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Preface Environment, Ecology & 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!!!

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Themes asked in Prelims Exam in the last Three Years

GEOGRAPHY		
PRELIMS 2020 - TOPICS	**PRELIMS 2019 - TOPICS**	**PRELIMS 2018 -TOPICS**
1. Ocean mean temperature	1. Summer Solstice	1. Earth's magnetic field, early atmosphere
2. Siachen Glacier	2. Water reservoirs in news	2. Barren island
3. Ground Water - Authority	3. Dewdrops	3. Coral reefs
4. Jet Streams, Cyclones	4. International Sea - bordering countries	4. City on a longitude closest to that of Delhi
5. International Rivers	5. Glacier - River	

ENVIRONMENT		
PRELIMS 2020 - TOPICS	**PRELIMS 2019 - TOPICS**	**PRELIMS 2018 -TOPICS**
1. Benzene pollution	1. 'Extended producer responsibility'	1. Carbon fertilization
2. Desert national park	2. Compensatory Afforestation Fund Act, 2016	2. Adaptation of plants in deserts
3. Largest area under critical Tiger Habitat	3. Indian Forest act 1927 , FRA 2006	3. National Green Tribunal (NGT) different from the Central Pollution Control Board (CPCB)
4. Schedule 6 WPA 1972	4. Environment protection act 1986	4. Aral Sea - shrinkage
5. Social Cost of Carbon	5. Solid waste management rules 2016	5. "Conservation Agriculture"
6. Indian Elephants	6. Cirrus cloud thinning technique and the injection of sulphate aerosol into stratosphere	6. "Sixth mass extinction/sixth extinction"
7. Protected Areas in Cauvery River Basin	7. 'Pyrolysis and plasma gasification'	7. Artificial Lake
8. Birds - Biodiversity in news - Ceylon frogmouth	8. Agasthyamala Biosphere Reserve	8. Consequence/s of heavy sand mining in riverbeds
9. Indian Swamp deer(Bara Singha) - Found in which areas	9. Species - Herbivorous, viviparous etc	9. Agricultural soils
10. Steel Slag	10. Wildlife - Natural habitat - Mahseer, Dolphin etc	10. Partnership for Action on Green Economy (PAGE)
11. Musk Deer - Habitat	11. Microbeads	11. Prosopis Juliflora

12. Environmental sustainability in rural road construction	12. National park in temperate alpine zone - valley of flowers	12. "Momentum for Change: Climate Neutral Now"
13. Coal Pollution	13. Green house gases released by - cattle, soils, Poultry	13. Pakhui Wildlife Sanctuary
14. Biochar	14. Hydrogen-enriched CNG (H-CNG) as fuel - Alternative fuels	14. Forest Rights Act - tribals - Wildlife habitat
	15. Himalayan nettle (Girardinia diversifolia)	15. Plant disease
	16. Forest Cover	16. 'Global Alliance for Climate-Smart Agriculture (GACSA)'
	17. Methane Hydrates	
	18. Pollutants by burning of crops/Biomass	
	19. Carbofuran, methyl parathion, phorate and triazophos - Pesticides	
	20. Ramsar Convention	

SECTION 1

BASICS OF ECOLOGY, ENVIRONMENT & BIODIVERSITY

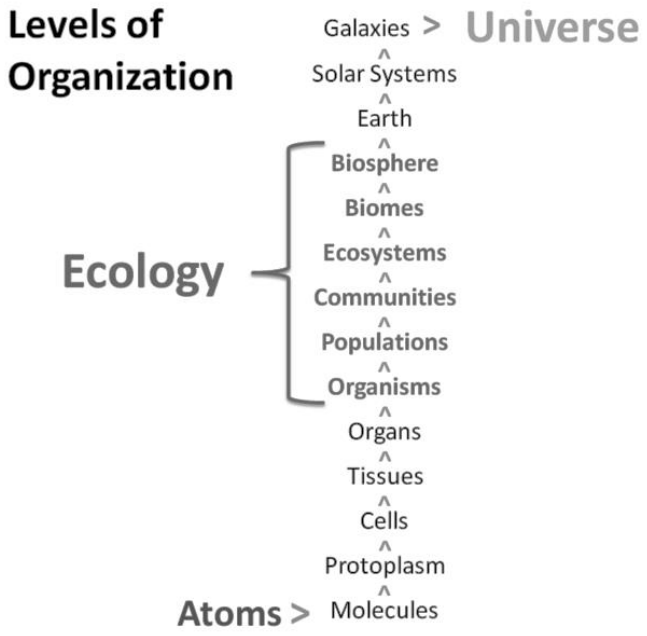
►ECOLOGY

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

►ENVIRONMENT

Environment is biotic (living organisms) and abiotic (non-living organisms) surrounding of an organism or population and also includes the 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, like ways, 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 e.g. an elephant in Kaziranga.

SPECIES

It is similar organisms having the potential to inter-breed and produce fertile offspring e.g. Entire elephant population.

POPULATION

It is a group of individuals of a plant or an animal species inhabiting a given area e.g. All Elephants of Kaziranga form the population of elephants in that particular area.

BIOLOGICAL COMMUNITY

- It is the 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 e.g. Elephants+ rhino+ bacteria+ other wild animals and plants of Kaziranga.
- Biological community DOES NOT involve interactions of living beings with abiotic /physical environment.

ECOSYSTEM

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

LANDSCAPE

It is a unit of land with a natural boundary having a mosaic of patches representing different ecosystems e.g. a view of river, its valley and 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 e.g. 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

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

►BIOTIC INTERACTION

Biotic interactions are the various mechanisms in which organisms interact with each other.

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.

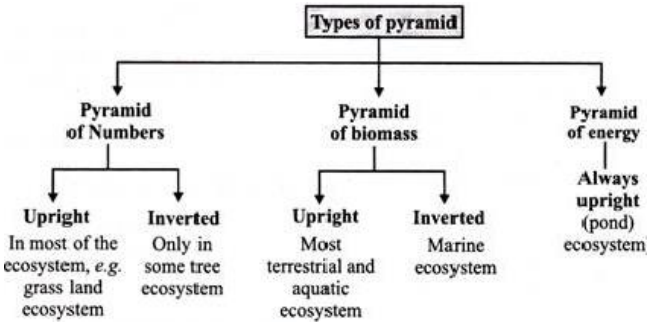
Competition	-	-	Lion and tiger in the same niche.
Predation	+	-	Lion and zebra, bear and fish, and fox and rabbit.

►FOOD CHAIN & FOOD WEB

- A **FOOD CHAIN** is a **linear** sequence of organisms through which nutrients and 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 Webs** consist of many **interconnected food chains** and are more realistic representation of consumption relationships in ecosystems.
- **Producers**, or **autotrophs**, make their own organic molecules.
  - **Photoautotrophs**, such as plants, use energy from sunlight to make organic compounds—sugars—out of carbon dioxide in **photosynthesis**.
  - **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 or animals or both)
  - Micro Consumers (Saprotrophs - Decomposers)
- **Types of food chain:**
  - Grazing food chain
    - It starts from the 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 of the ecosystems in nature follow this type of food chain.
    - For example –The 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 thus less dependent on direct solar energy.
    - These depend chiefly on the influx of organic matter produced in another system.
    - For example – food chain operating in the accumulated litter in a temperate forest.

►ECOLOGICAL PYRAMIDS

An ecological pyramid is 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) and abiotic (lithosphere, atmosphere, and hydrosphere) compartments of Earth.
- There are two basic types of biogeochemical cycles, gaseous and sedimentary.
- In the gaseous type of biogeochemical cycle there is a prominent gaseous phase. Cycling of carbon and nitrogen represents gaseous biogeochemical cycles.
- In sedimentary cycles the main reservoir is the lithosphere from which the 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 the soil and sediments and 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)
- Mangrove forests (between terrestrial and 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 odorless 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:**

  For terrestrial land: Bare rocks – Lichens -- Annual Plants -- Perennial Plants and Grasses – Shrubs – Softwood Tress, Pines – Hardwood trees

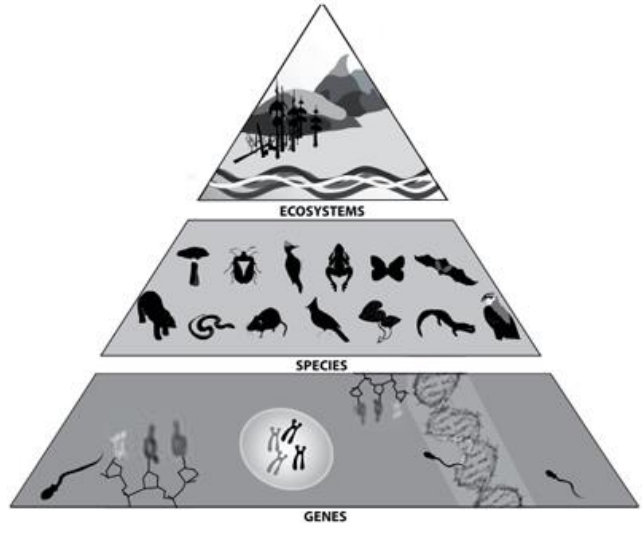
- For Hydrosere: Phytoplankton – submerged plant stage – Submerged free floating plant stage – Reed swamp stage(Sedge) – Marsh meadow stage – Scrub stage - Forest

SERAL COMMUNITY (SERE)

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

►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. The following parts will cover all levels of diversity.



FLAGSHIP SPECIES	INDICATOR SPECIES	KEYSTONE SPECIES
The one **chosen to represent** an environmental cause, such as an ecosystem in need of conservation.	The one whose presence **indicates** the presence of a set of other species and whose absence indicates the lack of that entire set of	It is a species whose addition or loss to an ecosystem will lead to major changes in the ecosystem.

	species.	
Chosen species could be either vulnerable or attractive or distinct.	For instance, a species might indicate presence of environmental pollution or arrival of monsoon and so on.	This is because certain species are considered more important in determining the presence of other species.
Example: Indian Tiger, African Elephant, Giant Panda of China, etc.	**Example:** Lichens (air quality), most amphibians, fishes, etc.	**Example**: All top predators - tiger, lion, crocodile, and elephant - as their addition or removal will distort the existing food chain in the ecosystem.

►INVASIVE SPECIES

An alien species is a species introduced by humans – either intentionally or accidentally - outside of its natural past or present distribution, however not all alien species have negative impacts, and it is estimated that between 5% and 20% of all alien species become problematic. It is these species that are termed '***Invasive alien species***' **(IAS).**

IMPACT

- Driver of biodiversity loss
- Lead to changes in the structure and composition of ecosystems leading to significant detrimental impact on ecosystem services, affecting economies and human wellbeing.

COMMON INVASIVE SPECIES OF INDIA

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

CORALS

►CORAL REEFS

- Coral reefs 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 degree south latitudes)
- Oceanic water free of sedimentation;
- Transparent parts of ocean bodies;
- Relatively low salinity ocean bodies

TYPES OF REEF FORMATIONS-

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

DISTRIBUTION IN INDIA

- The Gulf of Kutch - The coral formations of the Gulf of Kutch represent one of the extreme northern limits of corals in the Indian Ocean
- The West Coast of India
- The Lakshadweep Islands
- The Gulf of Mannar
- Palk Bay
- Andaman and Nicobar Group of Islands

THREATS

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

IMPORTANT

- **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.

►GLOBAL FUND FOR CORAL REEFS

- It is a 10-year $500 million blended finance instrument to mobilise action and resources to protect and restore coral reef ecosystems with two windows:
  1. Grant Window
  2. Investment Window
- It blends private and public funding and will also support businesses and finance mechanisms.
- The Global Fund for Coral Reefs 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 and UN organisations such as UNEP, UNDP, and UN Capital Development Fund etc.

►MESOPHOTIC CORALS

- A Mesophotic coral reef (meso meaning middle and photic meaning light) is characterized by the presence of both light dependent coral and algae, and organisms that can be found in water with low light penetration.
- They normally grow between 30 and 40 meters and up to 150 meters in tropical and subtropical water.
- The most common species at the mesophotic level are corals, sponges and algae.
- The corals ranges can overlap with Deep-water coral but are distinguished by the presence of zooxanthellae and their requirement for light.

►BIO-ROCK TECHNOLOGY

Zoological Survey of India (ZSI) is trying to restore coral reefs in the Gulf of Kachchh by using a new method, Biorock process, to grow **solid limestone rock structures** in the sea.

AKA MINERAL ACCRETION TECHNOLOGY OR SEAMENT

Steel structures (to which coral fragments are fixed) are lowered onto the sea bed → 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** ($CaCO_3$) or **white limestone structures**.

- Their **composition** is similar to that of natural coral reefs and tropical sand beaches.
- **Strength** is similar to concrete.
- It is the only marine construction that grows, gets stronger with age and is self-repairing.

HOW BIOROCK HELPS IN CORAL REEF RESTORATION?

- Corals adhere to $CaCO_3$ 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
- Beach Erosion
- Adaptation to sea level rise
- Oyster Reef restoration
- Sea Grass Restoration
- Salt Marsh Restoration
- Fisheries Restoration
- Sustainable Aquaculture

→ANGRIA BANK

- It is a **shallow submerged** atoll island located 100 miles off the western coast of India. It is off the coast of Ratnagiri and Sindhudurg district of Maharashtra.
- Corals reefs have been found in the area. The peculiarity of coral reefs present here is that it is in the middle of the ocean, unlike other corals which are either coastal in nature like the Gulf of Mannar or Andaman and Nicobar corals which are island corals, the Angria Bank is in the middle of the sea.
- It has the potential to become **India's Great Barrier** Reef.
- **The Angria Banks falls outside the territorial waters but inside the EEZ of India. Thus, it cannot be protected under the Wildlife Protection Act.**
- The area can be designated for conservation under the **Maritime Zones Act.**

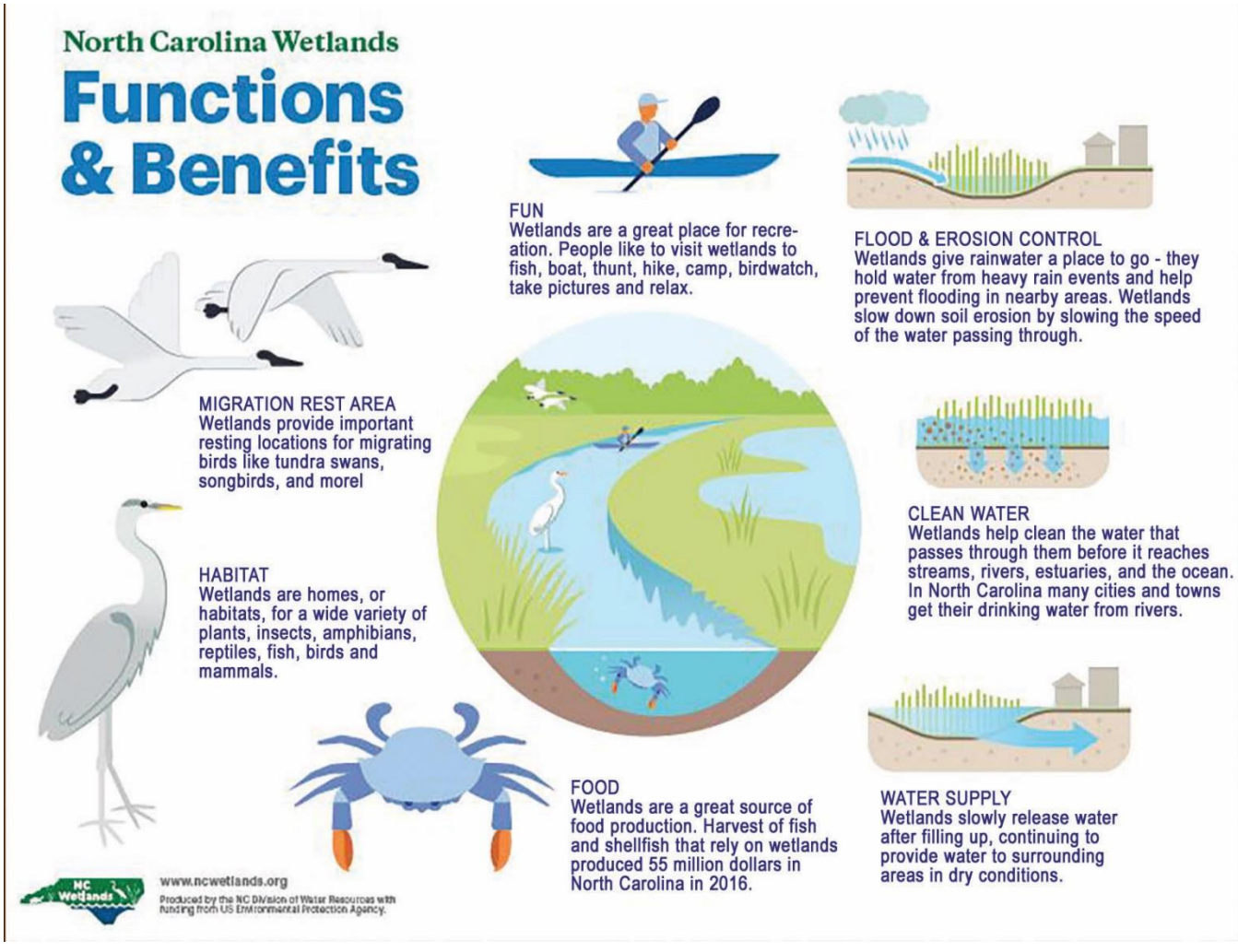
▶WETLANDS

- Wetlands are **transition zones between terrestrial and aquatic ecosystems**.
- E.g. **Mangroves**, lake littorals (marginal areas between highest and 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) and **other marshy or swampy areas.**
- These habitats experience periodic flooding from adjacent deep water habitats and therefore support plants and animals specifically adapted to such shallow flooding or water logging.
- **Waterlogged soil adapted plant life (hydrophytes) and hydric soils (not enough O2) are the chief characteristics of wetlands.**

SEVEN WETLANDS BIOGRAPHIC ZONES OF INDIA

Adopting the landscape approach for wetland conversation, seven new biographic zones have been declared:

	ZONES	DESCRIPTION
1	Wetlands in the 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.
2	Wetlands in Desert and Semi-arid zone	• Arid zone spanning Rajasthan & Gujarat has vast saline marshes & monsoon fed freshwater lakes &reservoirs. • Rann of Kachchh& salt lakes like Sambhar, Pachpadra, Didwana & Lukransar are wetlands of this part of this country.
3	Wetlands in the Western Ghats	• Western Ghats are one of the biodiversity hotspots of India. They are criss-crossed by a number of rivers & streams giving rise to several riverine wetlands, swamps & marshes &Lukransar are wetlands of this part of the country. • **Myristica swamps** found in the region have an abundance of **Myristica trees, which are most primitive flowering plants on earth. Found in Kerala and Southern Karnataka.** The evergreen, water-tolerant trees have dense stilt roots which help them to stay erect in the thick, black, wet alluvial soil. The swamps are typically found in valleys, making them prone to inundation during monsoon rains.
4	Wetlands in the 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.
5	Wetlands in the North East 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.
6	Wetlands in the 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.
7	Wetlands in the Coasts and 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.



►IMPORTANCE OF WETLANDS

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

NEED TO PRESERVE WETLANDS BECAUSE

- Provide food for species, flora, fauna and humans.
- Protects and improves water and air quality, provide fish and wildlife habitats, stores floodwaters and also maintain surface water flow during dry periods.
- Acts as natural sponges as it traps CO_2 and release Oxygen.

PRESERVING WETLANDS HELPS IN COMBATING CLIMATE CHANGE

- Proper use and restoration of wetlands is essential to protect stored carbon and reduce avoidable carbon emissions.
- Enhance climate adaptation and 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 and 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

- The Convention came in to force in 1975.
- The Convention's mission is "the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world".
- It is the only global environment treaty dealing with a particular ecosystem and Wetlands.
- Wetlands covered in its mission, include lakes and rivers, swamps and marshes, wet grasslands and peatlands, oases, estuaries, deltas and tidal flats, near-shore marine areas, mangroves and coral reefs, and human-made sites such as fish ponds, rice paddies, reservoirs, and salt pans.
- **Wise use (the core philosophy of Ramsar) is the maintenance of ecological character within the context of sustainable development.**
- The country with the highest number of Sites is the United Kingdom. Bolivia has the greatest area of listed wetlands.
- India has a total of 42 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

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

Note: Indian Sundarbans met four of the nine criteria's, i.e.,

1. presence of rare species and threatened ecological communities,
2. biological diversity,
3. significant and representative fish, and
4. fish spawning ground and migration path

- The part of the Sunderbans Delta which lies in Bangladesh (60% of the total area) was accorded status of International Importance in 1992. With Indian Sunderbans (40% of the total area) also getting the same status, the whole of the Sunderbans now is Wetland of international Importance.

►MONTREUX RECORD

- The Montreux Record is a register of wetland sites on the List of Wetlands of international importance where changes in ecological character have occurred, are occurring, or are likely to occur as a result of technological developments, pollution or other human interference 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 the catchment area, infestation of water hyacinth and pollution. The construction of a hydroelectric power plant has caused the local extinction of several native 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.

►HIGHLIGHTS OF WETLANDS (CONSERVATION AND MANAGEMENT) RULES, 2017

The MoEF&CC has notified Wetlands (Conservation and Management) Rules, 2017 (Wetlands Rules) under the provisions of the **Environment (Protection) Act, 1986** as regulatory framework for conservation and 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

- **National Wetland Committee** replaces **Central Wetlands Regulatory Authority (CWRA)**:
  - NWC will be headed by the MoEFCC Secretary, to monitor implementation of these rules.
  - NWC has a merely advisory role. These include -
    - Advising the central government on proposals received from states/UTs for "omission of the prohibited activities".
    - Prescribing norms and 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

- It is the world's **largest nature conservation Partnership**.
- Together there are 120 BirdLife Partners worldwide.
- Bird Life International 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.
- It identifies the sites referred to as '**Important Bird and Biodiversity Areas'**.
- For India, the partner organisation is **Bombay Natural History Society (BNHS).**

WHAT IS IMPORTANT BIRD AREA?

It is 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

Central Asian Flyway

It covers continental area of Eurasia between Arctic Ocean and Indian Ocean. It covers northern most breeding grounds in Siberia, non-breeding winter grounds in India, West Asia, Maldives and British Indian Ocean Territories.

The flyways pass through Indian landmass.

1. Central Asian Flyway

Tsomoriri

Tsomoriri was included as a Ramsar site in 2002. It is a brackish lake that lies at a height of 4,595 metres above the sea level. This site is the only breeding ground of the black-necked cranes outside China. These birds are endangered.

►NATIONAL WETLAND CONSERVATION PROGRAMME (NWCP)

- The Government operationalized National Wetland Conservation Programme (NWCP) in closed collaboration with concerned State Government during the year 1986.
- The scheme aims at **Conservation and wise use of wetlands** in the country so as to prevent their further degradation.
- The scheme was initiated to lay down policy guidelines for conservation and management of wetlands in the country; to undertake intensive conservation measures in priority wetlands; to monitor implementation of the programme and to prepare an inventory of Indian wetlands.

►NATIONAL RIVER CONSERVATION PLAN (NRCP)

- The river conservation programme 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.

LOKTAK AND PHUMDIS

- It is a lake located near **Moirang in Manipur state**. It is the largest freshwater lake in North East.
- 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 lake bed 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.
- The **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, the sangai**, whose habitat is also under threat.

►MEKEDATU PROJECT

- Mekedatu, literally 'Goat's leap' in Kannada, is at the confluence of Cauvery and Arkavathi rivers, near Kanakapura which is at a distance of 110 km from Bengaluru.
- Karnataka aims to build the Mekedatu balancing reservoir and drinking water project.
- The project aims to supple drinking water to Bengaluru and would also focus on generation of power.

►DEATHS OF BIRDS NEAR SAMBHAR LAKE

- Birds which have been found with infection are mostly omnivorous and insectivorous. Important bird species that have been affected include Northern shovelers, Kentish plovers, common teals, common sandpipers, Ruff, Pied avocets, whistling ducks, common coots. Avian Botulism is responsible for the death of birds in Sambhar Lake.
- **Avian Botulism** caused by Clostridium botulinum. Several factors have been attributed to favoring the growth of Clostridium botulinum. Like:
  - Presence of crustaceans, invertebrates
  - Heavy rains in month of July and August and thereby decrease in salinity level

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 of the world 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.
- Harbour a variety of life forms like invertebrates, fish, amphibians, reptiles, birds and 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	• **Largest single block of tidal halophytic mangroves of the world.** • Famous for the **Royal Bengal Tiger** and **crocodiles**. • Mangrove areas here are being cleared for **agricultural use**.
Bhitarkanika, Orissa	• **Second largest** in the Indian sub-continent, • Harbour high concentration of typical mangrove species and high genetic diversity.
Godavari-Krishna deltaic regions, Andhra Pradesh	Mangrove swamps occur in profusion in the intertidal mudflats on both side of the creeks
Maharashtra, Goa and Karnataka	Mostly scrubby and degraded mangroves occur along the intertidal region of estuaries and creeks
Kerala	Very sparse and thin
Gulf of Kachchh and the Kori creek, Gujarat (north-west coast)	Range from bushy stands of dwarf mangroves found in Gulf of Kuchchh, to taller stands found in the Sunderbans.
Andaman & Nicobar Islands	Small tidal estuaries, neritic inlets and the lagoons support a dense and diverse undisturbed mangrove flora.

According to the State of Forest Report 2019

- Mangroves cover 0.15% of the country's total geographical area.
- There has been a net increase of 54 sq km of mangrove cover in the country as compared to 2017 assessment.
- Order of States by Mangrove Cover: West Bengal (42.5%), Gujarat (23.6%), Andaman and Nicobar Islands (12.4%), Andhra Pradesh (8.1%), Maharashtra, Odisha, etc.

►MANGROVES FOR FUTURE (MFF)

- It is 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 and animals;
- Important for keeping the water cycle alive - store the rain water 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.

►FOREST SURVEY OF INDIA (FSI)

- It is an organization under the union 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.

►BOTANICAL AND ZOOLOGICAL SURVEY OF INDIA

- Botanical Survey of India (BSI) - An institution set up by the GOI in **1890**
- Objective - Identifying the plant resources of this country.
- **Zoological Survey of India (ZSI) –**Established in **1916** to
- **Objective -** Explore and research the fauna.
- The history of ZSI goes back to **Asiatic Society of Bengal** founded by Sir William Jones in 1784. It is the mother of institutions like Indian Museum, ZSI and Geological Survey of India
- They are under the Ministry of Environment, Forest and Climate Change.
- The Headquarters of both the institutions are situated at Kolkata with many regional centres.

►STATE OF FOREST REPORT 2019

The report is published by the Forest Survey of India (FSI) which has been mandated to assess the forest and tree resources of the country including wall-to-wall forest cover mapping in a biennial cycle. Starting 1987, 16 assessments have been completed so far. ISFR 2019 is the 16th report in the series.

SALIENT FEATURES

- India is among the few countries in the world where forest cover is consistently increasing.
- Total forest and tree cover of the country is 80.73 million hectare which is **24.56 percent** of the geographical area.
  - Total forest cover – 21.67%
  - Tree cover – 2.89%
- As compared to 2017, there is an increase of 5188 sq. km in the total forest and total tree cover (forest cover – 3976 sq. km; tree cover – 1,212 sq. km).
- Forest cover in the hill districts is 40.3%.
- Total forest cover in the tribal districts is 37.54%.
- Forest cover within the reserved forest are has shown a slight decrease of 330 sq. km (0.05%).
- Highest range increase in forest cover has been observed in open forest followed by very dense forest and moderately dense forest.
- Top three states showing increase in forest cover are Karnataka (1,025 sq. km) followed by Andhra Pradesh (990 sq. km) and Kerala (823 sq. km), Jammu and Kashmir and Himachal Pradesh.
- Total Forest cover in the North Eastern Region is 65.05% of its geographical area. Current assessment shows a decrease of forest cover to the extent 0.45% in the region. Except Assam and Tripura, all the States in the region show decrease in forest cover.
- Soil Organic Carbon represents the largest pool for carbon stock in forests – 56% to the total forest carbon stock of the country.
- Area-wise **Madhya Pradesh has the largest forest cover** in the country followed by Arunachal Pradesh, Chhattisgarh, Odisha and Maharashtra.
- In terms of forest cover as percentage of total geographical area, the top five States are Mizoram (85.41%), Arunachal Pradesh (79.63%), Meghalaya (76.33%), Manipur (75.46%) and Nagaland (75.31%).

- Mangrove cover has been separately reported in the ISFR 2019
  - Total mangrove cover in the country is 4,975 sq km.
  - An increase of 54 sq Km in mangrove cover has been observed as compared to the previous assessment of 2017.
  - Top three states showing mangrove cover increase are Gujarat (37 sq km) followed by Maharashtra (16 sq km) and Odisha (8 sq km).
- The extent of bamboo bearing area of the country has been estimated 16.00 million hectare – an increase of 0.32 million hectare.
- Under the current assessment the total carbon stock in country's forest is estimated 7,124.6 million tonnes and there an increase of 42.6 million tonnes in the carbon stock of country as compared to the last assessment of 2017.
- FSI has carried out an exercise at the national level to identify wetlands of more than 1 ha within RFA.
  - There are 62,466 wetlands covering 3.8% of the area within the RFA/GW of the country.
  - Total number of wetlands located within reserved forest area is 8.13%.
  - Amongst the States, Gujarat has largest area of wetlands within reserved forest area followed by West Bengal.
- The report included a chapter on forest and people which collects information on the dependence of the people living in close proximity to forests for their day to day needs for forest produce such as Fuelwood, Fodder, Small timber and bamboo.

