bakhira Sanctuary** Uttar Pradesh Natural Freshwater	• Largest natural flood plain (river connected wetland) of India in Sant Kabir Nagar district in Eastern Uttar Pradesh. • A prominent waterbird found in the lake is Indian Purple moorhen or Purple Swamphen & Sarus Crane. • Receives water from Ami River; discharge from its flows into Rapti River. It is rich in perennial reed grasses called Phragmites which attracts many species of the Central Asian Flyway.

►ELEPHANT CORRIDORS

- Part of Schedule I, Wildlife (Protection) Act, 1972.
- IUCN Status: Endangered.
- Included in Convention on International Trade in Endangered Species of Flora and Fauna (CITES).

PROJECT ELEPHANT

- Project Elephant is a Central Government scheme launched in 1992 for protection and management of elephants to states having wild elephants in a free-ranging population. It ensures protection of elephant corridors and elephant habitat for survival of elephant population in the wild.

OBLIGATIONS OF CENTRAL GOVERNMENT

- Central Government provides technical & financial help to these states to carry out & achieve goals of project elephant. Not just that, assistance for the purpose of the census, training of field officials is also provided to ensure the mitigation and prevention of man-elephant conflict.

- Central agencies along with state officials coordinate to prevent illegal trade of ivory and ensure elephant protection from hunters and poachers.

ELEPHANT – NATIONAL HERITAGE ANIMAL

Union Government declared Elephant as national heritage animal (2010) on recommendations of standing committee of National Board for Wildlife.

ELEPHANT RESERVES IN INDIA

There are 30 Elephant Reserves in India. First elephant reserve was Singhbhum Elephant Reserve of Jharkhand.

MIKE PROGRAM (CITES PROGRAM)

- MIKE stands for Monitoring of Illegal Killing of Elephants Program. It was started in South Asia in 2003 after conference of parties a resolution of CITES.
- Aim of MIKE program: Provide information required by elephant range countries for proper management and long-term protection of elephant populations.

OBJECTIVES OF MIKE PROGRAM

- Measure levels & trends in illegal poaching & ensure changes in the trends for elephant protection.
- Determine factors responsible for changes & to assess impact of decisions by conference of parties to CITES.

ELEPHANT RESERVES IN INDIA

There are 30 Elephant Reserves (ERs) in the country spread over 15 states.

ELEPHANT RANGE	ELEPHANT RESERVE WITH DATE OF NOTIFICATION	STATE
Eastern India (South West Bengal-Jharkhand-Odisha)	1. Mayurjharna ER	W. Bengal
	2. Singhbhum ER	Jharkhand
	3. Mayurbhanj ER	Odisha
	4. Mahanadi ER	Odisha
	5. Sambalpur ER	Odisha
	6. Badalkhol-Tamorpingla	Chhattisgarh
North Brahamputra (Arunachal – Assam)	7. Kameng ER	Arunachal
	8. Sonitpur ER	Assam
South Brahamputra (Assam- Arunachal)	9. Dihing-Patkai ER	Assam
	10. South Arunachal ER	Arunachal
Kaziranga (Assam- Nagaland)	11. Kaziranga – Karbi Anglong ER	Assam
	12. Dhansiri-Lungding ER	Assam
	13. Intanki ER	Nagaland
	14. Singphan ER	
Eastern Dooars (Assam- W. Bengal)	15. Chirang-Ripu ER	Assam
	16. Eastern Dooars ER	West Bengal
E. Himalayas (Meghalaya)	17. Garo Hills ER	Meghalaya
Nilgiri –Eastern Ghat (Karnataka- Kerala-Tamilnadu-Andhra)	18. Mysore ER	Karnataka
	19. Dandeli ER	Karnataka
	20. Wayanad ER	Kerala
	21. Nilgiri ER	Tamil Nadu
	22. Rayala ER	Andhra
South Nilgiri (Kerala- Tamilnadu)	23. Nilambur ER	Kerala
	24. Coimbatore ER	Tamil Nadu

Western Ghat (Tamilnadu- Kerala)	25. Anamalai ER	Tamil Nadu
	26. Anamudi ER	Kerala
Periyar (Kerala- Tamilnadu)	27. Periyar	Kerala
	28. Srivilliputtur ER	Tamil Nadu
Northern India (Uttaranchal-U.P.)	29. Shivalik ER	Uttaranchal
	30. Uttar Pradesh ER	U.P.

TIGER CONSERVATION

►NATIONAL TIGER CONSERVATION AUTHORITY

- A statutory body constituted under the Wildlife (Protection) Act, 1972 for tiger conservation.
- It is headed by the minister of MOEFCC.

OBJECTIVES

- Providing statutory authority to **Project Tiger** so that compliance of its directives becomes legal.
- Fostering accountability of Centre-State in management of Tiger Reserves, by providing a basis for MoU with States within our federal structure.
- Providing for an oversight by Parliament.
- Addressing livelihood interests of local people in areas surrounding Tiger Reserves.
- **Functions**: Its functions are to assist in population assessment of tigers, law enforcement, wildlife forensics, infrastructural development, mitigation, smart patrolling & advisory role in policy formulation.
- Monitoring System for Tigers – Intensive Protection and Ecological Status (M-STrIPES): It is a software-based monitoring system launched across Indian tiger reserves by the NTCA.

INDIAN TIGER
- IUCN Red List: Endangered
- Wildlife protection Act: Schedule 1
- CITES: Appendix 1
- The tiger reserves are constituted on a core/buffer strategy. The core areas have the legal status of a national park or a sanctuary. The buffer or peripheral areas are a mix of forest and non-forest land, managed as a multiple use area.
- India is home to 70% of global tiger population.

►PROJECT TIGER

- **Project Tiger launched** in **1973** is a 100% centrally sponsored scheme.
- It gives fund help to the 'tiger range States', for in-situ conservation of tigers in the chosen tiger reserves.
- It has put the endangered tiger on a guaranteed path of revival by protecting it from extinction.
- The Project Tiger aims to promote an exclusive tiger agenda in the core areas of tiger reserves, with inclusive people participation.

OBJECTIVES OF PROJECT TIGER

- To guarantee a viable population of tigers for financial, scientific, aesthetic, social and ecological values.
- Limit elements which lead to the reduction of tiger habitat and to tone them down by suitable strategy.
- Site-particular eco-development to decrease the dependency of local individuals and indigenous people on tiger reserve.

►CONSERVATION ASSURED TIGER STANDARDS (CA|TS)

- Launched in 2013. Till date 17 tiger reserves from India have been accredited by CA|TS.
- Conservation Assured (CA) is a new conservation tool to set best practice standards for effective management of target species.
- CA fulfils the requirement for protected area management effectiveness in international agreements such as the Convention on Biological Diversity's (CBD) Program of Work on Protected Areas and will help national governments, and their partners in conservation, to meet the CBD's Strategic Plan for Biodiversity.
- CA is also linked to and partnered in the development of IUCN's Green List of Protected and Conserved Areas.

►ST. PETERSBURG DECLARATION

For doubling tiger population (India was a party to this declaration) by 2022.

NOTE: TX2 program was launched by World Wildlife Foundation (WWF) at the 2010 St Petersburg Tiger Summit held in Russia.

TX2 PROGRAM BY WWF

Nepal is set to become the first country in the world to double its tiger population as part of the World Wildlife Foundation's (WWF) 'Tx2' program.

SIGNIFICANCE

- The success of Nepal in doubling tiger numbers has been largely attributed to the country's political commitment and the adoption of innovative tools and approaches towards tiger conservation.
- Nepal was the first country to achieve global standards in managing tiger conservation areas, an accreditation scheme governed by the Conservation Assured Tiger Standards (CA|TS).

ABOUT TX2 PROGRAM

- World Wildlife Foundation had launched its ambitious TX2 program at the St Petersburg Tiger Summit in 2010.
- The program aims to double the world tiger population by 2022, which is the year of the tiger in the Chinese calendar.
- Global Tiger Initiative (GTI): It was launched in 2008 as a global alliance of governments, international organizations, civil society, the conservation and scientific communities and the private sector and includes organization like the World Bank, the Global Environment Facility (GEF), etc. It aims to work together to save wild tigers from extinction. In 2013, the scope was broadened to include Snow Leopards. The initiative is led by the 13 tiger range countries (Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Lao PDR, Malaysia, Myanmar, Nepal, Russia, Thailand, and Vietnam).
- Global Tiger Forum (GTF) is the only inter-governmental international body established with members from willing countries to embark on a global campaign to protect the Tiger.

►ALL INDIA TIGER ESTIMATION SURVEY 2018

MOEFCC came out with the results of All India Tiger Estimation Survey 2018, on the eve of the Global Tiger Day celebrated on July 29 every year.

HIGHLIGHTS OF REPORT

- Tiger Population in India by year

2006	2010	2014	2018
1411	1706	2266	2967

- Tiger population in India is increasing at the rate of 6% per annum.
- There are a total of 50 tiger reserves in the country though three of them – Dampa Reserve (Mizoram), Buxa Reserve (West Bengal) and Palamau Reserve (Jharkhand) have no tiger left in it.
- No tigers were found in Mizoram & Nagaland.
- Corbett Tiger Reserve in Uttarakhand has highest number of 231 tigers in the country, followed by Nagarhole and Bandipora Reserves in Karnataka with 127 and 126 tigers respectively.
- Reserves such as Simlipal (Odisha), Amrabad & Kawal (Telangana), Nagarjunasagar Srisailam (Andhra Pradesh), Sanjay-Dubri (MP), Nameri & Manas (Assam). have tigers below their overall potential and they require resources and targeted management.
- Madhya Pradesh has the highest number of (526) followed by Karnataka (524) and Uttarakhand (442). Madhya Pradesh also recorded the highest increase in the number of tigers.
- Tiger occupancy has increased in Andhra Pradesh while declined in Chhattisgarh & Odisha.
- There are 13 tiger range countries in the world – India, Bangladesh, Bhutan, Cambodia, China, Indonesia, Lao PDR, Malaysia, Myanmar, Nepal, Russia, Thailand & Vietnam. India is ready to take on the leadership role in the tiger conservation efforts around the countries.

METHODS EMPLOYED

- Estimation of tigers was done by double sampling approach involving a mark-recapture framework to ascertain tiger numbers.
- Data was collected using M-StriPES (Monitoring system for Tiger's Intensive Protection and Ecological Status). This application greatly eased out analysis of a large quantum of data that was collected.
- India achieved its commitment to the St Petersburg Declaration, of doubling Tiger Population much in advance to the 2022 deadline.

►TIGER CORRIDORS IN INDIA

- NTCA in collaboration with Wildlife Institute of India has published a document titled 'Connecting Tiger Populations for Long Term Conservation' which has mapped 32 major corridors across the country.

- Currently, there is no provision in the Wildlife (Protection) Act, 1972 to notify and conserve areas as 'Corridors'.
- Tiger Corridors can be protected under the Tiger Conservation Plans.
- State governments can notify tiger corridors as Eco-Sensitive zones, conservation reserves or community reserves. They are provided statutory basis by the Wildlife (Protection) Act, 1972.

►TIGER CONSERVATION FOUNDATION

- State Governments to establish a TCF in each tiger reserve for facilitating & supporting its management for conservation of tiger and biodiversity, apart from taking eco-tourism and eco-development initiatives by involving people in such process.
- The area of operation of the TCF shall be the tiger reserve and its adjoining landscape, forming the impact zone with possible corridor value for dispersal of wild animals from the tiger reserve.
- Out of the 51 tiger reserves, TCFs have been constituted in most except for Kamlang, Orang, Pilibhit, Rajaji & Srivilliputhur TRs.

OBJECTIVES

- Facilitate ecological, economic, social & cultural development in the tiger reserves.
- Promote eco-tourism with involvement of local stakeholder communities & provide support to safeguard natural environment in the tiger reserves.
- Facilitate creation of and maintenance of such assets
- Solicit technical, financial, social, legal and other support required for the activities of the Foundation
- Augment & mobilise financial resources including recycling of entry & such other fees received in a tiger reserve, to foster stakeholder development & eco-tourism.
- Support research, education and training.

GOVERNANCE

- Tiger Reserve State shall constitute a governing body for giving overall policy guidance & direction to Tiger Conservation Foundation. Governing Body of TCF shall be headed by Minister in charge of wildlife in the State.
- Every TCF shall have an Executive Committee to look after its day-to-day operations. It will be headed by Field Director of the Tiger Reserve.

►ECO-BRIDGES FOR TIGERS

- Telangana became the 1st state in India to have eco-friendly bridges for the movement of tigers over a canal cutting across a tiger corridor linking the Tadoba-Andhari Tiger Reserve (TATR) in the Chandrapur district of Maharashtra with the forests in Telangana's Komaram Bheem Asifabad district.
- The eco-bridge has been conceptualised by the National Board for Wildlife and the Wildlife Institute of India.
- The intervention requires the laying of fertile soil to grow grass and plants over the structure, so that fragmentation of the reserve forest is camouflaged.

TADOBA-ANDHARI TIGER RESERVE

- Tadoba-Andhari Tiger Reserve is a tiger reserve in Maharashtra state in central India.
- It is Maharashtra's oldest and largest national park.
- Andhari, a minor river in Wainganga basin flows through the tiger reserve.

►E-EYE SURVEILLANCE SYSTEM

- The e-eye is a software-based system where high resolution thermal and infrared cameras capture all activities.
- This system of surveillance is being expanded to keep track of tigers in wildlife sanctuaries and to prevent poaching and animal-human conflict.

►CANINE DISTEMPER VIRUS

- Tigers in the Ranthambore Tiger reserve are facing threat from canine distemper virus. It gets transferred from dogs to tigers and leopards in the national park.
- Canine Distemper Virus (CDV) — that can be transmitted from CDV- infected dogs living in and around wildlife sanctuaries into Tigers has started to raise concern among wildlife biologists.
- Canine distemper is a contagious disease caused by a virus that attacks the respiratory, gastrointestinal and nervous systems of puppies and dogs.
- This virus was also responsible for the deaths of lions last year in the Gir National park of Gujarat.

►LIST OF TIGER RESERVES

SL. NO.	NAME OF TIGER RESERVE	STATE
1	Nagarjunsagar Srisailam (part)*	Andhra Pradesh
2	Namdapha	Arunachal Pradesh
3	Kamlang Tiger Reserve	Arunachal Pradesh
4	Pakke	Arunachal Pradesh
5	Manas	Assam
6	Nameri	Assam

7	Orang Tiger Reserve	Assam
8	Kaziranga	Assam
9	Valmiki	Bihar
10	Udanti-Sitanadi	Chhattisgarh
11	Achanakmar	Chhattisgarh
12	Indravati	Chhattisgarh
13	Palamau	Jharkhand
14	Bandipur	Karnataka
15	Bhadra	Karnataka
16	Dandeli-Anshi	Karnataka
17	Nagarahole	Karnataka
18	BiligiriRanganatha Temple	Karnataka
19	Periyar	Kerala
20	Parambikulam	Kerala
21	Kanha	Madhya Pradesh
22	Pench	Madhya Pradesh
23	Bandhavgarh	Madhya Pradesh
24	Panna	Madhya Pradesh
25	Satpura	Madhya Pradesh
26	Sanjay-Dubri	Madhya Pradesh
27	Melghat	Maharashtra
28	Tadoba-Andhari	Maharashtra
29	Pench	Maharashtra
30	Sahyadri	Maharashtra
31	Nawegaon-Nagzira	Maharashtra
32	Bor	Maharashtra
33	Dampa	Mizoram
34	Similipal	Odisha
35	Satkosia	Odisha
36	Ranthambore	Rajasthan
37	Sariska	Rajasthan
38	Mukandra Hills	Rajasthan
39	Kalakad-Mundanthurai	Tamil Nadu
40	Anamalai	Tamil Nadu
41	Mudumalai	Tamil Nadu
42	Sathyamangalam	Tamil Nadu
43	Kawal	Telangana
44	Amrabad	Telangana
45	Dudhwa	Uttar Pradesh
46	Pilibhit	Uttar Pradesh
47	Amangarh (buffer of Corbett TR)	Uttar Pradesh
	Corbett	Uttarakhand
48	Rajaji TR	Uttarakhand
49	Sunderbans	West Bengal
50	Buxa	West Bengal
51	Srivilliputhur-Megamalai Tiger Reserve (Latest edition to the list)	Tamil Nadu Famous for Grizzled giant squirrel (IUCN Status: Near Threatened). Located south of Palghat gap and bordered by Periyar Tiger Reserve.
	TOTAL	**51**
	Proposed Tiger Reserves: (1) Guru Ghasidas National Park Chhattisgarh (2) Malai Mahadeshwar Sanctuary, Karnataka (3) Dibang Sanctuary, Arunachal Pradesh (4) Kaimur Sanctury, Bihar (5) Suhelwa Sanctuary, UP (6) Mhadei Sanctuary (It will be first Tiger Reserve in Goa (7) Nandhaur Sanctuary, Uttarakhand (8) Wayanad Sanctuary, Kerala.	