FUELWOOD

- In terms of total removal of fuelwood the people living in forest fringe villages, the highest quantity of removal of fuelwood is estimated for Maharashtra followed by Odisha and Rajasthan.
- In terms of average removal of fuelwood per capita in a year, highest dependence is observed in Nagaland followed by Himachal Pradesh and Tripura.
- At the national level, fuelwood consumption is terms of per capita at the national level have reduced from 294.28 kg in 2011 to 278.21 kg in 2019.

FODDER

Quantity of removal of fodder in terms of total removal is estimated highest for Madhya Pradesh followed by Maharashtra and Gujarat. In terms of average removal of fodder per capita in a year, the highest dependence is observed in Mizoram followed by Jharkhand and Arunachal Pradesh.

SMALL TIMBER

- Total removal of small timber is estimated highest for Madhya Pradesh followed by Gujarat and Maharashtra.
- It has been assessed that the annual removal of small timber by the people living in forest fringe villages is nearly 7% of the average annual yield of forests in the country.

BAMBOO

- Total removal of bamboo from forest by the people living in forest fringe villages is estimated highest for Madhya Pradesh followed by Chhattisgarh and Gujarat.
- In terms of average removal of bamboo per capita in year, the highest dependence is observed in A&N Islands followed by Chhattisgarh and Dadra & Nagar Haveli.
- Report reveals that 21.40% of the forest cover of the country is highly to extremely fire prone.
- Non-Timber Forest Produce (NTFP) are important source of livelihood for many tribal communities and villagers living in the proximity of forests. Top five NTFP species in each State & UT in terms of their availability in forests i.e. relative occurrence is provided in the report.

METHODOLOGY

The biennial assessment of forest cover of the country using Indian Remote Sensing satellite data **(Resourcesat-II)**

SHANNON-WEINER INDEX

- State of Forest Report 2019 has used Shannon-Weiner Index to measure diversity of Tree, Shrub and Herb in states.
- The index is a measure of species abundance and richness to quantify diversity of woody species. It takes both species abundance and species richness into account.

►THE 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.** Camp fires 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 the Himalayas, fires have made the situation less favourable for oaks to grow and more favourable 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.

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 (O2) 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 the atmosphere. Natural processes, such as **volcanic eruptions and forest fires**, also contribute to an ambient existence of PAHs.

►COMPENSATORY AFFORESTATION IN FOREST RICH STATES

- Forest Advisory Committee under the Forest Conservation Act, 1980 has decided that:

1. States/UT having forest land of more than 75% of their area, will not be required upon providing non-forest land for afforestation equal to the forest area diverted in the same state/UT. However, the same may be taken up in any other state/UT having deficient forest land/cover and having land bank for Compensatory Afforestation.
2. Site should have an area of more than 5 hectare. However, land parcels contiguous with Reserved Forest/Protected Forest can be accepted for Compensatory Afforestation irrespective of their sizes.

- States/UT having more than 75% area of forested area: Mizoram, Lakshadweep, Andaman & Nicobar Islands, Arunachal Pradesh, Nagaland, Meghalaya and Manipur

►FOREST-PLUS 2.0

- India's Ministry of Environment, Forest and Climate Change (MoEF&CC) and US Agency for International Development (USAID) have officially launched Forest-PLUS 2.0.
- It was initiated in the year 2018 as Forest-PLUS has already completed its five years in 2017.
- Forest-PLUS 2.0 is five-year programme that focuses on developing tools and techniques to bolster ecosystem management and harnessing ecosystem services in forest landscape management.
- The Forest-PLUS focused on capacity building to help India participate in Reducing Emissions from Deforestation and forest Degradation (REDD+).

►ONE TRILLION TREES INITIATIVE

- Launched by The World Economic Forum (WEF) to grow, restore and conserve 1 trillion trees around the world.
- It is a bid to restore biodiversity and help fight climate change.
- 1t.org offers a platform for leading governments, businesses, civil society and ecopreneurs committed to serving the global trillion trees community.
- 1t.org is designed to support the UN Decade on Ecosystem Restoration 2021-2030, led by UNEP and FAO.

►TROPICAL FOREST ALLIANCE 2020

- It was founded in 2012 at Rio+20.
- The Alliance is committed to reducing tropical deforestation associated with the production of palm oil, soy, beef and pulp and paper.
- It involves working across Latin America, West and Central Africa and Southeast Asia to implement these commitments.
- TFA is funded by the governments of Norway, the United Kingdom and the Netherlands, and its **secretariat is hosted at the World Economic Forum**.
- The **Commodities and Forests Agenda 2020,** is under the aegis of World Economic Forum,

summarizes the strategic priorities that must be addressed to eliminate tropical deforestation from beef, soy, and palm oil production.

MISSION MILLION TREES

- It was organised by Ahmedabad Municipal Corporation. The Mission was started on world environment day i.e. 5th June 2019.
- A total of 10,87,000 trees were planted in Ahmedabad.

►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

It is an initiative launched by Global Wildlife Conservation, Rainforest Foundation Norway, UNDP, Wildlife Conservation Society and World Resources Institute.

AIM

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.

►INDIA'S NATIONAL GREENING GOALS

- Restoring ***26 million*** hectares of degraded land by 2030 (Bonn Challenge)
- 33 percent of area under tree and forest cover. (*National Forest Policy 1952*)
- Additional carbon-sink of 2.5 to 3 billion tonnes of CO_2 equivalent by 2030.
- Emissions intensity reduction of the GDP by about a third by 2030.
- 40% of the installed capacity for electricity from non-fossil fuel sources.

SECTION 2

CONVENTIONS

►BASEL CONVENTION ON THE CONTROL OF TRANSBOUNDARY MOVEMENTS OF HAZARDOUS WASTES AND THEIR DISPOSAL

Adopted in 1989 with the objective of protecting **human health and environment against the 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 the Basel convention 1992. India has been taking measures for the effective management of hazardous wastes and thereby meeting the obligations of the Basel Convention.

The 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.

►THE 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 (POPs)

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.

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 OF INDIA APPROVES RATIFICATION OF 7 ORGANIC POLLUTANTS

Union Cabinet recently approved the ratification of seven 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, Hexabrom-obiphenyl ether and Heptabromodiphenylether (Commercial octa BDE), Tetrabromodiphenyl ether and Pentabromodiphenyl ether (Commercial penta-BDE), Pentachlorobenzene, Hexabromocyclodo-decane, Hexachlorobutadiene

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 to the 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 United Nations.

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.

►THE 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 programmes 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:

- The **Working Group on Access and Benefit-Sharing (ABS)** is currently the forum for negotiating an international regime on access and benefit sharing;
- The **Working Group on Article 8(j)** addresses issues related to protection of **traditional knowledge;**
- **The Working Group on Protected Areas** is guiding and monitoring implementation of the programme of work on protected areas;
- **The 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 land owners 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

►CARTAGENA PROTOCOL ON BIOSAFETY TO THE UNCBD

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

It was 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 Clearing-House** 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.

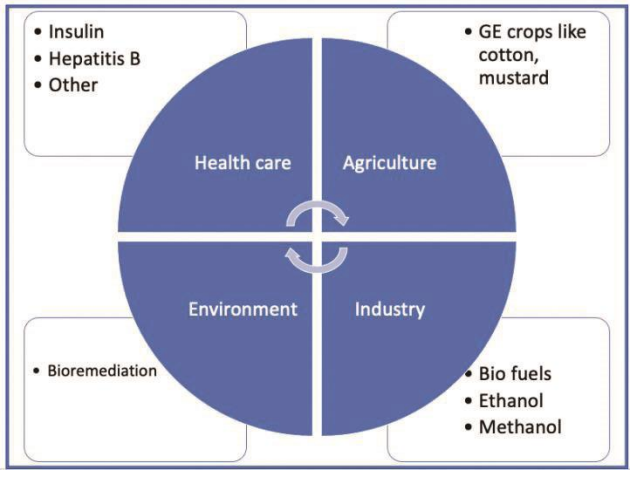
The convention does not apply to Pharmaceuticals for humans that are addressed by other international Agreements or organizations

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, the 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:

The precautionary principle

It is proposed as a new guideline in environmental decision making, has four central components:

- taking preventive action in the face of uncertainty;
- shifting the burden of proof to the proponents of an activity;
- exploring a wide range of alternatives to possibly harmful actions;
- increasing public participation in decision making.

LEGISLATIONS RELEVANT TO BIOSAFETY

- Environmental (Protection) Act, 1986
- Rules For The Manufacture, Use/Import/Export And Storage Of Hazardous Micro Organisms/ Genetically Engineered Organisms Or Cells, 1989
- The Biological Diversity Act, 2002
- Drugs and Cosmetic Act 1940
- Seed Act, 1966
- Protection of Plant Varieties and Farmers Rights, 2001
- Food Safety and Standards Act, 2006
- Plant Quarantine Order 2003
- Environmental Policy, 2006

GENETIC ENGINEERING APPRAISAL COMMITTEE (GEAC)

- GEAC established under MoEFCC 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.
- Approval of proposals relating to release of GMOs and products into the environment including

experimental field trials (Biosafety Research Level trial-I and II known as BRL-I and BRL-I1).

- To permit the use of GMOs and products thereof for commercial applications ✓ To adopt procedures for restriction or prohibition, production, sale, import & use of GMOs both for research and applications under EPA
- To authorize large scale production and release of GMOs and products thereof into the environment.

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 October 14, 2009, the GEAC recommended the approval of commercial cultivation of Bt brinjal (eggplant) On 9th February, 2010, the MoEF&CC announced a moratorium on the approval
GE Mustard, DMH-11		Technology developed by Centre for Genetic Manipulation of Crop Plants (CGMCP), University of Delhi (South Campus) GE Mustard, DMH-11, containing Barnase-Barstar system is under evaluation by Government of India

- 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

- The Antarctic Treaty was framed with the objective that the Antarctic shall continue to be a zone that shall be used for peaceful purposes only and shall not become an object of international discord.
- The treaty covers the area south of 60 degree South latitude and is known as the Antarctic Treaty Area (ATA) and imbibes the suspension of territorial claims, prohibition of all military activities in the region, freedom of scientific inquiry, and international co-operation in scientific activities.
- India signed into the Antarctic Treaty system in 1983 as a Consultative Party Member.

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.

►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. I**t 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 the United Nations; 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 less 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.

WHAT ARE THE 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.

HOW EFFECTIVE HAS THE CMS BEEN IN PROTECTING THE MIGRATORY SPECIES?

As per CMS, despite the listing and consequent efforts, 73% of 175 migratory species listed on Appendix-I and 48% of the 518 on Appendix-II have an overall decreasing population trend.

SO WHAT ARE THE 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.

►INTERNATIONAL CONSORTIUM ON COMBATING WILDLIFE CRIME (ICCWC)

It is the collaborative effort of five inter-governmental organizations working to bring coordinated support to the national wildlife law enforcement agencies and to the sub-regional and regional networks that, on a daily basis, act in defense of natural resources. The partner agencies to ICCWC are the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Secretariat, INTERPOL, the United Nations Office

on Drugs and Crime (UNODC), the World Bank and the World Customs Organization (WCO).

It is frontline officers from national agencies responsible for wildlife law enforcement and prosecuting authorities who bring criminals engaged in wildlife crime to justice, and ICCWC therefore works directly with these authorities to support them, by building long-term capacity and providing them with the tools, services and technical support they need to effectively combat wildlife and forest crime.

►AGENDA 21

Agenda 21 is a product of the Earth Summit organized by the United Nations (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.

SECTION 3

ORGANZIATIONS

►IUCN

IUCN is a membership Union composed of both government and civil society organisations. IUCN is the global authority on the status of the natural world and the measures needed to safeguard it. It is headquartered in Switzerland.

IUCN RED LIST

The 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.

It is based on an objective system for assessing the **risk of extinction of a species** based on past, present, and projected threats. Species assessments are conducted following a standardized process 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. Species listed as Critically Endangered, Endangered or Vulnerable are collectively described as threatened.

The IUCN Red List is produced and managed by the IUCN Global Species Programme, the Species Survival Commission (SSC) and The IUCN Red List Partnership.

FUNCTIONS OF RED LIST

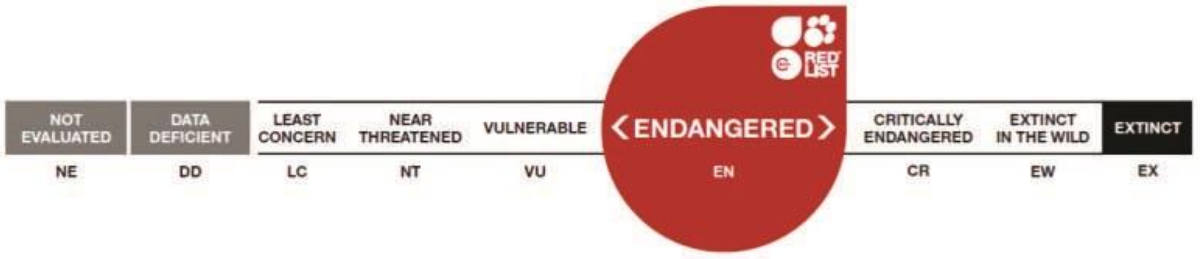
- **It tells us where we ought to be concerned** and where the urgent needs are to do something to prevent the despoliation of this world.
- It is used to inform decisions taken by **Multilateral Environmental Agreements.**
  - It is often used as a guide to revise the annexes of some agreements, such as the Convention on International Trade in Endangered Species (**CITES**) and the Convention on Migratory Species (**CMS**).
  - The IUCN Red List assessments of freshwater species have also contributed to the work of the **Ramsar** Convention in selecting sites that are important for freshwater biodiversity.
  - The IUCN Red List will contribute to the function of the **Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES)** to strengthen the science-policy interface on biodiversity and ecosystem services to improve decision making.
  - It has been adopted by the **United Nations as one of the indicators for the 2015 Millennium Development Goal 7** on environmental sustainability.
  - It is also a useful tool for assessing progress towards achieving **Target 12 of the Aichi Biodiversity Targets**.

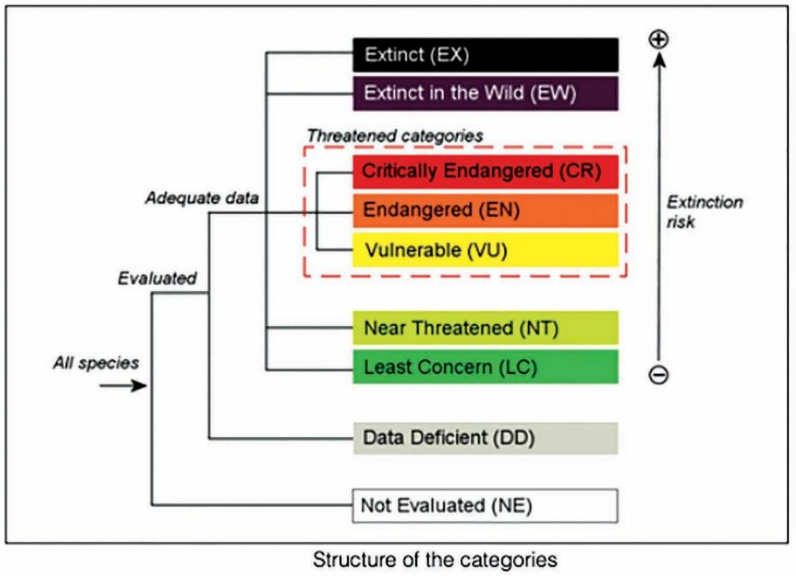
THE RED LIST INDEX (RLI)

It shows trends in overall extinction risk for species, and is used by governments to track their progress towards targets for reducing biodiversity loss.

The RLI is calculated from the genuine changes in IUCN Red List Categories of all assessed species in a taxon over time. A decreasing RLI value means the expected rate of extinctions is increasing (i.e. the rate of biodiversity loss is increasing). An upward trend or increasing RLI value means that there is a decrease in

expected future rate of species extinctions (i.e. a reduction in the rate of biodiversity loss).





Structure of the categories

SUMMARY OF THE FIVE CRITERIA (A-E) USED TO EVALUATE IF A TAXON BELONGS IN AN IUCN RED LIST THREATENED CATEGORY (CRITICALLY ENDANGERED, ENDANGERED OR VULNERABLE).[1]

A. Population size reduction. Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3 & A4	≥ 80%	≥ 50%	≥ 30%

A1 Population reduction observed, estimated, inferred, or suspected in the past where the causes of the reduction are clearly reversible AND understood AND have ceased.

A2 Population reduction observed, estimated, inferred, or suspected in the past where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction projected, inferred or suspected to be met in the future (up to a maximum of 100 years) *[(a) cannot be used for A3]*.

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

based on any of the following:

(a) direct observation *[except A3]*
(b) an index of abundance appropriate to the taxon
(c) a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality
(d) actual or potential levels of exploitation
(e) effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)

	Critically Endangered	Endangered	Vulnerable
B1. Extent of occurrence (EOO)	< 100 km²	< 5,000 km²	< 20,000 km²
B2. Area of occupancy (AOO)	< 10 km²	< 500 km²	< 2,000 km²
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented **OR** Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: **(i)** extent of occurrence; **(ii)** area of occupancy; **(iii)** area, extent and/or quality of habitat; **(iv)** number of locations or subpopulations; **(v)** number of mature individuals			
(c) Extreme fluctuations in any of: **(i)** extent of occurrence; **(ii)** area of occupancy; **(iii)** number of locations or subpopulations; **(iv)** number of mature individuals			

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 the 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 United Nations Observer Status ensuring that nature conservation has a voice at the highest level of international governance.

COMMISSIONS OF IUCN

The work of IUCN's six Commissions covers a wide range of disciplines: education and communication, environmental, economic and social policy, ecosystem management, species survival, environmental law and protected areas.

The Commission on Education and Communication (CEC) is organised into three main areas of work, each aiming to raise awareness of the importance of nature and its conservation through experience, effective communication and youth involvement.

The fundamental socio-economic and cultural concerns of human communities, such as livelihoods, human rights and responsibilities, human development and the fair and effective governance of natural resources, are some of the main aspects of the work of the **Commission on Environmental, Economic and Social Policy (CEESP).**

The Commission on Ecosystem Management (CEM) promotes ecosystem-based approaches for the management of landscapes and seascapes, provides guidance and support for ecosystem-based management and promotes resilient socio-ecological systems to address global challenges. It has a major role in providing information to IUCN on the inherent value of species within biodiversity conservation that in turn feeds into the IUCN Red List of Threatened Species.

Through their projects and expertise, the network of environmental law and policy specialists of the **World Commission on Environmental Law (WCEL)** serve as the principal source of legal technical advice on all aspects of environmental law to IUCN and its partners. The Commission functions as an integral part of the IUCN Environmental Law Programme (ELP), collaborating closely with the Environmental Law Centre (ELC) based in Bonn.

In collaboration with the IUCN Protected Areas Programme, the **World Commission on Protected Areas (WCPA)** works to develop policy, advice and guidance on issues relating to protected areas. Global experts work together to find solutions for priorities, including global protected area standards and best practice guidelines.

WORLD HERITAGE CONVENTION

Created in 1972, the primary mission of the Convention is to identify and protect the world's natural and cultural heritage considered to be of Outstanding Universal Value.

It embodies a visionary idea – that **some places are so important that their protection is not only the responsibility of a single nation, but is also the duty of the international community as a whole**; and not only for this generation, but for all those to come.

The implementation of the World Heritage Convention is facilitated through the Operational Guidelines, which define the procedures for new inscriptions, site protection, danger-listings, and the provision of international assistance under the World Heritage Fund.

The **Convention is governed by the World Heritage Committee supported by the UNESCO World Heritage Centre**, the secretariat for the Convention, and three technical advisory bodies to the Committee: IUCN, ICOMOS, ICCROM. IUCN is the Advisory Body on natural heritage. It monitors listed sites and evaluates sites nominated to the World Heritage List, in accordance with the relevant natural criteria for selection (vii) - (x):

The World Heritage Committee is the governing body on World Heritage and meets every year

The intergovernmental World Heritage Committee is responsible for the implementation of the World Heritage Convention, defines the use of the World Heritage Fund and allocates financial assistance upon requests from States Parties.

IUCN is the Advisory Body on nature to the World

Heritage Committee. Ahead of the annual session of the Committee, IUCN submits its recommendations regarding the inscription of new sites following a rigorous evaluation process through which it works with members on the ground, scientific experts, independent feedback and desk reviews. IUCN also submits state of conservation reports for sites under threat, including sites inscribed on the List of World Heritage in Danger or that it considers should be.

The Committee has the final say on whether a property is inscribed on the World Heritage List, and can also defer its decision and request further information from the States Parties. The Committee examines reports on the state of conservation of listed sites and asks States Parties to take action when these are facing major threats or are not being adequately managed. It also decides on inscriptions or deletions on the List in Danger.

India properties inscribed on the World Heritage List (38)

Natural

- Great Himalayan National Park Conservation Area (2014)
- Kaziranga National Park (1985)
- Keoladeo National Park (1985)
- Manas Wildlife Sanctuary (1985)
- Nanda Devi and Valley of Flowers National Parks (1988,2005)
- Sundarbans National Park (1987)
- Western Ghats (2012)

Mixed

- Khangchendzonga National Park (2016)

►UNEP

United Nations Environment Programme (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:

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

The **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.

The **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

THE COMMITTEE OF PERMANENT REPRESENTATIVES

The 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 Programme (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 the 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

- The **Environment Fund** is the core source of flexible funds.
- In addition, **earmarked funds** (funds given or "earmarked" to a specific project, theme, country etc.) enable us to expand and replicate our programme 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.

►UNEP ADAPTATION GAP REPORT 2020

It finds that while **nations have advanced in planning, huge gaps remain** in finance for developing countries and bringing adaptation projects to the stage where they bring real protection against climate impacts such as droughts, floods and sea-level rise.

Public and private finance for adaptation must be stepped up urgently, along with faster implementation. Nature-based solutions – locally appropriate actions that address societal challenges, such as climate change, and provide human well-being and biodiversity benefits by protecting, sustainably managing and restoring natural or modified ecosystems – must also become a priority

ADAPTATION GAP

It is defined as the **difference between actually implemented adaptation and a societal set goal,** determined largely by preferences related to tolerated climate change impacts, and reflecting resource limitations and competing priorities.

Adaptation is the **process of reducing countries' and communities' vulnerability to climate change** by increasing their ability to absorb impacts and remain resilient.

Adaptation is a key pillar of the Paris Agreement. The Agreement requires all of its signatories to plan and implement adaptation measures through national adaptation plans, studies, monitoring of climate change effects and investment in a green future.

►UNEP EMISSIONS GAP REPORT 2020

The report finds that, despite a brief dip in carbon dioxide emissions caused by the COVID-19 pandemic, the **world is still heading for a temperature rise in excess of 3°C this century** – far beyond the Paris Agreement goals of limiting global warming to well below 2°C and pursuing 1.5°C.

However, **a low-carbon pandemic recovery could cut 25 per cent off the greenhouse emissions expected in 2030**, based on policies in place before COVID-19. Such a recovery would far outstrip savings foreseen with the implementation of unconditional Nationally Determined Contributions under the Paris Agreement, and put the world close to the 2°C pathway.

India is among a small group of countries that are on their way to achieve their self-declared climate targets

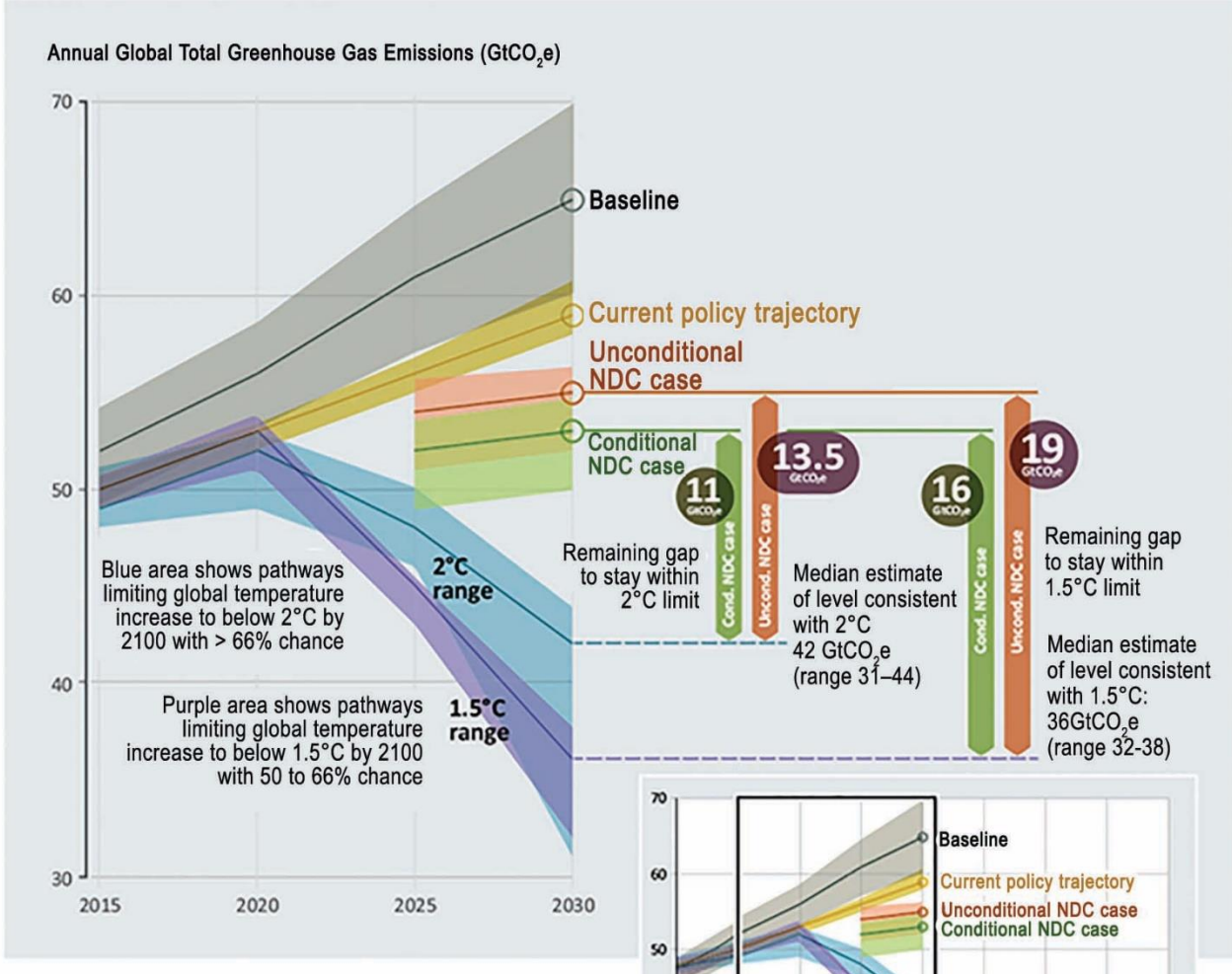
under the Paris Agreement. However, the emissions largely depend on the growth of the economy of the country.

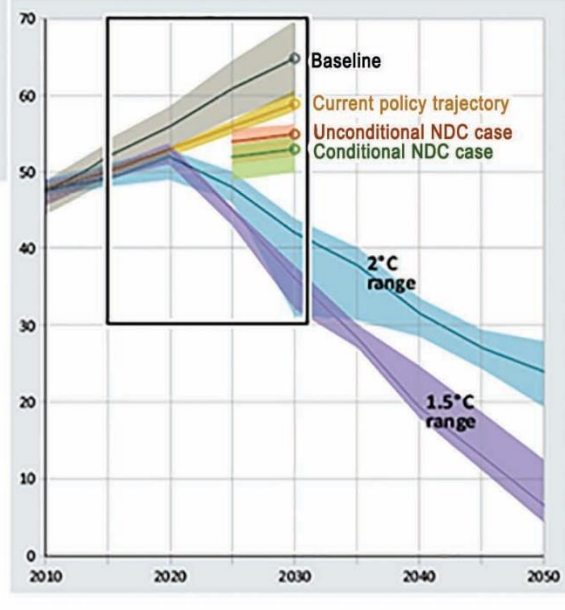
EMISSIONS GAP

The difference between the emissions level countries have pledged to achieve under international agreements and the level consistent with limiting warming to well below 2 degrees C (3.6 degrees F).

That benchmark exists because warming above 1.5-2 degrees C would bring increasingly catastrophic impacts. (Learn more in our post describing the world's "carbon budget.")

Emissions gap in 2030





Note: the emissions range for 1.5° is smaller than for 2°C, as a smaller number of studies for 1.5°C are available. For current policy the minimum -maximum across all assessed studies are provided.

Source: The Emissions Gap Report 2017. UNEP.

►THE UNEP GLOBAL CLIMATE LITIGATION REPORT: 2020

It provides an overview of the current state of climate change litigation globally, as well as an assessment of global climate change litigation trends. It finds that a **rapid increase in climate litigation** has occurred around the world. This growing tidal wave of climate cases is driving much-needed change.

The report shows **how climate litigation is compelling governments and corporate actors to purse more ambitious climate change mitigation and adaptation goals.**

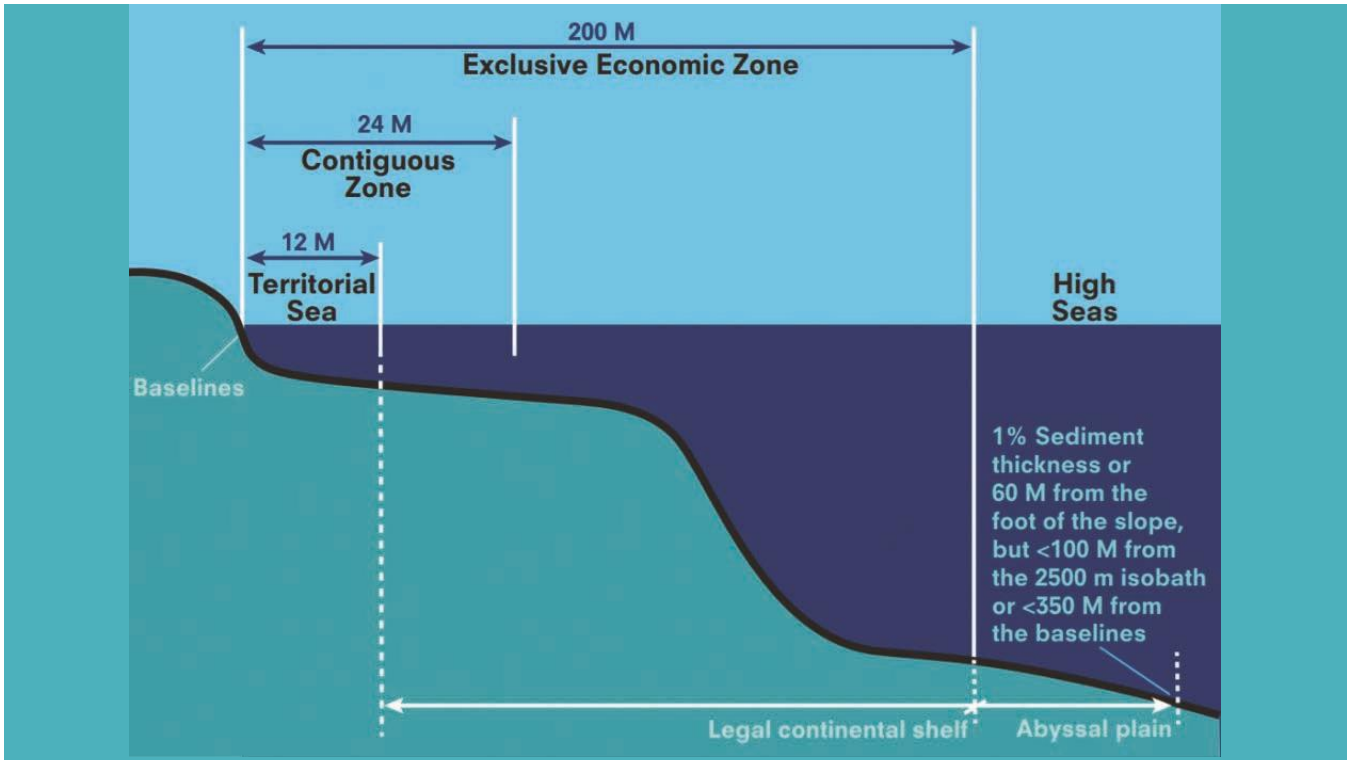
It reports on key emerging trends in these cases, including the role of fundamental human rights connected to a safe climate and cases that bring to life the right to a healthy environment we now see in the constitutions of over 100 countries. It outlines how cases are forcing greater climate disclosures and ending "corporate greenwashing" on the subject of climate change and the energy transition. It reports how people are holding their governments to account, seeking to keep fossil fuels in the ground and challenging non-enforcement of climate-related laws and policies.

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

- UNCLOS lays down a comprehensive regime of law and order in the world's oceans and seas.
- The 1982 convention was signed by 117 states and 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.



THE 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.

National Meteorological and Hydrological Services work around the clock to monitor Earth System provide vital weather and climate information worldwide. Their early and reliable warnings of severe weather and fluctuations in air quality as well as of climate variability and change allow decision-makers, communities and individuals to be better prepared for weather and climate events.

Their warnings help save life and property, protect resources and the environment and support socio-economic growth. WMO supports National Meteorological and Hydrological Services with this work and in meeting their international commitments in the areas of disaster risk reduction, climate change mitigation and adaptation, and sustainable development.

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

►STATE OF CLIMATE SERVICES REPORT OF WMO

The 2020 State of Climate Services Report, prepared by WMO and 17 partners organizations and initiatives, **highlights progress made in EWS implementation globally and identifies where and how governments can invest** in effective EWS to strengthen countries' resilience to multiple weather, climate, and water-related hazards. Being prepared and able to react at the right time, in the right place, can save many lives and protect the livelihoods of communities everywhere. View the 2019 State of Climate Services.

Early warning system is an adaptive measure for climate change, using integrated communication systems to help communities prepare for hazardous climate-related events. A successful EWS saves lives and jobs, land and infrastructures and supports long-term sustainability.

►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.

►THE WORLD WIDE 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 World Wide 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

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

IMPORTANT TAKEAWAYS FROM THE 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.

WHAT THE LPI DOES NOT TELL US?

- The LPI does not show the numbers of species lost or extinctions.
- It does not mean that X% of the species or the populations are declining.
- Or that X% of populations or individuals have been lost.

►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.

►DASGUPTA REVIEW

It is a report commissioned by the UK Government under Cambridge University Professor Partha Dasgupta to provide a global review on the economics of biodiversity.

The report argues that natural capital, long ignored by economic thought, should be viewed as an asset, like produced and human capital. As such, humanity's demands on Nature for natural resource extraction and waste disposal have far exceeded Nature's ability to supply, putting the prosperity of current and future generations at risk.

According to the review, while between 1992-2014 produced capital (such as manufactured goods) doubled per capita, and human capital (such as health, knowledge, and skills) increased 17% per capita, Natural capital declined 40% per person.

►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.

IT AIMS TO

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, which held this position for three years till November, 2020.

►BIOTRADE INITIATIVE

- **The UNCTAD (The United Nations Conference on Trade and Development) 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 programmes 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 verfiy 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.

SECTION 4

ENVIRONMENTAL LEGISLATIONS

►BIOLOGICAL DIVERSITY ACT, 2002

It was born out of India's attempt to realise the objectives enshrined in the United Nations Convention on Biological Diversity (CBD) 1992 which recognizes the sovereign rights of states to use their own Biological Resources.

Aims at the 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 OF THE ACT

- **The Act prohibits the following activities without the prior approval from the 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.
- **The act envisaged a three-tier structure to regulate the access to biological resources:**
  - The National Biodiversity Authority (NBA)
  - The State Biodiversity Boards (SBBs)
  - The Biodiversity Management Committees (BMCs) (at local level)
- **The Act 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).

The other laws that NGT deals with, include:

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

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, e.g. farmers, livestock keepers and bee keepers and traditional healers e.g. vaids and hakims are also exempted.

THE 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 chair person 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

►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.

THE WILDLIFE ADVISORY BOARD (SEC. 6)

The Sec. 6 of this Act enforces and enables the state governments and the administrators of the Union Territories to constitute a Wildlife Advisory Board in each states and union territories.

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.

The 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

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

- The 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.

The 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 and any purpose ancillary or incidental thereto;

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 AND RECOGNITION OF ZOOS

The central government shall constitute the Central Zoo Authority, **consisting of a chair person, 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 programmes 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 the Central 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	The Chief Wild Life Warden shall be the authority who shall control, manage and maintain all sanctuaries State Government shall appoint a Collector to determine rights of persons

		respective State Government	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 wild life therein or its environment	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 ***The Chief Wild Life 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?** (i) Alteration of Boundaries of National Park; or (ii) removal of wild life 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 wild life **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 Wild Life 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 Wild Life 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 Wild Life 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 Wild Life.***		***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.

►FOREST RIGHTS ACT

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

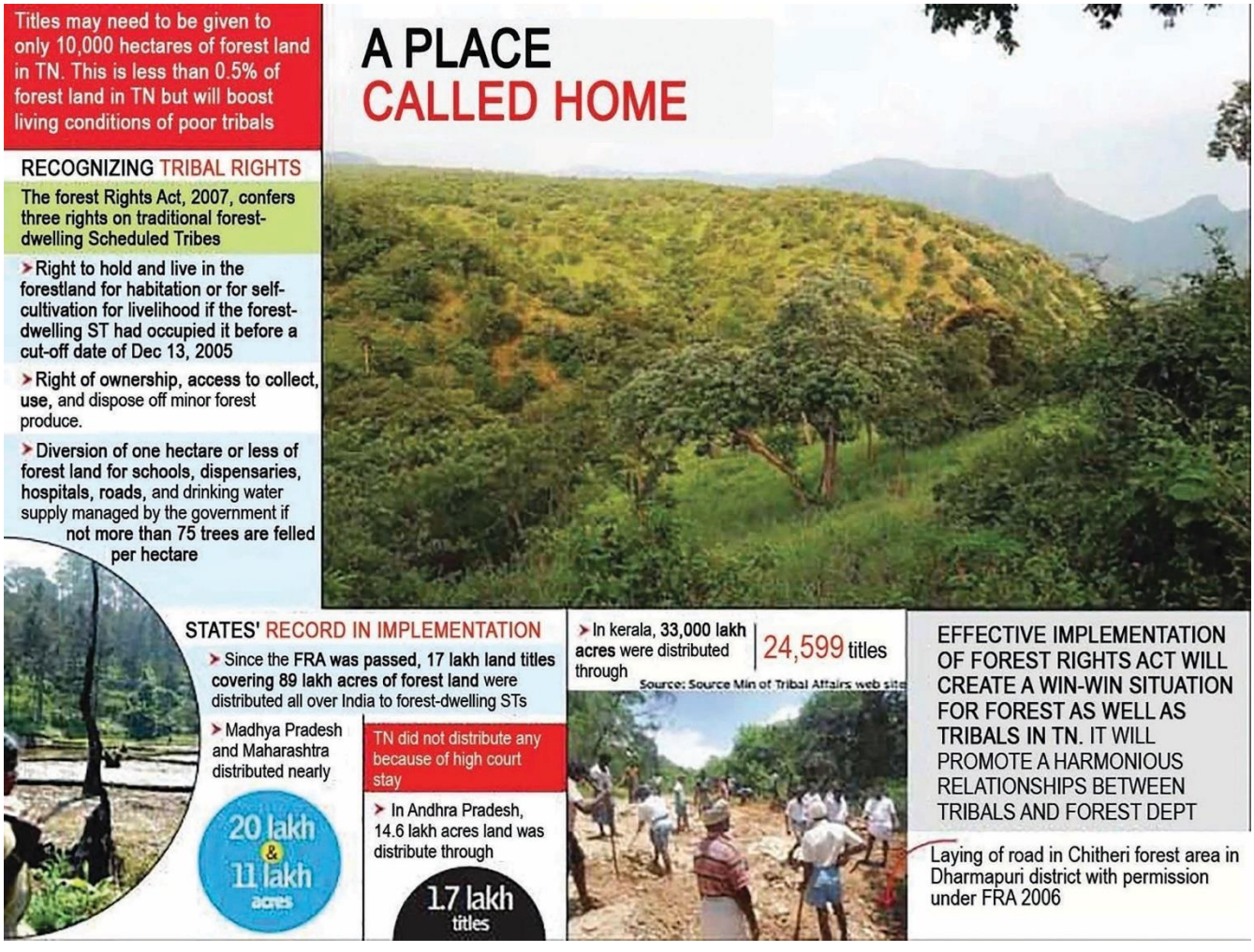
- **Title rights:** It gives FDST and OTFD the right to ownership to land farmed by tribals or forest dwellers

subject to a maximum of 4 hectares. Ownership is only for land that is actually 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, on the basis of scientific and objective criteria, that such areas are required to be kept as inviolate for the purposes of wildlife conservation'.

In order 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 the 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 programme 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 the 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 for 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 in order 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)	• It is a sectoral management institute, which constantly **endeavors to evolve knowledge useful for the managers in the area of Forest**, Environment and Natural Resources Management and allied sectors. • It disseminates such knowledge in ways that **promote its application by individuals and organizations.** • It is located in **Bhopal**.
Wildlife Institute of India (WII)	• Established in 1982, it is an internationally acclaimed Institution. • It offers training program, academic courses and advisory in wildlife

	research and management. • It is located in Dehradun
CPR Environmental Education Centre	• It strives to increase awareness and knowledge of key target groups (school children, local communities, woman etc.) about the various aspects of environment. • It is established jointly by the MoEFCC and The C.P. Ramaswami Aiyar Foundation. • It is located in Chennai.
Indian Plywood Industries Research and Training Institute	• It works for development and adoption of efficient technologies in the field of wood and panel products from renewable fibers including plantation timbers and bamboo while meeting the vital needs of the developing society. • It was initially formed as a co-operative research laboratory under the umbrella of Council of Scientific and Industrial Research (CSIR). • It is located in Bengaluru.
Centre for Environment Education (CEE)	• The organization works towards developing programmes and materials to increase awareness about the environment and sustainable development. • It was established in 1984 as a Centre of Excellence of the MoEFCC. • The head office is located in Ahmedabad.

►GUIDELINES FOR REGULATING GROUND WATER EXTRACTION

Department of Water Resources, River Development & Ganga Rejuvenation (Under Ministry of Jal Shakti) has notified guidelines to regulate and control groundwater extraction in India under the Environment (Protection) Act, 1986.

SALIENT FEATURES OF THE GUIDELINES ARE:

1. **Pan India applicability**
2. **Ground water abstraction in States/UTs (which on their own do not regulate ground water abstraction) shall continue to be regulated by CGWA.**
3. **Exemptions from seeking 'No Objection Certificate'**
   - **a.** Individual domestic consumers in rural and urban areas for drinking water and domestic uses
   - **b.** Rural drinking water supply systems
   - **c.** Armed forces establishment and Central Armed Police Forces establishments in rural and urban areas
   - **d.** Agricultural activities
   - **e.** MSME drawing ground water less than 10 cum/day.
4. State/UT governments responsible for registering drillings rigs and for maintaining database of wells drilled by them.
5. Abstraction of saline ground water in areas having either saline ground water at all depths for use by industries/mining/infrastructure projects would be encouraged. Such industries will be exempted from paying ground water abstraction charges.
6. Protection of Wetland areas: Projects falling within 500 m. from the periphery of demarcated wetland areas shall mandatorily submit a detailed proposal indicating that any ground water abstraction by the project proponent does not affect the protected wetland areas. Furthermore, before seeking permission from CGWA, the projects shall take consent/approval from the appropriate Wetland Authorities to establish their projects in the area.
7. No objection certificate for drinking & domestic use for Residential apartments/Group Housing Societies/Government water supply agencies shall be granted only where local government water supply agency is unable to supply requisite amount of water in the area. 'No objection certificate' will be provided only if
   - **a.** There is installation of Sewage Treatment Plants (STP) is mandatory for all housing societies where ground water requirement is more than 20 cum/day. Water from STPs shall be utilised for toilet flushing, car washing, gardening etc.
   - **b.** NOC to be valid for 5 years.
   - **c.** Proponents to pay ground water abstraction charges.
8. **Agriculture**

Proposes a participatory approach for sustainable ground water management in agriculture sector. States/UTs advised to review their free power policy, bring suitable water pricing policy and promote crop

rotation/diversification to reduce over-dependence on groundwater.

9. Commercial Use

- **No new major industries** shall be granted NOC (old ones need not) in over-exploited assessment areas except as per the policy guidelines.

Conditions for Commercial entities to extract ground water:

- Commercial entities extracting ground water shall be required to submit online annual water audit report including an audit of water use. All such water audit reports to be published online.
- CGWA/SGWAs to engage independent agencies to verify compliance of NOC conditions periodically.

10. Industrial Use

- In over-exploited assessment units, NOC shall not be granted for ground water abstraction except MSMEs. However, NOC for drinking water/domestic use for work force, green belt use by these industries shall be permitted. NOC not be given to new packaged water industries in Overexploited areas, even if they belong to MSME category.

Conditions for giving of NOC are:

- NOC shall be granted only in such cases where local government not able to supply desired quantity of water.
- Industries to adopt water efficient technologies to reduce dependence on ground water resources.
- Industries extracting ground water more than 100 cum/day to undertake annual water audit through CII/FICCI/NPC certified auditors and submit the reports to CGWA. All such industries to reduce their ground water use by at least 20% over next 3 years.
- Construction of observation well within premises and installation of appropriate water level monitoring mechanism shall be mandatory for industries drawing more than 10 cum/day of ground water.
- Proponent to adopt roof top rain water harvesting in the project premises.
- Injection of treated/untreated water into aquifer is strictly prohibited.
- Industries which cause ground water pollution need to undertake necessary well head protection measures
- All industries drawing ground water (anywhere) to pay ground water abstraction charges.

11. Mining Projects

- All existing as well as new mining projects required to obtain NOC for ground water abstraction. Since mining projects are location specific, there will be no ban on grant of No Objection Certificate for abstraction of ground water for such projects in over-exploited assessment units.

NOC for mining will be given on following conditions

- All the mining industries to ensure that water available from de-watering operations is properly treated and should be utilised for irrigation, dust suppression, mining process, recharge in downstream and for maintaining e-flows in the river.
- Construction of observation well within premises and installation of appropriate water level monitoring mechanism shall be mandatory for industries drawing more than 10 cum/day of ground water.
- In case of coal and other base metal mining the project proponent shall use the advance dewatering technology (by construction of series of dewatering abstraction structures) to avoid contamination of surface water.
- All mining units shall also monitor the water quality of mine seepage and mine discharge through NABL accredited/ Govt. approved laboratories
- All mining projects to pay ground water abstraction charges.

12. Infrastructure Projects

- Since infrastructure projects are location specific, grant of No Objection Certificate to such projects located in over-exploited assessment units shall not be banned.
- New infrastructure projects/residential building may require dewatering during construction activity or use ground water for construction.
- Applicants shall seek NOC from CGWA before commencement of work.
- However, in over-exploited assessment units, use of ground water for construction activity shall be permitted only if no treated sewage water is available within 10 km radius of the site.
- New as well as existing Infrastructure projects shall also be required to seek No Objection Certificate for abstraction of ground water. No 'No Objection Certificate' shall be granted for extraction of groundwater for Water Parks, Theme Parks and Amusement Parks in over-exploited assessment units.
- Conditions for ground water extraction charges for infrastructure sector
- Installation of STP for units using more than 20 cum/day.
- New as well as existing Infrastructure projects shall also be required to seek No Objection Certificate for abstraction of ground water. No 'No Objection Certificate' shall be granted for extraction of

groundwater for Water Parks, Theme Parks and Amusement Parks in over-exploited assessment units.

- Payment of ground water usage charges by infrastructure sector.

13. Charges for Ground Water Abstraction

Who are required to pay ground water abstraction charges?

- Residential apartment/group housing societies/government water supply agencies in urban areas
- Industries/mining/infrastructure projects
- Existing mining/infrastructure projects and existing industries including MSME drawing ground water in over-exploited assessment units
- Existing industries, infrastructure units and mining projects which have installed/constructed artificial recharge structures shall be eligible for a rebate of 50% (fifty percent) in the ground water abstraction charges/ground water restoration charges, subject to their satisfactory performance and verification.
- Revenue generated from the proposed water abstraction/ restoration charges shall be kept in a separate fund for implementation of site specific suitable demand/ supply side interventions.

14. Compliance of NOCs

- Installation of digital water flow meter having telemetry system
- Proponents to mandatorily get water flow meter calibrated on from an authorised agency.
- Proponents to install roof top rain water harvesting & recharge systems in project area.
- Payment of Ground Water Abstraction charges
- Construction of observation wells for ground level monitoring
- Requirement of water for greenbelt shall be met from recycled/treated waste water.
- In case of change of ownership, new owner will have to apply changes in NOC within 60 days of taking over.

15. Monitoring of compliance of NOC conditions

- District Collectors/DCs/DMs are authorised to take enforcement measures like sealing of unauthorised ground water abstraction and impose of Environmental Compensation.
- Officers of CGWA/CGWB and State ground water organisations to take actions with respect to monitoring and periodic inspections

16. Environmental Compensation for non-compliance

The norms prescribed by Central Pollution Control Board (CPCB) shall be utilized for calculating the Environmental compensation as mentioned below: ECGW = Ground water consumption per day x Environmental Compensation rate (ECRGW) x No. of days x Deterrence factor where ground water consumption is in m3/day and ECRGW in Rs. / cum.

ABOUT CENTRAL GROUND WATER AUTHORITY

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

Functions:

1. Regulation and control of ground water management and development
2. It issues 'No Objection Certificates' for ground water extraction
3. It frames guidelines in this connection from time to time in 22 States and UTs, where ground water development is not being regulated by the State or UT government.

►GUIDELINES FOR CENTRAL ASSISTANCE FOR COMMAND AREA DEVELOPMENT (CAD) IN PRIORITISED AIBP FUNDED IRRIGATION PROJECTS

Under the Pradhan Mantri Krishi Sinchayee Yojana, 99 ongoing AIBP funded irrigation projects have been identified for prioritised implementation along with their CAD works. The Central Assistance for CAD works of these 99 projects will be funded through the ongoing Command Area Development & Water Management (CADWM) Program covered under the PMKSY Har Khet Ko Pani (HKKP) component.

INTENT FOR CAD DEVELOPMENT:

1. Utilise irrigation potential created under Project soon after its creation
2. Improve water use efficiency
3. Increase agricultural productivity and production
4. Bring sustainability in the irrigated agriculture in a participatory environment

INSTITUTIONAL ARRANGEMENT

1. All CAD works will be planned, designed and executed by State Governments
2. Central Water Commission through its CAD cells will overall monitor and coordinate
3. Handholding support for strengthening of Participatory Irrigation Management (PIM) will be provided by select Social Facilitator. A Social

Facilitator may be an NGO, or similar entity, having substantial experience in influencing village level social activities and reforms.

4. Activities of Social Facilitator will be monitored by an agency to be engaged by Ministry of Jal Shakti.

ACTIVITIES COVERED UNDER COMMAND AREA DEVELOPMENT

1. Structural Intervention includes survey, planning, design and execution of
   a. On-Farm Development works (Construction of field channels, land levelling, infrastructure for Micro-irrigation). Planning of micro-irrigation should ensure maximisation of Culturable Command Area (CCA)beyond areas under gravity flow, assured irrigation to tail enders and supply of water on volumetric basis. Micro-irrigation shall cover at least 10% of the CCA
   b. Construction of field, intermediate and link drains
   c. Correction of system deficiencies
   d. Reclamation of waterlogged areas
2. Non-structural activities directed at strengthening of Participatory Irrigation Management including
   a. One time functional grant to the registered Water Users' Associations (WUAs)
   b. One time Infrastructure Grant to the registered WUAs
   c. Training, demonstration and trials for water use efficiency, increased productivity and sustainable irrigation in participatory environment.

   All activities of CAD component shall be part of District Irrigation Plan and State Irrigation Plan.

FUNDING PATTERN

Funds under PMKSY (HKKP) for the CAD component will be provided to the State Governments as per Cost Sharing Ratios (which will be applied on the Ceiling Costs) as below:

S. No.	Activities Eligible for Funding	Cost sharing ratio b/w Centre and States
1.	All activities of structural interventions	50:50
1.	All activities of non-structural interventions excluding functional grants for WUAs	60:40
1.	Functional Grant to registered WUA	45:45:10 (Centre: State: Farmer)
1.	Incremental Establishment Cost	50:50

For the eight North Eastern States and the three Himalayan States of Himachal Pradesh, Jammu & Kashmir, and Uttarakhand, the cost sharing norms for 'All activities of Non-Structural interventions except Functional Grant to WUAs' will be 75:25 (Centre : State) in lieu of 60:40 norm applicable for other States.

►INDIAN FOREST ACT (IFA), 1927

The Ministry of Environment, Forest and Climate Change (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 the legal framework for:
  - the protection and management of forest,
  - transit of forest produce and timber, and
  - the duty leviable on timber and other forest produce.
- It is an umbrella Act, which provides the basic architecture for the management of forests in the country including **the procedure to be followed for declaring an area to be a Reserved Forest, a Protected Forest or a Village Forest.**
- It **defines what a forest offence is**, what are the 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.

SECTION 5

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. The Intergovernmental Panel on Climate Change (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.

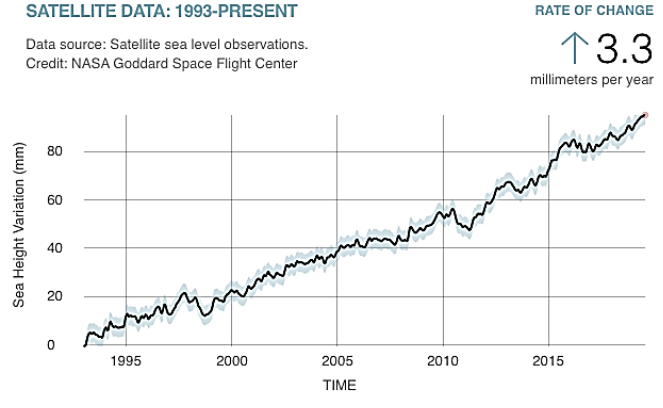
The IPCC predicts that increases in global mean temperature of less than 1.8 to 5.4 degrees Fahrenheit (1 to 3 degrees Celsius) above 1990 levels will produce beneficial impacts in some regions and harmful ones in others. Net annual costs will increase over time as global temperatures increase.

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

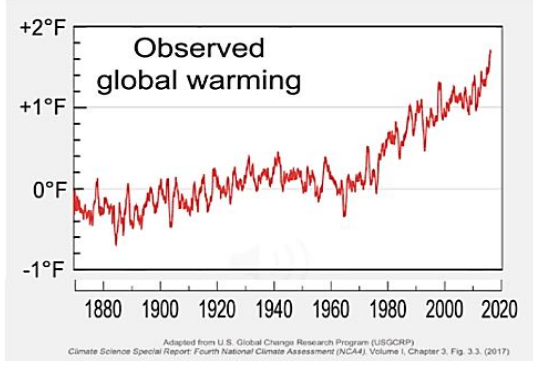
Sea level: The mean sea level has been continuously rising since past two decades

Due to:

1. Melting of Ice
2. Expansion of water as temperatures increase



Temperature: The planet's average surface temperature has risen about 1.62 degrees Fahrenheit (0.9 degrees Celsius) since the late 19th century, a change driven largely by increased carbon dioxide and other human-made emissions into the atmosphere

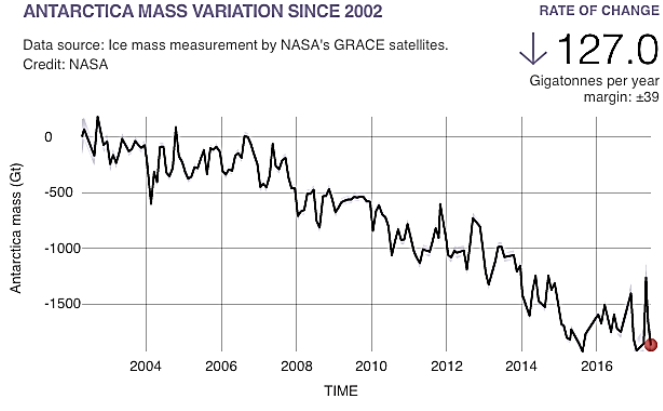


Warming Oceans: The ocean does an excellent job of absorbing excess heat from the atmosphere. The top few meters of the ocean stores as much heat as Earth's entire atmosphere. So, as the planet warms, it's the ocean that gets most of the extra energy.

Shrinking of Cryosphere:

Shrinking of Ice sheets:

The Greenland and Antarctic ice sheets have decreased in mass.



Frost-free Season (and Growing Season) will Lengthen

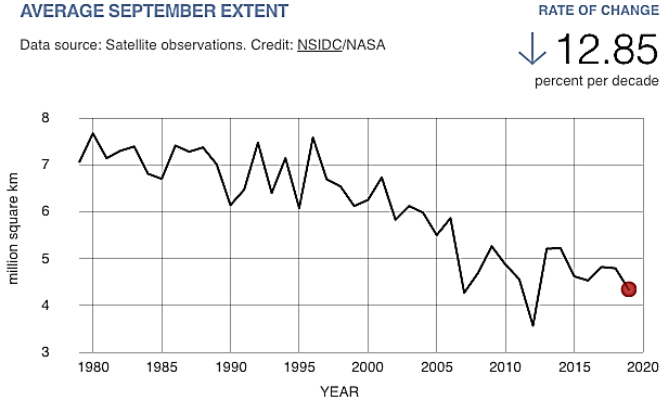
The length of the frost-free season (and the corresponding growing season) has been increasing since the 1980s.

Glacial retreat

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

Decreased snow cover

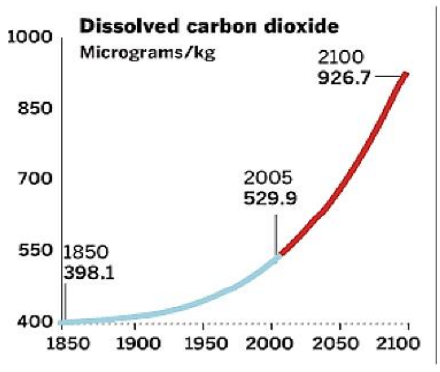
Satellite observations reveal that the amount of spring snow cover in the Northern Hemisphere has decreased over the past five decades and that the snow is melting earlier.

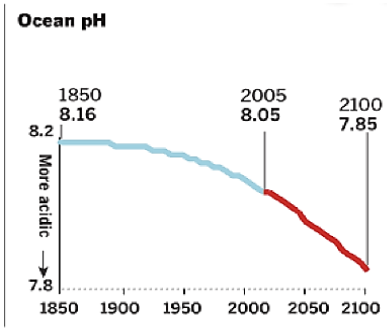


Ocean Acidification:

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 that 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 that contribute to the greenhouse effect include:**
  - **Water vapor:** The most abundant greenhouse gas, but importantly, it acts as a 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 (CO2):** A minor but very important component of the atmosphere, carbon dioxide 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 powerful greenhouse gas produced by soil cultivation practices, especially the use of commercial and organic fertilizers, fossil fuel combustion, nitric acid production, and biomass burning.
  - **Chlorofluorocarbons (CFCs):** Synthetic compounds entirely of industrial origin used in a number of 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.