►LIST OF BIOSPHERE RESERVES IN INDIA

BIOSPHERE RESERVES	LOCATION	FLORA	FAUNA	TRIBALS
Nilgiri (Included in MAB list of UNESCO)	Part of Wayanad, Nagarhole, Bandipur & Madumalai, Nilambur, Silent Valley & Siruvani hills in Tamil Nadu, Kerala & Karnataka.	Tropical forest; Mixed mountain and highland systems	Tiger, Elephant, Nilgiri Tahr, Lion-tailed macaque, Nilgiri Langur	Cholanaikans-only surviving hunter-gatherers of the Indian subcontinent
Nanda Devi (Included in	Part of Chamoli, Pithoragarh and Almora	Herbaceous species and scrub communities such	Snow leopard, Himalayan black bear,	Bhotia tribe

MAB list of UNESCO)	districts & Valley of Flowers in Uttarakhand.	as Rhododendron. Plant species including lichens, fungi, bryophytes and pteridophytes	Brown Bear, Musk deer, Bharal/blue Sheep, Asiatic black bear, Himalayan Tahr, Koklas Pheasant.	
Nokrek (Included in MAB list of UNESCO)	Part of East, West and South Garo Hill districts in Meghalaya.	Evergreen and semi-evergreen deciduous forests dominate the landscape	Slow Loris, Giant flying squirrel, Pig-tailed macaque, Red Panda (Sighted only once), leopards, elephants, Hoolock gibbons.	Garo (Achikmande), Banias or Hajjons
Manas	Part of Kokrajhar, Bongaigaon, Barpeta, Nalbari, Kamprup and Darang districts in Assam.		Golden Langur, Red Panda, Pygmy Hog, Hispid Hare	
Sunderbans (Included in MAB list of UNESCO)	Part of delta of Ganges & Brahmaputra River system in West Bengal.	Tropical humid forest; Mangroves, Sundari Tree	Royal Bengal tiger, Salvator Lizard, Bengal Monitor Lizard.	
Gulf of Mannar (Included in MAB list of UNESCO)	India part of Gulf of Mannar extending from Rameswaram island in the North to Kanyakumari in the South of Tamil Nadu. There are 21 Islands	Islands including coastal/marine component; coral reefs and mangrove, sea grass beds (Halophila gas), coral reefs	Dugong or Sea Cow, Sea cucumber, Sea Fan	Marakeyars, local people mainly engaged in fishing
Great Nicobar (Included in MAB list of UNESCO)	Southernmost island of A&N Islands. It incorporates two national parks Campbell Bay National Park and Galathea National Park.	Part of Sundaland Biodiversity Hotspot, Tropical Wet Evergreen Forests.	Saltwater Crocodile, Edible-nest swiftlet, Nicobar tailed macaque, Giant Leatherback sea turtle (Only breeding site), Nicobar tree shrew, Nicobar scrub fowl, Serpent Eagle, Crab Eating Mazaque	Shompen and Nicobarese
Similipal (Included in MAB list of UNESCO)	Part of Mayurbhanj district in Orissa.	The park derives its name from abundance of semul (red silk cotton trees) that grow here. Orchids, medicinal plants,etc.	Asiatic Elephant,Gaur, Royal Bengal Tiger, Wild elephant. Mugger Crocodile management program was launched here.	ErengaKharias and the Mankirdias, Ho, Gonda and Munda, etc.
Dibru-Saikhova	Part of Dibrugarh and Tinsukia districts in Assam.		Golden Langur	
Dehang-Dibang	Part of Upper Siang, West Siang and Dibang		Mishmi takin, Red goral, musk deer, Red	

	Valley districts in Arunachal Pradesh.		Panda, Asiatic Black bear, Green Pit Viper, Takin.	
Pachmarhi (Included in MAB list of UNESCO)	Satpura Hills runs across it. Covers three protected areas – Satpura National Park, Bori and Pachmarhi Wildlife Sanctuary	Sal Forests	Barasinga, Gaur, Bears, Tigers and leopards, Giant Squirrel and Crested , Flying Squirrel.	Gond, Korkus-tribes introduced the cultivation of potatoes and made use of honeycombs to produce honey in significant quantities for commercial use. Most primitive Bhariya Tribe are found here.
Khangchendzonga (Included in MAB list of UNESCO)	Part of North and West districts in Sikkim.		Snow Leopard, Red Panda	
Agasthyamalai (Included in MAB list of UNESCO)	Covers Peppara and Shendurney wildlife sanctuaries and parts of Neyyar sanctuary in Kerala and Kalakad Mundanthurai Tiger Reserve of Tamil Nadu.	Tropical Wet Evergreen Forests.	Lion Tailed Macaque, Slender Loris, Great Pied Hornbill, Nilgiri Tahr, Elephants, Tiger	**Kani tribes** from both Tamil Nadu and Kerala
Achanakmar-Amarkantak (Included in MAB list of UNESCO)	Maikala hills of Satpura range passes through it. It separates the rivers that drain into the Arabian Sea and Bay of Bengal. Source of three rivers: Narmada, Son and Johila.		Four horned antelope, Indian wild dog, Saras crane , Asian white-backed vulture, Sacred grovebush frog ,striped Hyaena, , Chital, Wild Bear, Leopard.	Amarkantak the site for origin of Son, Johilla and Narmada rivers is located in it.
Kachchh	Part of Kachchh, Rajkot, Surendranagar and Patan districts in Gujarat.	Banni Grasslands, Prosopis juliflora (Native of Central America, Invasive Alien Species).	Indian Wild Ass, Site for Flamingo breeding (Flamingo City), Chinkara, Caracal, Desert Cat, Desert Fox	Fossil Park at Khadir Bet, Maldhari pastoralists
Cold Desert	Pin Valley National Park, Chandratal, Sarchu Kibber Wildlife sanctuary in Himachal Pradesh.	Deodar tree	Snow Leopard	
Seshachalam	Seshachalam hill ranges in Eastern Ghats.	Tropical dry deciduous forests, Red Sanders	Slender Loris, Indian giant squirrel, Mouse deer Golden Gecko, Yellow throated bulbul.	Tirupati Balaji temple is located here.

Panna (Included in MAB list of UNESCO)	Part of Panna & Chhattarpur districts in Madhya Pradesh	Dry deciduous forests of Teak, Salai, Kardhai.	Tiger, Chital, Chinkara, Sambhar, Sloth bear	Gond, Famous temple of Prannathji of Pranami Sect.

►NATURAL WORLD HERITAGE SITES

Created in 1972, the primary mission of the Convention is to identify and protect world's natural and cultural heritage considered to be of Outstanding Universal Value.

It is governed by World Heritage Committee supported by UNESCO World Heritage Centre, it meets annually. IUCN is Advisory Body on natural heritage.

40 sites from India are on the World Heritage List.

Natural World Heritage Sites from India

- Great Himalayan National Park Conservation Area, Himachal Pradesh: This national park is in Western Himalayan region. It is characterized by alpine peaks, alpine meadows & riverine forests. It's glaciers are sources of rivers like Sainj, Jiwa Nal, Tirthan and Parvati Rivers (all tributaries of Beas River). Covers: Great Himalayan National Park, Sainj Wildlife Sanctuary and Tirthan Wildlife Sanctuary. Important Flora & Fauna: Snow Leopard, Musk Deer, Himalayan Serow. Himalayan Yew forms the undergrowth of forests.
- Kaziranga National Park, Assam: Last unmodified natural areas in northeast India. This park accounts for 2/3rd of world population of one-horned rhinoceros. West alluvial grassland formed by elephant grass occupies most of the area. It is also a tiger reserve. Fauna: Tiger, One-Horned Rhinoceros, Wild Water Buffaloes, Ganges River Dolphin, Hoolock Gibbon.
- Keoladeo National Park: (Covered in Wetlands)
- Manas Wildlife Sanctuary: It is located on the borders of Bhutan and spans districts of Kokrajhar, Chirang, Buxa and Udalgiri in North-West Assam. It is separated from the Royal Manas National Park of Bhutan by the River Manas and it is separated by Buxa Tiger Reserve of West Bengal by River Sankosh. It forms part of a large conservation landscape which includes Buxa-Nameri-Pakke-Namdapha tiger and protected areas of Bhutan and Myanmar. Flora: Sal Forests, Bhabar Savannah, Dry deciduous forests. Fauna: Tiger, Pygmy Hog, One-horned Rhinoceros and Elephant, Bengal Florican. Wild Buffalo population is probably the only pure strain.
- Nanda Devi and Valley of Flowers National Parks: Valley of Flowers National Park is renowned for its meadow of endemic alpine flowers and outstanding natural beauty. The landscape is dominated by Nanda Devi peak which approached through RishiGanga gorge. Fauna: Asiatic Black Bear, Snow Leopard, Brown Bear and Blue Sheep, Himalayan Musk Deer.
- Sundarbans National Park
- Western Ghats:

Mixed

- Khangchendzonga National Park

Tentative Sites (These sites do not have World Heritage Status as of now but have been submitted by India for inclusion in the list)

- Majuli River Island, Assam: It is a fluvial riverine island. It is the first island to be made a district in India. The island is formed by Brahmaputra River in the South and Kherkutia Xuti, a branch of Brahmaputra, joined by Subansiri in the north. The island is the cultural capital of Assamese culture whose foundation is laid by Srimanta Sankardeva. Jadhav Payeng, an environmental activist, also known as forest man of India, has planted Molai Forest which one of the largest afforested this forest to protect Majuli from riverine erosion.
- Namdapha National Park, Arunachal Pradesh: This national park along with Kamlang Wildlife Sanctuary is in the eastern extremity of Arunachal Pradesh, close to trijunction of India, China & Myanmar. Located between Patkai bum and Mishmi hills. The park has northernmost lowland evergreen rainforests in the world along with alpine forests in the higher reaches. It is the fourth largest national park in India by area. Dihing River, a tributary of Brahmaputra passes through it. Dapha Bum (4571 m) is the highest point of this national park. Fauna: Namdapha Fying Squirrel (IUCN status: Critically Endangered) is endemic to this area. The park boasts of four large cats: Snow Leopard (IUCN status: Vulnerable), Leopard, Tiger and Clouded Leopard (IUCN status: Vulnerable).

- Wild Ass Santuary, Little Rann of Kutch, Gujarat: One of the last places where endangered wild ass sub-species Indian Wild Ass (IUCN Status: Near Threatened) can be spotted.
- Neora Valley National Park, Kalimpong, West Bengal: It is a compact patch of virgin late succession forests, rich in biodiversity located in the Eastern Himalayan region. Altitude varies between 183 m to 3200 m. It has Temperate & Sub-tropical forests. Fauna: Red Panda (IUCN Status: Endangered)
- Desert National Park, Rajasthan: It is one of the Hot deserts of the world with highest human density. It is spread across two districts of Jaisalmer and Barmer. Fauna: Only landscape having breeding population of Great Indian Bustard. Spiny Tailed Lizards. Desert Fox, Chinkara, Desert Cat Flora: Sewan Grass found here which is a major source of nutrition for birds and animals found here. Rohida state flower of Rajasthan is found here. Orans are grasslands found here. Khejri tree is commonly found here and protected by local community called Bishnois. There are settlements in the National Park called Dhanis.
- Apatani Cultural Landscape: Ziro Valley in Arunachal Pradesh
- Chilika Lake (Odisha): It is a brackish water lake & a shallow lagoon with estuarine character spread across districts of Puri, Khurda & Ganjam. Located on the mouth of Daya River. It the largest coastal lagoon in India & largest brackish water lagoon in the world and largest saltwater lake in India. Fauna: Irrawaddy Dolphins
- Narcondam Island, A&N islands: It is a separate island part of A&N islands. This volcanic island has a endemic population of Narcondam Hornbill (Only found here) which has the smallest range of all Asian Hornbills.
- Cold Desert Cultural Landscape of India: It stretches in the Himalayas from Ladakh to Kinnaur in Himachal Pradesh. This region is know for its harsh climate due to its high altitude and location on the leeward side of Himalayas, which makes it a rain-shadow zone. This area is inhabited by Indo-Mongoloid people who are buddhist in faith. Buddhist monasteries known as Gompas with a trademark prayer flag fluttering on top. (Important Monasteries in the region are:
- Satpura Tiger Reserve, MP: It is a prime example of central Indian highland eco-system. Species from both Himalayan and Western Ghats meet here. Pachmarhi a famous tourist destination is located near it and Dhoopgarh the highest peak of Madhya Pradesh are located in it. Pandav Caves which are group of 5 caves.
- Keibul Lamjao Conservation Area (Covered in Wetland)
- Garo Hills Conservation Area: It accompanies three protected areas: Nokrek National Park, Bapakram National Pak & Siju Sanctuary. Garo mountains and its caves gives an idea about earth's evolutionary history. Fauna: Insectivorous plants such as Sundew and Pitcher Plant. National Citrus Gene Sanctuary in Nokrek is noted for wild varieties of citrus fruits. Indian Wild Orange found here is considered to be progenitor of all citrus species in the world. Fauna: Hoolock Gibbon.
- Bhedaghat-Lametaghat in Narmada Valley, MP: Bhedaghat (Dhuandhar waterfalls), known as Grand Canyon of India, is in Jabalpur, MP. It appears as if smoke is coming out of the river. The site has outstanding beauty of marble rocks. These magical marble mountains assume different colours and even shapes of animals and other living forms as one moves through them.
- Living Root Bridges Cultural Landscapes: Locally known as Jingkieng Jri. They are ficus based rural connectivity and livelihood solutions within dense moist forests in Meghalaya. Roots of Indian Rubber Tree are engineered for the construction of these structures. They are grown by Khasi tribal communities.
- Geoglyphs of Konkan region: Geoglyphs are rock art produced on the surface earth (open-air) either by positioning rocks, rock fragments or by carving out or removing part of a rock surface to form a design. The geoglyphs found in the Konkan region are the only evidence of prehistoric human occupation in this region. The geoglyphs have been prominently made in the period starting from Prehistoric to Mesolithic period. Important sites where Geoglyphs are found in Konkan region. Important sites where geoglyphs are found in Konkan region: (a) Jambhrun (Maharashtra) (b) Ukshi (Maharashtra) (c) Kasheli (Maharashtra): Largest rock engraving in Indiia (18X13 in Elephant) (d) Rundhetali (Maharashtra) (e) Devi hasol (Maharashtra) (f) Barsu (Maharashtra) (g) Devache Gothane (Maharashtra) (h) Kudopi (Maharashtra).

►HUMAN-WILDLIFE CONFLICT

Human Wildlife Conflict are increasingly being observed across the globe. Recently this issue was brought to the fore by a killing of an elephant in Kerala. This is just one of the occurrences where it caught the media attention.

REASONS FOR ANIMAL-HUMAN CONFLICT

- Human population explosion
- Shrinking forest cover
- Poaching
- rapid and unplanned urbanisation
- Infra development in forest areas like
- electrification penetrating into forest areas
- increasing road density,
- Destruction of natural animal corridors
- Agricultural expansion and cultivation up to forest boundaries
- Increases the availability of easily accessible food crops.
- The absence of large predators outside forests

DECLARING A SPECIES AS "VERMIN"

- If a species is put under schedule V of WPA, 1972- its killing is allowed.
- Govt very rarely does this.
- Even if declared, the actions are not taken often enough
- However, government is hesitant to cull vermin because vocal urban wildlife activist groups generally create a social media storm when such decisions are taken and challenge the order in court.

►NATIONAL ACTION PLAN FOR CONSERVATION OF MIGRATORY BIRDS

There are 9 flyways in the world. The central Asian flyway is one among them. It encompasses migration routes over 30 countries. It includes breeding Grounds of Russia, Maldives, west and South Asia, British Indian ocean territory. The fly away is important to India because it provides critical stop over sites to over 90 percentage of the birds migrating in this route.

ABOUT THE PLAN

- The plan was launched to be implemented between 2018 and 2023. The overall goal of the plan is to reduce population decline of migratory birds and to secure their habitat. The short-term goal of the plan is to stop the decline in population by 2027.
- The plan is to be implemented by the Ministry of Environment Forest and Climate Change. A status report of the plan implementation is to be published by the Ministry every two years.
- The plan aims to conserve the migratory birds and their habitats within the agenda of Sustainable Development Goals.
- It draws upon the five major goals of conservation of migratory species strategic plan 2015 to 2023.

MAJOR COMPONENTS OF THE PLAN

In order to achieve its objectives, the plan has been structured in the following six interrelated components

- Species conservation
- Habitat conservation and sustainable management
- Communication and outreach
- Capacity development
- Research and knowledge base development
- International cooperation

►INDIA'S FIRST FIVE ANIMAL BRIDGES

India is to see the first five animal overpasses on the Delhi-Mumbai Expressway. The expressway is under construction.

HIGHLIGHTS

The animal bridges were planned to avoid disturbances to Ranthambore Wildlife Corridor that connects Mukundra and Ranthambhore Wildlife Sanctuaries. The plan of the animal bridges has been approved by the Central Wildlife Board. The Rajasthan Government has also approved the project. Following these approvals, the NHAI (National Highway Authority of India) has begun the infrastructure activities.

ABOUT ANIMAL BRIDGES

- Animal bridges are natural looking structures over the corridor that will provide safe passage for the wildlife.
- The animals under the plan will get passage at every 500-metre interval.
- The animal passages are to be developed as a part of forest corridor with trees. Therefore, the animals will find the corridor natural.
- The animal bridges will have boundary wall of eight metres with a sound barrier of 3-4 metres in the wildlife section.
- Under the plan, around five underground stretches are to be developed. The combined length of these stretches is 2.5 km.
- The animal bridges will help prevent man-animal conflict and also avoid collisions between animals and vehicles.

►KAISER-I-HIND

- Arunachal Pradesh has decided to make Kaiser-i-Hind as its State butterfly. It is brightly coloured with green iridescence. It usually flies at tree top level and descends to sit on low vegetation where there is strong morning sunlight.
- It is found in 6 States along the Eastern Himalayas. It is also found in Nepal, Bhutan, Myanmar, Laos, Vietnam & southern China.
- Part of Schedule II of Wildlife Protection Act, 1972
- IUCN Status: Near Threatened

Other State butterflies in India

Seven Indian States have declared State Butterflies in India.

- Maharashtra: Blue Mormon (First State to declare a State butterfly)
- Uttarakhand: Common Peacock
- Karnataka: Southern Birdwings (Largest Butterfly in India)
- Kerala: Malabar banded Peacock
- Tamil Nadu: Tamil Yeoman
- Arunachal Pradesh: Kaisar-i-Hind
- Goa: Malabar Tree Nymph (Black & White Wing pattern)

NATIONAL BUTTERFLY IN INDIA

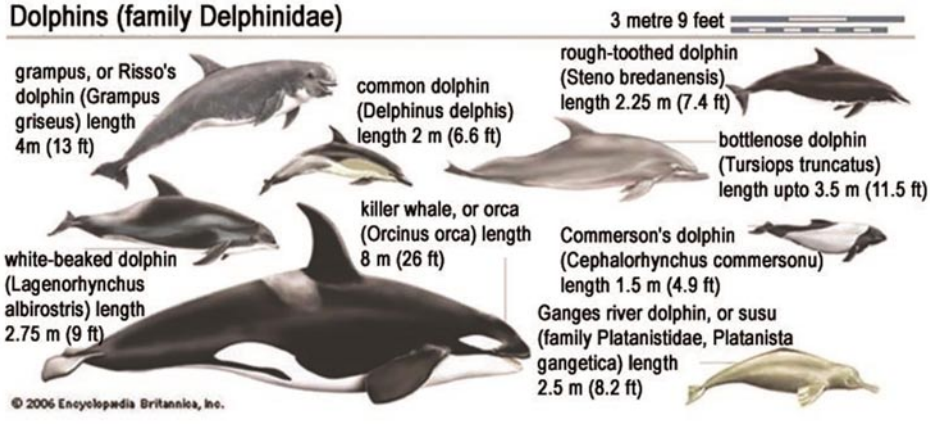
A citizen poll was organised to choose among 7 butterfly species, the national butterfly.

7 butterflies' candidates for national butterfly are:

- Indian Jezebel: Found across the country.
- Orange Oakleaf: Found in Central, Northern & North-Eastern India. Blue and Orange in colour.
- Common Nawab: Found all over the country.
- Krishna Peacock: Black in colour with beautiful colours. Found in Sikkim, Northwest Bengal & Arunachal Pradesh.
- Five-bar Sword Tail: Found in evergreen forests of Western Ghats, eastern Himalaya & North-East India.
- Northern Jungle Queen: Extraordinarily large size. Traditional weaving patterns of Mishmi communities of Arunachal Pradesh are inspired from this.
- Yellow Gorgon: Bright Yellow in colour. Found in Arunachal Pradesh, Meghalaya, Northern West Bengal & Sikkim.

►PROJECT DOLPHIN

The government announced the plan to launch Project Dolphin. The proposed project is aimed at saving both river and marine dolphins.



WHAT WILL PROJECT DOLPHIN DO?

- The Project Dolphin will be on the lines of Project Tiger, which has helped increase the tiger population. Special Conservation program needs to be taken up for Gangetic Dolphin which is national aquatic animal and also indicator species for the river Ganga spread over several states.
- So far, the National Mission for Clean Ganga (NMCG), which implements the government's flagship scheme Namami Ganga, has been taking some initiatives for saving dolphins. Now, Project Dolphin is expected to be implemented by the Ministry of Environment, Forest and Climate Change.

WHAT IS THE GANGETIC DOLPHIN?

- The Gangetic river system is home to a vast variety of aquatic life, including the Gangetic dolphin.
- The Gangetic dolphin is one of five species of river dolphin found around the world. It is found mainly in the Indian subcontinent, particularly in Ganga-Brahmaputra-Meghna and Karnaphuli-Sangu river systems.
- The Conservation Action Plan for the Ganges River Dolphin, 2010-2020, describes male dolphins as being about 2-2.2 metres long and females as a little longer at 2.4-2.6 m. An adult dolphin could weigh between

70 kg and 90 kg. The breeding season of the Gangetic dolphin extends from January to June. They feed on several species of fishes, invertebrates etc.

WHY IS IT IMPORTANT TO SAVE DOLPHINS?

- The construction of dams and barrages and increasing pollution have led to a decline in the population of aquatic animals in the rivers in general and of dolphins in particular.
- Aquatic life is an indicator of the health of river ecosystems. As the Gangetic dolphin is at the top of the food chain, protecting the species and its habitat will ensure conservation of aquatic lives of the river.

HAVE OTHER GOVERNMENTS USED AQUATIC LIFE AS AN INDICATOR OF THE HEALTH OF A RIVER SYSTEM?