The 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.

Let's see what happens by variation of the Green House effect

Not enough greenhouse effect: The planet Mars has a very thin atmosphere, nearly all carbon dioxide. 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 carbon dioxide. 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.

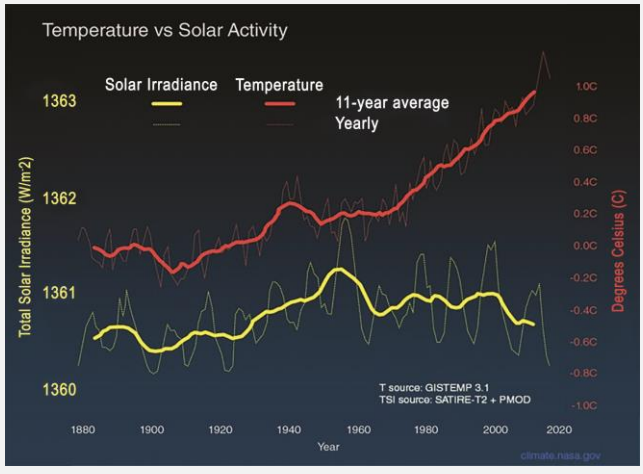
Could Solar Irradiance be behind rising global Temperature?

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.

GREEN HOUSE GAS	GWP	SOURCES AND CAUSES
Carbon dioxide (CO2)	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	12400	Used as refrigerants, aerosol

fluorocarbons (HFCs)		propellants, solvents and fire retardants.
Sulphur hexafluoride (SF6)	23500	Used as tracer gas for leak detection, used in electrical transmission equipment

CLIMATE CHANGE PERFORMANCE INDEX

The Global Climate Change Performance Index was released by the **New Climate Institute, Germanwatch and CAN (Climate Action Network).** The index has been rating the **fifty-seven greenhouse emitters in the world since 2005**. These countries account to 90% of global emissions. The index aims to enable comparison of mitigation efforts, enhance transparency in international climate politics.

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.

►KEY WORDS RELATED TO 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.
Decarbon-isation	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.

►UNFCCC

The UNFCCC entered into force on 21 March 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 United Nations 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 programme and is administered under United Nations rules and regulations.

SUBSIDIARY BODIES

Subsidiary Body for Scientific and Technological Advice (SBSTA)

The SBSTA assists the governing bodies through the provision of **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)

The 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 programmes** 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 programmes 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.

The Clean Development Mechanism

It is defined in Article 12 of the 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 THE WARSAW INTERNATIONAL MECHANISM FOR LOSS AND DAMAGE

The 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)

The GEF is an operational entity of the financial mechanism of the Convention that **provides financial support to the activities and projects of developing country Parties**. The COP regularly provides guidance to the GEF. The GEF, as an entity entrusted with the operation of the Financial Mechanism of the Convention, also serves the Paris Agreement.

The 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 programmes 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 in order 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.

THE PARIS COMMITTEE ON CAPACITY-BUILDING (PCCB)

It was 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, programmes 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 programme and assist LDCs carry out, inter alia, the preparation and implementation of national adaptation programmes 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 i**ncrease 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.

In order to make the Paris Agreement fully operational, a work programme 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**, so as 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).

►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)

- It is a mechanism negotiated **under UNFCC since 2005.**
- Its objective is 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 the 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 the 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++ RESULTS

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 PROGRAMME

The REDD++ Himalayan Programme 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 CLIMATE ACTIONS

Climate Highlights – 2020

Rapidly Growing Renewables

- The share of installed capacity from renewable energy (not includingincluded large hydro) sources increased from 13% to 24% (36 GW in July 2015 to 88 GW in July 2020) while the share of thermal capacity declined from 70% to 68%.[12]
- During the COVID-19 economic slowdown, renewable energy's share of generation rose due to the higher day-by-day operating costs of thermal power plants and the decline in total power demand.[13]

Lowest Solar Tariffs to Date

- Reaching one of the lowest tariffs in the world, in July 2020 India's solar tariffs dropped to ₹ 2.36 ($0.0316)/kWh for a 2 GW project in Karnataka, showing that the cost of solar has reached 20% to 30% lower than thermal power tariffs.[14]
- India took encouraging steps towards Round-The-Clock (RTC) renewable power supply in May 2020 with a discovered tariff of ₹ 2.90 ($0.0386)/kWh for a Solar Energy Corporation's RTC tender.[15]

Advancing Electric Mobility

- Under Phase-II of Faster Adoption and Manufacture of (Hybrid and) Electric Vehicles (FAME) Scheme, India allocated ₹ 10,000 crore ($1.4 billion) for advancing electric mobility in public transportation fleets, four-wheelers, and three-wheelers, and privately owned two-wheelers, as well as, electric vehicle charging infrastructure.[16]

Energy Efficient Buildings

- Thirteen states have notified the Energy Conservation Building Code (ECBC) with four states including a detailed compliance program and five states incorporating the ECBC into their state bye-laws.[17]

New Temperature Set Points for Air Conditioners

- The Bureau of Energy Efficiency (BEE) employed a new default temperature of 24°C (75.2°F) for all indoor air conditioning units.

Air Pollution

- While air pollution levels remain high, the COVID-19 lockdown in April to May 2020 led to dramatic reductions in $PM_{2.5}$, PM_{10}, NO_2, and CO; the largest declines occurred in Bangalore (86% in $PM_{2.5}$), Delhi (70% in PM_{10}), Ahmedabad (67% in NO_2), and Nagpur (63% in CO).[18]

Assessment of Climate Change over the Indian Region report

- India's Ministry of Earth Sciences (MOES) released the *Assessment of Climate Change over the Indian Region*, which highlights how both flooding and droughts are projected to be more frequent due to an increase in average temperature, aerosol concentration levels, and variation in precipitation.[19]

Emerging Policy Developments

- The Ministry of Environment, Forest and Climate Change (MOEFCC) released a Draft Environmental Impact Assessment Notification, superseding the 2006 version and proposing new rules on industrial projects; the Ministry of Power released the Draft Electricity (Amendment) Bill 2020 to increase private players in the market.[20]

Jawaharlal Nehru National Solar Mission

Objective: To establish India as a global leader in solar energy

Budget ₹8,795 crore

Key achievements

- **Installed** 2,970 MW of grid-connected solar generation capacity
- **Installed** 364 MW of off-grid solar generation capacity
- **Installed** 8.42 million sq m of solar thermal collectors

National Mission for Enhanced Energy Efficiency

Objective: To achieve growth with ecological sustainability by devising cost-effective, energy-efficient strategies

Budget ₹190 crore

Key achievements

- **Distributed** 2.58 million LED bulbs (7 watts); cost of an LED bulb down from ₹500 to ₹204
- **Super-efficient** ceiling fans to be introduced this year

National Water Mission

Objective: To conserve water, minimise wastage and ensure equal distribution both across and within states through integrated water resources development

Budget ₹89,101 crore

Key achievements

- **Revised** National Water Policy (2012) adopted by National Water Resources Council
- **Created** 1,082 new Ground Water Monitoring Wells

National Mission on Sustainable Habitat

Objective: To promote sustainability of habitats by improving energy-efficiency in urban planning

Budget ₹950 crore

Key achievements

- **Energy** Conservation Building Code 2007 made mandatory for new as well as old buildings
- **Long-term** transport plan for cities prepared
- **Sanctioned** 760 water supply projects

National Mission for Sustaining the Himalayan Ecosystem

Objective: To safeguard the Himalayas and attempt to address impacts of climate change on Himalayan glaciers, biodiversity and wildlife conservation

Budget ₹1,695 crore

Key achievements

- **Established** 6 new centres relevant to climate change in existing institutions in Himalayan states
- **Created** an observational network to monitor health of the Himalayan ecosystem

National Mission for a Green India

Objective: To grow and maintain sustainably managed forests and other ecosystems

Budget ₹46,000 crore

Key achievements

- **11 Indian** states have submitted perspective plans that cover 33 landscapes and working area of 85,000 hectares
- **Finalised** implementation norms after extensive consultations with state governments & civil society

National Mission for Sustainable Agriculture

Objective: To transform agriculture into an ecologically sustainable climate-resilient production system and ensuring food security

Budget ₹1,08,000 crore

Key achievements

- **Developed** 11,000 hectares of degraded land
- **1 million** hectares brought under micro-irrigation to promote water efficiency
- **Created** 5.4 million tonne agricultural storage capacity

National Mission on Strategic Knowledge for Climate Change

Objective: To identify challenges and responses to climate change through research and technology development; ensure funding of high-quality and focused research

Budget ₹2,500 crore

Key achievements

- **Established** 12 thematic knowledge networks
- **Developed** 3 regional climate models
- **Trained** 75 high-quality climate change professionals

SOURCE: MINISTRY OF ENVIRONMENT GRAPHIC: GURURAJ VAIDYA

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 (CSCAF) 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'.

- The objective of CSCAF is to provide a clear roadmap for cities towards combating Climate Change while planning and 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; 1 ESCert = 1 TOE saved	REC Certificates are measured in MWh value; 1 REC = 1 MWh
Coverage	11 energy-intensive sectors have been notified for PAT - Aluminum, Cement, Chlor-	• 2 categories of RECs: solar RECs and non-solar RECs. • The following categories are

	Alkali, Fertilizer, Iron & Steel, Paper & Pulp, Thermal Power Plants, Textile, Railways, Refineries and Electricity Distribution Companies.	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

THE ATMOSPHERE AND OZONE LAYER

WHAT IS 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 wave-length, 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 also 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. T**he 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 bio-diversity 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, e.g. carbon dioxide (CO2), 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 is 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 01st August, 2008.

What are the commonly used ODS alternatives?

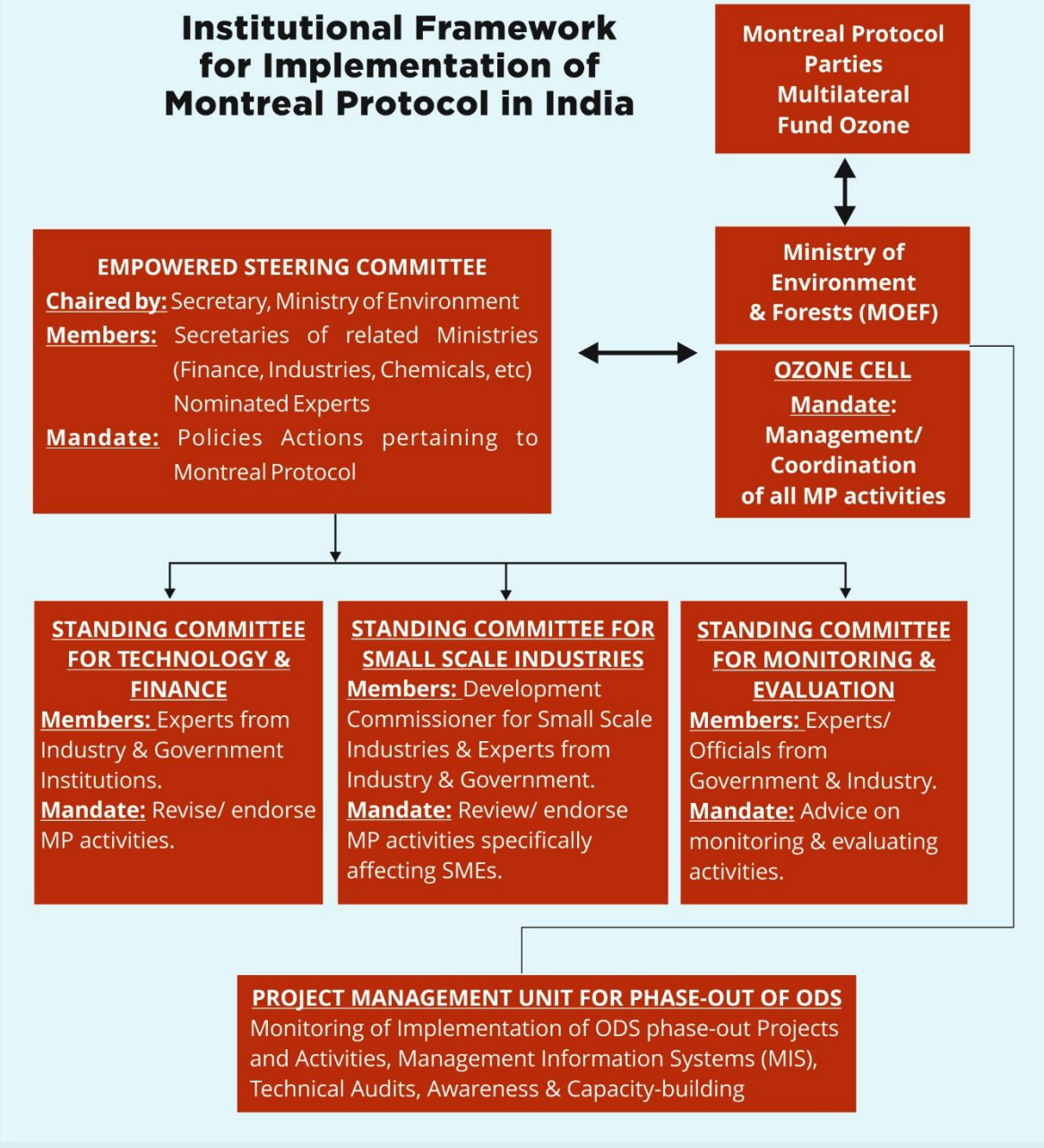
ODS Alternatives

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 a large number of 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 programme 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.
- The IPCC produces reports that support the UNFCCC, which is the main international treaty on climate change.
- The **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.

IPCC SPECIAL REPORT ON CLIMATE CHANGE AND LAND (SRCCL)

- They are also known as the "Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems", is a landmark study by 107 experts from 52 countries.
- The SRCCL provides a comprehensive overview of the entire land-climate system for the first time, and addressed land itself as a "critical resource".
- **The main findings of the reports are:**
  - **People, land and climate in a warming world:**
    - the SPM says that human-induced land degradation—with increased consumption and population growth causing more land use for "food, feed, fibre, timber and energy"—has negatively affected ice-free land area globally.
    - Approximately "25-30% of total food produced is lost or wasted" while "821 million people are undernourished" and " 2 billion adults now being overweight or obese."
  - **Adaptation and mitigation response options:**
    - Increased food productivity, dietary choices and food losses and waste reduction, can reduce demand for land conversion.
  - **Enabling response options:**
    - Suggested response options that will also help eradicate poverty, include "improving access to markets, securing land tenure, factoring environmental costs into food, making payments for ecosystem services, and enhancing local and community collective action
  - **Action in the near-term**
    - "Many sustainable land management technologies and practices are profitable within three to 10 years (medium confidence). While they can require upfront investment, actions to ensure sustainable land management can improve crop yields and the economic value of pasture.
    - Land restoration and rehabilitation measures improve livelihood systems and provide both short-term positive economic returns and longer-term benefits in terms of climate change adaptation and mitigation, biodiversity and enhanced ecosystem functions and services.

IPCC SPECIAL REPORT ON THE OCEAN AND CRYOSPHERE IN A CHANGING CLIMATE (SROCC)

- SROCC was approved at the IPCC's 51st Session (IPCC-51) in **September 2019 in Monaco.**
- The SROCC's **approved Summary for policymakers (SPM)**.
- The report is the third in the series of three Special Reports in the current **Sixth Assessment Report (AR6) cycle**, which began in 2015 and will be completed in 2022.
- The other reports are:
  - The first was the Special Report on Global Warming of 1.5 °C,
  - The second was the Special Report on Climate Change and Land (SRCCL),
    - also known as the "Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems",
- The Key points of the reports highlighted in SROCC summary for policymakers (SPM)
  - In their Summary for Policymakers, the report said that, since 1970, the "**global ocean has warmed unabated**" and "**has taken up more than 90% of the excess heat in the climate system."**
  - The rate of ocean warming has "**more than doubled**" since 1993.
  - **Marine heatwaves are increasing in intensity** and since 1982, they have "very likely doubled in frequency".
  - **Surface acidification has increased** as the oceans absorb more CO2.
  - Global mean sea levels (GMSL) rose by 3.66 mm (0.144 in) per year which is "2.5 times faster than the rate from 1900 to 1990".
  - **Ocean deoxygenation:** Ocean chemistry is changing resulting in the disruption of "species throughout the ocean food web". As the temperature of the ocean warms, there is a decrease in "mixing between water layers" which results in a decrease in the "supply of oxygen and nutrients for marine life".
  - **Melting glaciers:** There has been an acceleration of glaciers melting in Greenland and Antarctica as

well as in mountain glaciers around the world, from 2006 to 2015.

- **Ice sheets:** The melting of Greenland's ice sheets is "unprecedented in at least 350 years."

►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

- It is 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 aims to
  - Protect at least 30% of world's land and ocean by 2030
  - Effective management of protected and conserved areas
  - Increased public and 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, on the basis of 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 in a given 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 is able to 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 considered to be 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, the UNCCD collaborates closely with the other two Rio Conventions; the Convention on Biological Diversity (CBD) and the United Nations Framework Convention on Climate Change (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 the Delhi Declaration in which 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 (LDN) 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.

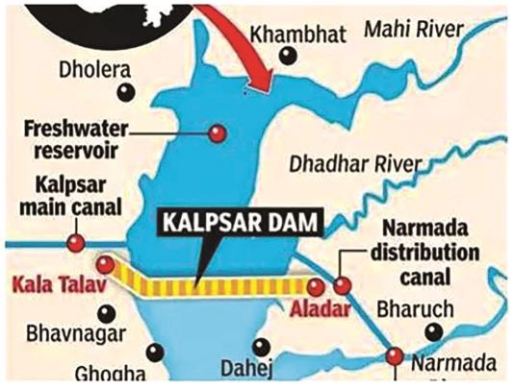
ABOUT LDN

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.

► ONE LINERS

India-Norway: To Conduct Marine Spatial Planning	• India and Norway have agreed to jointly work in the area of marine spatial planning (MSP). • Marine spatial planning (MSP) is a process that brings together multiple users of the ocean – including energy, industry, government, conservation and recreation – to make informed and coordinated decisions about how to use marine resources sustainably.
Vulture Protection	Bangladesh has become the first country that has banned the painkiller ketoprofen
Jalabhishekam Water Conservation Campaign	Under the campaign, 57,000 water structures costing over Rs. 2,000 crores have been inaugurated under the Mahatma Gandhi NREGA and Pradhan Mantri Krishi Irrigation Scheme. The structures were created in the COVID-19 era.
Denmark to create world's first energy island in the North Sea	• Denmark approved a plan to build the world's first energy island in the North Sea that will produce and store enough green energy to cover the electricity needs of 3 million European households. • The artificial island, which in its initial phase will be the size of 18 football fields, will be linked to hundreds of offshore wind turbines and will supply both power to households and green hydrogen for use in shipping, aviation, industry and heavy transport.
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.

Khadi Prakritik Paint	The Khadi Prakritik Paint is a non-toxic eco-friendly paint with **anti-bacterial and anti-fungal properties**. It is the first-of-its kind product. The Khadi Prakritik Paint was developed with cow dung as its main ingredient. It is odourless and cost-effective. The paint is free from heavy metals such as mercury, lead, arsenic, chromium, cadmium. The paint will help in doubling farmers income. This is because, the technology adopted in the making of Khadi Prakritik paint will increase consumption of cow dung as raw material for eco-friendly products.
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.
DRDO Biodigester Mk II technology in metro rail	The biodigester technology degrades and converts human waste into usable water and gases. The generated gas is used for cooking and water for irrigation purposes. This is done in an eco-friendly manner.
European Union bans Export of Plastic Waste to poor countries	The European Union recently announced that it is to completely ban the exports of unsorted plastic to poor countries. The new rules of the European Union will amend the 2006 Waste Shipment Regulation. The new rules are to ban the exports to less industrialised nations outside OECD.
Kalrav	Bihar's first state-level bird festival 'Kalrav' will be held at the world famous Nagi-Nakti bird sanctuaries in the Jamui district from January 15.
Australia India Water Centre (AIWC)	• This Water Centre will help the Indian and Australian partners to explore opportunities and create synergy for a long-time collaboration in the field of research and education between the two countries. • This Water Centre will help in fighting against the common water challenges and issues faced by both the countries like floods, droughts, water security, climate change, over-exploitation of water, degradation of water quality, etc.
BHADHUT PROJECT	• It is planned to be a 1.7-km causeway-cum-weir barrage, across the River Narmada, 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.

	
CANINE DISTEMPER VIRUS (CDV)	Canine distemper is a contagious and serious disease caused by a virus. Canine distemper virus is known mainly to cause a severe infection in dogs respiratory, gastrointestinal, respiratory and central nervous systems, as well as the conjunctival membranes of the eye. A lion does not eat the entire prey at one go. In between, the dogs consume the kill and infect it with the CDV. Once the lion returns to finish it off, its gets the deadly disease.
Tamil Nadu Protected Agricultural Zone Development (TNPAZD) Act, 2020	The Act declaring the Cauvery delta region as a Protected Agricultural Zone. **The salient features of the Bill are as follows:** o The Act announces the entire districts of Thanjavur, Thiruvarur and Nagapattinam as Protected Agricultural Zone. o The Act prohibits the setting up of zinc, copper and aluminum smelter plants, iron and steel processing industries, industries which process animal bones, horns etc., leather processing industries, oil and coal-based exploration projects for hydrocarbon, methane and natural gases and ship breaking industries in the protected zone. o The Act also specifically states that it will not affect the infrastructure works in these regions like developing harbours, laying pipelines, roads, telecommunications, electricity and water distribution works.
DHARMA APP	Application (DHARMA) is a web-based software to support the effective collection and management of dam safety data in respect of all large dams of India.
SHAISYS APP	Seismic Hazard Assessment Information System (SHAISYS) is a web based interactive application tool to estimate the seismic hazard at any point in Indian region.
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.
Nagar Vana Udyan Yojana	A Nagar Van-Udyan is a forested area in the vicinity of a city accessible to the city dwellers suitably managed for providing wholesome natural environment for recreation, conservation education, biodiversity conservation and supported services like water and soil conservation, pollution abatement, reduction of heat islands effect of the city with the essential elements for regular use. Nagar Van-Udyan Yojana is a Pilot scheme for implementation for a period of five Years (beginning 2015-16) by the the Ministry of Environment, Forests & Climate Change.
Keystone XL pipeline	The US president elect Joe Biden is expected to cancel the Keystone XL pipeline project. Keystone pipeline system The keystone pipeline system is an oil pipeline system in the United States and Canada.
Great Green Wall Initiative	The Great Green Wall initiative aims to transform the lives of 100 million Africans by growing 8,000 kilo metre long and fifteen kilo metre wide mosaic of trees, vegetation,

	grasslands, plants. The Great Green Wall is an African-led initiative. It was started in 2007 by the African Union to combat desertification, land degradation, drought. The project aims to restore 100 million hectares of degraded land by 2030. So far between 2007 and 2019, the Great Green Wall initiative has restored only four million hectares of land.
Sustainable Mountain Development Summit	The ninth edition of the Sustainable Mountain Development Summit (SMDS) was organized in December 2020. **Theme:** Emerging Pathways for Building Resilient Post COVID-19 Mountain Economy, Adoption, Innovation and Acceleration. **About the Summit** The summit was organised by Indian Mountain Initiative. The summit aimed to deliberate on issues such as water security, migration, climate resilience and innovative solutions for disaster risk reduction and farm sector in the Indian Himalayas. The first edition of the summit was launched in 2011 in Nainital.
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 kilometre resolution. The model provides information such as equality atmospheric composition and Wildfire smoke. It is capable of solving the inverse dispersion problem. The model is capable of taking 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 most likely 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 in order to prevent, halt, and reverse land degradation within G20 member states and globally. The implementation has to be done by taking into account possible 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 the them, the pink colour is formed due to an algae found in the ice.

►GLOBAL CARBON PROJECT

Global carbon emissions are set to hit an all-time high of 37.1 billion tonnes of CO2 in 2018, according to researchers at the University of East Anglia (UEA) and the Global Carbon Project.

FINDINGS

- **India, the third-highest contributor (China, US, India**, Russia, Japan being the top 5) is projected to see emissions rise by 6.3% from 2017.
- The 2.7% projected global rise in 2018 has been **driven by appreciable growth in coal use** for the second year in a row, and sustained growth in oil and gas use.
- Limiting global warming to the 2015 Paris Agreement goal of keeping the global temperature increase this century to well below 2°C, would **need carbon dioxide emissions to decline by 50% by 2030** and reach net zero by about 2050.

ABOUT GLOBAL CARBONPROJECT

- It was **formed in 2001.**
- **Aim:** To help the international science community to **establish a common, mutually agreed knowledge base** that supports policy debate and action to slow the rate of increase of greenhouse gases in the atmosphere.
- It is a Global Research Project of **Future Earth** and a research partner of the **World Climate Research Programme**.

WHAT IS BLUE ECONOMY?

- According to the World Bank, the **blue economy** is the "sustainable use of **ocean** resources for economic growth, improved livelihoods, and jobs while preserving the health of **ocean** ecosystem."
- For others, it simply refers to any economic activity in the maritime sector, whether sustainable or not."

►GLOBAL CARBON ATLAS

- It is an online platform to explore, visualise and interpret global and regional carbon data arising from both human activities and natural processes.
- It is a community effort under the Global Carbon Project.

COMPONENTS

- **Outreach:** traces history and possible future relationship between carbon emissions and human development.
- **Emissions:** shows CO2 emissions from combustion of fossil fuels, cement production and land use change over decades including their drivers.
- **Research**

ACCORDING TO THE GLOBAL CARBON ATLAS, 2019

1. List of CO_2 emitters in decreasing order: China, USA, India, Russia, Japan
2. Emissions by industry: Coal>Oil>Gas>Cement > Gas Flaring

It also released Global Methane Budget

Sources of Methane Emissions:

Agricultural Waste (Anthropogenic) > Wetlands (Natural) > Fossil Fuel (Anthropogenic) > Other natural emissions (geological processes, lakes, rivers, termites) > Biomass burning (anthropogenic)

SUSTAINABILITY INDEX

The report uses data from Global Carbon Atlas, to create sustainability index. The index ranks countries on excess carbon emissions compared with the 2030 target. India's rank on the sustainability index is 77.

SECTION 6

DISASTERS

►GLACIAL LAKE OUTBURST FLOOD

CONTEXT

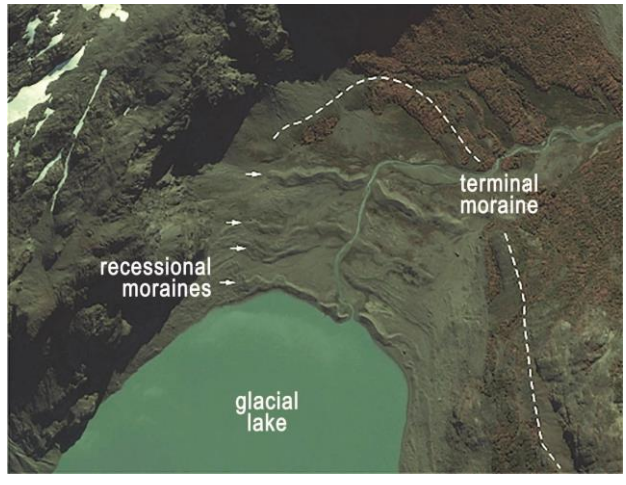
A portion of the Nanda Devi glacier broke off in Uttarakhand's Chamoli district on February 7, triggering an avalanche and a deluge in the Alaknanda river system that washed away hydroelectric stations and trapped more than 100 labourers who are feared dead.

WHAT COULD BE BEHIND THE 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.

WHAT ARE GLOFS?

- Glacial lake outburst floods (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.

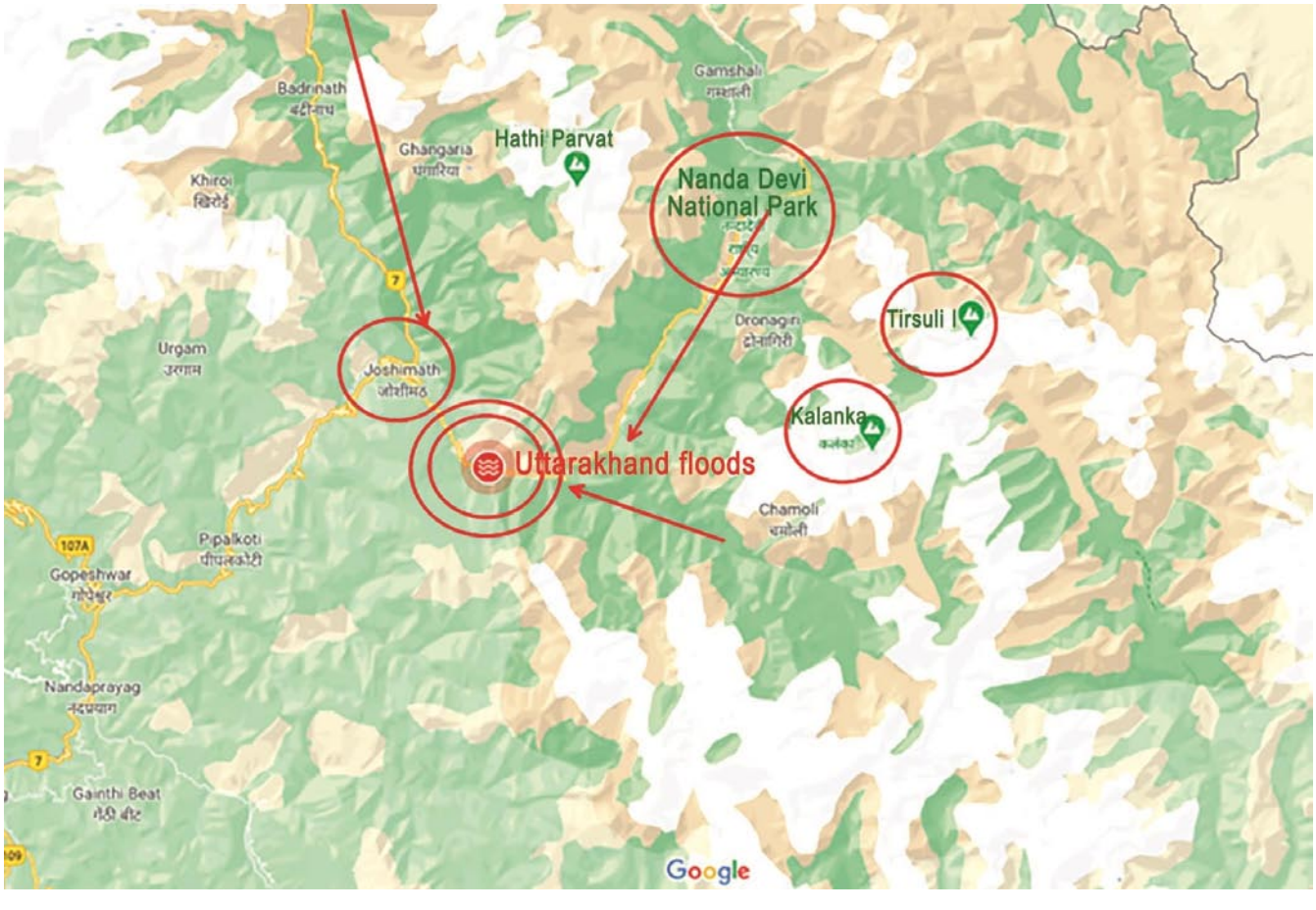
- Terminal moraines act as dams for these lakes, but as the lakes swell from rising water levels and the retreating glacial ice tongue, the moraine dam can weaken. Moraine dams that become too weak may crumble under too much pressure from the swelling lake, creating a GLOF. If the moraine dams of a glacial 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.

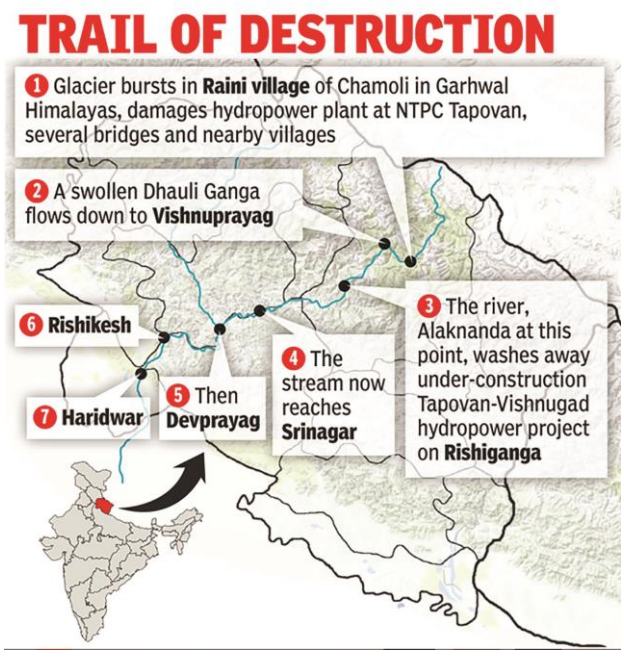
HOW LARGE CAN BE THESE LAKES?

Glacial lake volumes vary, but may hold millions to hundreds of millions of cubic metres of water. Catastrophic failure of the containing ice or glacial sediment can release this water over periods of minutes to days.

CAN THEY CAUSE SUCH FLOODS?

- Peak flows as high as 15,000 cubic metres per second have been recorded in such events, suggesting that the V-shaped canyon of a normally small mountain stream could suddenly develop an extremely turbulent and fast-moving torrent some 50 metres (160 ft) deep.
- Glacial Lake Outburst Floods are often compounded by a massive river bed erosion in the steep moraine valleys, as a result, the flood peaks increase as they flow downstream until the river reaches, where the sediment deposits.





►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- S**teepness 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. North West Himalayas (Uttarakhand, Himachal Pradesh, Jammu and Kashmir).
- The **Himalayan mountain ranges** and hilly tracts of the North-Eastern region are highly susceptible to slope instability due to the **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.

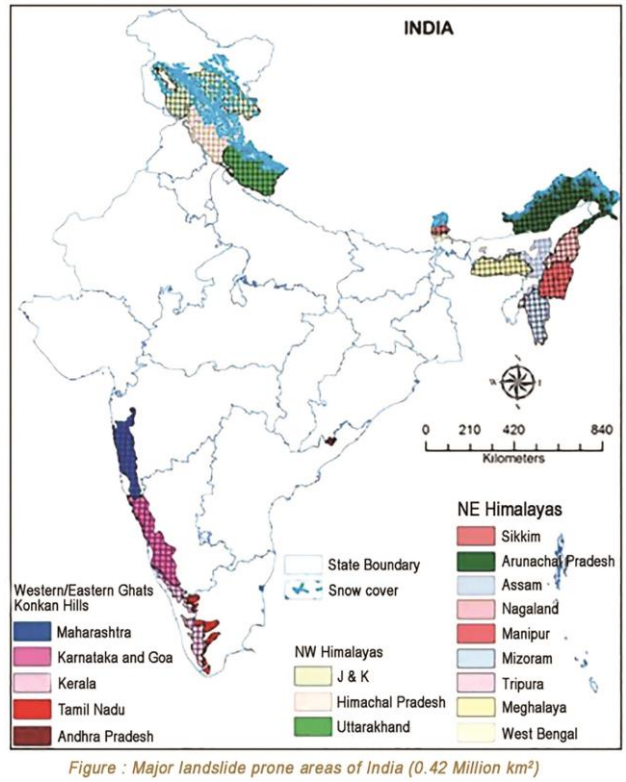


Figure : Major landslide prone areas of India (0.42 Million km²)

- 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 a number of 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 and 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.
- On September 21, 2016, breaking a 16-year record, Hyderabad received 16 cm of rain in a single day; in September 2017, the city witnessed a 450% increase compared to the average rainfall it receives during this month; in September 2019, the rainfall was the highest in 100 years, while in October it was in 62% in excess.
- **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.
  - Encroachment in the immediate upper catchments of hilly urban area has also caused serious flooding in the flood plains of cities surrounded by hills.
  - Hyderabad's century-old drainage system (developed in the 1920s) covered only a small part of the core city. In the last 20 years, the city has grown at least four times its original built-up area.
- **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)

The India Meteorological Department (IMD) 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.

WHAT ARE 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 river beds, 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.

HOW DO FLASH FLOODS FORM?

- 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 very 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 very difficult as an event can occur within three to six hours and the water run-off quantity is very 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?

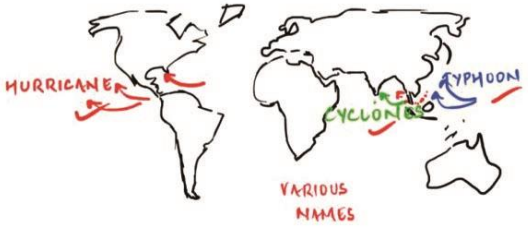
Forecasts, on their own, are important, but they cannot override the importance of preparedness by State agencies. The formation of cyclones is preceded by 'depressions', and they are often the first warnings. Not all depressions become cyclones, but many coastal States — especially those with a history 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

LET US NOW UNDERSTAND FROM WHERE NAMES ARE DERIVED

How are they named?

- 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.

WHY NO CYCLONE DEVELOPMENTS IN OCTOBER 2020?

According to the Indian Meteorological Department, weak La Nina is the main reason for no cyclone in October 2020.

►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.

WHAT ARE WESTERN DISTURBANCES?

A western disturbance is an extratropical storm originating in the Mediterranean region that brings sudden winter rain to the north western 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.

HOW ARE THEY FORMED?

- 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 ON INDIAN CLIMATE

- Western disturbances are usually associated with cloudy sky, higher night temperatures and unusual rain.
- Western disturbances, specifically the ones in winter, bring moderate to heavy rain in low-lying areas and heavy snow to mountainous areas of the Indian Subcontinent.
- They are the cause of most winter and pre-monsoon season rainfall across northwest India.
- Precipitation during the winter season has great importance in agriculture, particularly for the rabi crops.
- Wheat among them is one of the most important crops, which helps to meet India's food security.

ARE THERE ANY ILL-EFFECTS OF WESTERN DISTURBANCES?

- Excessive precipitation due to western disturbances can cause crop damage, landslides, floods and avalanches.
- Over the Indo-Gangetic plains, they occasionally bring cold wave conditions and dense fog. These conditions remain stable until disturbed by another western disturbance.
- When western disturbances move across northwest India before the onset of monsoon, a temporary advancement of monsoon current appears over the region.

►DROUGHTS

WHAT ARE 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 DROUGHT

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**

- The South-west monsoon accounts for 70 to 80 per cent 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 south west monsoon results in occurrence of drought in the Indian region.

- **El-Nino Southern Oscillation**
  - Also there seems to be a clear association between El Nino and La Nina events and weak monsoons. (explained in ENSO section)

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 mainly 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.

ECOLOGICAL AND ENVIRONMENTAL 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 largely 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 on account of 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 the 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

Severe heat waves were witnessed in the year 2020.

HEAT WAVE

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.

The extreme temperatures and resultant atmospheric conditions adversely affect people living in these regions as they cause physiological stress, sometimes resulting in death.

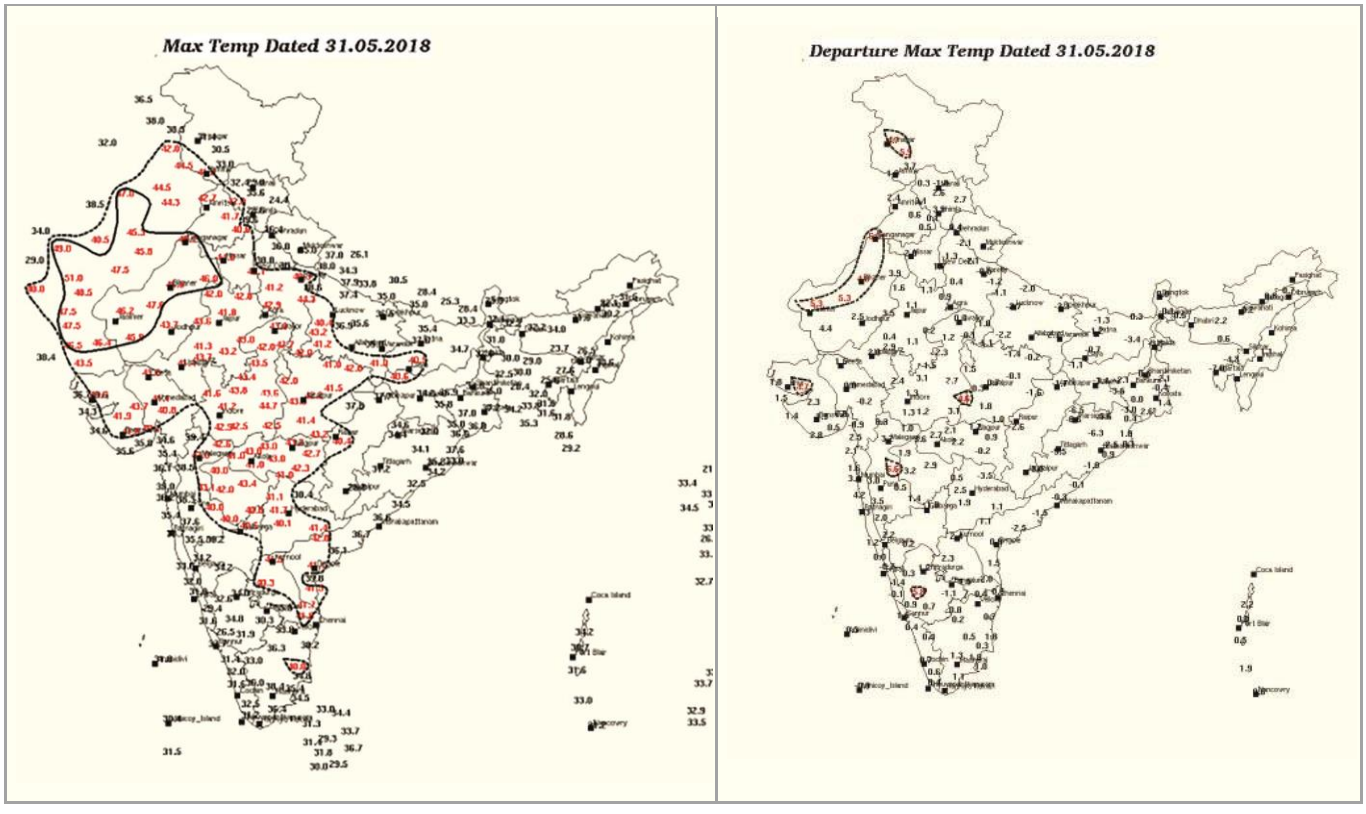
THE INDIAN METEOROLOGICAL DEPARTMENT (IMD) HAS GIVEN THE FOLLOWING CRITERIA FOR HEAT WAVES

There are two conditions which need to be satisfied:

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:

1. Based on Departure from Normal
    1. **Heat Wave:** Departure from normal is 4.5°C to 6.4°C
    2. **Severe Heat Wave:** Departure from normal is ≥ 6.4°C
2. Based on Actual Maximum Temperature (for plains only)
    1. **Heat Wave:** When actual maximum temperature ≥ 45°C
    2. **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.

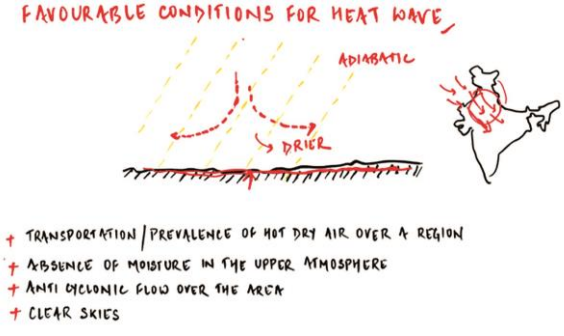


Left: Maximum T across India (Stations crossing 40 Degree C denoted in Red)

Right: Stations Observing departure from Mean maximum T by more than 4.5 degree C denoted in Red (regions of heat wave)

WHAT ARE FAVOURABLE CONDITIONS FOR HEAT WAVE?

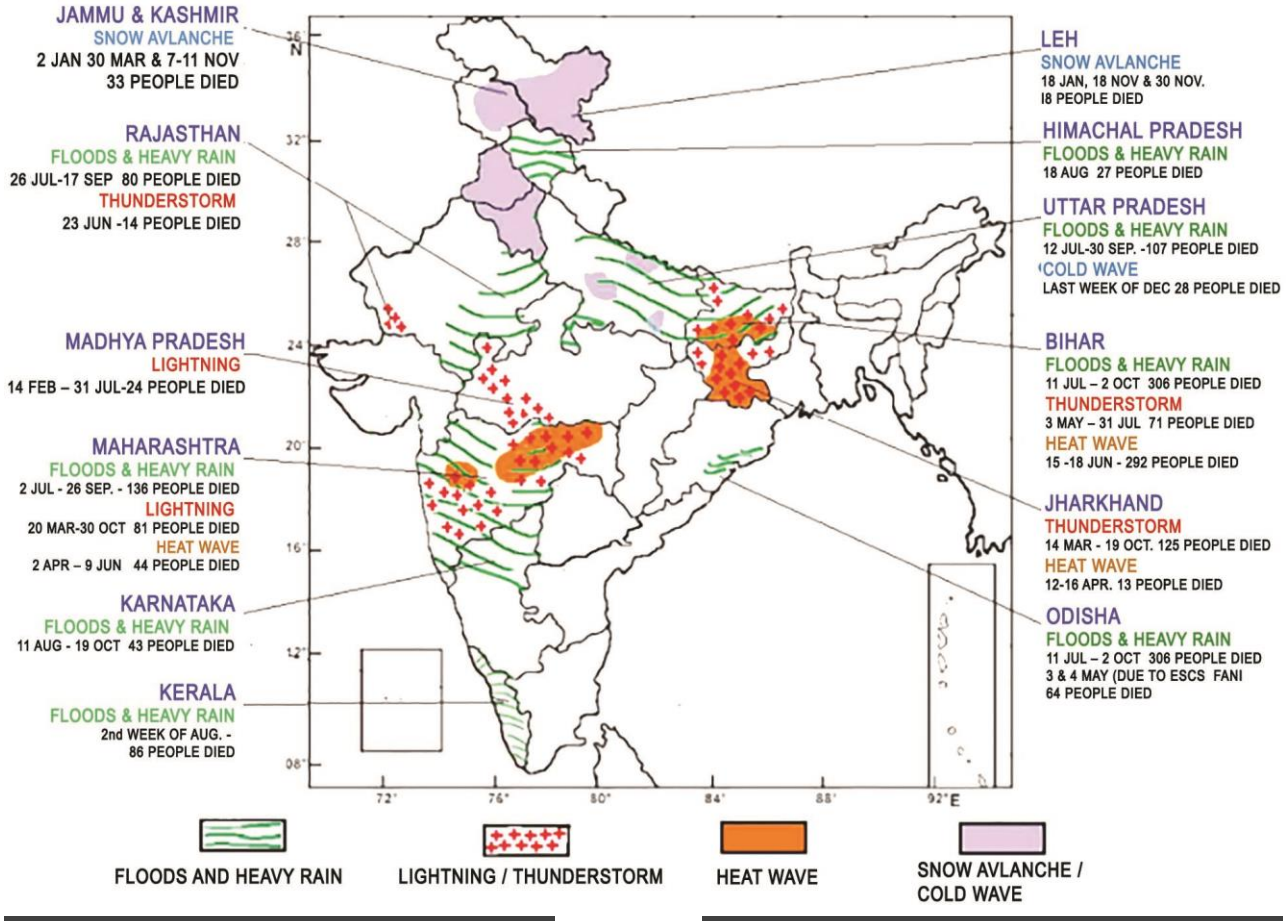
- Transportation / Prevalence of hot dry air over a region (There should be a region of warm dry air and appropriate flow pattern for transporting hot air over the region).
- Absence of moisture in the upper atmosphere (As the presence of moisture restricts the temperature rise).
- The sky should be practically 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 the favourable conditions.



HEALTH IMPACTS OF HEAT WAVES

The 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) and Syncope (Fainting) generally accompanied by fever below 39 i.e.102*F.
- **Heat Exhaustion**: Fatigue, weakness, dizziness, headache, nausea, vomiting, muscle cramps and sweating.
- **Heat Stoke**: Body temperatures of 40*C i.e. 104*F or more along with delirium, seizures or coma. This is a potential fatal condition.



MAJOR EXTREME WEATHER EVENTS OCCURRED 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.

WHAT ARE LOCUST ATTACKS AND HOW ARE THEY CAUSED?

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 the desert locust, the gregaria nymphs become darker with strongly contrasting yellow and black markings, they grow larger, and have longer developmental periods.

HOW DO THESE LOCUSTS HARM AGRICULTURE?

- The 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 kilometre of a swarm and travel up to 150 kilometres 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 kilometre, containing about 40 million locusts, eats the same amount of food in one day as about 35,000 people.

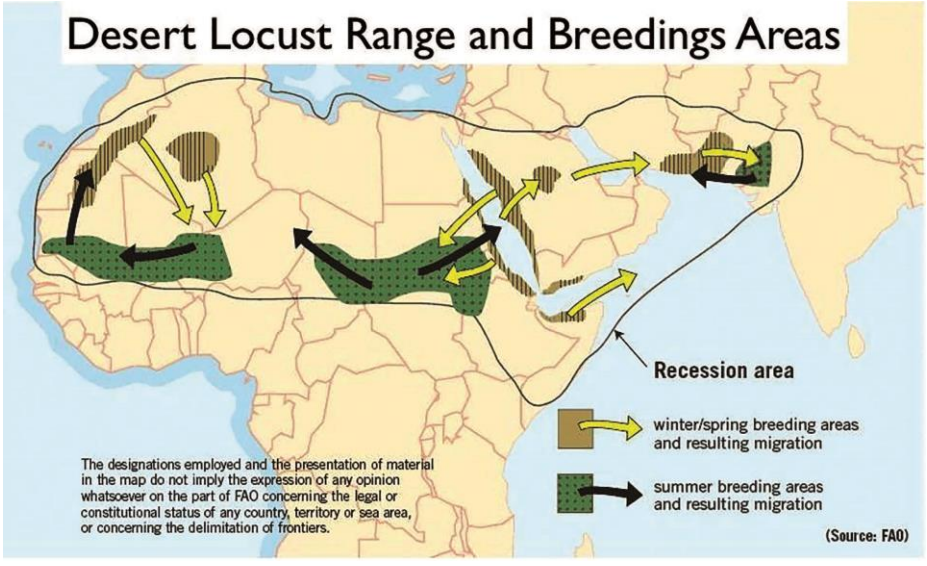


Fig: *The locusts coming to India (Rajasthan and Gujarat) originate from Horn of Africa and traverse Middle Eastern countries before coming via Pakistan after monsoon.*

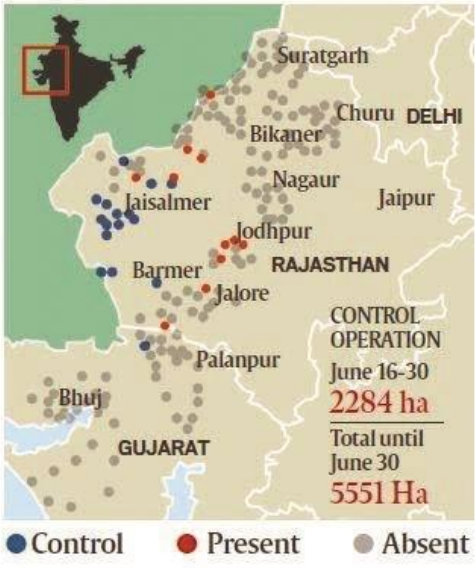


Fig: Areas impacted due to locust attack in India

HOW MANY 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)

HOW DOES INDIA PLANS TO CONTROL THESE 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.

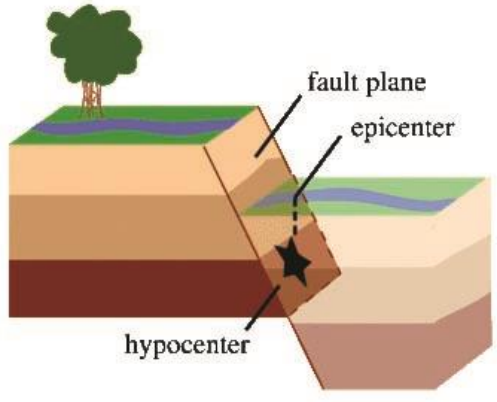
India is most at risk of a swarm invasion just before the onset of the monsoon. The swarms usually originate in the Arabian Peninsula and the Horn of Africa.

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 AND EARTHQUAKE PREDICTION

IN NEWS

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 regards, 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 the earthquakes occurrence with respect to:-
- time,
- location,
- and 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 some kind of 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 generally 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 somewhat 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 particular fault, scientists know there will be another earthquake sometime in the future, but they have no way of telling when it will happen.

►O-SMART SCHEME: TSUNAMI EARLY WARNING CENTRE PROVIDING SERVICES TO 25 INDIAN OCEAN COUNTRIES

KEY FEATURES OF THE O-SMART SCHEME

The following are the main features of the O-SMART scheme

- O-SMART is Ocean Services, Modelling, Applications, Resources and Technology scheme.
- The system generates and updates information on Marine living resources in the Indian Exclusive Economic Zone.
- It monitors free water pollutants. This data is then used for health assessment of coastal waters of India. The scheme also develops shore line change maps that help assist the coastal erosion due to anthropogenic activities and natural calamities.
- It develops wide range of ocean observation systems. These systems in turn help acquire real time data from the seas in India.
- It provides warnings, advisories and user-oriented Ocean information for the benefit of the society.
- It develops Ocean forecast and Re analysis system.
- The scheme develops technologies that are used to tap marine bio-resources.
- It provides algorithms that help in validating satellite data related to coastal research.
- It is responsible for establishing water treatment facilities along coastlines.
- It is responsible for the operation and maintenance of 5 research vessels that are deployed in Ocean survey monitoring and demonstration programmes.
- The scheme is also carries out exploration of polymetallic nodules from the water depth of 5500 metres. This was allocated by the United Nations in the central Indian ocean basin. The International Organisation has a located 75000square kilometre of maritime area to carry out investigations of gas hydrates.

INDIAN TSUNAMI EARLY WARNING CENTRE

The centre was established at Indian national Centre for Ocean information Services (INCOIS) Hyderabad. It operates under Ministry of earth sciences. The centre is currently providing Tsunami warning services to over 25 Indian ocean countries. This is being done under the the intergovernmental oceanographic commission of UNESCO framework.

INCOIS

- The INCOIS has established strong motion accelerometers in Andaman and Nicobar Islands and global Navigation satellite system. 20 sensors help in quick and reliable estimation of earthquake sources.
- It also conducts training and exercises on preparedness during tsunami conditions and create awareness about Tsunami.
- It is also implementing the tsunami ready program full stop the program was introduced by UNESCO.

SECTION 7

CONCEPTS

►WHAT ARE 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.

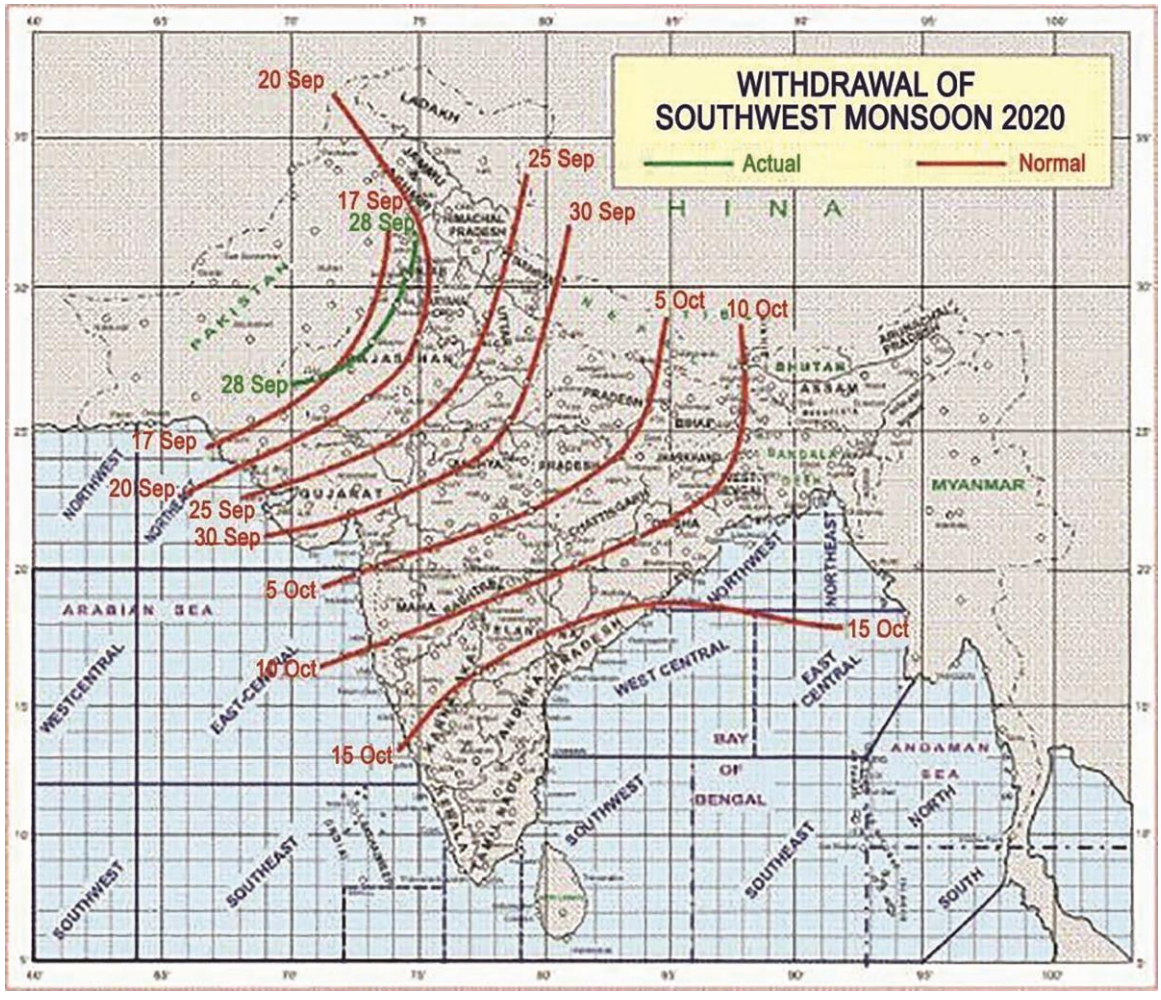
Canopy bridges for Nilgiri Langurs (IUCN status: Vulnerable) and lion-tailed Macaques (IUCN status: Endangered) have been built in Western Ghats.

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. The Ranthambore National Park is located 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. 10°N and Long. 55°E to 80°E. The zonal wind speed over the area bounded by Lat. 5-10°N, Long. 70-80°E 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. 5-10°N and Long. 70-75°E.

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.

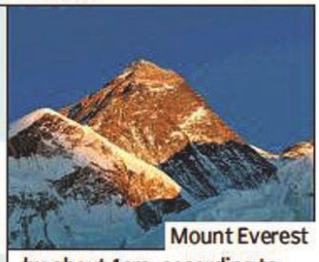
WHY ELSE HAS THE HEIGHT BEEN QUESTIONED?