Globally, there have been such examples. For instance, the Rhine Action Plan (1987) of the International Commission for the Protection of the Rhine (ICPR) — representing Switzerland, France, Germany, Luxemburg and the Netherlands — brought back the salmon. The return of the migratory fish is taken as an indicator of the river's improved health.

►CHEETAH

Century-old Mysuru zoo has become the second Indian zoo to house the African cheetah, the fastest land animal, as it managed to get a male and two females from a cheetah conservation centre in South Africa under an animal exchange program.

Also, Supreme court had lifted seven years stay on a proposal to introduce African cheetahs from Namibia into the Indian habitat on an experimental basis.

Why is there a need for re-introduction? Because the Cheetah species has got extinct in the country and the plan is to revive the Cheetah population in India.

Reintroduction of the cheetah in India involves the re-establishment of a population of cheetahs into areas where they had previously existed. A part of the reintroduction process is the identification and restoration of their former grassland scrub forest habitats.

CHEETAH CONSERVATION FUND

- It is an international non-profit organization headquartered in Namibia, founded in 1990.
- Its mission is to be the internationally recognized center of excellence in the conservation of cheetah's and their ecosystems.
- CCF was the result of efforts of Dr. Laurie Marker who moved to Namibia to fight farmer-cheetah conflict in the region.

ORIGINAL GEOGRAPHICAL RANGE

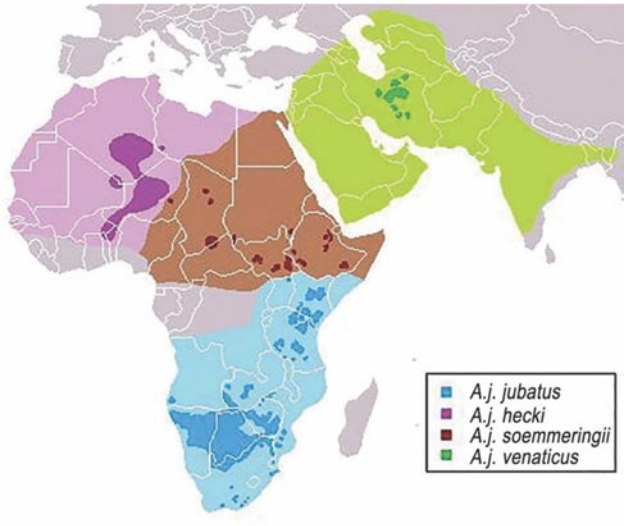


Fig: showing the range of Cheetah

CAUSES OF EXTINCTION OF CHEETAHS

- Hunting: They were hunted into extinction during and after the Mughal Period, largely by Rajput and Maratha Indian royalty and later by British colonialists, until the early 20th century when only several thousand remained.
- Captive (help in hunting): Trapping of large numbers of adult Indian cheetahs, who had already learned hunting skills from wild mothers, for assisting in royal hunts is said to be another major cause of the species rapid decline in India as they never bred in captivity with only one record of a litter ever.

SO, WHAT ARE THE WAYS IN WHICH A CHEETAH POPULATION CAN BE REVIVED?

- Biotechnology: Cloning
- India first proposed this method during last decade, but it didn't work. But it was not successful due to lack of cooperation from Iran.
- Reintroducing live Cheetahs
- So, it was decided that African Cheetah would be introduced in protected areas in India. India has decided to get Cheetahs from Namibia.

WHAT ARE THE ISSUES WITH THE REINTRODUCTION?

Clash with lion conservation

- As the habitat for Asiatic lion as well as the Cheetah is similar, many sites identified for Cheetah reintroduction clash with lion conservation. As we know that there is only a single population of Lion in India in Gir and that has become unsustainable due to rapid growth in their population and there is a need to relocate many lions from Gir.

- An expert panel formed by the government shortlisted a number of protected areas where cheetahs could be relocated. These were Kuno-Palpur and Nauradehi Wildlife Sanctuary in Madhya Pradesh, Velavadar National Park in Gujarat and the Shahgarh bulge in Rajasthan.
- Kuno reintroduction plan ran into trouble. The protected area had also been shortlisted for introduction of Asiatic Lions from heavily populated Gir in Gujarat. To not give lions to Kuno, Gujarat's legal counsel had put forward the argument that Kuno was being used for the introduction of African cheetah which might take several years to fully settle down and repopulate area and hence reintroduction of lions should only be done after that.

PERPETUAL PROBLEMS WITH INDIA'S WILDLIFE

- As the import of the Cheetahs from Africa will be limited, the problems being faced by the wildlife in the country might undo the efforts.
- It is advisable to resolve following issues first:
- Human-wildlife conflict,
- loss of habitat and loss of prey
- illegal trafficking.
- The advent of climate change and growing human populations have only made these problems worse.
- With less available land for wildlife, species that require vast home range like the cheetah are placed in competition with other animals and humans, all fighting over less space.

►HIMALAYAN SEROW

Himalayan serow has been sighted for the first time in Himalayan cold desert region in Spiti, Himachal Pradesh.

HIMALAYAN SEROW

- It's a medium-sized mammal with a large head, thick neck, short limbs, long, mule-like ea and a coat of dark hair.
- There are several species of serows, and all of them are found in Asia. The Himalayan serow is restricted to the Himalayan region. It is a subspecies of the mainland.
- Himalayan serows are herbivores and are typically found at altitudes between 2,000 metres and 4,000 metres (6,500 to 13,000 feet). They are known to be found in eastern, central, and western Himalayas, but not in the Trans Himalayan region.

WHY IS THE SIGHTING OF THE SEROW UNUSUAL?

- Spiti lies in the cold mountain desert region of the western Himalaya, and its valley floor has an average elevation of 4,270 metres above sea level.
- Serows are generally not found at this altitude, and never before has a serow been seen in the Himalayan cold desert.
- Wildlife officials believe this particular animal may have strayed into the Spiti valley from the Rupi Bhaba Wildlife Sanctuary in adjoining Kinnaur.
- It is otherwise a very elusive animal, and few people have ever caught so much as a glimpse of it. We have been frantically trying to spot serows in the national park for the last 10-12 years and have so far managed only two sightings through camera traps in the Tirthan valley.
- The animal has also been spotted in the Rupi Bhaba Wildlife Sanctuary, and in the higher reaches of Chamba.

IS THE SEROW A THREATENED OR ENDANGERED SPECIES?

- According to the International Union for Conservation of Nature (IUCN), Himalayan serows have experienced significant declines in population size, range size and habitat in the last decade, and this is expected to continue due to intensive human impact.
- IUCN status: Vulnerable
- It is listed under Schedule I of The Wildlife Protection Act, 1972, which provides absolute protection.

►STATUS OF LEOPARD IN INDIA 2018

Kerala has 650 leopards stealthily roaming its tiger reserves. The State's leopard population is the third highest in the Western Ghats region. Karnataka tops the list with 1,783 leopards, followed by Tamil Nadu with 868, according to the Status of Leopards in India 2018 report.

ABOUT LEOPARDS

- The leopard (Panthera pardus) is one of the five extant species in the genus Panthera, a member of the Felidae.
- It occurs in a wide range in sub-Saharan Africa, in small parts of Western and Central Asia, a small part of European Russia, and on the Indian subcontinent to Southeast and East Asia.
- It is listed as Vulnerable on the IUCN Red List because leopard populations are threatened by habitat loss and fragmentation and are declining in large parts of

the global range. In Hong Kong, Singapore, South Korea, Jordan, Morocco, Togo, the United Arab Emirates, Uzbekistan, Lebanon, Mauritania, Kuwait, Syria, Libya, Tunisia and most likely in North Korea, Gambia, Laos, Lesotho, Tajikistan, Vietnam, and Israel, leopard populations have already been extirpated.

- Contemporary records suggest that the leopard occurs in only 25% of its historical global range.

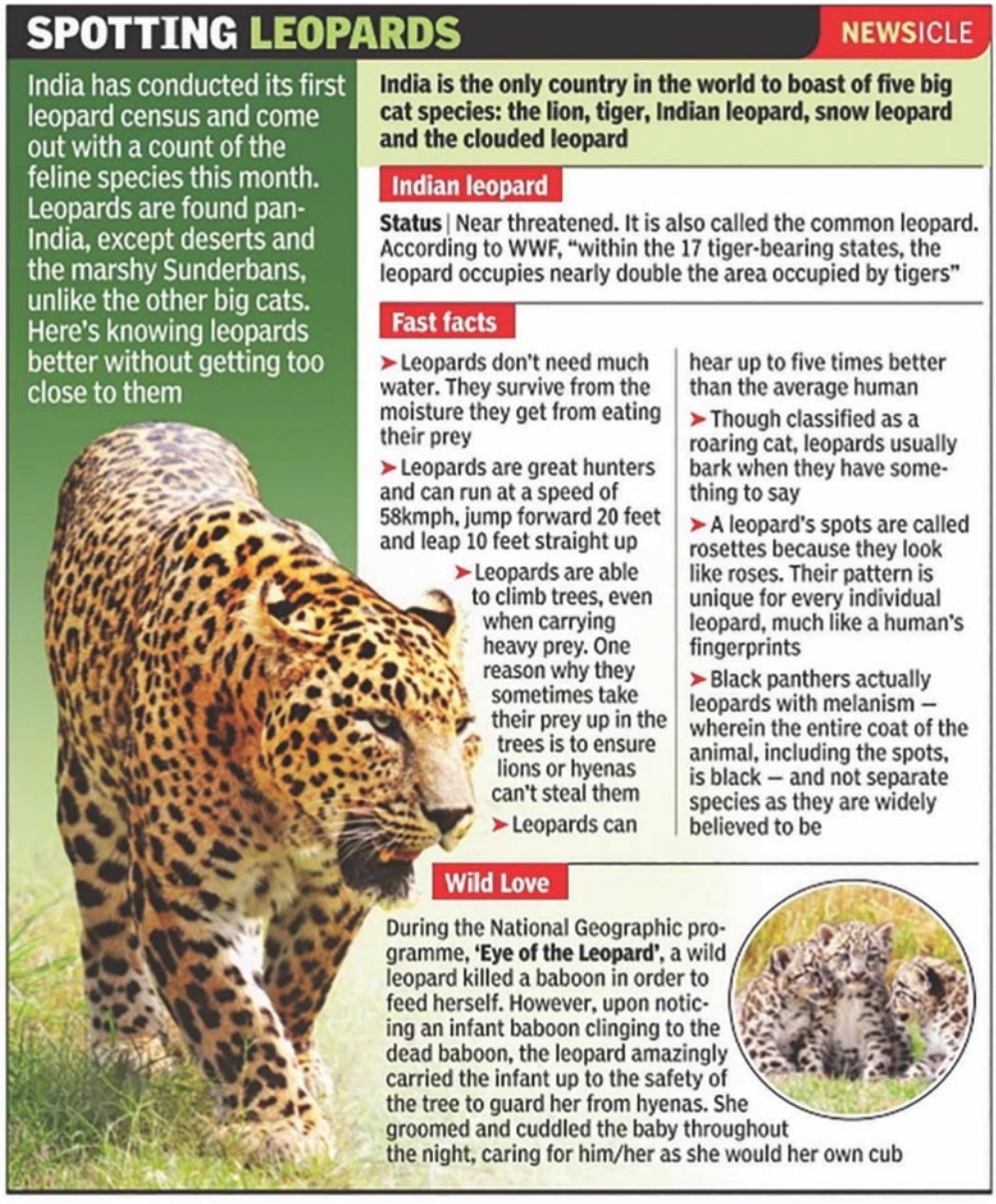
INDIAN LEOPARD

- The Indian leopard (Panthera pardus fusca) is a leopard subspecies widely distributed on the Indian subcontinent.

The species Panthera pardus is listed as Vulnerable on the IUCN Red List because populations have declined following habitat loss and fragmentation, poaching for the illegal trade of skins and body parts, and persecution due to conflict situations.

Since the main conservation efforts towards Leopards have been enabled by Tiger Reserves,

Project Tiger: The Government of India launched the centrally Sponsored Scheme the 'Project Tiger' in 1973 for in-situ conservation of wild tigers in designated tiger reserves. The Project Tiger coverage has increased to 50 tiger reserves at present.



►ILLEGAL WILDLIFE TRAFFICKING

WILDLIFE CRIME CONTROL BUREAU

- It is a statutory body under MOEFCC established to combat organized wildlife crime under Wildlife Protection Act, 1972.
- Wildlife Protection Act prohibits illegal capturing, killing, buying, selling of animals & animal parts. Any person committing a breach of any of the conditions listed in the Act shall be punished with

imprisonment which may extend up to 3 years, or with a fine which may extend to Rs 25,000 or both.

Functions

- Collect & collate intelligence related to wildlife crime.
- Disseminate information to States and other enforcement agencies for immediate actions to apprehend criminals.
- Create a centralized wildlife crime data bank.
- Coordinate and assist foreign authorities/organisations to curb illegal wildlife trade and wildlife products.

TRAFFIC.

- It was established by WWF and IUCN in 1976 as a wildlife trade monitoring network to undertake data collection, analysis and recommend on sustainable wildlife trade.
- It became an independent NGO in 2017, with WWF and IUCN sitting on its Board along with independent Board members.

ANIMALS FREQUENTLY TRAFFICKED FROM INDIA

Tibetan Antelope

- They are a rare wild species of antelopes (also called Chiru) who live in high altitudes of 3,250-5,500 m. They are capable of surviving in extreme climates.
- Their exceptionally fine underfur, called shahtoosh, is one of the finest qualities of wool used in luxury garments.
- They are threatened due to massive poaching.
- Operation Softgold has been launched for curbing illegal trade in Tibetan Antelope.
- IUCN Status: Near Threatened

Ladakh banded apollo

- A rare butterfly found in the mountains of Central Asia mountains. It is found in high altitude alpine meadows and pastures.
- It is threatened by illegal trade and estimated to be sold at $20,000 per specimen for ornamental use.

Mongoose

- They are trafficked for their hair which are used to make paint brushes. They inhabit open forests, scrublands and cultivated fields, often close to human habitations. It preys on rodents, snakes, birds eggs and hatchlings.
- IUCN Status: Least Concern

Pangolin

- They are mammals. They have large, protective keratin scales, covering their skin (only mammals with this feature).
- Also known as scaly anteaters. Their diets mainly consist of ants and termites, which they capture using their long tongues.
- They are one of the most trafficked mammals in the world mainly for their scales which is used in traditional medicine.

Turtles

- As per a report released in 2019 by TRAFFIC, at least 200 tortoises and freshwater turtles fall prey to illicit poaching and smuggling every week, making them the most trafficked in the country.
- One of the major challenges for freshwater turtle conservation in the country is that wildlife crime prevention agencies are not sufficiently equipped to know how to distinguish one species from the other, or their protection status in accordance with CITES (Convention on International Trade in Endangered Species) and the Wildlife Protection Act.
- There are five species in Indian waters i.e., Olive Ridley, Green turtle, Loggerhead, Hawksbill, Leatherback. (Loggerhead Turtles: Galathea Bay in Great Nicobar island is the most important nesting site of Leatherback turtles in India).
- Olive Ridley, Leatherback and Loggerhead are listed as 'Vulnerable' on IUCN Red List of Threatened Species.
- Hawksbill turtle is listed as 'Critically Endangered' and Green Turtle is listed as 'Endangered' on IUCN Red List.
- They are protected in Indian Wildlife Protection Act of 1972, under Schedule I.
- Turtles have been protected in India under the Biodiversity Conservation and Ganga Rejuvenation program.

►CENTRAL ASIAN FLYWAY

- Covers a large continental area of Eurasia between Arctic & Indian Ocean and associated island chains.
- The CAF comprises several important migration routes of waterbirds, most of which extend from the northernmost breeding grounds in Siberia to the southernmost non-breeding wintering grounds in West Asia, India, the Maldives and the British Indian Ocean Territory.

- India has a strategic role in the flyway, as it provides critical stopover sites to over 90% of the bird species known to use this migratory route.

►NOCTILUCA SCINTILLANS

- A strange single-celled organism that acts both as a plant and an animal has come to dominate wintertime algal blooms in the northern Arabian Sea.
- Winter blooms of Noctiluca scintillans, also known as the sea sparkle, have displaced microscopic algae called diatoms that form the basis of the marine food chain, a paper in Nature says.
- Scientists at Columbia University fear the outbreaks could herald massive declines in fisheries in the region, potentially impacting millions of fishers in India, Pakistan, Iran, Oman and Yemen.
- They have linked the emergence of N. scintillans blooms with the loss of ice cover in the Himalayan-Tibetan Plateau driven by climate change.
- The outbreaks occur every winter in the northern Arabian Sea, stretching from India's western coast to the edges of the boot-shaped Arabian Peninsula.
- N. scintillans grazes on other microorganisms like larvae, fish eggs, and diatoms. But the unicellular phytoplanktons that live inside it can photosynthesize, turning sunlight into energy. They help their host cell survive even when food is scarce. It this sense, N. scintillans acts as both a plant and an animal.
- Its robustness makes it a threat to fragile marine food webs.

►MANDARIN DUCK

- The migratory Mandarin Duck breeds in Russia, Korea, Japan and north-eastern parts of China. It now has established its populations in Western Europe and America too. In 2018, when a Mandarin Duck was spotted in a pond in New York City's Central Park, it created a flutter among the local residents.
- The Duck, however, rarely visits India, as it does not fall in its usual migratory route. There are only a handful of recorded sightings here.
- It was recorded in 1902 in the Dibru River in the Rongagora area in Tinsukia. It was sighted in Manipur's Loktak Lake in 2013, and in Saatvoini Beel in the Manas National Park and Tiger Reserve in Assam's Baksa district in 2014.
- Floating in the Maguri Motapung Beel (or wetland) in Assam's Tinsukia district for over a week is the spectacular and rare Mandarin Duck. First spotted in February, 2021, by Madhab Gogoi, a Tinsukia-based birder and tour guide, the Duck has since become the star of the wetland — an area affected by a blowout and fire at a natural gas well, located close by, in 2020.
- IUCN Status: Least Concerned.

►BLACKBUCK

- Found only in the Indian subcontinent, mainly in three countries: India (95% of population is present); Nepal (small population survives in the arid part or *Terai)*, Pakistan (extinct as a free-ranging animal but an introduced population is found in Lal Suhanra National Park in Bahawalpur)
- Male Blackbuck are strikingly handsome animals with long, spiralling horns marked with rings and distinctly marked faces with white patches around their eyes. Their bodies have contrasting countershading, with white underparts against their dark back and legs. Females and juveniles are much less conspicuous, fawn in colour with white underparts which resemble the widespread Impala from Africa.
- Due to co-evolution with cheetah as their main predator, Blackbuck are extremely fast and rely on speed to escape from their main predators. (Considered to be the fastest animal next to Cheetah).
- Found in arid and semi-arid short grass plains once abundant in undivided Punjab, Haryana, parts of UP, Rajasthan, MP, Gujarat and down south up to Tamil Nadu. Lives in open countryside, avoiding forest and hilly areas.
- Included in Appendix III of CITES & Schedule I of the Wildlife Protection Act of 1972. IUCN Status: Least Concern.

- Inhabits several protected areas of India
  - Gujarat: Velavadar Wildlife Sanctuary, Gir Forest National Park.
  - Bihar: Kaimur Wildlife Sanctuary.
  - Maharashtra: Great Indian Bustard Sanctuary.
  - Madhya Pradesh: Kanha National Park.
  - Rajasthan: Tal Chhapar Sanctuary, National Chambal Sanctuary, Ranthambhore National Park.
  - Karnataka: Ranibennur Blackbuck Sanctuary.
  - Tamil Nadu: Point Calimere Wildlife and Bird Sanctuary, Vallanadu Wildlife Sanctuary, Guindy National Park.