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 nearly 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.

THE TECTONIC FACTOR

- Some scientists claim the area's plate tectonics are adding to the height and moving the summit north-eastwards
- India's northward movement compresses the Himalayas and raises Everest 3-4 mm/year
- Earthquakes lower the height a little, say geologists
- The 2015 earthquake decreased the peak's height



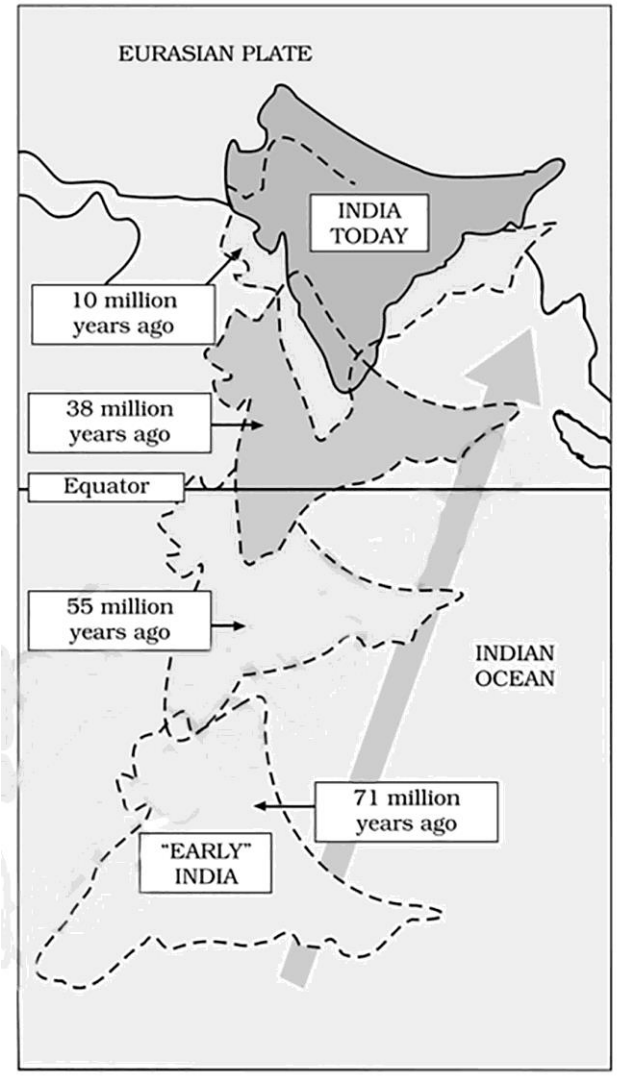
Mount Everest by about 1cm, according to geologist Roger Bilham

- Errors occur while assessing mean sea level

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, among other benefits, 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 actually 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.

►RED SNOW

RED SNOW IN ANTARCTICA: WHY IT HAPPENS

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 is able to reflect back. Changes in albedo lead to more melting. In the melting of snow in the Arctic, the key drivers have been snow and ice albedo, according to a 2016 study in the journal Nature.

►EU CLIMATE LAW

The draft climate law, unveiled in Brussels, would make a legally binding commitment for the EU to reduce its greenhouse-gas emissions to net zero by 2050.

WHAT ARE THE KEY POINTS IN THIS LAW?

The Commission's proposal for the first European Climate Law aims to write into law the goal set out in the European Green Deal – for Europe's economy and society to become climate-neutral by 2050.

This means achieving net zero greenhouse gas emissions for EU countries as a whole, mainly by cutting emissions, investing in green technologies and protecting the natural environment.

The law aims to ensure that all EU policies contribute to this goal and that all sectors of the economy and society play their part.

HAS IT BECOME BINDING?

No, the climate law needs the approval of the European Parliament and member states.

►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.

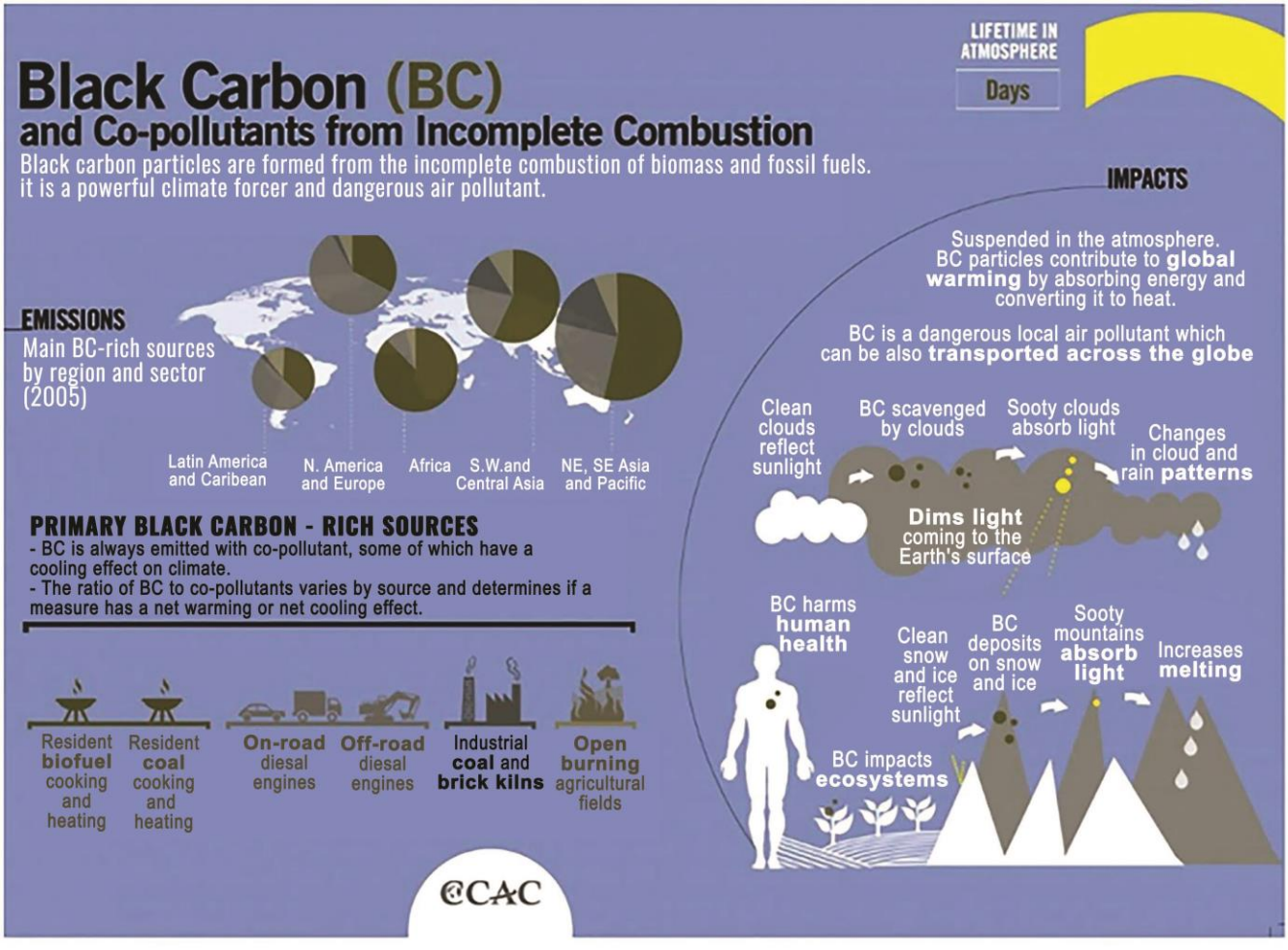
Black Carbon (BC) has recently emerged as a major contributor to global climate change, possibly second only to CO_2 as the main driver of change.

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.



►TARBALLS

WHAT ARE 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.

►FLY ASH

WHAT IS 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.

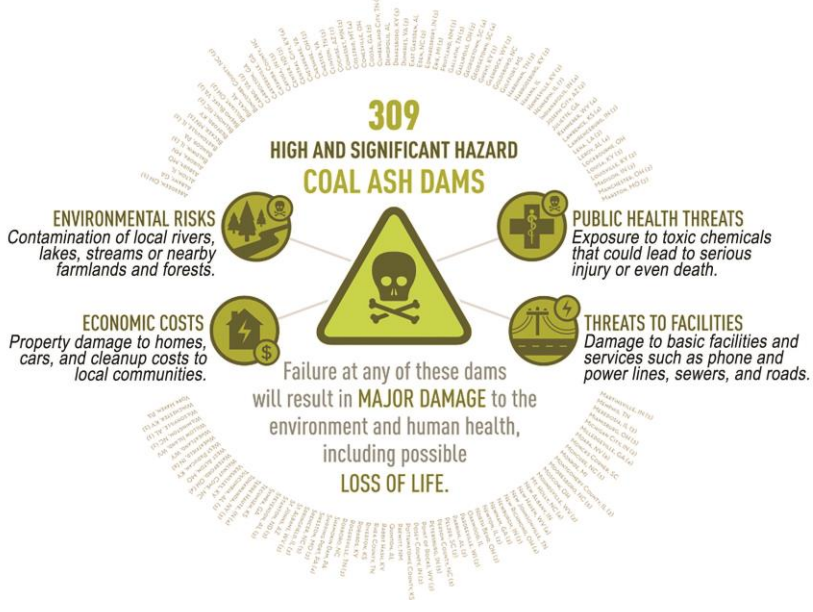
IMPORTANT TERMS RELATED TO FLY ASH

- **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 (SiO2)
  - Aluminum oxide (Al2O3) and
  - Calcium oxide (CaO), the main mineral compounds in coal-bearing rock strata.

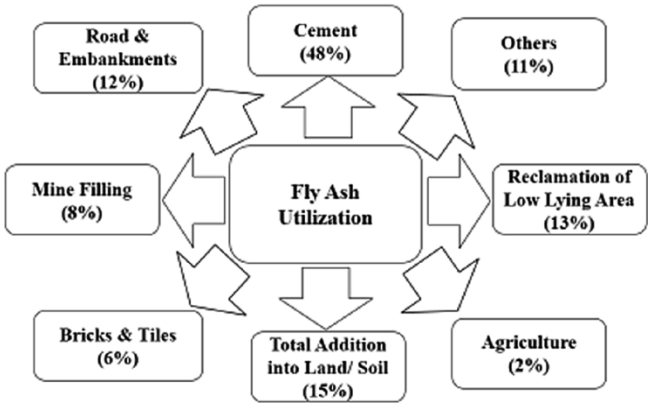
The minor constituents of fly ash depend upon the specific coal bed composition but may include one or more of the following elements or compounds found in trace concentrations - arsenic, beryllium, boron, cadmium, chromium, hexavalent chromium, cobalt, lead, manganese, mercury, molybdenum, selenium, 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 MINISTRY OF ENVIRONMENT, FORESTS AND CLIMATE CHANGE (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

WHAT IS 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

The **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 Programme 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 programmes, certification services and green building training programmes.**

►GREEN TAX

The Ministry of road transport 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.

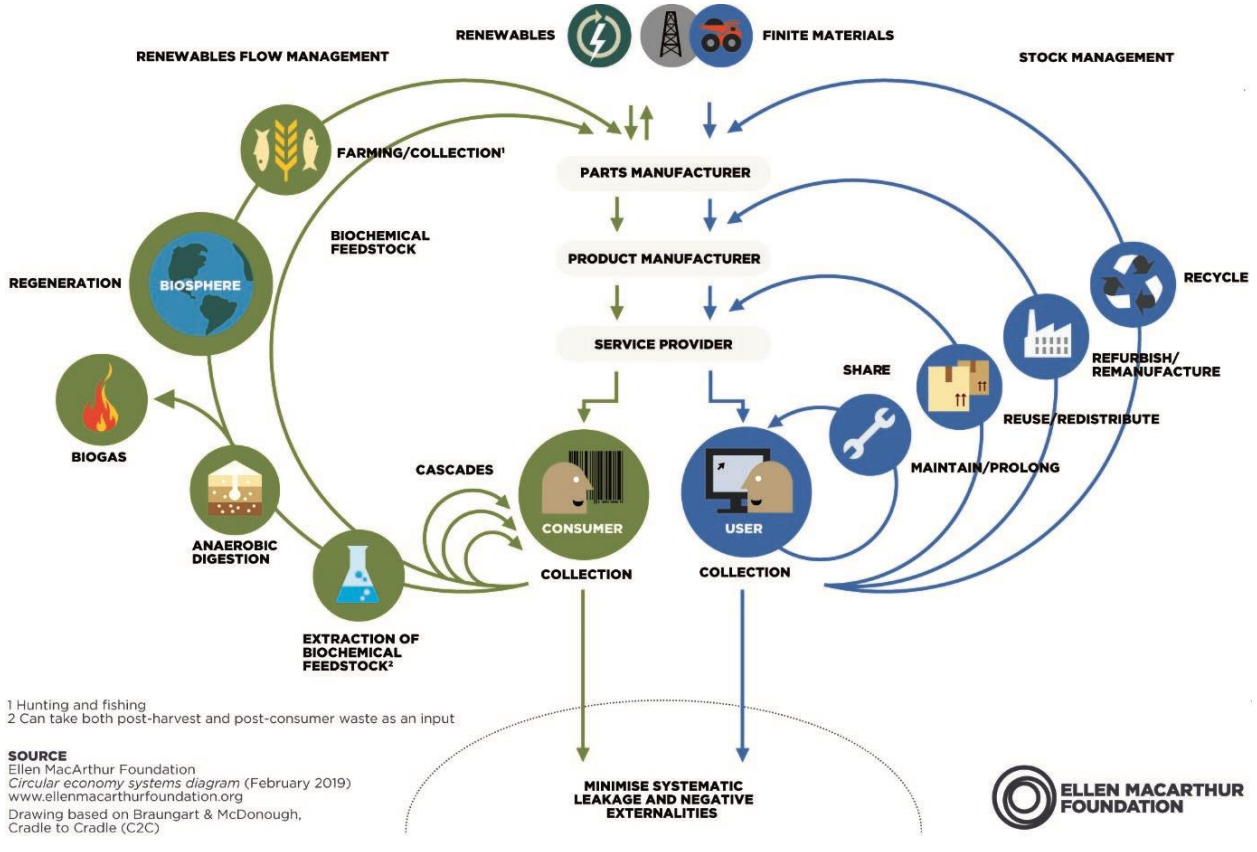
DIFFERENTIAL TAXATION

- 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.

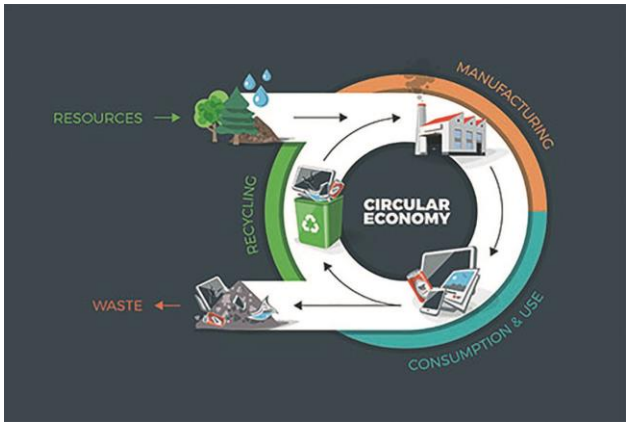
►CIRCULAR ECONOMY



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.



THE PRINCIPLES OF THE CIRCULAR ECONOMY

The 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 (e.g. washing machines), components (e.g. motherboards), and materials (e.g. 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

WHAT IS IT?

- 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.
- Indian Ocean Dipole (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	Westerly winds weaken along the equator allowing warm water to shift	Westerly winds intensify along the equator, allowing warmer waters to

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.

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 the 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 Australia.

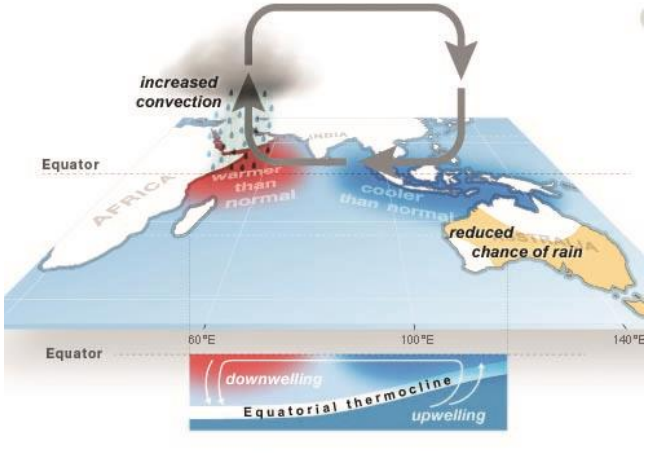
2019 witnessed the record level of positive phase of Indian Ocean Dipole

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.

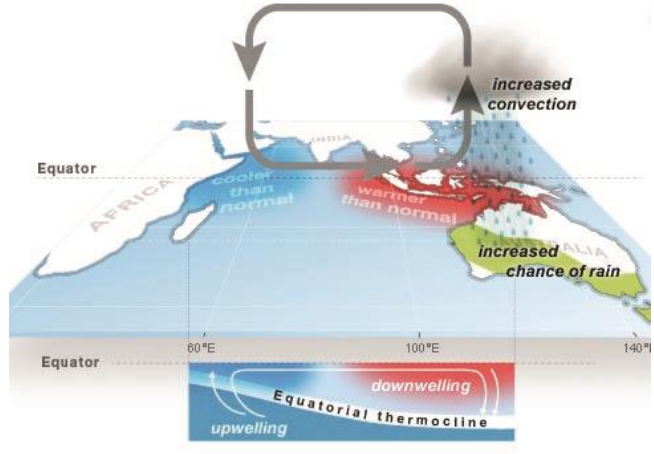
concentrate near Australia.

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.



Indian Ocean Dipole (IOD): **Positive phase**



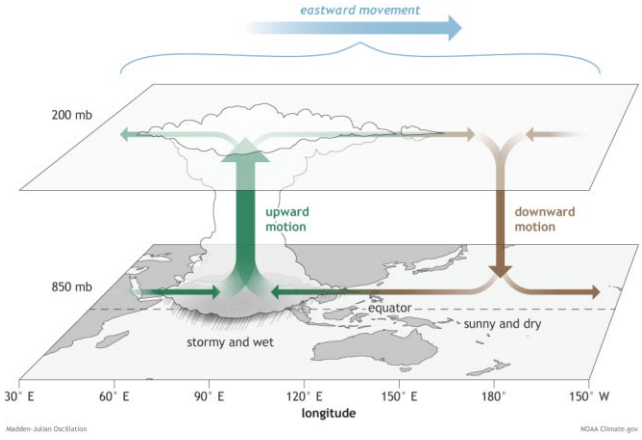
Indian Ocean Dipole (IOD): **Negative phase**

►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 the 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.

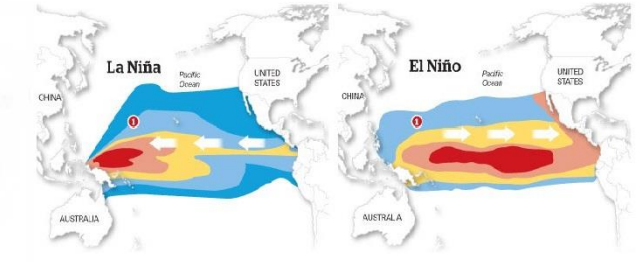
► EL NINO AND LA NINA

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

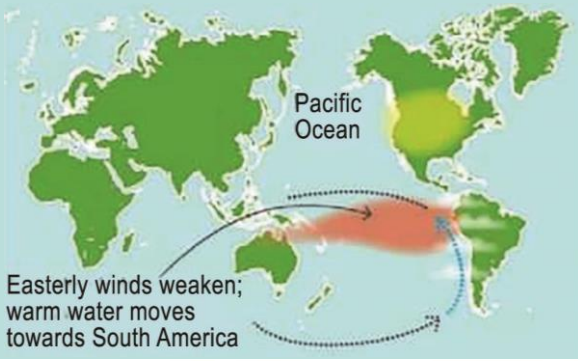
- La Nina means Little Girl in Spanish. La Nina is also sometimes called El Viejo, anti-El Nino, or simply "a cold event." La Nina has the opposite effect of El Nino.
- During La Nina events, trade winds are even stronger than usual, pushing more warm water toward Asia. Off the west coast of the Americas, upwelling increases, bringing cold, nutrient-rich water to the surface.

WHAT ARE 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



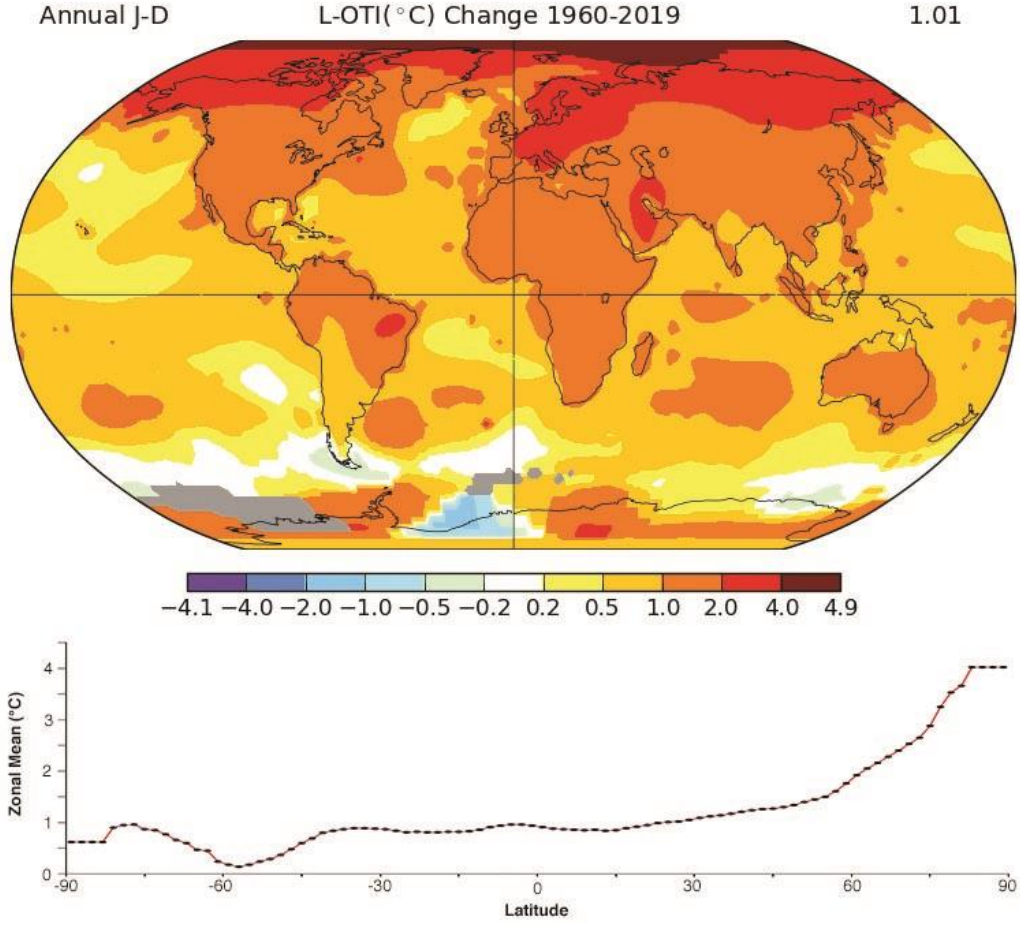
La Nina year

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

►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.

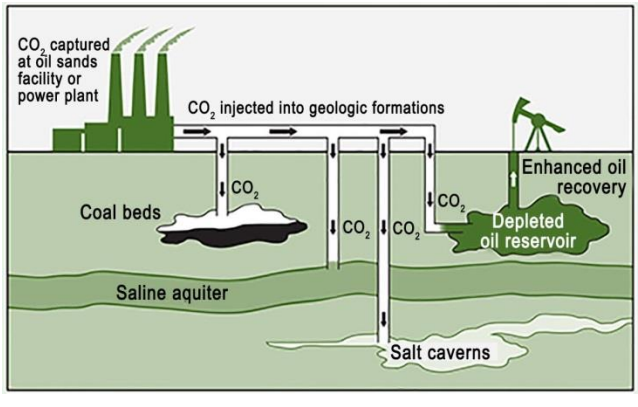
Changing Ocean currents:

- 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

►CARBON CAPTURE AND STORAGE (CCS)



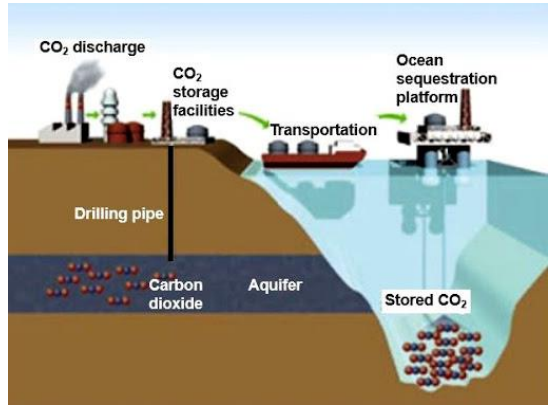
Carbon capture and storage (CCS), or carbon capture and sequestration and carbon control and sequestration, is the process of capturing waste carbon dioxide (CO2), transporting it to a storage site, and depositing it where it will not enter the atmosphere. Usually the CO2 is captured from large point 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 CO2 into the atmosphere from heavy industry, and so help to limit climate change.

Although CO2 has been injected into geological formations for several decades for various purposes, including enhanced oil recovery, the long-term storage of CO2 is a relatively new concept.

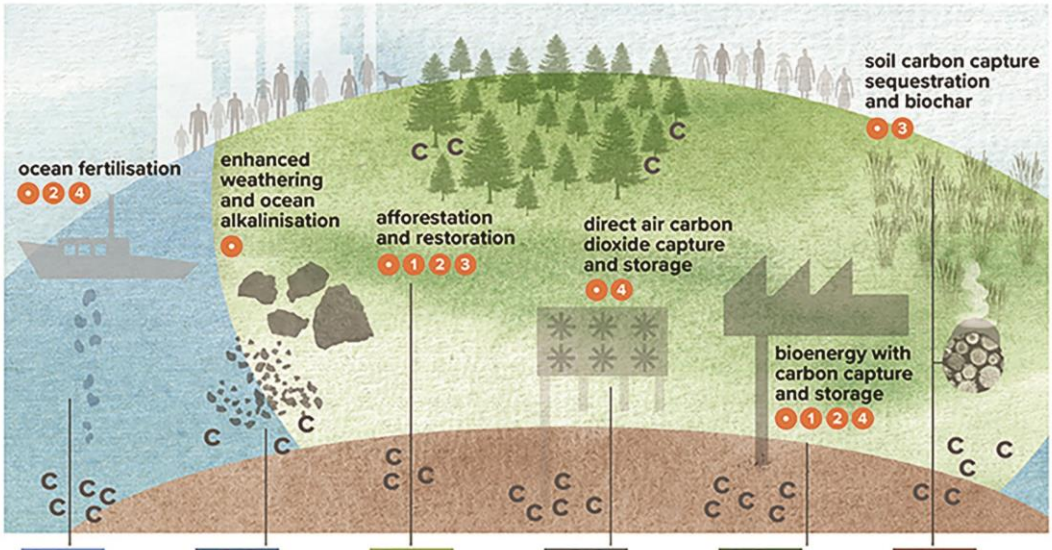
Carbon dioxide can be captured directly from an industrial source, such as a cement kiln, by using a variety of technologies; including absorption, adsorption, chemical looping, membrane gas separation or gas hydrate technologies. As of 2019 there are 17 operating CCS projects in the world, capturing 31.5Mt of CO2 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 CO2 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 CO2 might leak into the atmosphere



Governing Carbon Dioxide Removal



Shared Governance Challenges include:

- Measurement and reporting;
- Speed/scale issues;
- Potential public concerns. including transparency of information, accountability, involvement in decisions;
- Liability and compensation

Specific Governance Challenges include:

1. Managing the competition for land use and related impacts on the SDGS at domestic and transboundary levels;
2. Managing risks and potential implications for biodiversity
3. Addressing permanence of CO_2 isolated from atmosphere;
4. High costs - land use, capital, deployment, energy - mean policy signals. e.g. price on carbon or other regulation, are needed.

Fertilising ocean ecosystems to acc-elerate phytoplankton growth, which partly sinks to transport carbon from atmo-sphere to seabed

Enhancing natural weathering of rocks by extracting. grinding. and dispersing carbon binding minerals on land, or adding alkaline minerals to the ocean to increase carbon uptake

Planting forests and restoring ecosystems, for long-term carbon storage in above - and below- ground biomass

Using chemical process to capture co, directly from ambient air: using or permanently storing the CO_2

Burning biomass for energy generation capturing and permanently storing the resulting CO_2.

Burning biomass under low oxygen conditions, yielding charcoal "biochar" to add to soil and enhance soil carbon levels

C2G Carnegie Climate Governance Initiative

An initiative of CARNEGIE COUNCIL for Ethics in International Affairs

5 November 2019

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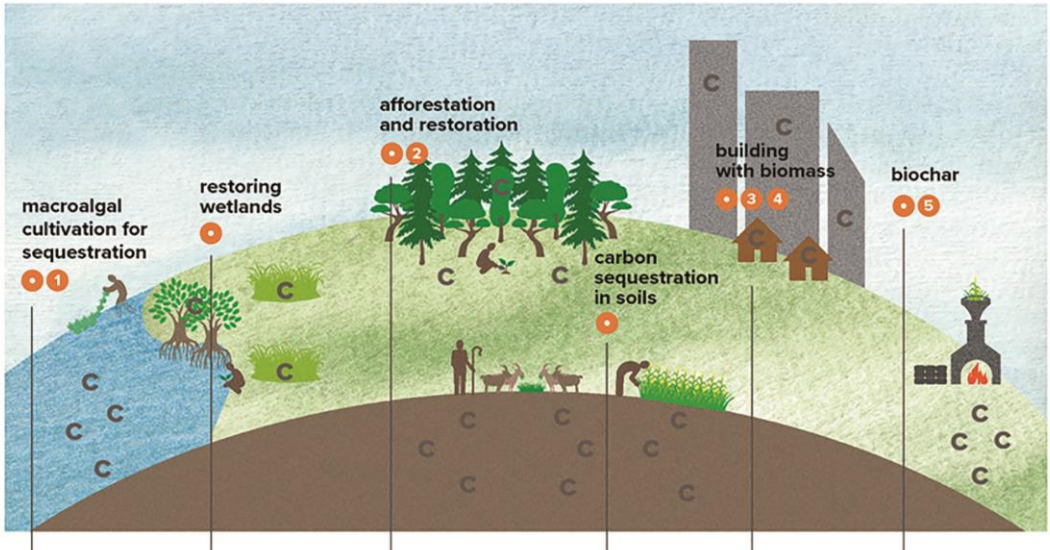
Governing Nature-Based Approaches to Carbon Dioxide Removal



Shared Governance Challenges include:

- Better monitoring, verification and reporting of achieved sequestration, longevity of storage and potential negative effects is required.

Specific Governance Challenges include:

1. Cultivation within inshore or offshore waters requires different types of governance.
2. Solving remaining questions regarding social justice (i.e., land-use issues).
3. Imported timber may, in the future, require international agreement regarding carbon credit allocation.
4. Potential governance issues around land-use change.
5. Transboundary trade in biochar may require international agreement regarding carbon credit allocation.

Large-scale growing and sequestration of marine macgroalgae

Rewetting and reclaiming wetlands (e.g. peatlands and mangroves) to enhance carbon storage

Planting and restoring forests for long-term carbon storage

Land management changes to increase soil carbon concentration

Using carbon embedded in biomass (such as timber) in construction

Burning biomass under low oxygen conditions, yielding charcoal "biochar" to add to soil and enhance soil carbon levels

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7 February 2020

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►GEOTHERMAL ENERGY

The first geothermal power project of India will be established at Puga village of eastern Ladakh.

WHAT IS IT?

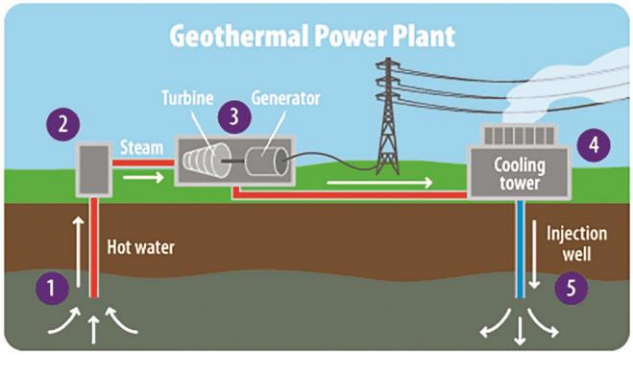
Geothermal energy is heat within the earth. The word geothermal comes from the Greek words geo (earth) and therme (heat). Geothermal energy is a renewable energy source because heat is continuously produced inside the earth. People use geothermal heat for bathing, to heat buildings, and to generate electricity.

WHERE DOES GEOTHERMAL ENERGY COME FROM?

Geothermal energy is the heat that comes from the sub-surface of the earth. It is contained in the rocks and fluids beneath the earth's crust and can be found as far down to the earth's hot molten rock, magma.

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.



►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).

WHAT ARE THE BLUE JETS?

- 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

WHAT IS 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

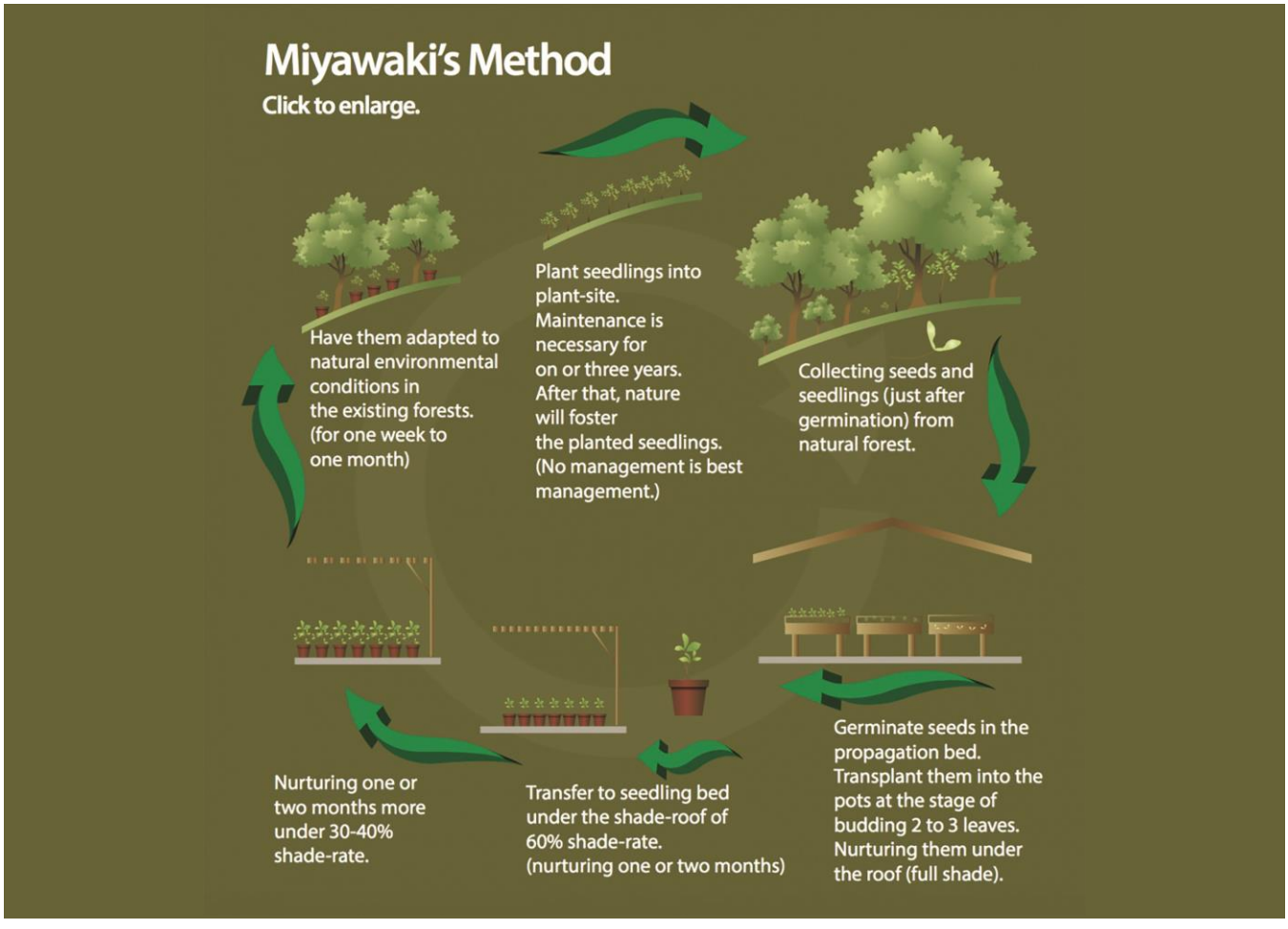
There is no consensus about this. SSWs are natural fluctuations in the atmosphere and are not caused by climate change.

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

The blue tide phenomenon was observed in several stretches of Maharashtra coast – such as in the 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 bio-luminescence. 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 night time 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 Bio-Luminescence.

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, Bio-luminescence 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

The '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 period 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 amount 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

On October 2, 2020, the Indian Navy along with Greater Vishakhapatnam Municipal Corporation had undertaken Aerial Seeding in Vishakhapatnam. The initiative is aimed to increase green cover in and around Vishakhapatnam.

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

The 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.

WHAT ARE 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 permafrost 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.

►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.

THE LOSS OF OXYGEN IN THE OCEAN HAS TWO MAJOR CAUSES

- **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 very low oxygen concentrations are expanding and new regions are exhibiting low oxygen conditions.

►PEATLAND

- Peats are **a heterogeneous mixture of plant material** (vascular plants, mosses and humus) that had accumulated in a water-saturated area and are only partially decomposed due to absence of oxygen.
- The **natural areas covered by peat are called peatlands.**
- Various types of peat are – swamp forests, fens, bogs or mires.
- They form where climate, bedrock and relief create an **area with permanent water saturation** i.e. either in shallow water over layers of lake sediments (called territorialisation) or directly on mineral soil (called palaudification).
- They are **mostly found in permafrost regions** towards the poles and at high altitudes, in coastal areas, beneath tropical rainforest and in boreal forests.
- Other countries with largest peatland areas are – Russia, Canada, Indonesia, USA, Finland etc.

►EXTINCTION REBELLION

Extinction Rebellion (abbreviated as XR) is a global environmental movement that has three main demands:

- The government must declare a climate "emergency"
- The UK must legally commit to reducing carbon emissions to net zero by 2025
- A citizens' assembly must be formed to "oversee the changes"

►RED MUD

- It is produced during the Bayer Process for alumina production. It is the 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.

SECTION 8

POLLUTION AND ITS CONTROL

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, SO2.
- Particulate matter in the air accelerates formation of oxides of sulphur catalyses the process of oxidation.

SOURCES OF SO2 POLLUTION

- Burning of fossil fuels such as coal, oil and natural gas are the main source of SO2 emissions.
- Volcanic eruptions are also a major source of SO2 emissions.
- Hydrogen sulphide, released from biological decay, reacts with O2 in the atmosphere to produce SO2.

HARMFUL EFFECTS OF SO2

- SO2 is a poisonous gas known to cause respiratory diseases such as asthma, bronchitis, emphysema in human beings, irritation to the eyes.
- High concentration of SO2 leads to stiffness of flower buds.
- SO2 is responsible for acid rain.
- SO2 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 programmes 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 programme 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; and
- Track progress and share experiences and best practices through an international network supported by the BreatheLife campaign.

►CLEAN AIR-INDIA INITIATIVE

Recently, the clean Air-India initiative was launched in Delhi by Prime Minister of Netherlands.

THE CLEAN AIR INDIA INITIATIVE IS A COLLABORATIVE PROJECT BETWEEN

- **Get in the Ring** (a platform for start-ups by the government of the Netherlands),
- **Start-up India** and
- **INDUS Forum** (an online matchmaking platform of Indian and Dutch businesses).

AIM

- To curb air pollution in Indian cities by **promoting partnerships between Indian start-ups and Dutch companies** and build a network of entrepreneurs working on business solutions for cleaner air.
- Under the initiative, an **'INDUS impact'** projects is also present which aims to **halt the hazardous burning of paddy stubble** by promoting business partnerships that "up cycle" it.
- This entails **using paddy straw as feedstock** to make materials that would find use in construction and packaging.

►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, i**ncluding India**.
- Core partners are the International Energy Agency, Sustainable Energy for All, the SEforAll Energy Efficiency Accelerators and Hub, the UN Environment Programme, the European Bank for Reconstruction and Development, the Global Environment Facility, and the 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's 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 so mobility helps check climate change and pollution

WATER POLLUTION

►BIOCHEMICAL OXYGEN DEMAND (BOD)

- 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 Programme' (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 programme 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 programme has been initiated for major urban centers of Haridwar, Rishikesh, Gharmukteshwar, Mathura-Vrindavan, Kanpur, Allahabad, Varanasi, Patna, Sahibganj, Kolkata and Nabadwip.
- This programme 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

►INDIAN NATIONAL CENTRE FOR OCEAN INFORMATION SERVICES (INCOIS)

INCOIS is a unit of the **Earth System Science Organization (ESSO),** established as ESSO-INCOIS in 1999 under the Ministry of Earth Sciences (MoES).

OBJECTIVES

To provide the best possible ocean information and advisory services to society, industry, government agencies and the scientific community through sustained ocean observations and constant improvements through systematic and focused research.

MAJOR ACTIVITIES

- **Potential Fishing Zone (PFZ)**: Identify the potential fishing zones to help the fishermen to get better catch.
- **Tsunami Early Warning Centre (TEWS):** To provide important tsunami advisories to the people living in the coastal areas of the country.
- **Ocean State Forecast (OSF):** To predict the surface and sub-surface features of the Indian Ocean in advance to plan and execute commercial activities safely.
- **Ocean Observation Group (OOG):** To measure and monitor the surface temperature and salinity of the upper 2000 meters of the ocean.

►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

- The projects 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.

►COMPOSITE WATER MANAGEMENT INDEX

Recently, **NITI Aayog** released Composite Water Management Index (CWMI).

PURPOSE OF INDEX

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 kilometer.
- 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.

►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

- The 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)

►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.

►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 due to the strong scent of the 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 a 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.

  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.

►RECYCLING OF SHIPS BILL, 2019

- The Union Cabinet has approved the proposal for enactment of Recycling of Ships Bill, 2019 and accession to the Hong Kong International Convention for Safe and Environmentally Sound Recycling of Ships, 2009.

►GETTING TO ZERO COALITION

- 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.

AIMS

- 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.

►NATIONAL GREEN TRIBUNAL (NGT)

- NGT is a **tribunal** set up to address environmental issues.
- It is a **statutory body** established under the **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

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

➔ **It does not deal with Wildlife (Protection) Act,1972**

POLLUTION RELATED CONVENTIONS

►STOCKHOLM CONVENTION

- It is an International treaty and aims to eliminate or restrict the production and use of **Persistent Organic Pollutants (PoPs).**
- India is a party to this treaty.

→ ANNEXES OF THE CONVENTION

The chemicals targeted by the Stockholm Convention are listed in the annexes of the convention.

ANNEX A

Parties must take measures to eliminate the production and use of the chemicals listed under Annex A. Specific exemptions for use or production are listed in the Annex and apply only to Parties that register for them.

ANNEX B

Parties must take measures to restrict the production and use of the chemicals listed under Annex B in light of any applicable acceptable purposes and/or specific exemptions listed in the Annex.

ANNEX C

Parties must take measures to reduce the unintentional releases of chemicals listed under Annex C with the goal of continuing minimization and, where feasible, ultimate elimination.

►PERSISTENT ORGANIC POLLUTANTS (POPS)

- POPs are chemical substances that:
  - i) Persist in the environment,
  - ii) Bio-accumulate through the food web,
  - iii) Pose a risk of causing adverse effects to human health.
- The environment Intergovernmental Forum on Chemical Safety (IFCS) and the International Programme for Chemical Safety (IPCS) prepared a list, known as the **Dirty Dozen**:
  - o **Eight organ chlorine pesticides**: aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex and toxaphene;
  - o **Two industrial chemicals**: hexachlorobenzene (HCB) and the polychlorinated biphenyl (PCB) group;
  - o Two groups of industrial by-products: dioxins and furans.
- **List of POPs can change and evolve over time**.
- There is provision that developed countries provide new and additional financial resources and measures to minimise/regulate POPs to developing nations.

ENDOSULPHAN

- Endosulfan is an **organic chlorine pesticide and a colourless solid** which emerged as a highly controversial agrichemical due to its acute toxicity, endocrine effects, and potential for bio-accumulation.
- Endosulfan is **used as an insecticide** on a variety of **crops**, including many food crops such as teas, grains, fruit, vegetables, and also on non-food crops such as tobacco and cotton. It is also used as wood preservative.
- This chemical is classified among the **worst of POPs** (persistent organic pollutants).
- It is listed in **Annex A of Stockholm convention**

►BASEL CONVENTION

- Formally known as "The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal"
- Aims to **reduce the movements of hazardous waste** between nations and specifically to prevent transfer of hazardous waste from developed to less developed countries.
- The Convention is also intended to:
  - Minimize the amount and toxicity of wastes generated,
  - To ensure their environmentally sound management as closely as possible to the source of generation,
  - To assist Least Developed Countries (LDCs) in environmentally sound management of the hazardous and other wastes they generate.
  - It does not address the movement of radioactive waste.
  - Its objective was to stop dumping of hazardous waste from developed countries in developing nations.

►BASEL BAN AMENDMENT

- The Ban Amendment has become an international law after Croatia became the 97th country to ratify it in September 2019.
- It was adopted by the parties to the Basel Convention in 1995 to protect human health and environment against adverse effects of hazardous wastes.
- It **prohibits all exports of hazardous wastes,** including electronic wastes and obsolete ships from 29 member countries of **OECD to non-OECD countries.**
- Countries like USA, Canada, Japan, Australia, New Zealand, South Korea, Russia, India, Brazil and Mexico have not ratified the ban amendment.
- Basel Action Network is charity organisation
- It will tackle the problem of ***toxic colonialism*** where in rich countries dump their toxic waste to poor countries.

►TRIPPLE COP TO BRS CONVENTIONS 2019

The "Triple COPs" meeting is taking place in Geneva, Switzerland in May 2019.

- Basel Convention (COP-14)
- Rotterdam Convention (COP-9)
- Stockholm Convention (COP-9)

OUTCOMES OF THE RECENT MEETING

Basel Convention

- Technical guidelines on e-waste were finalised.
- Inclusion of plastic waste in ***Prior Informed Consent*** procedure.

Stockholm Convention

- Decided to list "Dicofol" in Annex A (Elimination) without any exemption.
- The "PFOA", (Perfluorooctanoic acid) was also listed with some exemptions in Annex A

Rotterdam Convention

- Two new chemicals named Phorate and HBCD (hexabromocyclododecane) were added in list for mandatory Prior Informed Consent procedure in international trade.

►ROTTERDAM CONVENTION

- Formally called as" Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade"
- Aims to **promote shared responsibilities in relation to import of hazardous chemicals**.
- **What it does?**
  - The convention promotes open exchange of information between importers-exporters of hazardous chemicals.
  - Calls on exporters of hazardous chemicals to use proper labelling, include directions on safe handling, and inform purchasers of any known restrictions or bans.
  - Signatory nations can decide whether to allow or ban the importation of chemicals listed in the treaty.
  - Exporting countries are obliged to make sure that producers within their jurisdiction comply.
  - Convention has a list of substances which can change and evolve over time.

►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.

►FOURTH SESSION OF UNITED NATIONS ENVIRONMENT ASSEMBLY IN 2019

THEME: "Innovative Solutions for environmental challenges and sustainable production and consumption"

India piloted resolutions on two important global environment issues relating to -

- Single-use Plastics
- **Sustainable Nitrogen management,**

Both resolutions was adopted with consensus. The final declaration committed to reducing single-use plastic products by 2030.

The global nitrogen use efficiency is low, resulting in pollution by reactive nitrogen which threatens human health, eco system services, contributes to climate change and stratospheric ozone depletion. Only a small proportion of the plastics produced globally are recycled with most of it damaging the environment and aquatic bio-diversity. **Resolutions piloted by India are vital first steps towards addressing these issues and attracting focus of the global community.**

►INDIAN NITROGEN ASSESSMENT (INI)

- 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.**

►COMMON POLLUTANTS, SOURCE AND THEIR HEALTH EFFECTS

	POLLUTANTS	SOURCES	HEALTH EFFECTS	OTHER RELATED INFORMATION
1.	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.
2.	Cadmium	Used in Ni-Cd batteries, colouration of plastics and various discarded electronic products	Itailtai Disease (Softening of bones and causes kidney stones)	Western U.P is most affected by Cadmium poisoning in India.
3.	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.

4.	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
5.	Coal Dust	Coal mines, heavy industry	Pneumoconiosis also known as black lung disease.	Chhattisgarh, Odisha, Jharkhand, West Bengal
6.	Silica	Sand blasting, ship breaking industry	Silico - tuberculosis	Alang in Gujarat is worst affected, Rajasthan, U.P, Bihar, Chhattisgarh, Jharkhand, Odisha, West Bengal
6.	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
7.	Arsenic	Ground water contamination	Causes skin cancer, cancer of lungs, affects kidney and in rare cases is linked to diabetes	Ganga Brahmaputra fluvial plains
8.	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.

►COMMON COMPOUNDS, SOURCE AND THEIR HEALTH EFFECTS

	COMPOUNDS	SOURCES	HEALTH EFFECTS	OTHER RELATED INFORMATION
1.	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.	
2.	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
3.	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
4.	Aflatoxins	Produced by mould where cereals and oilseeds are mishandled	Carcinogenic and poisonous	ICRISAT has made peanuts free of aflatoxins
5.	Radon	Naturally occurring radioactive gas	Lung cancer	It has spread across few areas of Bangalore
6.	PM 2.5	Vehicular emission	Affects functioning of	

			lung, chronic cough, asthma and heart disease	
7.	PM 10	Vehicular emission	Affects functioning of lung, chronic cough, asthma and heart disease	
8.	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.	
9.	Endosulphan	Sprayed as a pesticide on crop such as tea, paddy, cashew, etc	Causes dysfunctioning of endocrine glands and affects DNA strands in human beings. It causes mental and physical and physical disorders.	Kerala farmers have faced severe toxicity from Endosulphan pollution sprayed on cashew plants. It is banned under Stockholm Convention on Persistent Organic Pollutant
10	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 a number of 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 also 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

►PERFORM, ACHIEVE AND TRADE (PAT)

Refer page no. 70

►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 programmes have been developed i.e. Bachat Lamp Yojana (BLY) and Super-Efficient Equipment Programme (SEEP).

→ 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 programme.
- In the next phase of BLY, BEE will promote use of LED lights using the institutional structure of BLY Programme.

→SUPER-EFFICIENT EQUIPMENT PROGRAMME (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.

►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 Programmes

►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 also helps in arranging finances for energy efficiency projects by providing a savings guarantee, risk management in the implementation of the energy efficiency projects and also 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 got registered under the companies Act, 1956 in 2009.
- **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.

►INDIA'S FIRST EVER BIO-JET FUEL FLIGHT

Recently, 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% bio fuel 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.

►GREEN BONDS

Green bonds of **huge amounts from India are stuck** because of rising interest rates and global uncertainties.

- Green bonds are **debt instruments** like normal bonds.
- But the **proceeds are used for renewable energy projects**, or for services that are ecologically sustainable.
- The bond is **voluntary** and may be issued by a financial institution, the government or even a company to raise funds for a defined period.

INDIAN GREEN BOND MARKET

- India **entered the green bond market in 2015**.
- **YES Bank issued the first green bond** for financing the renewable and clean energy projects particularly, for wind and solar.
- **BSE** launched the Green Index called **Greenex, carbon-efficient live index.**

►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 commonly 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, that 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 (H2), carbon monoxide (CO) and carbon dioxide (CO2).
- The by-products of coal gasification include coke, coal tar, sulfur, ammonia and fly ash, all having their own potential uses.
- CO2 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.

SECTION 9

PROTECTED AREAS & WILD LIFE

►RAMSAR WETLANDS SITES IN INDIA

	RAMSAR SITE	LOCATION	DESCRIPTION
1	Chandertal Land (Freshwater)	Himachal Pradesh	• Situated in Spiti part of Lahul & Spiti at **Samudra Tapu Plateau** which overlooks Chandra river. • It is high altitude lake on the upper Chandra valley near the Kunzam pass joining the Himalayan and Pir Panjal ranges. • It supports **IUCN Red Listed Snow Leopard** and many other species.
2	Pong Dam Lake (Freshwater) (Reservoir)	Himachal Pradesh	• 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 (Freshwater) (Natural)	Himachal Pradesh	• 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 (Brackish Water) (Natural Lagoon)	Orissa	• 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 (Mangrove Swamps)	Orissa	• 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 (Freshwater) (Natural)	Assam	• A permanent freshwater lake in a former channel of the Brahmaputra river. • 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 waste water and 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" (RIS)
8	Sundarbans Wetland	West Bengal	• 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 (Freshwater) (Man-Made)	Punjab	• 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 (Man-Made reservoir) (Freshwater)	Punjab	• 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 (Freshwater Lake) (Manmade)	Punjab	• 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 (Freshwater Swamps) (Manmade)	Rajasthan	• 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 Paspalumdistichum 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 (Saline) (Natural)	Rajasthan	• 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 (Freshwater) (Natural)	Andhra Pradesh	• 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 (Freshwater) (Natural)	Manipur	• 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 (Freshwater) (Natural)	Gujarat	• 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 and Bird Sanctuary (Coastal Swamps and salt pans)	Tamil Nadu	• 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 (Freshwater lake) (Natural)	Kerala	• 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 (Natural) (Brackish)	Kerala	• 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 (Brackish)(Natural)	Kerala	An extensive estuarine system, the second largest in Kerala State. The site supports a number of mangrove species.
21	Surinsar-Mansar Lakes (freshwater) (Natural)	Jammu & Kashmir	• 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 (Freshwater) (Natural)	Jammu & Kashmir	• The largest freshwater lake in India with extensive marshes of emergent and floating vegetation, particularly water chestnut, that provide an important source of revenue for the State Government and fodder for domestic livestock. • Fed by Jhelum river.
23	Hokera Wetland (natural) (Freshwater)	Jammu and Kashmir	Located at the northwest Himalayan biogeopgraphic province of Kashmir, back of the snow-draped Pir Panchal.
24	Tsomoriri (Freshwater to brackish)	Jammu & Kashmir	• 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 (Freshwater) (Man-made)	Madhya Pradesh	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 (Freshwater) (Riverstretch)	Uttar Pradesh	• 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.

	(freshwater)		
27	RudraSagar Lake (Freshwater) (Natural)	Tripura	A lowland sedimentation reservoir in the northeast hills, fed by three perennial streams discharging to the River Gomti.

12 NEW RAMSAR SITES HAVE BEEN DECLARED

1	Nandur Madhameshwar (Manmade)(Freshwater)	Maharashtra	• First Ramsar site in Maharashtra • It has been 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.
2	Saman Bird Sanctuary (Natural) (Freshwater)	Uttar Pradesh	• Seasonal oxbow lake on the Ganges floodplain. • Host over 1% of the South Asian population of graylag goose during winter.
3	Nawabganj Bird Sanctuary (Natural) (Freshwater)	Uttar Pradesh	• Shallow wetland fed by monsoon rain and Sarda canal. • Known to host Siberian cranes during winter.
4	Samaspur Bird Sanctuary (Natural) (Freshwater)	Uttar Pradesh	• Perennial lowland marsh typical of the Indo-Gangetic Plains • It 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.
5	Sandi Bird Sanctuary (Natural) (Freshwater)	Uttar Pradesh	• 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.
6	Parvati Arga Bird Sanctuary (Freshwater)(Natural)	Uttar Pradesh	• 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.
7	Sarsai Nawar Jheel (Freshwater)(Natural)	Uttar Pradesh	• 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.
8	Beas Conservation Reserve	Punjab	• It is a 185-kilometre stretch of the Beas River majorly in Punjab. • Hosts the only known population in India of the endangered Indus

	(Natural) (Freshwater)		river dolphin. • Other Important species: endangered mahseer and hog deer as well as the vulnerable smooth coated otter. • Here a programme was initiated to re-introduce the critically endangered gharial.
9	Nangal Wildlife Sanctuary (Manmade) (Freshwater)	Punjab	• 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.
10	Keshopur-Miani Community Reserve (Natural)(Freshwater)	Punjab	• 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
11	Tso Kar Wetland Complex (Natural)(Mix- One lake saline, one freshwater)	UT of Ladakh	• The 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. The Tso Kar lake is a hypersaline lake of 1800 hectares. • Most important breeding areas of the **Black necked Cranes** in India.
12	Lonar Lake (Saline) (Created by meteorite impact)	Maharas-htra	• 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.
13	Sur Sarovar (Freshwater) (Man-made)	Uttar Pradesh	• 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.
14	Asan Conservation reserve (Freshwater) (Natural)	Uttarakha nd	• 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.
15	Kabartal Wetland (Freshwater) (Natural)	Bihar	• 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 (Sarcogyps calvus), white-rumped vulture (Gyps bengalensis) and Indian vulture (Gyps indicus) – and two waterbirds, the sociable lapwing (Vanellus gregarius) and Baer's pochard (Aythya baeri).

►PROTECTED AREAS IN NEWS

➔ **MANSAR LAKE** is located in Jammu. It has been designated as Ramsar convention site in 2005. It is a freshwater lake. It is a natural lake and fishing is the major activity.

➔ **WULHAR LAKE:** The Wulhar Lake is the largest freshwater lake of India located in Kashmir. It was formed due to tectonic forces. The Tulbul Project was begun in this lake. The project was begun in 1984 and was stopped in 1987 as Pakistan raised concerns that the project violated Indus Waters Treaty.

➔ **DAL LAKE** is located in Sri Nagar. It is also a freshwater lake. It holds the Char Chinar and the Nami Islands.

➔ ULSOOR LAKE

Ulsoor Lake' or Halasuru Lake is one of the biggest lakes in Bangalore, located on the eastern side of the city.

The southern bench of the National Green Tribunal (NGT) has directed the constitution of a joint committee to take samples of water from Bengaluru's Ulsoor lake and neighbouring areas to ascertain whether the lake is being polluted due to illegal activity and tasked the panel with also carrying out an analysis of the water in the lake.

➔ SAMBHAR LAKE

A large saline lake fed by four streams set in a shallow wetland and subject to seasonal fluctuations. It is surrounded by sand flats and dry thorn scrub and fed by seasonal rivers and streams.

The site is important for a variety of wintering waterbirds, including large numbers of flamingos. Human activities consist of salt production and livestock grazing.

➔ PANNA TIGER RESERVE

The UNESCO has described the National Park as a critical tiger habitat and has also pointed out that it is home to World Heritage site of Khajuraho temples.