►ECOLOGICALLY SENSITIVE ZONES

- Created to act as a buffer for further protection around Protected Areas such as National Parks & Wildlife Sanctuaries Activities around such areas are regulated and managed to protect the environment.
- ESZ is notified under Section 3 of the Environment (Protection) Act, 1986 by Union Ministry of Environment and Forest.
- ESZ Guidelines classify activities under three categories:
  - **Prohibited:** Commercial Mining, Setting of Saw Mill, Setting of industries causing pollution, establishment of major hydroelectric projects etc.
  - **Regulated:** Felling of Trees, Establishment of hotels and resorts, erection of electrical cables, drastic change of agricultural systems etc.
  - **Permitted:** Ongoing agriculture and horticulture practices by local communities, rain water harvesting, organic farming etc.
- Many states are opposed to ESZ because of presence of minerals and resources side by side.
- Local people in many areas are also opposed to ESZ for loss of livelihood due to restriction placed by it on various activities.

►BLUE FLAG CERTIFICATION

- Society for Integrated Coastal Management (SICOM), under MOEFCC is developing 12 beaches in India for a 'Blue Flag' certification.
- 10 Indian Beaches have Blue Flag Certification.

BLUE FLAG STANDARDS

- Established in 1985 by Copenhagen-based Foundation for Environmental Education (FEE), a not-for-profit, non-governmental organisation.
- Blue Flag criteria include standards for water quality, safety, environmental education and information, the provision of services and general environmental management criteria.
- To achieve the Blue Flag standards, a beach must be plastic-free and equipped with a waste management system. Clean water should be available for tourists, apart from international amenities. The beach should have facilities for studying the environmental impact around the area.
- Blue flag project has been started by Environment Ministry in December 2017.

LIST OF BLUE FLAG BEACHES ON INDIA

- Shivrajpur in Gujarat
- Kovalam in Tamil Nadu
- Ghoghla in Diu
- Eden in Puducherry
- Kasarkod, in Karnataka
- Padubidri in Karnataka
- Kappad in Kerala
- Rushikonda in Andhra Pradesh
- Golden in Odisha
- Radhanagar in Andaman and Nicobar Islands

SOCIETY FOR INTEGRATED COASTAL MANAGEMENT (SICOM)

- Established by MOEFCC. It is implementing World Bank assisted Integrated Coastal Zone Management (ICZM) project.
- ICZM PROJECT - Born in 1992 Earth Summit, aims to build a national capacity for implementation of comprehensive coastal management approach in the country in an attempt to achieve sustainability. India is a member of it.

►STATE OF INDIA'S BIRDS REPORT

The report was published in partnership by the following organisations ATREE, BNHS, Foundation for Ecological Security, NCF, National Biodiversity Authority of India, National Centre for Biological Sciences, SACON (Salim Ali Centre for Ornithology and Natural History), Wetlands International, WII and WWF.

It is an assessment of long term trend, current trend, distribution range size, and the overall conservation status of 867 Indian bird species.

The report is based on more than 10 million observations contributed by more than 15000 birdwatchers to the eBird Platform.

SALIENT POINTS

1. 55% of Indian bird species have seen population decrease over the past decades.
2. Species close to people, such as House Sparrow and Indian Peafowl are doing well.
3. Some globally Near Threatened species including Black headed Ibis and Oriental Darter have stable or increasing populations.
4. Raptors, migratory shorebirds and endemics to the Western Ghats have declined considerably.
5. Common species like Small Minivet, Common Greenshank and Oriental Skylark have declined.
6. Birds that eat invertebrates have declined as a group
7. Species that have suffered the highest declines in the past 25+ years:
    - White rumped Vulture
    - Richard's pit
    - Indian Vulture
    - Large Billed Leaf Warbler
    - Pacific Golden Plover
    - Curlew Sandpiper
8. Species that have increased the most in pas 25+ years:
    - Rosy Starling
    - Feral Pigeon
    - Glossy Ibis
    - Plain Prinia
    - Ashy Prinia
    - Indian Peafowl (India's national bird)

E-BIRD PLATFORM

- E-Bird India Portal is designed for use of birders and ebirders from India. It is managed by Bird Count India, partnership of a large number of organisations and groups working to increase our understanding of the distribution, abundance and population trends of Indian birds.
- Data on the portal is submitted by Birdwatchers.

►FLORA & FAUNA IN NEWS

1. **AGARWOOD:** A tree species native to Assam and parts of Northeast India. Also known as Gharuwood and Aloeswood. Uses: For aromatic, medicinal and religious purposes. It is called *'Xasi'* in Assamese and is most famed for its utility in making expensive perfumes. Often termed as 'liquid gold' due to its high demand in Arab countries. Only infected Agarwood tree (either by fungal infection or by the borer insect produces dark resin (as a defense mechanism), that makes the aromatic oil. IUCN status: Critically Endangered.
2. **RED SANDERS:** An Indian endemic tree species, with a restricted geographical range in Eastern Ghats especially in Seshachalam forests of Andhra Pradesh. It has no aroma like regular sandalwood tree, the heartwood of it is heavily impregnated with a natural red dye called 'santalin', for which it is valued and considered among the finest luxury woods globally. Red Sanders are known for their rich hue & therapeutic properties, are high in demand across Asia, particularly in China and Japan, for use in cosmetics and medicinal products as well as for making furniture, woodcraft and musical instruments. Directorate General of Foreign Trade, under Ministry of Commerce & Industry, has revised its export policy to permit the export of red sanders if it is obtained from cultivated land. IUCN Status: Endangered (Changed) & Appendix II of CITES.
3. **NEELAKURINJIIS:** A shrub found in shola forests of Western Ghats between height of 1000 m to 2000 m. Blossoms once in 12 years. The flower being bluish in colour paints, entire mountains blue. Nilgiri mountains has got their names from this. Last bloomed in 2018. Paliyan tribal people living in Tamil Nadu used it as a reference to calculate their age.
4. **DRAGON FRUIT:** A fruit of cactus species indigenous to Americas (Mexico and Central America). Also known as Pitaya. Cultivated throughout tropical and subtropical regions of the world. Doesn't require much water and specific soil condition, but slightly acidic soil (pH 5.5-6.5) is preferable for their growth. Contains several antioxidants and rich in fibre & magnesium and a very low-calorie content. Promotes growth of healthy gut bacteria which in turn results into reduction in Fatty liver,

inflammation and reduced insulin resistance.

5. **BAMBOO:** Parliament has enacted Indian Forest Act (IFA) amendment to exempt bamboo grown in non-forest areas from the definition of trees. The amendment aims to exempt bamboo grown in non-forest areas from definition of tree. Bamboo, though, taxonomically a grass, was defined as a tree under the Indian Forest Act, 1927 which meant that the felling and transit of bamboo grown on forest as well non-forest land for economic use required permit. However, bamboo grown in the forest areas shall continue to be governed by the provisions of Indian Forest Act, 1927.
6. **SNAKE PLANT:** They help to filter indoor air. It is one of the few plants that can convert CO_2 into oxygen at night. This makes it an ideal plant for bedroom décor as it can regulate healthy airflow.
7. **BAMBOO PLANT:** Bamboo palms are good at absorbing formaldehyde, benzene, chloroform and carbon monoxide from the air. They are one of the best plants to remove CO_2 from the air around it.
8. **GAMBUSIA FISH:** It is a freshwater fish species. It is also known as mosquitofish or gambezi. They feed on mosquito larvae and are used as biological control for containing pests. Particularly, they have been used for controlling malaria and dengue. It is also a invasive alien species.
9. **Halari donkey:** Found in Jamnagar & Dwarka districts that constituting Halar region in Saurashtra, Gujarat. They are white in colour. They have a strong built and large in size (close to horses). These donkeys are very docile in temperament and are used as pack animals during pastoralist migration and for transportation as donkey cart. Communities associated with: (1) Bharwad and Rabari pastoralist communities who use them as pack animals to carry luggage during migration. (2) Kumbhar who use them in their pottery work. Other species of donkeys found In India are: Spiti Donkey (Found in Spiti region of Himachal Pradesh, they are adapted to cold desert high altitude regions) and Kutchi Donkey (Found in Kutch region, grey in colour and smaller in size as compared to Halari donkeys).

10. WHITE BELLIED HERON

- A bird species, also known as Imperial heron, has been listed as critically endangered in IUCN red list.
- The heron is listed as a Schedule I species in India's Wild Life Protection Act, 1972, according it the highest legal protection.
- Remaining population inhabits wetlands and rivers in north eastern India , Bhutan and North Myanmar.
- The bird is extinct in Nepal and possibly extinct in Bangladesh too.
- The global population has dwindled to 250, out which only 50 are possibly left in India.
- In India mainly threatened by human interference and habitat loss, while Hydro power projects in Bhutan have disrupted the nesting grounds.
- Recent sightings at high altitude (in Arunachal Pradesh) for the first time has sparked hope for potential conservation habitats.

11. MUDHOL DOGS

- Also known as Pissouri Hound or Lahori Hound. These dogs are mainly distributed in Bagalkot and Vijayapur districts of Karnataka.
- The KCI (kennel club of India) registers it as a Caravan Hound while the INKC (Indian national kennel club) uses the name Mudhol Hound.
- Known for their endurance and stamina , have been used for hunting and guarding.
- Several trials are being conducted to asses their utility as a police dogs.

12. NEW SPECIES OF TREE IN ANDAMAN & NICOBAR ISLANDS

- Researchers have found a 15-meter-tall tree of coffee family in Andaman and Nicobar Island. This new species holds another significance as it is first record of genus Pyrostria in India, which is usually found in Madagascar. Named after Lal ji Singh, an official of botanical survey of India. It is categorized as 'Critically Endangered' by IUCN, in its Red list.
- The tree has some distinguished features like long stem with a whitish coating on the trunk, oblong-obovate (elliptical) leaves with a cuneate base.
- Umbellate inflorescence with 8-12 flowers is another feature which distinguished this tree from other members of this genus.
- It was first reported from South Andaman's Wandoor forest.

►SPECIES RECOVERY PROGRAM

SPECIES	DETAILS
1. Asian Wild Buffalo	The wild buffalo was once widely distributed over the tracts of tall grasslands and riverine forests in India and Nepal. The present population of wild buffalo in its entire range is estimated to be lower than 2,000 individuals. Currently, found in North-East India and Chhattisgarh where only a small population survives. **IUCN Status:** Endangered. Schedule I of Wildlife Protection Act, 1972 (Highest Protection). State Animal of Chhattisgarh.
2. Asiatic Lion	GIR forest, a dry deciduous forest ecosystem in the Saurashtra region of Gujarat, is the abode of the last surviving population of the free ranging Asiatic Lion (Panthera leo persica). The total distribution range of lion in this region is estimated to be around 9000 sq.km in three districts, i.e. Junagadh, Amreli and Bhavnagar, of which GIR National Park, GIR Wildlife Sanctuary, Paniya Wildlife Sanctuary and Mitiyal Wildlife Sanctuary account for about 1,193 sq.km. The conservation initiatives taken so far have resulted in arresting the trend of population decline of lions. **IUCN Status:** Endangered State Animal of Gujarat. New sites identified for possible relocation of lion in the future are: 1. Madhav National Park, MP 2. Sitamata Wildlife Sanctuary, Rajasthan 3. Mukundra Hills Tiger Reserve, Rajasthan 4. Gandhi Sagar Wildlife Sanctuary, MP 5. Kumbhalgarh Wildlife Sanctuary, Rajasthan 6. Jessore-Balaram Ambaji Wildlife Sanctuary, Gujarat 7. Kuno Palpur Wildlife Sanctuary, MP
3. Brow-Antlered Deer or Sangai	It is a unique animal found only in Manipur, India. The only deer which has adapted itself to swampy habitat. Phumdis of Loktak lake is the residence of this species. **IUCN status:** Critically Endangered
4. Dugong	Dugong is the only herbivorous mammal that is strictly marine, and the only member of the Order Sirenia found in India. Dugongs are restricted to coastal shallow marine habitats and grazes on the sea grass meadows in coastal waters and are called as "Sea Cows." In India, it is one of the most seriously endangered species of large mammals. Dugongs are vulnerable to anthropogenic pressures as they are solely dependent on sea grasses in coastal areas, which now have been seriously damaged by mining, trawling etc. Dugongs have also been hunted for their meat, oil, hides, bones and teeth. **IUCN Status:** Vulnerable Tamil Nadu Government in Palk Bay have established a Dugong conservation reserve. It will be India's first dugong conservation reserve. The site is of the coast of Thanjavur.
5. Edible Nest Swiftlet	Found in Andaman & Nicobar Islands. **IUCN Status:** Least Concern.
6. Gangetic River Dolphin	Gangetic or River Dolphin is one of the most endangered species found in the Ganges, Brahmaputra and their tributaries. They are the symbols of the ecological health of our major river systems. The emphasis on crocodiles, as the flagship species of the river systems has helped this species to some extent, but the waning of focused efforts of conservation have again resulted in their decline.

	IUCN Status: Endangered
7. Great Indian Bustard	The Bustards are an extremely endangered group of birds dependent on grassland ecosystems. Once upon a time, they used to occur in the arid, semi-arid and moist grasslands across the country. There are four species of Bustards in India Great Indian Bustard, Lesser Florican, Bengal Florican and Houbara Bustard. They are among the most threatened of the 22 Bustards found in the world. The Great Indian Bustard is now locally extinct from almost 90 per cent of its former range. The present population is estimated to be less than 1000 only. Similarly, perhaps, only less than 2500 Lesser Floricans survive in the whole world. The total global population of Bengal Florican could be between 400 to 500 individuals. The status of Houbara Bustard is also no more encouraging. These species have depleted, mainly due to the degradation of grasslands. **IUCN Status:** Critically Endangered
8. Hangul	Kashmir Stag or Hangul is one of the most critically endangered species found in the temperate grasslands of western Himalayas. Dachigam National Park in Kashmir represents one such grassland habitat that supports Hangul, a highly threatened and the only subspecies of the Red deer *(Cervus elaphus)* to be found in India, which is now confined only to the Kashmir Valley. **IUCN Status:** Critically Endangered
9. Indian Rhino or Great One-horned Rhinoceros	The great one-horned or Indian rhinoceros once existed across the entire northern part of the Indian subcontinent from Pakistan to the Indian-Burmese border, and including parts of Nepal and Bhutan. The species now exists only in a few small population units generally situated in the north-eastern India and in Nepal. The latest population estimation of the species shows that only less than 2,700 animals remain in the wild. Successfully, reintroduced in Dudhwa National Park. **IUCN Status:** Vulnerable
10. Jerdon's Courser	It is a nocturnal bird endemic to India. It is found in small geography in the Eastern Ghats of Andhra Pradesh. It's principal habitat is the Sri Lankamalleswara Wildlife Sanctuary, in the Rayalaseema region of Andhra Pradesh. **IUCN Status:** Critically Endangered.
11. Malabar Civet	The Malabar large spotted civet was once a common species in the coastal districts of Malabar and Travancore in southwest India in the low elevation moist forests of the Western Ghats. By the late 1950s it was reported to be almost 'extinct'. None were seen for a long period of time until 1987, when it was rediscovered about 60 km east of Calicut in Kerala. Extensive deforestation has reduced the Malabar civet's. **IUCN Status:** Critically Endangered
12. Marine Turtles	Leatherback turtle (Dermochelys coriacea) is one of the most charismatic creatures inhabiting the tropical and temperate waters from Pacific to North Atlantic and throughout the Indian Ocean (Shanker 2003). It is the largest extant marine turtle in the world and follows the longest migratory route known for turtles. The species is currently listed as Vulnerable under the IUCN red list and has been given the highest level of protection under Schedule I (Part II) of the Indian Wildlife protection Act, 1972. In India, Leatherback nesting is specific only to the Andaman and Nicobar archipelago (Namboothri et. al 2010). Pioneering work done by ANET/MCBT, IISc (CES) and Forest department in the past three decades has highlighted Little Andaman and Southernmost Great Nicobar Islands as the potential nesting sites
13. Nicobar Megapode	Found in Andaman & Nicobar Islands. **IUCN Status:** Vulnerable
14. Nilgiri	Nilgiri Tahr, a mountain goat, is the highly threatened flagship species occur on the crest lines and

Tahr	ridge forests of the southern Western Ghats. The ideal habitat of this species is the rocky outcrops adjacent to the shola-grasslands and other ridge forests. Only less than 2000 individuals of this species is remaining in the wild in the whole world with the major population confined to Eravikulam National Park in Kerala and Grizzled Giant Squirrel Wildlife Sanctuary in Tamil Nadu. **IUCN Status:** Endangered
15. Snow Leopard	Snow leopard is perhaps the most endangered of the large cats, with an estimated population of only 400 to 700 individuals in five Himalayan states in India. This species suffers from intense conflicts with rural communities, habitat degradation and depletion of natural prey base, poaching for its exquisite fur and valuable bones (used in traditional Chinese medicine). The UT of Ladakh has the distinction of harbouring a major portion of existing snow leopard population in India. **IUCN Status:** Vulnerable
16. Swamp Deer	Swamp deer or Barasingha were once abundant throughout tall wet grasslands of North Indian Terai region, Brahamaputra flood plains & Central Indian grasslands bordering sal forests. Currently, swamp deer populations are confined to Uttarakhand, Uttar Pradesh, Assam & Madhya Pradesh in India. It differs from all other Indian deer species as its antlers carry more than three teeths. It has three sub-species: 1. Western Swamp Deer: It is adapted to flooded tall grassland habitat in the Indo-gangetic plains and terai in India (UP and Uttarakhand) and Nepal. 2. Southern Swamp Deer: It is adapted to hard ground in open sal forests with a grass understorey. It survives only in Kanha National Park. It has also been reintroduced in Satpura National Park. 3. Eastern Swamp Deer: Found only in Assam mostly in Kaziranga & Manas National Park. State Animal of Uttar Pradesh and Madhya Pradesh. **IUCN Status:** Vulnerable
17. Vultures	Vultures are scavenging birds of prey. They have been divided into New World vultures, which include the Californian and Andean condors, and the Old World vultures, which include the White-rumped and Red-headed vultures. Old World vultures are found in Europe, Africa, and Asia. There are no vultures in Australia and Antarctica. Distinguishing characteristics of most vultures includes a bald head, devoid of normal feathers and feathery neck. The bare head is supposedly to maintain hygiene while feeding on carcass and also for thermoregulation. Nine species of vultures exist in India, which five belong to the genus Gyps. Three Gyps vultures, namely White-rumped Vulture, Long-billed Vulture and Slender-billed Vulture are residents, and remaining two, Eurasian Griffon Vulture and Himalayan Griffon Vulture are largely wintering species. Vultures are nature's most efficient scavengers. The Gyps vultures are specialized to feed on the soft tissue of the large ungulate carcasses. They play a vital role in the ecosystem by cleaning up the rotten carcasses left in the open. The population of Gyps vultures in the Indian subcontinent has crashed since 1990s onwards. The populations of White-rumped Vulture, Long-billed Vulture and Slender-billed Vulture had declined by around 97% during the last two decades. Veterinary use of the non-steroidal anti-inflammatory drug 'diclofenac' is the main cause attributed for this drastic population decline. Government of India has banned the use of diclofenac in veterinary medicine, has initiated Vulture Breeding Program for ex situ conservation and enhanced in situ protection of the remaining populations. Vulture Breeding Centre has been established at Pinjore, Haryana. Species of Vultures in India and their IUCN Status: 1. White-rumped Vulture (Critically Endangered) 2. Red-headed Vulture (Critically Endangered)

	3. Slender Billed Vulture (Critically Endangered) 4. Indian Vulture (Critically Endangered) 5. Egyptian Vulture (Endangered) 6. Cinerous Vulture (Near Threatened) 7. Lammergeyer Vulture (Near Threatened) 8. Himalayan Griffon (Near Threatened)
18. Northern River Terrapin - Species of riverine turtle	Rivers that flow in Eastern India. Hunted for meat and carapace. **IUCN Status:** Critically Endangered
19. Clouded Leopard	Himalayan foothills from India, South-East Asia and South China. State animal of Meghalaya. It uses its tail for balancing when moving in trees. It can climb down vertical tree trunks headfirst. It rests in trees during the day and hunts by night on the forest floor. **Habitat loss:** poached for its skin and is also as a live pet trade. **IUCN Status:** Vulnerable
20. Arabian Sea Humpback Whale	All major oceans Threatened due to ship strikes, unforgiving fishing gear and seismic explorations **IUCN Status:** Endangered
21. Red Panda	Closely associated with montane forests with dense bamboo-thicket, is found in Sikkim, West Bengal and Arunachal Pradesh. Poached for its meat, and for use in medicines, and as a pet. **IUCN Status:** Endangered

►PROTECTED AREAS IN NEWS

Papikonda National Park (Andhra Pradesh)	River Godavari passes through it. Part of the National Park is proposed to be submerged due to the Polavaram Hydroelectric Project.
Panna National Park (Madhya Pradesh)	• Some parts of the park will sink due to Ken-Betwa river linkage project and construction of Daudhan dam. • Tiger Reserve
Shoolpaneswar Wildlife Sanctuary (Gujarat)	Located close to Surat city. Located in Western Satpura Range (Rajpipla hills). It is located on the boundary of Madhya Pradesh and Maharashtra. Zarwani Waterfall is located in it.
	It was initially established as a protected area for protection of Sloth Bear. It is also home of Flying Squirrels (IUCN status) The area is predominantly tribal with Vasavas as the main tribal community.
Simlipal National Park (Odisha)	• Famous for sighting of slightly black coloured Melanistic breed of tigers. • Mankidia tribes live in there • The park derives its name due to red silk cotton trees.
Karlapat Sanctuary (Odisha)	Recently, 7 elephants died in the wildlife sanctuary due to haemorhagic septicimia which is a bacterial infection.

Marayoor Sandalwood Reserves, Kerala	Situated in Kerala, this reserve is known for its high-quality sandalwood in India. Reserve has many wild animals like elephants and Indian bison. Owing to high oil content and high amount of hardwood, marayoor sandals have huge global demand. This reserve is crucial in connecting several national parks like Eravikulam, Chinnar, Kurinjimala, Anamudi and Pambadum sholai.

►IMPORTANT REPORTS

REPORT	ORGANISATION
Financing for Sustainable Development Report	United Nations
The World in 2030 Survey Report (Most participants selected climate change and loss of biodiversity as their top concern.	UNESCO
Making Peace With Nature Report	United Nations
UN World Water Development Report	UN Water & UNESCO
The People's Climate Vote (Largest survey of public opinion on climate change ever conducted. Part of Mission 1.5 Campaign launched in 2020)	UNDP
Youth Solutions Report	Sustainable Development Solutions Network (SDSN)
State of World's Indigenous People	UN DESA
Food Waste Index Report	UNEP and partner organisation WRAP.
Global E-Waste Monitor (India is the 3rd largest E-Waste Generator)	
Emission Gap Report	UNEP
Adaptation Gap Report	UNEP
Inclusive Wealth Report	UNEP
Global Environmental outlook	UNEP
Global Resources Outlook	UNEP
Trade in Environmentally Sound Technologies: Perspectives from Developing Countries	UNEP
Global Trends in Renewable Energy Investment Report	UNEP
Environmental Rule of Law	UNEP
FrontiersReport - Emerging Issues of Environmental Concern.	UNEP
"Sand and Sustainability: Finding new solutions for environmental governance of global sand resources"	UNEP
Global Chemicals Outlook II Report	UNEP
Global Forest Resource Assessment	FAO
The Global Land Outlook	United Nations Convention to Combat Desertification
Habitat Commitment Index	UN-Habitat
Ambient Air Pollution Report	WHO
Global biodiversity outlook	CBD in collaboration of UNEP
Global Environment Performance Index 2016	World Economic Forum
Greenhouse Gas Bulletin	WMO
Statement on the Status of World Climate	WMO
State of the Global Climate	WMO
Global Atmosphere Watch	WMO

Program	
Talanoa Dialogue Synthesis Report	UNFCCC
Yearbook of Global Climate Action 2018	UNFCCC
Global Climate Risk Index 2019	German watch
Climate Change Performance Index	German Watch
'Financing for Sustainable Development Report 2019'.	Inter-agency Task Force on Financing for Development
The Living Planet Index (LPI)	WWF
Global Soil Biodiversity Atlas	WWF
The Special Report on Global Warming of 1.5 °C	IPCC
India State of Forest Report	Forest Survey of India (FSI)

Red Data Book	Botanical Survey of India
National Air Quality Indices	Central Pollution Control Board (CPCB)
Strengthening Forest Fire Management in India	MoEFCC and the World Bank
India's state of the environment report	Centre for science and environment
Climate Vulnerability Assessment for the Indian Himalayan Region Report	Department of Science and Technology
Envistats India 2018 report	Ministry of Statistics and Program Implementation
POLLUTION AND HEALTH METRICS	Global Alliance on Health and Pollution (GAHP)

DISASTERS

►GLACIAL LAKE OUTBURST FLOOD

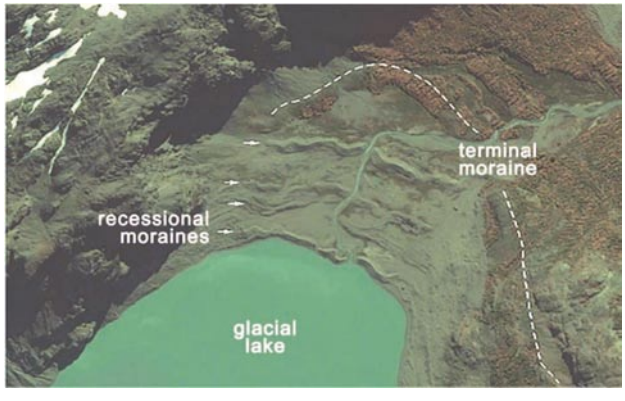
A portion of Nanda Devi glacier broke off in Uttarakhand's Chamoli district in February 2020 triggering an avalanche & a deluge in Alaknanda River system that washed away hydroelectric stations, trapped more than 100 labourers who are feared dead.

REASONS FOR DISASTER IN UTTARAKHAND?

It seems like an incident triggered by a snow avalanche. The area had seen two days of heavy snowfall last week. And suddenly the weather cleared and became a little warmer. That seems to have led to some melting of snow, triggering an avalanche, which resulted in a series of events leading to the flash floods.

GLOFS

- GLOFs are floods that occur from an unstable natural dam formed from a glacial retreat. Glaciers are dynamic bodies of ice that change frequently.
- When a glacier retreats, it can leave behind a large impression in the ground that fills with water, turning it into a lake. This is typically known as a moraine.



- These lakes can be impounded by an unstable pile of debris and buried ice. As the climate warms, glaciers generally shrink. In many mountains such as the Andes, Himalayas, Alps, Rockies, and elsewhere, the retreat of glacier tongues sometimes allows unstable moraine dammed lakes to form.
- Terminal moraines act as dams for these lakes, but as the lakes swell from rising water levels and the retreating glacial ice tongue, the moraine dam can weaken. Moraine dams that become too weak may crumble under too much pressure from the swelling lake, creating a GLOF. If the moraine dams of a glacial lake fail, the water can burst out, leading to massive floods and debris flows with potentially extensive damage downstream, including loss of life and infrastructure.
- Alternatively, and more commonly, glacial ice from the retreating glacier can crash into lakes, generating giant waves that erode weak moraine dams in a matter of minutes, thereby also triggering GLOFs.

►LANDSLIDES

The heavy rainfall in the State of Kerala has led to devastating landslide in Idukki district of Kerala leading to death of more than 20 people. As per Geological Survey of India (GSI), about 0.42 million sq.km covering nearly 12.6% of land area of our country is prone to landslide hazards.

DEFINING LANDSLIDES

- Landslide is rapid movement of rock, soil and vegetation down the slope under the influence of gravity. These materials may move downwards by falling, toppling, sliding, spreading or flowing. Such movements may occur gradually, but sudden sliding can also occur without warning. They often take place

in conjunction with earthquakes, floods and volcanic eruptions.

- The extent and intensity of landslide depends upon number of factors- Steepness of the slope, amount of vegetation cover, tectonic activity, bedding plane of the rocks etc.
- Landslide Prone areas in India: **T**he major landslide prone areas in India include: -
  1. Western Ghats and Konkan Hills (Tamil Nadu, Kerala, Karnataka, Goa and Maharashtra).
  2. Eastern Ghats (Araku region in Andhra Pradesh).
  3. North-East Himalayas (Darjeeling and Sikkim).
  4. Northwest Himalayas (Uttarakhand, Himachal Pradesh, Jammu and Kashmir).
- Himalayan mountain range and hilly tracts of North-Eastern region are highly susceptible to slope instability due to immature and rugged topography, fragile rock conditions, high seismicity resulting from proximity to the plate margins, and high rainfall. Extensive anthropogenic interference, as part of developmental activities, is another significant factor.

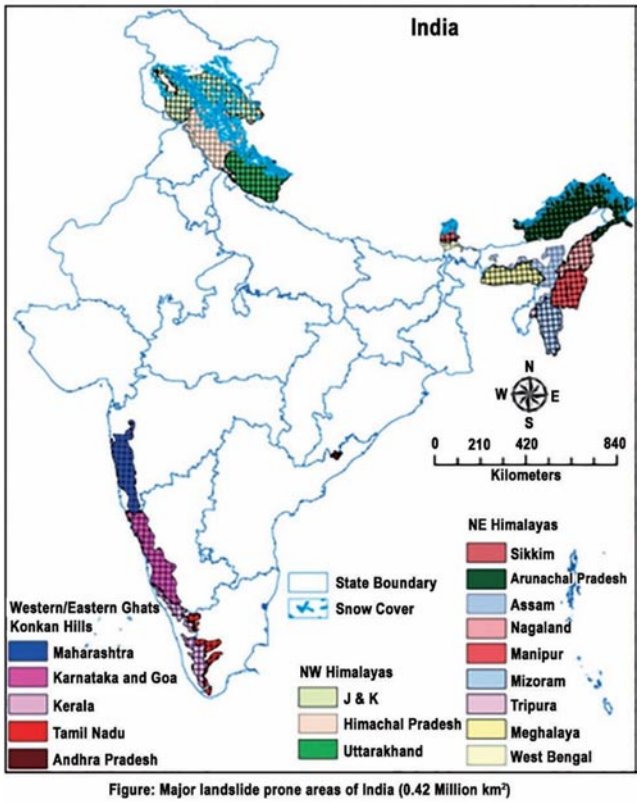


Figure: Major landslide prone areas of India (0.42 Million km²)

- Similarly, the **Western Ghats**, though located in a relatively stable domain, experiences landslides due to number of factors- steep hill slopes, high intensity rainfall and anthropogenic activities. The Nilgiris hills located at the convergence zone of the Eastern Ghats and the Western Ghats experiences several landslides due to high intensity and protracted rainfall.

TYPES OF LANDSLIDES

- Falls: Abrupt movements of materials that become detached from steep slopes or cliffs, moving by free-fall, bouncing, and rolling.
- Creep: Slow, steady downslope movement of soil or rock.
- Debris flow: Rapid mass movement in which loose soils, rocks, and organic matter combine with water to form slurry that then flows down slope. Usually associated with steep gullies
- Mudflow: Rapidly flowing mass of wet material that contains at least 50 percent sand-, silt-, and clay-sized particles.
- Flows: General term including many types of mass movement, such as creep, debris flow, mudflow etc.

CAUSES OF LANDSLIDES

- Geological Causes: Weak, Sensitive and Weathered material, Sensitive material, Presence of Joints and Fissures, Variation in physical properties such as Permeability.
- Morphological Causes: Tectonic or volcanic uplift, Erosion due to Wind and Water, Higher deposition of load on the slope or its crest, Removal of Vegetation.
- Physical Causes: Intense rainfall, Earthquake/ Volcanic eruption, Rapid snow melt/ freeze.
- Human Causes: Excavation of the slope or its toe, Deposition of load on the slope, Drawdown of Reservoir, Deforestation, Mining, Irrigation and artificial vibration.

IMPACT OF LANDSLIDES

Short run: Loss & damage to property, loss of lives, Destruction to agricultural crops, damages to vegetation, obstruction of vehicular movement leading to traffic jam, temporary loss of livelihood for the poor people etc.

Long-run:

- Increase in the sediment load of the river which can lead to floods.
- Reduce the effective life of hydroelectric and multipurpose projects by adding an enormous amount of silt load to the reservoirs.
- Loss of cultivable land
- Environmental impact in terms of erosion and soil loss
- Demographic Impact in terms of relocation of population towards other areas

- Frequent disruption of transportation networks leads to geographical isolation and hence perpetuates under-development

NDMA GUIDELINES FOR LANDSLIDE DISASTER MANAGEMENT

- Landslide Hazard, Vulnerability and Risk Assessment: This includes delineating areas susceptible to landslide hazards in different areas and to assess the resources at risk.
- Early Warning Systems for Landslides: This includes the continuous monitoring of movements, development of stresses and the transmission of this data at regular time intervals.
- Investigations for Landslide Risk Assessment: Multi-disciplinary investigations of landslide risk assessment leading to formulation of Standards to mitigate impact of landslides.
- Landslide Risk Mitigation and Remediation:
  - Restricting Development in Landslide-Prone Areas through Land use planning.
  - Laying down standards to be followed for Excavation and Construction
  - Protecting Existing Developments through restraining walls and rock anchors
  - Slope Stabilisation measures: Generally, include works involving modification of the natural landslide conditions such as topography, geology, ground water, and other conditions that indirectly control portions of the entire landslide movement. These include drainage improvement works, soil/debris removal works etc.
  - Landslide Insurance and Compensation for Losses

REGULATION AND ENFORCEMENT

- The state governments/SDMAs will adopt the model techno-legal framework for ensuring compliance with land use zoning and landslide safety issues in all development activities and plans.
- Awareness and Preparedness: Comprehensive awareness campaigns targeting different groups of people living in landslide prone areas should be carried out systematically

CAPACITY DEVELOPMENT (INCLUDING EDUCATION, TRAINING AND DOCUMENTATION)

- Introduction of curriculum related to Disaster Management, including Landslides in the Schools
- Training of the Administrators to plan, respond and mitigate the impact of Landslides
- Technical institutes located in vulnerable areas should develop adequate technical expertise on the various subjects related to landslide management.

IMMEDIATE RESPONSE

- Put in place Standard Operating Procedure (SoP) which should ensure coordinated and sustained action from various agencies in the aftermath of landslides
- Research and Development: Government should encourage, promote, and support R&D activities to address current challenges, offer solutions, and develop new investigation techniques, with the application of the latest developments in remote sensing, communications, and instrumentation technologies.

►URBAN FLOODS

The frequency of urban floods is increasing in India. Recently Hyderabad, Mumbai every year, Bengaluru, Chennai and many more.

WHAT IS AN URBAN FLOOD?

Urban pluvial (surface water) flooding – flooding in urban areas caused by intense and/or prolonged rainfall which overwhelms the capacity of the drainage system – is one of the principal hazards in modern towns and cities. This type of flooding often leads to major economic losses and devastating social and environmental impacts.

REASONS FOR URBAN FLOODING

- Urban flooding is caused by three main factors – meteorological, hydrological and human factors.
- Meteorological factors include heavy rainfall, cyclonic storms and thunderstorms.
- Hydrological factors include presence or absence of overbank flow channel networks and occurrence of high tides impeding the drainage in coastal cities.
- Human factors include land use changes, surface sealing due to urbanization (which increases run-off), occupation of flood plains and obstruction of flood flows, urban heat island effect (which has increased the rainfall in and around urban areas), poor solid waste management etc.
- Urbanisation:
  - Rapid urbanization combined with a lack of efficient waste disposal systems have left several water bodies in the cities in poor condition.
  - Blocked waterways and reduced width and depth of canals, while the speed and scale of

construction reduces the permeability of the ground.

- Improper Drainage:
  - In Indian cities and towns, large habitations are coming up in low-lying areas, often encroaching over drainage channels.
- Population Growth:
  - Most of our cities have now reached a saturation point in terms of population growth and accommodation, and the developmental activities have now shifted to low-lying areas and areas next to the riverbanks. So, whenever a city experiences a large amount of rainfall within a short time, there are chances it gets flooded.

MAJOR THREATS THAT URBAN FLOODS POSES

- **Economic:** Urban areas are also centers of economic activities with vital infrastructure which needs to be protected. In most of the cities, damage to vital infrastructure has a bearing not only for the state and the country but it could even have global implications. Therefore, management of urban flooding has to be accorded top priority.
- Urban Planning: Increasing trend of urban flooding is a universal phenomenon and poses a great challenge to urban planners the world over. Problems associated with urban floods range from relatively localized incidents to major incidents, resulting in cities being inundated from hours to several days.

►FLASH FLOOD GUIDANCE SYSTEM (FFGS)

India Meteorological Department (IMD) launched South Asian Flash Flood Guidance System aimed at helping disaster management teams and governments make timely evacuation plans ahead of the actual event of flooding.

ABOUT FLASH FLOODS

- A flood caused by heavy or excessive rainfall in a short period of time, generally less than 6 hours. Flash floods are usually characterized by raging torrents after heavy rains that rip through riverbeds, urban streets, or mountain canyons sweeping everything before them.
- They can occur within minutes or a few hours of excessive rainfall. They can also occur even if no rain has fallen, for instance after a levee or dam has failed, or after a sudden release of water by a debris or ice jam.

FORMATION OF FLASH FLOODS

- Most rivers flow fairly gently as they slope slowly towards the sea. Therefore, when a river floods it does so quite slowly as it takes time for the rain to percolate through the ground and into the rivers and out to sea, allowing time for some warning. With flash flooding, there is often little time between the rain falling and flash flooding occurring.
- Flash flooding commonly happens more where rivers are narrow and steep, so they flow more quickly. It can also occur from small rivers in built-up urban areas, where hard surfaces such as roads and concrete don't let the water drain away into the ground. This leads to surface overflow and can often overwhelm local drainage systems, leading to flash flooding.
- Flash floods occur within a few minutes or hours of excessive rainfall, a dam or levee failure, or sudden release of water held by an ice jam. Flash floods can roll boulders, tear out trees, destroy buildings and bridges, and scour out new channels. Rapidly rising water can reach heights of 30 feet or more.
- Deforestation plays many roles in the flooding equation because trees prevent sediment runoffs and forests hold more water than farms or grasslands. The flood equation is simple. If a river cannot handle the load of water it is required to carry, it will rise above its banks. This is when floods occur.
- Human factors increasing flood risk: Urbanisation, because towns and cities have more impermeable surfaces. Deforestation, because removing trees reduces the amount of water intercepted and increases run-off.

CONCERNS

- Forecasting flash floods is difficult as an event can occur within three to six hours and the water run-off quantity is extremely high.
- Frequency of extreme rainfall events has increased due to climate change and South Asia is highly prone to flash floods.
- Data suggest that across the world, about 5,000 people die annually due to flash floods.
- Despite such high mortality, there was no robust forecasting or warning system for flash floods.

HOW CAN WE AVOID FLASH FLOODS?

- Control of Floods: Some methods of flood control have been practiced since ancient times. These methods include planting vegetation to retain extra water, terracing hillsides to slow flow downhill, and

the construction of floodways (man-made channels to divert floodwater).

- During heavy rains, trees reduce the risk of flooding. There are two major ways in which trees provide protection against flooding. Woodland acts as a barrier to floodwater, while trees also prevent soil erosion, reducing sediment going into rivers and increasing water absorption into the ground.

Other methods include construction of levees, dams, reservoirs and channels diverting floodwater, called flood ways.

South Asian Flash Flood Guidance System: The India Meteorological Department (IMD) has launched the South Asian Flash Flood Guidance System (FFGS), which is aimed at helping disaster management teams and governments make timely evacuation plans ahead of the actual event of flooding.

►TROPICAL CYCLONES

Cyclone Nivar, that barrelled through Tamil Nadu and brought copious rain in its wake, was the third major cyclone to land on India's coast this year, besides Amphan and Nisarga.

April-June and October-December are India's cyclone seasons. The arriving monsoon, as well as its retreat, stir up the surrounding seas and generate cyclones.

ABOUT CYCLONES

Cyclones are rapid inward air circulation around a low-pressure area. The air circulates in an anticlockwise direction in the Northern hemisphere and clockwise in the Southern hemisphere. Cyclones are usually accompanied by violent storms and bad weather.

CONDITIONS FOR FORMATION OF CYCLONES:

- Sufficient warm temperature at sea surface
- Atmospheric instability
- Impact of Coriolis force so that low pressure can be developed
- High humidity in the lower to middle levels of the troposphere
- A pre-existing low-level focus or disturbance
- Low vertical wind shear.

WHY NO CYCLONE NEAR EQUATOR?

The Coriolis force that compels the surface winds to spiral towards the low-pressure system. As Coriolis force is negligible in the equatorial belt between latitudes 5 degrees north and 5 degrees south, cyclonic systems do not develop in this region.

NAMING OF CYCLONE?

The naming of tropical cyclones is a recent phenomenon. The process of naming cyclones involves several countries in the region and is done under the aegis of the World Meteorological Organization (WMO).

For the Indian Ocean region, a formula for naming cyclones was agreed upon in 2004. Eight countries in the region - Bangladesh, India, Maldives, Myanmar, Oman, Pakistan, Sri Lanka and Thailand - all contributed a set of names which are assigned sequentially whenever a cyclonic storm develops.

WHY WERE THERE NO CYCLONE DEVELOPMENTS THIS YEAR?

October to December period is among the favourable months for the development of cyclones in the Bay of Bengal and the Arabian Sea. This year, however, October passed without witnessing a cyclonic storm.

IMD officials have attributed it to the weak La Nina conditions along the equatorial Pacific Ocean. Cooler than normal sea surface temperatures over this region—termed as La Nina— has been prevailing since August this year. Because Madden Julian Oscillation (MJO) was positioned in a favorable phase, the low-pressure systems intensified maximum up to a deep depression.

MJO is kind of an eastward moving cyclic weather event along the tropics that influences rainfall, winds, sea surface temperatures and cloud cover. They have a 30 to 60-day cycle.

WHY WAS THE NIVAR STORM EASIER TO TRACK, AND HOW DO METEOROLOGICAL WARNINGS HELP IN PREPARATION?

The Nivar storm originated in the Bay of Bengal and whipped up windspeeds close to 125-145 kmph, blowing away roofs and felling standing crop. However, relatively fewer lives were lost compared to the havoc wreaked by Amphan in West Bengal in May. What aided relief operations in the anticipation of Nivar was that it largely conformed to forecasts issued by the India Meteorological Department (IMD).

HOW ARE CYCLONES FORECAST?

Over the years, India's ability to track the formation of cyclones has improved significantly.

- Doppler Weather Radars
  - There is a network of 12 doppler weather radars (DWR) along India's coast if one were to begin counting from Kolkata and trawl up to Mumbai — there are 27 in all in the country.
  - Depending on where a storm is forming, these radars send pulses of radio waves to gauge the size

as well as the speed at which water droplets are moving.

- The earlier generation of radars was unable to track such progress in real time, but with DWRs, now the base standard of weather radars, it is usually possible to detect a potential storm at least four-five days in advance.

- Collaboration
  - The IMD also collaborates with similar international networks, such as the Japan Meteorological Agency, the U.S. National Hurricane Center, and the U.S. Central Pacific Hurricane Center, and these bodies constantly send warnings and forecasts about changes in the ocean weather.
  - The near ubiquity of ocean-buoys that track changes in ocean sea surface temperatures as well as dedicated meteorological satellites improve the odds of early detection.

ARE CYCLONES FORMING IN ARABIAN SEA DIFFICULT TO PREDICT?

Though the Bay of Bengal is three times more likely to generate cyclones, the ones that originate in the Arabian Sea are trickier, as the cyclone, while ostensibly moving away from India's western coast, can suddenly 'recurve' and move back in.

There are also fewer radars along India's west coast than the eastern coast, and all these reasons make the Bay of Bengal cyclones more tractable.

In this context, Nivar, because it conformed to a fairly predictable trajectory and was not super cyclonic in intensity, gave State administrations in Puducherry, Tamil Nadu and Andhra Pradesh time to prepare, and was far less damaging than Amphan. However, the cyclone season is not yet over, and more systems are likely to form in the coming weeks, according to the IMD.

HOW HAS DISASTER WARNING CHANGED?

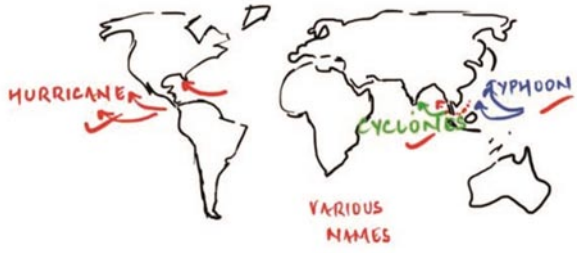
Forecasts, on their own, are important, but they cannot override the importance of preparedness by State agencies. The formation of cyclones is preceded by 'depressions', and they are often the first warnings. Not all depressions become cyclones, but many coastal States — especially those with a history of being battered — begin organising shelters and evacuation of coastal residents. Sea pockets, where cyclones form, are also places that drive schools of fish and lure fisherfolk.

While meteorological agencies give advisories on where fish-catches are likely, they suspend such advisories during storm formation to dissuade fishermen from venturing out. The ubiquity of mobile communication makes it much easier to quickly give warnings. The IMD also issues flood forecast maps, in collaboration with urban bodies that forecast which pockets in a city are likely to be flooded and where crop damage is likely to be maximum.

ARE THEY CALLED SOMETHING ELSE ALSO?

Cyclones are given many names in different regions of the world – They are known as:

- Typhoons in the China Sea and Pacific Ocean.
- Hurricanes in the West Indian islands in the Caribbean Sea and Atlantic Ocean.



WHEN DOES A "DEPRESSION" BECOMES A "CYCLONE"?

- The World Meteorological Organisation uses the term 'Tropical Cyclone' to cover weather systems in which **winds exceed 'Gale Force'** (minimum of 34 knots or 63 kph). A gale is a strong wind, typically used as a descriptor in nautical contexts. The U.S. National Weather Service defines a gale as 34–47 knots (63–87 km/h, 17.5–24.2 m/s or 39–54 miles/hour) of sustained surface winds.
- Further categories are determined similarly by wind speeds.

Type of Disturbances	Wind Speed in Km/h	Wind Speed in Knots
Low Pressure	Less than 31	Less than 17
Depression	31-49	17-27
Deep Depression	49-61	27-33
Cyclonic Storm	61-88	33-47
Severe Cyclonic Storm	88-117	47-63
Super Cyclone	More than 221	More than 120

NAMING OF CYCLONES

- Cyclones that form in every ocean basin across the world are named by the Regional Specialised Meteorological Centres (RSMCs) and Tropical Cyclone Warning Centres (TCWCs). There are six RSMCs in the

world, including the India Meteorological Department (IMD), and five TCWCs.

- The RSMC New Delhi Tropical Cyclone Centre is responsible to name the tropical cyclones that have formed over the Bay of Bengal and the Arabian Sea when they have reached the relevant intensity.
- As an RSMC, the IMD names the cyclones developing over the north Indian Ocean, including the Bay of Bengal and Arabian Sea, after following a standard procedure. The IMD is also mandated to issue advisories to 12 other countries in the region on the development of cyclones and storms.

►WESTERN DISTURBANCES

An average of four to five western disturbances form during the winter season. In this context let us understand this important topic from the perspective of prelims as well as mains examination.

WESTERN DISTURBANCES

A western disturbance is an extratropical storm originating in the Mediterranean region that brings sudden winter rain to the northwestern parts of the Indian subcontinent. It is a non-monsoonal precipitation pattern driven by the westerlies.

The moisture in these storms usually originates over the Mediterranean Sea, the Caspian Sea and the Black Sea.

FORMATION OF WESTERN DISTURBANCES

- Western disturbances originate in the Mediterranean region.
- A high-pressure area over Ukraine and neighborhood consolidates, causing the intrusion of cold air from polar regions towards an area of relatively warmer air with high moisture.
- This generates favorable conditions for cyclogenesis in the upper atmosphere, which promotes the formation of an eastward-moving extratropical depression.
- Traveling at speeds up to 12 m/s (43 km/h; 27 mph), the disturbance moves towards the Indian subcontinent until the Himalayas inhibits its development, upon which the depression rapidly weakens.
- The western disturbances are embedded in the mid-latitude subtropical westerly jet stream.

IMPACT OF WESTERN DISTURBANCES

- Western disturbances are usually associated with cloudy sky, higher night temperatures & unusual rain.
- Western disturbances, specifically in winter, bring moderate to heavy rain in low-lying areas & heavy snow to mountainous areas of Indian Subcontinent.
- They are the cause of most winter and pre-monsoon season rainfall across northwest India.
- Precipitation during winter season has great importance in agriculture, particularly for rabi crops.
- Wheat among them is one of the most important crops, which helps to meet India's food security.

ILL-EFFECTS OF WESTERN DISTURBANCES

- Excessive precipitation due to western disturbances can cause crop damage, landslides, floods & avalanches.
- Over Indo-Gangetic plains, they occasionally bring cold wave conditions & dense fog. These conditions remain stable until disturbed by another western disturbance.
- When western disturbances move across northwest India before onset of monsoon, a temporary advancement of monsoon current appears over region.

►DROUGHTS

A drought is a period of below-average precipitation in a given region, resulting in prolonged shortages in its water supply, whether atmospheric, surface water or ground water.

- Drought is a recurrent feature of climate and occurs in all climatic regimes.
- Drought is a temporary aberration unlike aridity, which is a permanent feature of climate.

WHAT ARE FLASH DROUGHTS?

Flash droughts are those that occur very quickly, with soil moisture depleting rapidly. Normally, developing drought conditions take months, but these happen within a week or in two weeks' time. Several factors including atmospheric anomalies, anthropogenic greenhouse gas emissions play an important role.

TYPES OF DROUGHTS

Meteorological Drought is simple absence/deficit of rainfall from the normal. It is the least severe form of drought and is often identified by sunny days and hot weather.

Hydrological Drought leads to reduction of natural stream flows or ground water levels, plus stored water supplies. Main impact is on water resource systems.

Agricultural drought occurs when moisture level is soil is insufficient to maintain average crop yields. Initial

consequences are in the reduced seasonal output of crops and other related production. An extreme agriculture drought can lead to a famine, which is a prolonged shortage of food in a restricted region causing widespread disease and death from starvation.

State Government is the final authority when it comes to declaring a region as drought affected. Indicators:

- Rainfall deviation and dry spell
- Agriculture
- vegetation indices based on remote sensing,
- soil moisture, and
- hydrology

TABLE: VULNERABILITY ANALYSIS USING MULTIPLE CRITERIA

Variables

Meteorological – rainfall, temperature etc.

Soils - depth, type, available water content etc.

Surface water use - percent irrigated area, surface water supplies

Ground water - ground water availability/ utilization

Crop- cropping pattern changes, geospatial land use, crop condition, anomalies of crop condition etc.

Socio-economic – population of weaker sections, size class of farm holdings

MAJOR CAUSES OF DRAUGHTS IN INDIA

- **Failure of Monsoon:** South-west monsoon accounts for 70 to 80% of the annual rainfall over major parts of India. Its timely occurrence in normal quantity and uniform distribution over all regions determine the prospects of agricultural production and allied activities every year. However, failure of rains from southwest monsoon results in occurrence of drought in the Indian region.
- **El-Nino Southern Oscillation:** There seems to be a clear association between El Nino and La Nina events and weak monsoons.

DROUGHT AND DESERTIFICATION

Desertification, as defined in Agenda 21 and in the International Convention on Desertification, is the degradation of the land in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities. It is accompanied by a reduction in the natural potential of the land and a decrease in surface and ground water resources.

While drought is a natural phenomenon, whose impacts can be exacerbated by human activities that are not adapted to the local climate, land degradation is the process of turning fertile land into less or non-productive land.

Although the cycles of drought and climatic disturbances can contribute to the development of desertification, it is caused by overgrazing, land clearance, over-exploitation of cultivated and natural lands, and by generally using land in a way that is inappropriate to local conditions.

Droughts occur frequently in the areas affected by desertification. Land degradation can hasten the effects of drought by reducing the chances of local people to face difficult, dry periods.

IMPACT OF DROUGHT

Drought produces wide-ranging impacts the reverberations of which are felt by the society and economy much beyond the areas actually experiencing the onslaughts of physical drought agricultural production and water resources are integral to our ability to produce goods and services. The greatest impact of drought is on weaker sections of society. These include landless labourers, small and marginal farmers as well as artisans like weavers etc.

IMPACT OF DROUGHTS

- Adverse effect on recharge of ground water, soil moisture and surface runoff
- Rivers, lakes, ponds, reservoirs tend to dry up, wells and tube wells are rendered unserviceable due to lowering of the ground water.
- Loss of forest cover, migration of wildlife and sharpening of man-animal conflicts and general stress on biodiversity
- Reduced stream, flow and loss of wetlands may affect levels of salinity
- Reduced groundwater recharge may damage aquifers and adversely affect the quality of water (ex. Salt concentration, acidity, dissolved oxygen, turbidity) which may lead to a permanent loss of biological productivity of soils.

ECONOMIC IMPACT OF DROUGHT

- Since Indian agriculture is dependent on monsoon and about two-thirds of arable land lacks irrigation facilities and is termed as rainfed. This leads to production losses in agriculture and allied sectors especially animal husbandry, dairy, poultry, horticulture and fisheries. There is decline in cultivated area.
- All industries dependent upon the primary sector for raw materials suffer on account of reduced supplies and hardening prices.

- Decline of purchasing power
- Fall in employment
- Distress sale of cattle and loss of cattle life
- Distress sale and mortgage of land, jewellery and personal property.
- Generation of hydroelectricity is adversely impacted by drought

SOCIAL IMPACTS

- Disruption in rural society due to stress migration
- Rise in school dropout rates,
- Greater immiseration and indebtedness
- Alienation of land and livestock assets
- Malnutrition and starvation
- Loss of social status among most vulnerable sections.
- Situation of scarcity in some cases may exacerbate social tensions and lead to erosion of social capital.
- Ill health and spread of diseases like diarrhoea, dysentery, cholera and opthalmia caused by malnutrition, hunger and starvation
- Low morale of people
- Growth of fatalism and belief in supernatural powers and superstitions

Rainwater harvesting and Efficient use		Suitable crops/varieties cropping system	
i	Rainwater harvesting structures	i.	Seed bank
ii.	Farm ponds	ii.	Seed treatment
iii.	Percolation tanks	iii.	Intercropping systems etc.
iv.	Micro irrigation system etc	iv.	Agro-forestry

Farm Mechanization		Water Saving Technologies	
i.	Suitable implements	a.	Drip and Sprinkler Irrigation Systems
ii.	Labour sharing mechanization	b.	Practices such as use of organic manure with the gradual reduction of chemical fertilizers, verminculture and agronomic practices, such as mulching, crop rotation and the use of biopest control measures.
iii.	Custom hiring centers		

- Establishment of functional Drought Management Centre at the State Headquarters
- Preparation of agriculture contingency plans for districts and sub district levels, especially in vulnerable districts
- Monitoring of seasonal forecasts of IMD and other national/international agencies

►HEAT WAVES

A Heat Wave is a period of abnormally high temperatures, more than the normal maximum temperature that occurs during the summer season in the North-Western parts of India. Heat Waves typically occur between March and June, and in some rare cases even extend till July.

Extreme temperatures & atmospheric conditions adversely affect people living in these regions as they cause physiological stress, sometimes resulting in death.

CRITIREA FOR HEAT WAVES

IMD has given two conditions for Heat Waves:

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. Following criteria are used to declare heat wave:

2. Based on Departure from Normal
   - Heat Wave: Departure from normal is 4.5°C to 6.4°C
   - Severe Heat Wave: Departure from normal is ≥ 6.4°C
3. Based on Actual Maximum Temperature (for plains only)
   - Heat Wave: When actual maximum temperature ≥ 45°C
   - Severe Heat Wave: When actual maximum temperature ≥ 47°C

To declare heat wave, the above criteria should be met at least in 2 stations in a Meteorological subdivision for

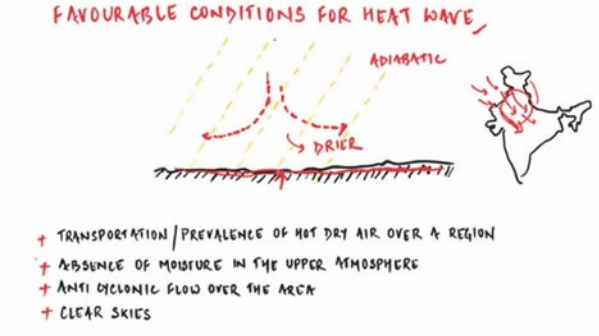
at least two consecutive days and it will be declared on the second day.

Left: Maximum T across India (Stations crossing 40 Degree C denoted in Red)

Right: Stations Observing departure from Mean maximum T by more than 4.5 degree C denoted in Red (regions of heat wave)

FAVOURABLE CONDITIONS FOR HEAT WAVE

- Transportation / Prevalence of hot dry air over a region (There should be a region of warm dry air and appropriate flow pattern for transporting hot air over the region).
- Absence of moisture in the upper atmosphere (As the presence of moisture restricts the temperature rise).
- Sky should be cloudless (To allow maximum insulation over the region).
- Large amplitude anti-cyclonic flow over the area.
- Heat waves generally develop over Northwest India and spread gradually eastwards & southwards but not westwards (since the prevailing winds during the season are westerly to north westerly).
- But on some occasions, heat wave may also develop over any region in situ under favourable conditions.



HEALTH IMPACTS OF HEAT WAVES

Health impacts of Heat Waves typically involve dehydration, heat cramps, heat exhaustion and/or heat stroke. The signs and symptoms are as follows:

- Heat Cramps: Ederna (swelling) & Syncope (Fainting) generally accompanied by fever below 39 i.e.,102*F.
- Heat Exhaustion: Fatigue, weakness, dizziness, headache, nausea, vomiting, cramps & sweating.
- Heat Stoke: Body temperatures of 40*C i.e., 104*F or more along with delirium, seizures or coma. This is a potentially fatal condition.

MAJOR EXTREME WEATHER EVENTS DURING 2019

Higher daily peak temperatures and longer, more intense heat waves are becomingly increasingly frequent globally due to climate change. India too is feeling the impact of climate change in terms of increased instances of heat waves which are more intense in nature with each passing year and have a devastating impact on human health thereby increasing the number of heat wave casualties.

► LOCUST ATTACK

Over the past two years, locust attacks emanating from the desert area in Pakistan have struck parts of Rajasthan and Gujarat, causing heavy damage to standing crop.

ABOUT LOCUSTS

- Locusts are a collection of certain species of short-horned grasshoppers in the family Acrididae that have a swarming phase.
- Swarm behaviour, or swarming, is a collective behaviour exhibited by animals, of similar size which aggregate together, perhaps milling about the same spot or perhaps moving en-masse or migrating in some direction.

MECHANISM BEHIND LOCUSTS SWARM

Normal situation: These grasshoppers are innocuous, their numbers are low, and they do not pose a major economic threat to agriculture.

Attack situation: However, under suitable conditions of drought followed by rapid vegetation growth, serotonin in their brains triggers a dramatic set of changes: they start to breed abundantly, becoming sociable and nomadic (loosely described as migratory) when their populations become dense enough.

Is the difference in environmental condition also reflected on their morphology? Yes, differences in morphology and development are seen.

In desert locust, gregaria nymphs become darker with strongly contrasting yellow and black markings, they grow larger, and have longer developmental periods.

LOCUSTS HARM AGRICULTURE

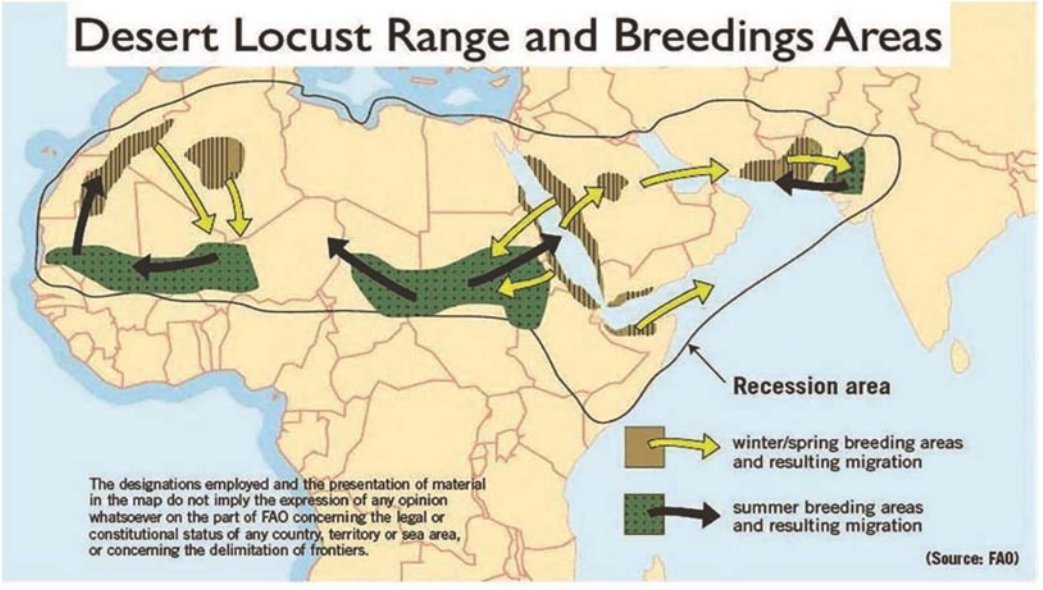
- Swarms eat leaves, flowers, fruits, seeds, bark and growing points, and also destroy plants by their sheer weight as they descend on them in massive numbers.
- Desert locusts can have about 40 million to 80 million locust adults in each square km of a swarm and travel up to 150 km a day, according to the FAO.
- There is an exponential increase in locust numbers with every new generation of breeding and a swarm the size of one square km, containing about 40 million locusts, eats the same amount of food in one day as about 35,000 people.

SPECIES OF LOCUSTS ARE NATIVE TO INDIA

Only four species of locusts are found in India:

1. Desert locust (Schistocerca gregaria),
2. Migratory locust (Locusta migratoria),
3. Bombay Locust (Nomadacris succincta)
4. Tree locust (Anacridium sp.).

The desert locust is regarded as the most important in India as well as internationally. The attack of 2019-2020 has been caused mainly due to Desert locust (Schistocerca gregaria)



The locusts coming to India (Rajasthan and Gujarat) originate from Horn of Africa and traverse Middle Eastern countries before coming via Pakistan after monsoon.

INDIA's PLANS TO CONTROL LOCUST ATTACKS

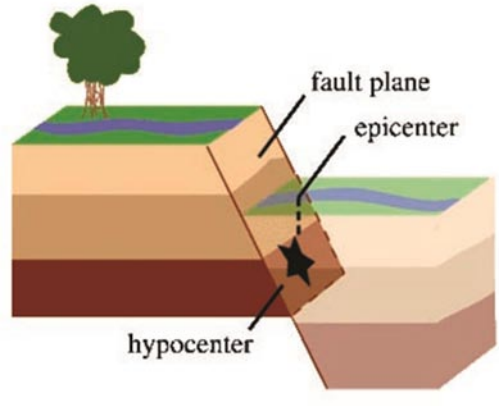
India has a locust control and research scheme that is being implemented through the Locust Warning Organisation (LWO) under Ministry of Agriculture. The LWO's responsibility is monitoring and control of the locust situation in Scheduled Desert Areas, mainly in Rajasthan and Gujarat, and partly in Punjab and Haryana.

India is most at risk of a swarm invasion just before the onset of the monsoon. The swarms usually originate in the Arabian Peninsula and the Horn of Africa.

What are the situations which exacerbate these attacks?
The task is more difficult because of political instability in some countries. In Somalia, for example, the FAO says that aerial spraying has been ruled out in areas not controlled by the government. The civil war in Yemen may also have contributed to the outbreak.

►EARTHQUAKE & IT'S PREDICTION

Eleven minor earthquakes have been recorded in and around Delhi since May, the most powerful of which happened to be of magnitude 3.4. These recent earthquakes have triggered discussions on the possibility of increased seismicity around Delhi, and fears of an impending big earthquake sometime soon. None of these apprehensions have any scientific basis. In this regard, it becomes important to cover Earthquake and why the predictions regarding earthquakes are so difficult.



- **Earthquake**
- An earthquake is what happens when two blocks of the earth suddenly slip past one another.
- **Fault plane**
- The surface where they slip is called the fault or fault plane.
- **Epicentre and Hypocentre**
- The location below the earth's surface where the earthquake starts is called the hypo centre, and the

location directly above it on the surface of the earth is called the epicentre.

FORESHOCK

- Sometimes an earthquake has foreshocks. These are smaller earthquakes that happen in the same place as the larger earthquake that follows. Scientists can't tell that an earthquake is a foreshock until the larger earthquake happens.

MAINSHOCK

- The largest, main earthquake is called the mainshock. Mainshocks always have aftershocks that follow. These are smaller earthquakes that occur afterwards in the same place as the mainshock.
- Depending on the size of the mainshock, aftershocks can continue for weeks, months, and even years after the mainshock!

EARTHQUAKE PREDICTION

It is about predicting earthquakes occurrence with respect to: -

- Time
- Location
- Magnitude of future earthquakes
- Special concern is regarding predicting the next "Big" Earthquake
- Prediction is different from earthquake warning systems, which upon detection of an earthquake, provide a real-time warning of seconds to neighbouring regions that might be affected. So, before we jump into prediction, it is important to note that Earthquake prediction is an immature science—it has not yet led to a successful prediction of an earthquake from first physical principles.

RESEARCH INTO METHODS OF PREDICTION THEREFORE FOCUS ON EMPIRICAL ANALYSIS, WITH TWO GENERAL APPROACHES

- Either identifying distinctive forerunner to earthquakes
- An earthquake precursor is an anomalous phenomenon that might give effective warning of an impending earthquake.

For example: Animal Behaviour

- In cases where animals display unusual behaviour some tens of seconds prior to a quake, it has been suggested they are responding to the P-wave.
- These travel through the ground about twice as fast as the S-waves that cause most severe shaking

For Example: Radon

- Most rock contains small amounts of gases that can be isotopically distinguished from the normal atmospheric gases.
- There are reports of spikes in the concentrations of such gases prior to a major earthquake; this has been attributed to release due to pre-seismic stress or fracturing of the rock.
- One of these gases is radon, produced by radioactive decay of the trace amounts of uranium present in most rock
- Identifying geophysical trend or pattern in seismicity that might precede a large earthquake.
- The most studied earthquake faults appear to have distinct segments.
- The characteristic earthquake model postulates that earthquakes are constrained within these segments.
- As the lengths and other properties of the segments are fixed, earthquakes that rupture the entire fault should have similar characteristics.
- These include the maximum magnitude (which is limited by the length of the rupture), and the amount of accumulated strain needed to rupture the fault segment.
- Since continuous plate motions cause the strain to accumulate steadily, seismic activity on a given segment should be dominated by earthquakes of similar characteristics that recur at regular intervals.
- However, it is unlikely they will be able to predict earthquake in near future. Scientists have tried many different ways of predicting earthquakes, but none have been successful. On any fault, scientists know there will be another earthquake sometime in the future, but they have no way of telling when it will happen.

SECTION-10

MCQs

Q1. Which of the following statements is/are correct?

1. Halocarbons containing bromine usually have much higher ozone-depleting potential, than those containing chlorine.
2. HCFCs (hydrochlorofluorocarbons) release much less chlorine per molecule.

Select the correct answer using the code given below:

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q2. Which of the following statements is/are correct about the Slender Loris?

1. The Slender Loris is secretive and has nocturnal habits.
2. It usually travels from the canopy of one tree to another.
3. It has been brought under Schedule I of India's Wildlife (Protection) Act, 1972.

Select the correct answer using the code given below:

(a) 2 only (b) 1 and 2 only
(c) 1 and 3 only (d) 1, 2 and 3

Q3. Consider the following statements about the E-Waste Management Rules, 2016:

1. Components and spare parts of electronics items are not covered under the Rules.
2. Collection of e-waste is exclusively the responsibility of the producers.
3. Extended Producer Responsibility authorization is given by the State Pollution Control Boards.

Which of the statements given above is/are ***incorrect***?

(a) 1 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

Q4. Consider the following statements about the Basel Convention:

1. Plastic waste is not tackled under the Convention.
2. The 'Basel Ban' Amendment bans the exports of hazardous waste to all developing countries.

Which of the statements given above are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q5. Consider the following pairs:

1.	Bhindawas Wildlife Sanctuary	Haryana
2.	Thol Lake Wildlife Sanctuary	Gujarat
3.	Wadhvana Wetland	Punjab

Which of the pairs given above is/are correctly matched?

(a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

Q6. Which of the following correctly defines "primary production"?

(a) Amount of biomass or organic matter produced per unit area over 100 years by the plants during respiration.
(b) Amount of biomass or organic matter produced per unit area over a time period by the secondary consumers.
(c) Amount of biomass or organic matter produced per unit area over a time period by the plants during photosynthesis.
(d) Amount of biomass or organic matter produced per unit area over a time period by the primary consumers.

Q7. Which of the following statements is/are correct?

1. India has set a target of being Net Zero by 2050.
2. Net Zero aims at reducing the CO2 emissions only.

Select the correct answer using the code given below:

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q8. With respect to the 'global dimming', consider the following statements:

1. It refers to the substantial declines in the amount of the Sun's energy reaching the Earth's surface.
2. It is only due to the changes in the Sun's luminosity.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q9. The Carbon Border Adjustment Mechanism is a fiscal method to address climate change. It was introduced by which of the following organization/countries?

(a) The European Union (b) The USA
(c) China (d) Japan

Q10. Which of the following statements is/are correct regarding the Global Climate Risk Index (GCRI)?

1. It is published annually by the United Nations Environment Programme (UNEP).
2. GCRI ranks countries on the basis of their impacts of weather-related loss events.

Select the correct answer using the code given below:

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q11. India's first Dugong Conservation Reserve will be built in which of the following states?

(a) West Bengal (b) Kerala
(c) Odisha (d) Tamil Nadu

Q12. Which of the following targets are correct regarding the "Panchamrit Strategy", as unveiled by India recently?

1. To raise the non-fossil fuel-based energy capacity of the country to 5000 GW by 2030.
2. To reduce carbon intensity of the economy to less than 45% by 2030.

Select the correct answer using the code given below:

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q13. "The Wildlife Sanctuary is rich in coal and oil – and is believed to be the last remaining contiguous patch of lowland rainforest area in Assam. The area is especially a draw for the ornithologists, since it is said to have the highest concentration of the rare endangered White Winged Wood Duck. It was recently notified as a National Park."

The above paragraph is talking about which of the following Wildlife Sanctuaries/National Parks?

(a) Kaziranga National Park (b) Orang National Park
(c) Manas National Park (d) Dehing Patkai National Park

Q14. "Landraces" term, recently seen in the news, is related to:

(a) Ethnic groups belonging to cultural hearths.
(b) Commercial crops which are grown over vast stretches of land.
(c) Invasive species which outcompete the native breeds.
(d) Naturally occurring variants of commonly cultivated crops.

Q15. The Climate Finance Leadership Initiative is launched by which of the following?

(a) The Intergovernmental Panel on Climate Change (IPCC)
(b) The United Nations Framework Classification for Resources (UNFC)
(c) France and the United Kingdom
(d) India and the United Kingdom

Q16. Which of the following statements is/are correct about the Green Status of Species?

1. The World Wide Fund for Nature launched the Green Status of Species.
2. The Green Status of Species reports not only a species' current Green Score and corresponding recovery category, but also how conservation actions have affected the current status.

Select the correct answer using the code given below:

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q17. Which of the following statements is/are correct about the 'Red Tide'?

1. A 'Red Tide' is a common term used for a harmful algal bloom.

2. It is caused by the microscopic algae that produce toxins that kill fish and make shellfish dangerous to eat.

Select the correct answer using the code given below:

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q18. Consider the following statements about Salt marshes:

1. They are coastal wetlands that are flooded and drained by salt water brought by tides.
2. They are mostly found in tropical and equatorial areas.
3. India has no presence of salt marshes.

Which of the statements given above is/are correct?

(a) 1 and 2 only (b) 1 only
(c) 2 and 3 only (d) 1, 2 and 3

Q19. Which of the following statements is/are correct about Western tragopan?

1. Western tragopan is related to the pheasant family.
2. It lives in the high altitudes of the Himalaya.
3. It is the state bird of Arunachal Pradesh.

Select the correct answer using the code given below:

(a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

Q20. Coupled Model Intercomparison Project (CMIP), recently in news, is related to which of the following?

(a) Biodiversity (b) Climate change
(c) Air Pollution (d) Artificial Intelligence

Q21. Which of the following is used for removing Methane from Atmosphere?

1. Afforestation
2. Iron Salt aerosols
3. Titanium Oxide
4. Porous Polymer Networks
5. Biotrickling filters

Select the correct answer using the code given below:

(a) 1, 2 and 3 only (b) 1, 2, 3 and 4 only
(c) 2, 3, 4 and 5 only (d) 1, 2, 3, 4 and 5

Q22. Which of the following are common water pollutants?

1. Streptococcus faecalis
2. Polychlorinated biphenyls
3. Methylmercury

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Q23. Super enzyme formed by stitching MHETase and PETase, sometime seen in news, has been found to be effective in?

(a) Removal of excessive pesticides from soil
(b) Faster Biodegrading of farm stubble
(c) Breaks polymeric Plastic Waste into monomers
(d) Efficient ripening of fruits

Q24. Which of the following is/are the marine primary producer(s)?

1. Cyanobacteria
2. Coccolithophores
3. Dinoflagellate

Select the correct answer using the code given below:

(a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

Q25. Which of the following chemicals is/are produced in photochemical smog?

1. Formaldehyde
2. Acrolein
3. Peroxyacetyl Nitrate

Select the correct answer using the code given below:

(a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

Q26. Which of the following is/are saprotroph(s)?

1. Oyster mushrooms
2. Escherichia coli
3. Oomycetes

Select the correct answer using the code given below:

(a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

Q27. Which of the following statements is/are correct about the Phosphorous Cycle?

1. Phosphorous is released into the atmosphere during this cycle.
2. The sources of phosphorus into this cycle are rocks, bones and skeletons.

Select the correct answer using the code given below:

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q28. Which of the following is/are parasite(s)?

1. Cuscuta
2. Female mosquito
3. Cuckoo

Select the correct answer using the code given below:

(a) 1 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

Q29. Consider the following statements:

1. Plants have the highest number of species on the Earth.
2. Vertebrates have the highest number of species within the animals.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) Both 1and 2 (d) Neither 1 nor 2

Q30. Which of the following Tiger Reserves has the highest tiger density?

(a) Ranthambore (b) Kaziranga
(c) Jim Corbett (d) Nagarhole

Q31. Which of the following pollutants is/are released by the petroleum refineries?

1. Xylene
2. Hydrogen Sulphide
3. Toluene

Select the correct answer using the code given below:

(a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

Q32. Which of the following Protected Areas are located in the Brahmaputra basin?

1. The Nameri National Park
2. The Orang National Park
3. The Sirohi National Park
4. The Laokhowa Wildlife Sanctuary

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 3 and 4 only
(c) 1, 2 and 4 only (d) 1, 2, 3 and 4

Q33. Consider the following statements about Megaflash lightning:

1. Megaflash lightning is defined as the discharges that cover a horizontal distance of hundreds of miles.
2. It does not occur in ordinary thunderstorms.
3. It requires expansive electrified clouds that discharge at sufficiently low rates to facilitate single horizontal flashes, spanning extraordinary distances.

Which of the statements given above is/are correct?

(a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

Q34. With respect to the 'Green Grids Initiative', consider the following statements:

1. It is an Initiative by India and France to tap solar energy and have it travel seamlessly across the borders.
2. It was announced in the Conference of Parties (COP)26.
3. It is being implemented by the International Solar Alliance (ISA).

Which of the statements given above is/are correct?

(a) 3 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

Q35. The World Health Organization's Global Air Quality Guidelines limit which of the following pollutants?

1. Ozone (O_3)
2. Benzene (C_6H_6)
3. Carbon monoxide (CO)
4. Sulphur dioxide (SO_2)
5. Particulate matter (PM)

Select the correct answer using the code given below:

(a) 1, 2 and 3 only (b) 2, 3, 4 and 5 only
(c) 1, 3, 4 and 5 only (d) 1, 2, 3, 4 and 5

Q36. 'Towards 1000' Strategy, sometimes seen in the news, is related to which of the following?

(a) Motivating the school students to opt for space sciences.
(b) Combatting desertification and encouraging afforestation.
(c) Promoting start-ups in India.
(d) Driving investments in solar energy.

Q37. With reference to the Tiger Conservation Foundation (TCF), consider the following statements:

1. As per the Wildlife (Protection) Act, 1972, the TCF is established by the Central Government for the Tiger Reserves in the states.
2. The Central Government has framed the National Tiger Conservation Authority (Tiger Conservation Foundation) Guidelines, 2007, for the purpose of the regulation of the Tiger Conservation Foundations (TCFs).
3. The TCFs have been constituted for all the Tiger Reserves in the country.

Which of the statements given above is/are correct?

(a) 1 and 2 only (b) 2 only
(c) 1 and 3 only (d) 1, 2 and 3

Q38. The Red List Index (RLI) is used for which of the following taxonomic groups?
1. Mammals
2. Amphibians
3. Cycads
4. Warm-water reef-forming corals

Select the correct answer using the code given below:
(a) 3 only (b) 1 and 2 only
(c) 1, 2 and 4 only (d) 1, 2, 3 and 4

Q39. Consider the following statements:
1. Mycorrhiza is a mutual symbiotic association between a fungus and a plant.
2. The Coralloid roots comprise symbiotic anabaena involved in fixing phosphorus.

Which of the statements given above is/are correct?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q40. Consider the following statements:
1. A considerable amount of Gross primary productivity is utilised by plants in respiration.
2. Net primary productivity is the available biomass for the consumption to heterotrophs.

Which of the statements given above is/are correct?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q41. Consider the following statements:
1. Thermoregulation is energetically expensive for shrews and humming birds.
2. Very small animals are rarely found in Polar Regions.

Which of the statements given above is/are correct?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q42. Consider the following statements about 'Other effective area-based conservation measures' (OECMs):
1. This status is given to sites which are outside of protected areas and have demonstrated effective biodiversity conservation.
2. The status is conferred by the UN Convention on Biodiversity.
3. India has no site with OECM status.

Which of the statements given above is/are correct?
(a) 1 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Q43. Consider the following statements about coking coal:
1. India's domestic coking coal is high ash coal.
2. India is self-sufficient in coking coal.
3. Coking is mainly used in steel production in both blast furnace and electric-arc methods.

Which of the statements given above is/are correct?
(a) 1 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Q44. Consider the following statements about the High Ambition Coalition for Nature and People (HAC):
1. It is a group of countries encouraging the adoption of the global goal to protect at least 30% of the world's land and oceans by 2030.
2. China is the first of the BRICS bloc of the major emerging economies to join the HAC.

Which of the statements given above is/are correct?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q45. With respect to "Carbon fertilization", consider the following statements:
1. It causes an increased rate of photosynthesis, while limiting leaf transpiration in the plants.
2. Carbon dioxide fertilization alone can exponentially increase the plant growth.

Which of the statements given above is/are correct?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q46. Consider the following statements:
1. Herbivores only eat things that need photosynthesis to live.
2. Oviparous animals are born as live young individuals.
3. Viviparous animals lay eggs.

Which of the statements given above is/are correct?
(a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

Q47. With respect to the "Compensatory Afforestation Fund (CAF) Act, 2016", consider the following statements:
1. The Compensatory Afforestation Fund Management and Planning Authority (CAMPA) is a

National Advisory Council, under the Chairmanship of the Prime Minister of India.

2. According to the CAF Rules, the funds can be used for catchment area treatment, wildlife management and payment of salary.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q48. With respect to the "Barren Island", consider the following statements:

1. It is one of the Nicobar Islands.
2. It is the only active volcano in the Indian sub-continent.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q49. With respect to the "Musk Deer", consider the following statements:

1. It is endemic to the Himalayas of Nepal, China, Bhutan, India and Pakistan.
2. It is listed as a 'Vulnerable' species in the Red List Data of the IUCN.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q50. With respect to "Biochar", consider the following statements:

1. It is produced during pyrolysis, a thermal decomposition of biomass in an oxygen-limited environment.
2. It contains only carbon.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q51. With reference to the Keibul Lamjao National Park, consider the following statements:

1. The largest area of the Phumdi in the Loktak Lake is in the Keibul Lamjao National Park.
2. It is home to the critically endangered brow-antlered deer, known as the Sangai.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q52. Consider the following pairs:

S.N.	Biotic interaction	Examples
1.	Commensalism	Process of pollination in the plants
2.	Amensalism	Lion and tiger in the same niche
3.	Mutualism	Allelopathy

Which of the pairs given above are ***incorrectly*** matched?

(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Q53. Consider the following statements:

1. A Food Web is a linear sequence of organisms, through which nutrients and energy pass, as one organism eats another.
2. The Food Chain consists of many interconnected food webs and are the more realistic representation of the consumption relationships in the ecosystems.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q54. Which of the following statements are correct regarding the biogeochemical cycle?

1. It is a pathway by which a chemical substance moves through biotic and abiotic compartments of the Earth.
2. Sedimentary cycle is one of the types of biogeochemical cycles.
3. Most of the sedimentary cycles are generally considered perfect biogeochemical cycles.

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

Q55. Consider the following statements regarding ecological niche:

1. Each species has a distinct niche and no two species are believed to occupy exactly the same niche.
2. A habitat contains only one ecological niche and supports a single variety of species.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q56. Consider the following statements regarding the Ramsar Convention:

1. It is the only global environment treaty dealing with a particular ecosystem and wetlands.

2. India has the highest number of Ramsar Convention Sites in the world.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q57. Which of the following statements is/are correct regarding the Wetlands (Conservation and Management) Rules, 2017?

1. The notified Wetlands (Conservation and Management) Rules, 2017, come under the provisions of the Environment (Protection) Act, 1986.
2. The power to manage the wetlands has been given to the state governments.

Select the correct answer using the code given below:

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q58. With respect to "The Paris Agreement", consider the following statements:

1. It was adopted at the Conference of Parties (COP 25).
2. It is a non-binding international treaty.
3. It aims to substantially reduce global greenhouse gas emissions to limit the global temperature increase in this century to 2 degrees Celsius.

Which of the statements given above is/are correct?

(a) 1 only (b) 3 only
(c) 1 and 2 only (d) 2 and 3 only

Q59. With respect to the "Peatlands", consider the following statements:

1. They are terrestrial wetland ecosystems in which waterlogged conditions prevent plant material from fully decomposing.
2. All peatlands are the major source of greenhouse gas emissions.
3. They occur in every climatic zone and continent.

Which of the statements given above is/are correct?

(a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1 and 3 only

Q60. With respect to the "Shola forests", consider the following statements:

1. They are evergreen tall trees with small and leathery leaves.
2. They are found in the upper reaches of the Nilgiris, Anamalais, Palni hills and Kanyakumari.
3. They produce good quality timber.
4. They act as overhead water tanks.

Which of the statements given above are correct?

(a) 1 and 3 only (b) 2 and 4 only
(c) 1, 3 and 4 only (d) 1, 2, 3 and 4

Q61. With respect to the 'Green Grids Initiative', consider the following statements:

1. It is an Initiative by India and France to tap solar energy and have it travel seamlessly across the borders.
2. It was announced in the Conference of Parties (COP)26.
3. It is being implemented by the International Solar Alliance (ISA).

Which of the statements given above is/are correct?

(a) 3 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

Q62. The World Health Organization's Global Air Quality Guidelines limit which of the following pollutants?

1. Ozone (O_3)
2. Nitrogen oxide (NO)
3. Carbon monoxide (CO)
4. Sulfur dioxide (SO_2)
5. Particulate matter (PM)

Select the correct answer using the code given below:

(a) 1, 2 and 3 only (b) 2, 3, 4 and 5 only
(c) 1, 3, 4 and 5 only (d) 1,2,3,4 and 5

Q63. With respect to the "Global Methane Pledge", consider the following statements:

1. It was launched at the UN COP25 Climate Conference in Madrid (Spain).
2. It is an effort led jointly by the United States and the European Union.
3. It aims to cut down methane emissions by up to 40% from the 2020 levels by the year 2030.

Which of the statements given above is/are correct?

(a) 2 only (b) 3 only
(c) 1 and 2 only (d) 2 and 3 only

Q64. With respect to the "Coral Reefs", consider the following statements:

1. They have a symbiotic relationship with photosynthetic algae, called zooxanthellae.
2. Deep-sea corals live in much deeper or colder oceanic waters and lack zooxanthellae.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q65. Which of the following factors are responsible for Ozone depletion?

1. Halogen release into the atmosphere
2. Formation of the Polar stratospheric clouds
3. Formation of the Polar Vortex

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

Q66. Which of the following statements are correct regarding the 'Cartagena Protocol'?

1. It is an international treaty related to the movements of the living modified organisms (LMOs), resulting from modern biotechnology.
2. It is supplementary to the Convention on Biological Diversity (UNCBD).
3. India has ratified this Protocol.
4. The Convention also applies to pharmaceuticals for humans that are addressed by other international agreements or organizations.

Select the correct answer using the code given below:

(a) 1 and 3 only (b) 1, 2 and 3 only
(c) 3 and 4 only (d) 1, 2 and 4 only

Q67. Which of the following statements are correct regarding the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)?

1. It is an international agreement between the governments that oversees trade in specimens of wild animals and plants.
2. It provides a framework to be respected by each Party, which has to adopt its own domestic legislation to ensure that CITES is implemented at the national level.
3. It places the species under 2 appendices, on the basis of the degree of protection.

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Q68. Which of the following statements is/are correct as per the Biological Diversity Act, 2002?

1. The Act provides for a 3-tier structure for the implementation of the Act.
2. The State Biodiversity Boards work at the level of the states, as well as the UTs.

Select the correct answer using the code given below:

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q69. Which of the following statements is/are correct regarding the Forest Rights Act, 2006?

1. This Act identifies only 4 types of rights, i.e., Title rights; Use rights; Forest management rights; and Relief and development rights.
2. Only the members or community of the Scheduled Tribes, who primarily reside in and who depend on the forests or forest lands for bona fide livelihood needs, can claim these rights.

Select the correct answer using the code given below:

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q70. With respect to "soil organic matter", consider the following statements:

1. It is any material produced originally by living organisms.
2. It consists of 60-90 percent carbon (C), nitrogen (N) and hydrogen (H).
3. Most soil organic matter originates from plant tissue.

Which of the statements given above are correct?

(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Q71. Which of the following statements are ***incorrect*** regarding the crocodilian species "Gharial"?

1. It is an 'Endangered' species, as per the IUCN Red List.
2. The wild populations of gharials can only be found in Bangladesh, India, Pakistan and Nepal.
3. They are the top predators in the river ecosystem.

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

Q72. Which of the following statements is/are correct?

1. The process of converting N_2 into biologically available nitrogen is called 'ammonification'.
2. The process of conversion of organic nitrogen to ammonia is called 'nitrogen fixation'.

Select the correct answer using the code given below:

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q73. Which of the following statements are correct?

1. The term "Dirty Dozen" is related to the pollution caused by the persistent organic pollutants (POPs).
2. The Stockholm Convention deals with reducing/eliminating the POPs.

3. India is a signatory, but has not yet ratified the Stockholm Convention.

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Q74. 'Towards 1000' Strategy', sometimes seen in the news, is related to which of the following?

(a) Motivating the school students to opt for space sciences.
(b) Combatting desertification and encouraging afforestation.
(c) Promoting start-ups in India.
(d) Driving investments in solar energy.

Q75. Which of the following statements is/are correct regarding the 'net-zero emissions'?

1. Net-zero emission means that the country would reduce its emission to zero.
2. India has pledged the net-zero emission target, but has not given any timeline yet.

Select the correct answer using the code given below:

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q76. Which of the following are the ways in which aerosols alter the Earth's climate?

1. They form layer in the stratosphere and get transformed into droplets.
2. They reflect the sunlight and hence produce a 'cooling effect.'
3. They produce 'desert dust', which, in turn, leads to the expansion of the deserts.

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Q77. The Wildlife (Protection) Act, 1972, provides for which of the following provisions to safeguard the wildlife of the country?

1. It empowers the Central and the State Governments to declare any area a Wildlife Sanctuary, National Park or Closed Area.
2. It defines wildlife, as wildlife includes any animal, bees butterflies, crustacean, fish and moths; and aquatic or land vegetation which forms part of any habitat.
3. Once a National Park is declared, no alteration of the boundaries shall be made, except on the resolution passed by the Parliament.

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Q78. With reference to the Ganges River Dolphins, consider the following statements:

1. The male dolphins are larger than the female dolphins.
2. The Ganges River Dolphins can live only in freshwater.
3. They are essentially blind and hunt by emitting ultrasonic sounds.

Which of the statements given above is/are correct?

(a) 1 and 2 only (b) 2 and 3 only
(c) 3 only (d) 1 and 3 only

Q79. With reference to the Basel Convention, consider the following statements:

1. The Convention is related to the Control of Transboundary Movements of Hazardous Wastes and their Disposal.
2. It was adopted in 2000 by the Conference of Plenipotentiaries.
3. India is a signatory to the Convention.

Which of the statements given above are correct?

(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

Q80. With reference to Antarctica, consider the following statements:

1. The entire area of Antarctica is a single ice sheet.
2. It is because of its mountains, that it has the distinction of being 'the highest continent on the Earth'.
3. Antarctica is the world's fifth largest continent in terms of area.

Which of the statements given above is/are correct?

(a) 1 and 2 only (b) 3 only
(c) 2 and 3 only (d) 1, 2 and 3

Q81. With reference to the Tiger Conservation Foundation (TCF), consider the following statements:

1. As per the Wildlife (Protection) Act, 1972, the TCF is established by the Central Government for the Tiger Reserves in the states.
2. The Central Government has framed the National Tiger Conservation Authority (Tiger Conservation Foundation) Guidelines, 2007, for the purpose of the regulation of the Tiger Conservation Foundations (TCFs).

3. The TCFs have been constituted for all the Tiger Reserves in the country.

Which of the statements given above is/are correct?

(a) 1 and 2 only (b) 2 only
(c) 1 and 3 only (d) 1, 2 and 3

Q82. With reference to the Northern River Terrapin, consider the following statements:

1. It is strongly aquatic, but uses the terrestrial nesting sites, frequenting the tidal areas of the estuaries, large rivers and the mangrove forests.
2. The Northern River Terrapin is omnivorous.
3. The species is considered 'Endangered' by the IUCN.

Which of the statements given above are correct?

(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Q83. Consider the following statements:

1. The Global Warming Potential (GWP) is a measure of the heat absorbed over a given time period due to the emissions of a gas, whereas the Global Temperature Potential (GTP) is a measure of the temperature change at the end of that time period.
2. The calculation of the GWP is more complicated than that for the GTP.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q84. With reference to the Red List Index (RLI), consider the following statements:

1. An increasing RLI value means that the rate of biodiversity loss is increasing.
2. A decreasing RLI value means that there is a decrease in the expected future rate of species extinctions.
3. The RLI is available for 5 taxonomic groups only.

Which of the statements given above is/are correct?

(a) 3 only (b) 1 and 2 only
(c) 1 and 3 only (d) 1, 2 and 3

Q85. With reference to the National Biodiversity Authority (NBA), consider the following statements:

1. It was established in 2003 by the Central Government to implement India's Biological Diversity Act, 2002.
2. One of ex-officio members of the Authority is from the Ministry dealing with the Tribal Affairs.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q86. With reference to the Indian Forest Act, 1927, consider the following statements:

1. It provides for the definition of forests.
2. It provides procedure to be followed for declaring an area to be a Reserved Forest, a Protected Forest or a Village Forest.
3. It provides the legal framework for the duty leviable on timber and other forest produce.

Which of the statements given above are correct?

(a) 1 and 3 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

Q87. With reference to the Red Sanders, consider the following statements:

1. It is an endemic tree of South India.
2. The export of red sanders is permitted, if it is obtained from cultivated land.
3. The species is in Appendix I of CITES.

Which of the statements given above are correct?

(a) 1 and 3 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

Q88. Consider the following statements:

1. Mycorrhiza is a mutual symbiotic association between a fungus and a plant.
2. The Coralloid roots comprise symbiotic anabaena involved in fixing nitrogen.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q89. With respect to "epiphytes", consider the following statements:

1. They have an attachment to the ground or other obvious nutrient sources and are parasitic to the supporting plants.
2. They are found in both tropical and temperate regions.
3. The majority of epiphytic plants are angiosperms.

Which of the statements given above is/are correct?

(a) 3 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

Q90. With respect to "forest-certification", consider the following statements:

1. It is a market-based non-regulatory conservation tool designed to promote sustainable management of forests and trees outside forests.
2. The Certification Standard for Sustainable Forest Management (SFM) is developed by the Forest Survey of India (FSI).

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q91. With respect to "Arsenic", consider the following statements:

1. The occurrence of arsenic in ground water increases with depth.
2. It is a carcinogenic element.
3. Blackfoot disease (BFD) has been reported to be one of the important complications of chronic arsenic toxicity.

Which of the statements given above are correct?

(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Q92. Biomass is converted into energy through which of the following processes?

1. Direct combustion to produce heat.
2. Thermochemical conversion to produce solid, gaseous and liquid fuels.
3. Chemical conversion to produce liquid fuels.
4. Biological conversion to produce liquid and gaseous fuels.

Select the correct answer using the code given below:

(a) 1, 2 and 4 only (b) 3 and 4 only
(c) 1 and 3 only (d) 1, 2, 3 and 4

Q93. With reference to the Trophic Pyramid, consider the following statements:

1. The base of the Pyramid is composed of species, called heterotrophs.
2. The higher the organism is on the Trophic Pyramid, the lower the amount of available energy.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q94. Consider the following statements regarding climax stage in the ecological succession:

1. The species composition of the climax community remains the same.
2. The climax stage is not completely permanent.
3. All succession, whether taking place in water or on land, proceeds to a similar climax community – the mesic.

Which of the statements given above is/are correct?

(a) 1 and 3 only (b) 2 only
(c) 2 and 3 only (d) 1, 2 and 3

Q95. Consider the following statements:

1. The Siachen Glacier is located in the Karakoram Range in the Himalayas.
2. The Siachen Glacier is the source of the Nubra River.
3. The Pindari Glacier is found in the upper reaches of the Kashmir Himalayas.

Which of the statements given above is/are correct?

(a) 2 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

Q96. Consider the following statements:

1. Permafrost is the ground below the Earth's surface that has been continuously frozen for at least two consecutive years.
2. Permafrost extends over a quarter of the Northern Hemisphere, including many regions that are not covered in snow.
3. The frozen ground is present beneath large parts of Alaska, Canada and Siberia.

Which of the statements given above is/are correct?

(a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

Q97. Recently, the explosive eruption of the Hunga Tonga Volcano was the biggest volcanic event recoded anywhere in the world in over 3 decades. Tonga is located in which of the following oceans?

(a) The Pacific Ocean (b) The Atlantic Ocean
(c) The Arctic Ocean (d) The Indian Ocean

Q98. With respect to "Nagoya protocol", consider the following statements:

1. It is a supplementary agreement to the United Nations Convention on Biological Diversity (CBD).
2. It provides a transparent legal framework for the effective implementation of one of the fair and equitable sharing of benefits arising out of the utilization of genetic resources.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q99. With respect to "International Treaty of Plant Genetic Resources for Food and Agriculture (ITPGRFA)", consider the following statements:

1. It was adopted in 2001.
2. Its objective is to ensure food security through the conservation, exchange, and sustainable use of the world's Plant Genetic Resources for Food and Agriculture (PGRFA).
3. India is not a signatory to the treaty.

Which of the statements given above are correct?

(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Q100. Consider the following statements:

1. Nagarhole National Park is located in Tamil Nadu.
2. The park is bounded by the Kabini River.
3. It is part of the Nilgiri Biosphere Reserve.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 and 3 only
(c) 1 and 2 only (d) 1, 2 and 3

ANSWER KEY

1.	c	**21.**	c	**41.**	c	**61.**	c	**81.**	b
2.	d	**22.**	d	**42.**	a	**62.**	c	**82.**	a
3.	b	**23.**	c	**43.**	a	**63.**	a	**83.**	a
4.	d	**24.**	d	**44.**	a	**64.**	c	**84.**	a
5.	b	**25.**	d	**45.**	a	**65.**	d	**85.**	c
6.	c	**26.**	d	**46.**	a	**66.**	b	**86.**	c
7.	d	**27.**	b	**47.**	d	**67.**	a	**87.**	b
8.	a	**28.**	b	**48.**	b	**68.**	a	**88.**	a
9.	a	**29.**	b	**49.**	a	**69.**	a	**89.**	c
10.	b	**30.**	c	**50.**	a	**70.**	c	**90.**	a
11.	d	**31.**	d	**51.**	a	**71.**	a	**91.**	b
12.	b	**32.**	c	**52.**	d	**72.**	d	**92.**	d
13.	d	**33.**	d	**53.**	d	**73.**	a	**93.**	b
14.	d	**34.**	c	**54.**	a	**74.**	d	**94.**	d
15.	d	**35.**	c	**55.**	a	**75.**	d	**95.**	b
16.	b	**36.**	d	**56.**	a	**76.**	d	**96.**	d
17.	c	**37.**	b	**57.**	c	**77.**	a	**97.**	a
18.	b	**38.**	d	**58.**	b	**78.**	d	**98.**	c
19.	b	**39.**	a	**59.**	d	**79.**	b	**99.**	a
20.	b	**40.**	c	**60.**	b	**80.**	b	**100.**	b