The UNESCO, under its Man and Biosphere programme has included Panna Biosphere region as one of its Biosphere Reserve. Panna National park was included as biosphere reserve by the Union Ministry of Environment and Forest. It is also a Tiger Reserve. It is spread over 4,300 hectares.

The Controversial Ken-Betwa River Linking Project will inundate around 400 hectares of the Panna National Park.

The river linking project involves the construction of Daudhan Dam across river Ken as well.

➔ NAGARHOLE NATIONAL PARK

Also known as Rajiv Gandhi National Park, located in Kodagu and Mysore district in Karnataka.

Declared as a Project Tiger reserve in 1999 and is also a notified Core/Critical Tiger habitat under the Wildlife (Protection) Act, 1972.

Forms an integral part of the Nilgiri Biosphere Reserve in addition to Mudumalai Wildlife Sanctuary, Wayanad Wildlife Sanctuary, Bandipur National Park, Mukurthi National Park and Silent Valley National Park and Sathya Mangalam National Park (Wildlife corridor between western and Eastern Ghats).

It is located to the north-west of Bandipur National Park and the Kabani reservoir separates the two park.

Forest: The major forests can broadly be classified into Southern Tropical Semi-evergreen forests.

It is one of the high-density tiger landscapes recognized by the Global Tiger Initiative for conservation of Tiger and is one of the richest

	Wildlife areas noted for seven large species such as Chital, Sambar, Chow Singha, Gaur, Muntjac, Wild Pig and Elephants. It supports very high density of Asian Elephants. **Important tribes -** Jenu Kurubas, Betta Kurubas, Yeravas, Soligas among others.
➔ RANTHAMBORE NATIONAL PARK It is located in Rajasthan. It was declared one of the Project Tiger reserves in 1973. The National Park hosts deciduous forests and wildlife such as Indian Leopard, Bengal Tiger, wild boar, sloth bear, mugger crocodile, etc. The park is bounded by Chambal river in the south and Banas river in the north.	**➔ RAJAJI NATIONAL PARK** It is an Indian national park and tiger reserve that encompasses the Shivaliks, near the foothills of the Himalayas. It is spread over 820 km2., and three districts of Uttarakhand: Haridwar, Dehradun and Pauri Garhwal. In 1983, three wildlife sanctuaries in the area namely, Chilla, Motichur and Rajaji sanctuaries were merged into one. Rajaji National Park has been named after C. Rajagopalachari (Rajaji), a prominent leader of the Freedom Struggle, the second and last Governor-General of independent India and one of the first recipients of India's highest civilian award Bharat Ratna (in 1954).
➔ DZUKO VALLEY The Dzüko Valley is a valley located at the borders of the states of Nagaland and Manipur in Northeast India. This valley is well known for its natural environment, seasonal flowers and flora & fauna. ➔ The Asian Highway 1 and also the NH-2 passes through its foothills. The nearest airport is Dimapur Airport at Dimapur near the Assam border about 96 kilometres (60 miles) away from Viswema while the Bir Tikendrajit International Airport is located about 120 kilometres (75 miles) south of Viswema	
➔ POBITORA WILDLIFE SANCTUARY It is a wildlife sanctuary on the southern bank of the Brahmaputra in Morigaon district in Assam, India. The natural boundary of the Pobitara wildlife sanctuary is the Garanga Beel on the south and the river Brahmaputra on the North, rest of the boundary are artificial and surrounded by 27 villages. Significantly, the PA is free from human habitation. It has higher density of one-horned rhinoceros than Kaziranga. Kaziranga has highest number of one-horned rhinoceros.	**➔ DESERT NATIONAL PARK** Desert National Park, Rajasthan, India, is situated in the west Indian state of Rajasthan near the towns of Jaisalmer and Barmer. This is one of the largest national parks, covering an area of 3162 km². The Desert National Park is an excellent example of the ecosystem of the Thar Desert. Sand dunes form around 20% of the Park. The major landform consists of craggy rocks and compact salt lake bottoms, intermedial areas

➔ WORLD HIGHEST RAILWAY BRIDGE IN RAESI

The construction of the arch of the world's highest railway bridge that soars 359 metres above the bed of the Chenab river in Jammu and Kashmir was completed today, with the Northern Railways zone of Indian Railways terming the achievement a milestone.

The 1.3-kilometre-long bridge aims to boost connectivity to the Kashmir Valley and it is being constructed at a cost of ₹1,486 crore as part of the Udhampur-Srinagar-Baramulla Railway Link (USBRL) project.

and fixed dunes.

Despite a fragile ecosystem, there is an abundance of birdlife.

The region is a haven for migratory and resident birds of the desert. Many eagles, harriers, falcons, buzzards, kestrel and vultures are spotted here. Short-toed eagles, tawny eagles, spotted eagles, laggar falcons and kestrels are the most common among these. Sand grouse are spotted near small ponds or lakes.

The endangered great Indian bustard is a magnificent bird found in relatively fair numbers. It migrates locally in different seasons. The most suitable time to visit the area is between November and January.

The Desert National Park has a collection of fossils of animals and plants which is 180 million years old. Some fossils of dinosaurs which are 60 million years old have been found in the area.

➔ THE UJH MULTIPURPOSE PROJECT HAS BEEN REVIVED AFTER 5 DECADES

The Ujh project is a multipurpose (Hydropower, Irrigation and Drinking) River valley scheme and is first of its kind in Jammu and Kashmir State. The proposed project is on the River Ujh, which is one of the main tributary of River Ravi.

➔ THE SHAHPUR KANDI IRRIGATION PROJECT WAS RECENTLY REVIVED

The Shahpurkandi Dam project is located on the Ravi River in Pathankot district, Punjab, India, downstream from the existing Ranjit Sagar Dam. The power houses will be constructed on Hydel Channel, which is downstream from Shahpurkandi Dam.

►WILD LIFE

➔ SNOW LEOPARD

It is a **Schedule I animal under Wildlife Protection Act** of India.

It is listed as **"Vulnerable"** by the International Union for Conservation of Nature.

They are listed under Appendix I of CITES.

The animal faces many threats to its existence due to poaching and habitat destruction.

In India, it inhabits the Himalayas at elevations ranging from 3,000 to 4,500 metres across **Jammu and Kashmir, Ladakh, Himachal Pradesh, Uttarakhand, Sikkim, and**

➔ TURTLES

In India, the **Green Turtle and Hawksbill turtles are listed under Schedule I** of the Wildlife Protection Act, 1972.

Turtles are also protected under the Biodiversity Conservation and Ganga Rejuvenation programme.

India has five species of turtles. They are Olive Ridley, Loggerhead, Leatherback, Green Turtle, Hawksbill.

The turtle population in Red Sea is turning female due to rise in sea temperature.

Arunachal Pradesh.

- This area contributes to about five per cent of the global snow leopard range.
- In Uttarakhand, snow leopards are found in Nanda Devi Biosphere Reserve, Gangotri National Park, Askot Wildlife Sanctuary and other places of altitude between 3000-4500 meters in total geographical area of around 13,000 square kilometres.

Snow leopards are found in 12 countries—including China, Bhutan, Nepal, India, Pakistan, Afghanistan, Russia, and Mongolia

➔ HIMALAYAN BROWN BEER

The brown bears prey on grasses, plants, roots, mammals such as goat and sheep. They are Top Carnivores and thus, they help to keep a balance in an ecosystem.

Conservation Status

They are categorised as "Critically Endangered" by the IUCN Red list of Threatened Species in Himalayas and Hindukush. In the rest of the world, the brown bear is categorised as "Least Concern" by the IUCN.

International trade of brown bear is prohibited under wildlife Protection Act.

Distribution of Brown Bear in India

The brown bear is found in 23 protected areas in the Himachal Pradesh, Uttarakhand and Jammu and Kashmir.

TOP CARNIVORES

The top carnivores are those animals that are in the top of the pyramid. They prey on other organisms and are not preyed on. They are important in maintaining and regulating the ecosystems. They help to balance the ecosystem by making sure, no single creature dominate an ecosystem. If the population of top carnivores declin the entire ecosystem will collapse soon.

➔ GIANT SQUIRRELS

India is home to three giant squirrel species namely Grizzled Giant Squirrel, Indian Giant Squirrel and the Malayan Giant Squirrel.

The animal is native to the Indomalayan region, which spreads across the South and South-East Asia.

In India, the species is spotted at higher numbers at the Kaziranga National Park in the state of Assam and parts of North-East India.

The Giant squirrels are characterized by dark upper body, pale under body and long bushy tails.

They are diurnal, herbivorous and arboreal. Animals and Birds active in day are diurnal. The animals and birds active during night are called nocturnal. Arboreal is tree dwelling.

As per a recent study conducted by Zoological Survey of India, this species of squirrel may become extinct, if proper conservatory measures are not taken.

➔ RED PANDA

Range: The red panda is a mammal native to the eastern Himalayas and southwestern China. **India has both species of Red Panda, with the Siang river acting as a Genetic divide between Himalayan Red Panda and Chinese Red Panda.**

Conservation status: It is listed as Endangered on the IUCN Red List.It is also enlisted in schedule 1 of Wildlife protection Act, 1972 which giver this species highest level of protection in India.

Main threats: Habitat loss and fragmentation, poaching, and inbreeding depression.

➔ DOLPHINS IN INDIA

Dolphins are aquatic mammals; belonging to Order Cetacea. *Cetus* means a whale or a huge fish. There are around 90 living species in Cetacea divided into two groups.

- First group comprises toothed animals such as dolphins, killer whales; porpoise; sperm whale; beaked whale,

➔ FISHING CAT

Range: It is a globally endangered species that is elusive and found in very few places in south and south-east Asia.

Speciality: Wild cat species usually hunt on ground. But the fishing cat hunts in water. It has specialised

narwhal.

- The second group comprises the whales which have filter feeder system. This group comprises blue whale and some other animals.

Thus, dolphins are **toothed marine mammals**. They have curved mouth that gives them a permanent smile. They vary in size from 5ft to 30ft. The food of dolphins is fish and squid. Dolphins use echolocation (the built in Sonar in dolphins) to locate their prey. At the same time, they also sometimes follow fishing boats, other whales, and birds to find their prey. Since they are marine Mammals; they are warm blooded animals.

Dolphins are considered to be highly social mammals which communicate with squeaks, whistles and clicks. They are also very playful and communicative.

Which dolphins are found in India?

The dolphins found in Indian subcontinent are South Asian river dolphins. Their zoological name is Platanista gangetica. They are freshwater dolphins divided into two subspecies.

- First is Ganges River Dolphin (*Platanista gangetica gangetica*): This is found in Ganges and Brahamputra rivers and their tributaries in India, Nepal and Bangladesh. It is endangered and around 3500 individuals are alive as of now.
- Second is Indus river dolphin (*Platanista gangetica minor*). It is found mainly in Indus river in Pakistan and some parts of Beas river in India also. It is also endangered and around 1500 individuals are alive currently.

Apart from that, Satpada of Chilika lake is the home of Irrawaddy dolphins in India. It is located in the state of Odisha.

features like partially webbed feet and water-resistant fur that helps it to thrive in wetlands.

The fishing cat is nocturnal and apart from fish also preys on frogs, crustaceans, snakes, birds, and scavenges on carcasses of larger animals.

It is capable of breeding all year round but in India its peak breeding season is known to be between March and May.

Protection status: The fishing cat is listed as Endangered on the IUCN Red List. The Convention on International Trade in Endangered Species (CITES) lists the fishing cat on Appendix II part of Article IV of CITES, which governs international trade in this species. In India, the fishing cat is included in Schedule I of the Indian Wildlife (Protection) Act, 1972 and thereby protected from hunting.

➔ SMOOTH COATED OTTER

Range: It is an otter species occurring in most of the Indian subcontinent and Southeast Asia, with a disjunct population in Iraq. As its name indicates, the fur of this species is smoother and shorter than that of other otter species.These otters have generally been described as fish specialist. They are strong swimmers and hunt in groups.

Distribution: It is distributed throughout the country from the Himalayas and to the south in India. It is sympatric with other otter species in the Western Ghats and the northeast India.

Smooth-coated otters are found in areas where freshwater is plentiful, preferring shallow and placid waters— wetlands and seasonal swamps, rivers, lakes, and rice paddies.

Protection status: Listed as Vulnerable on the IUCN Red List.

➔ OLIVE RIDLEY TURTLES

Range: It is found in warm and tropical waters, primarily in the Pacific and Indian Oceans, but also in the warm waters of the Atlantic Ocean.

Thus, olive ridley turtle has a circumtropical distribution, living in tropical and warm waters of the Pacific and Indian Oceans from India, Arabia, Japan, and Micronesia south to southern Africa, Australia, and New Zealand.

Mass Nesting Phenomenon

- Olive ridley turtles are best known for their behaviour of synchronized nesting in mass numbers, termed arribadas.
- Females return to the same beach from where they

➔ THE GREAT INDIAN BUSTARD OR INDIAN BUSTARD

It is found on the Indian subcontinent.

Morphology - A large bird with a horizontal body and long bare legs, giving it an ostrich like appearance, this bird is among the heaviest of the flying birds.

Range - Once common on the dry plains of the Indian subcontinent, as few as 150 individuals were estimated to survive in 2018 (reduced from an estimated 250 individuals in 2011).

Conservation status

- This species is critically endangered
- It is protected under Wildlife Protection Act 1972 of

hatched, to lay their eggs.

- They lay their eggs in conical nests about one and a half feet deep, which they laboriously dig with their hind flippers.
- In the Indian Ocean, the majority of olive ridleys nest in two or three large groups near Gahirmatha in Odisha.
- The coast of Odisha in India is one the largest mass nesting site for the olive ridley, along with the coasts of Mexico and Costa Rica.

CONSERVATION STATUS

- **IUCN:** Vulnerable
- **CITES:** It is listed in Appendix I of CITES**;**
- **India:** Enlisted in schedule 1 of Wildlife protection Act, 1972 which giver this species highest level of protection in India.

THREATS

- **Predators of eggs:** Known predators of olive ridley eggs include raccoons, coyotes, feral dogs and pigs, opossums, coatimundi, caimans, ghost crabs, and the sunbeam snake.
- **Predators of Hatchlings:** Known predators are preyed upon as they travel across the beach to the water by vultures, frigate birds, crabs, raccoons, coyotes, iguanas, and snakes.
- **Anthropogenic:** Other major threats include mortality associated with boat collisions, and incidental takes in fisheries. Trawling, gill nets, ghost nests, longline fishing, and pot fishing have significantly affected olive ridley populations, as well as other species of marine turtles**.**

To reduce accidental killing in India, the Orissa government has made it mandatory for trawls to use Turtle Excluder Devices (TEDs), a net specially designed with an exit cover which allows the turtles to escape while retaining the catch.

India.

Threats

- Main threats include hunting and loss of its habitat, which consists of large expanses of dry grassland and scrub
- Alleged hunting of GIB in Pakistan is believed to be one of the reasons for the plummeting numbers of the bird species.

What currently is the threat to GIB?

- A report by the Ministry, submitted to the National Green Tribunal in 2019, pointed out that **power lines, especially high-voltage transmission lines** with **multiple overhead wires**, are the most important current threat for GIBs in the
- Thar region, and are causing unsustainably high mortality in about 15% of their population.

What are these Diverters?

- "Firefly bird diverters are flaps installed on power lines. They work as reflectors for bird species like the GIB. Birds can spot them from a distance of about 50 meters and change their path of flight to avoid collision with power lines. Smaller birds can change their direction [swiftly] but for larger bird species, it is difficult because their body weight and other factors.
- The diverters are called fireflies because they look like fireflies from a distance, shining on power lines in the night.

➔ THE NICOBAR LONG-TAILED MACAQUE

Also popularly known as the Nicobar monkey.

Peculiar trait: The Nicobar long-tailed macaque is a frugivore, with its principal diet consisting of fruits and nuts.

Range: This primate is found on three of the Nicobar Islands—Great Nicobar, Little Nicobar and Katchal—in biome regions consisting of tropical and subtropical moist broadleaf forests.

➔ INDIAN GAUR

The gaur, also called the Indian bison, is native to South and Southeast Asia and has been listed as Vulnerable on the IUCN Red List since 1986.

The global population has been estimated at maximum 21,000 mature individuals by 2016. It declined by more than 70% during the last three generations, and is extinct in Sri Lanka and probably also in Bangladesh.

In well-protected areas, it is stable and increasing.

A leucistic Indian gaur has become the latest animal in the Nilgiris to have been recorded with the rare genetic condition.

Over the last few years, **leucism** — a condition which causes partial loss of pigmentation and manifests itself

in a change in the skin pattern of the animal — has been recorded in two tigers, a Sambar deer, and even a three-striped palm squirrel in the Nilgiris.

➔ FLAMINGOES

Flamingos usually stand on one leg while the other is tucked beneath their bodies.

Flamingos are capable flyers.

Flamingos filter-feed on brine shrimp and blue-green algae as well as insect larvae, small insects, mollusks and crustaceans making them omnivores.

Their bills are specially adapted to separate mud and silt from the food they eat, and are uniquely used upside-down.

The filtering of food items is assisted by hairy structures called lamellae, which line the mandibles, and the large, rough-surfaced tongue.

The pink or reddish color of flamingos comes from carotenoids in their diet of animal and plant plankton

➔ THE BARN OWLS

The barn owl (Tyto alba) is the most widely distributed species of owl in the world and one of the most widespread of all species of birds.

It is also known as the common barn owl, to distinguish it from the other species in its family, Tytonidae, which forms one of the two main lineages of living owls, the other being the typical owls (Strigidae).

The barn owl is found almost everywhere in the world except for the polar and desert regions, Asia north of the Himalayas, most of Indonesia, and some Pacific islands.

➔ SEA GRASSES

Seagrasses are flowering plants that grow **submerged in shallow marine waters like bays and lagoons** found in many parts of the world, from the tropics to the Arctic Circle.

They have roots, stems and leaves, and **produce flowers and seeds**.

Importance of Seagrasses

- They are considered to be **'Ecosystem Engineers'** which help maintain water quality and trap fine sediments and suspended particles in the water column and increase water clarity.
- Seagrasses **sequester up to 11% of the organic carbon buried in the ocean** and can capture carbon from the atmosphere up to 35 times faster than tropical rainforests.

➔ FOREST OWLET (IUCN STATUS: ENDANGERED)

Endemic to India, occurring in central and north-western ghats of India and Southern Madhya Pradesh (Along the Satpura range). Mainly found in Melghat Tiger Reserve (Maharashtra), Yawal Wildlife Sanctuary (Maharashtra), Purna Wildlife Sanctuary.

The bird was rediscovered in 1997

➔ Hoolock Gibbons (IUCN Status: Endangered)

- One species of apes found in India
- Found in North-Eastern India.

➔ HOUBARA BUSTARD

It is a large terrestrial bird found in parts of Asia, the Middle East and Africa. The North African houbara (Chlamydotis undulata) and the Asian houbara (Chlamydotis macqueenii) are separate species. The Asian houbara is related to the critically endangered great Indian bustard native to India.

After breeding in Central Asia during the spring, Asian houbara bustards migrate south to spend the winter in Pakistan, the Arabian peninsula and nearby Southwest Asia. Some Asian houbara bustards live and breed in the southern part of their ranges including parts of Iran, Pakistan and Turkmenistan.

According to the International Fund for Houbara Conservation (IFHC), roughly 42,000 Asian houbara bustards and over 22,000 of the North African houbara bustards remain today. The main reasons for the decline in the species' population are poaching, unregulated hunting and the degradation of its natural habitat, the IFHC website states.

Why is the houbara bustard hunted in Pakistan?

- Vast swathes of land in Pakistan are allocated in blocks to wealthy dignitaries from the UAE, Saudi Arabia and other Gulf countries, who arrive in the country to hunt the birds every year using hunting gear and falcons. They kill the bird for sport and also because its meat is supposed to have aphrodisiac qualities.
- Media coverage is not permitted of these secretive hunting expeditions, but the scale of each hunt is

	believed to be considerable. Each party has a convoy of over a dozen SUVs accompanying it and very often the dignitaries come with their own cooks and staff, locals told the BBC.
➔ DIBRU SAIKHOWA It is a National Park as well as a Biosphere Reserve situated in the south bank of the river Brahmaputra in Assam. The forest type of Dibru-Saikhowa comprises semi-evergreen forests, deciduous forests, littoral and swamp forests and patches of wet evergreen forests. It is the largest swamp forest in north-eastern India. It is an identified Important Bird Area (IBA), notified by the Birdlife International. It is most famous for the rare white-winged wood ducks as well as feral horses. Mammals found in the Park include Tiger, Elephant, Leopard, Jungle Cat, Bears, Small Indian Civet, Squirrels, Gangetic Dolphin, Hoolock Gibbon, etc. Maguri Motapung wetland is a part of the Reserve	**➔ PANGOLINS** • They are anteaters. • It is the only mammal with scales. • It curls itself into a ball hoping that the scales on its body would protect it. • One of the most vulnerable animals to Poaching for its scales. All 8 varieties of pangolins are added in the First Appendix of CITES.
➔ DHOLE (IUCN STATUS: ENDANGERED) They are dog like carnivorous species (Asiatic Wild Dogs). They are highly social animals and live in packs. Endemic to much of Asia. There populations have drastically reduced or vanished from Central or Eastern Asia. India has the largest population of Dholes in the world. Main regions are Western Ghats, Eastern Ghats and North-Eastern States.	**➔ PURPLE FROG (IUCN STATUS: ENDANGERED)** • It is a newly discovered species of frog from the Southern Western Ghats principally from Kerala. • The frog species remains for the most part of its life below the earth. Has been included in EDGE species list. It is also known as Mahabali frog or Maveli Frog.
➔ ASIATIC WILD BUFFALO (IUCN STATUS: ENDANGERED) • State Animal of Chhattisgarh • Found in North-Eastern States and Central India. • The population in Central India has been declining.	**➔ URIAL (IUCN STATUS: VULNERABLE)** • A wild sheep with long legs and relatively small horns • Added to the Convention of Migratory Species. • Found in Central Asia, Ladakh, Spiti Valley. They inhabit moderately arid habitats at an altitude range from below sea level to above 4000 m in the Pamirs, Hindu Kush and Himalayas. They prefer hills and gentle slopes.

►ELEPHANT CORRIDORS

ELEPHANT IN INDIAN CONSERVATION SCHEME

The species is included in the list of protected species according to **the Schedule I of the Indian Wildlife (Protection) Act, 1972** and in the Convention on International Trade in Endangered Species of Flora and Fauna (CITES).

WHAT IS PROJECT ELEPHANT?

- Project Elephant is a Central Government sponsored scheme launched in February 1992.
- Through the Project Elephant scheme, the **government helps in the protection and management of elephants to the states** having wild elephants in a free-ranging population. It ensures **the protection of elephant corridors** and elephant habitat for the survival of the elephant population in the wild.

OBLIGATIONS OF THE CENTRAL GOVT

- The union government provides **technical and financial help** to these states to carry out and achieve the 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 – THE NATIONAL HERITAGE ANIMAL

The government of India in the year 2010 declared Elephant as the national heritage animal of the country on the recommendations of the standing committee of the national board for wildlife. This was done to make sure that sufficient protection to elephants was provided before their numbers fall to panic levels like in the case of tigers.

ELEPHANT RESERVES IN INDIA

As notified by the government, there are around 32 elephant Reserves in India. The very first elephant reserve or elephant sanctuary was the Singhbhum Elephant Reserve of Jharkhand.

MIKE PROGRAMME (CITES PROGRAM)

- MIKE the abbreviation of the Monitoring of Illegal Killing of Elephants program was started in South Asia in 2003 after the conference of parties a resolution of CITES.
- The aim of MIKE was to provide information required by the elephant range countries for proper management and long-term protection of their elephant populations.

THE OBJECTIVES OF THE MIKE PROGRAM IS AS FOLLOWS

- To measure the levels and trends in the illegal poaching and ensure changes in the trends for elephant protection.
- To determine the factors responsible for such changes, and to assess the impact of decisions by the conference of parties to CITES.

►ELEPHANT RESERVES IN INDIA

There are 30 Elephant Reserves (ERs) in the country spread over 15 states.

SL. NO	ELEPHANT RANGE	ELEPHANT RESERVE WITH DATE OF NOTIFICATION	STATE
I	Eastern India (South West Bengal-Jharkhand-Odisha)	1. Mayurjharna ER(24.10.02)	W. Bengal
		2. Singhbhum ER (26.9.01)	Jharkhand
		3. Mayurbhanj ER (29.9.01)	Odisha
		4. Mahanadi ER (20.7.02)	Odisha
		5. Sambalpur ER (27.3.02)	Odisha
		6. Badalkhol-Tamorpingla(15.9.2011)	Chhattisgarh
II	North Brahamputra (Arunachal – Assam)	7. Kameng ER (19.6.02)	Arunachal
		8. Sonitpur ER (6.3.03)	Assam
III	South Brahamputra (Assam- Arunachal)	9. Dihing-Patkai ER (17.4.03)	Assam
		10. South Arunachal ER(29-2-08)	Arunachal
IV	Kaziranga (Assam- Nagaland)	11. Kaziranga – Karbi Anglong ER (17.4.03)	Assam
		12. Dhansiri-Lungding ER (19.4.03)	Assam
		13. Intanki ER (28.2.05)	Nagaland
		14. Singphan ER (16.8.18)	
V	Eastern Dooars	15. Chirang-Ripu ER (7.3.03)	Assam

	(Assam- W. Bengal)	16. Eastern Dooars ER (28.8.02)	W. Bengal
VI	E. Himalayas (Meghalaya)	17. Garo Hills ER (31.10.01)	Meghalaya
VII	Nilgiri –Eastern Ghat (Karnataka- Kerala- Tamilnadu-Andhra)	18. Mysore ER (25.11.02)	Karnataka
		19. Dandeli ER (26.3.15	Karnataka
		20. Wayanad ER (2.4.02)	Kerala
		21. Nilgiri ER (19.9.03)	Tamil nadu
		22. Rayala ER (9.12.03)	Andhra
VIII	South Nilgiri (Kerala- Tamilnadu)	23. Nilambur ER (2.4.02)	Kerala
		24. Coimbatore ER (19.9.03)	Tamilnadu
IX	Western Ghat (Tamilnadu- Kerala)	25. Anamalai ER (19.9.03)	Tamilnadu
		26. Anamudi ER (2.4.02)	Kerala
X	Periyar (Kerala- Tamilnadu)	27. Periyar (2.4.02)	Kerala
		28. Srivilliputtur ER(19.9.03)	Tamilnadu
XI	Northern India (Uttaranchal- U.P.)	29. Shivalik ER (28.10.02)	Uttaranchal
		30. Uttar Pradesh ER (9.9.09)	U.P.

TIGER CONSERVATION

►NATIONAL TIGER CONSERVATION AUTHORITY (NTCA)

- 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 and mitigation, smart patrolling and advisory role in policy formulation.

►PROJECT TIGER

- The **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 the 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
- 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) Programme 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.**
- Conservation Assured | Tiger Standards (CA|TS) scheme provides an incentive to those responsible for tiger conservation areas in the 13 tiger range countries to improve the effectiveness of management.

►4th CYCLE OF NATIONAL TIGER ASSESSMENT OF 2018-19

METHODS USED

- 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.
- Results

Tiger Population in India by year

2006	2010	2014	2018
1411	1706	2266	2967

- **Madhya Pradesh** showed the highest increase of 218 tigers, reaching an estimated 526, followed by Karnataka with 524.
- Madhya Pradesh along with Karnataka rank highest in tiger numbers followed by Uttarakhand.
- Tiger occupancy has increased in the state of Andhra Pradesh while declined in the states of Chhattisgarh and Odisha.
- Tigers were not recorded in Buxa, Dampa and Palamau tiger reserves. These reserves have poor tiger status in earlier assessments as well.
- According to the report, tiger population in country is increasing at the rate of 6% per annum.

  India achieved its commitment to the St Petersburg Declaration, of doubling Tiger Population much in advance to the 2022 deadline.
- No tigers were found in Mizoram and Nagaland.

►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 and serious 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.

►TIGER CORRIDORS IN INDIA

- National Tiger Conservation Authority in collaboration with the 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.
- These are operationalised through a Tiger Conservation Plan, mandated under Wildlife (Protection) Act, 1972.

►ECO-BRIDGES FOR TIGERS

ABOUT THE ECO-BRIDGE

- **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.

►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**

►LIST OF BIOSPHERE RESERVES IN INDIA

BIOSPHERE RESERVES	LOCATION	FLORA	FAUNA	TRIBALS
Nilgiri (Included in MAB list of UNESCO)	Part of Wayanad, Nagarhole, Bandipur and Madumalai, Nilambur, Silent Valley and Siruvani hills in Tamil Nadu, Kerala and Karnataka.	Tropical forest; Mixed mountain and highland systems	Tiger,Elephant,NilgiriTahr, Lion-tailed macaque	Cholanaikans-only surviving hunter-gatherers of the Indian subcontinent
Nanda Devi (Included in MAB list of UNESCO)	Part of Chamoli, Pithoragarh and Almora districts in Uttarakhand.	Herbaceous species and scrub communities such as Rhododendron. Plant species including lichens, fungi, bryophytes and pteridophytes	snow leopard, Himalayan black bear, brown bear , musk deer and bharal/blue sheep ,Asiatic black bear, snow leopard	Bhotia tribe
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, tigers, Red Panda, leopards, elephants and Hoolockgibbons,etc.	Garo (Achikmande), Banias or Hajjons
Manas	Part of Kokrajhar, Bongaigaon, Barpeta, Nalbari, Kamprup and Darang districts in Assam.		Golden Langur, Red Panda	
Sunderban (Included in MAB list of UNESCO)	Part of delta of Ganges &Brahamaputra river system in West Bengal.	Tropical humid forest; Mangroves	Royal Bengal tiger (Pantheratigristigris)	
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, coral reefs	Dugong or Sea Cow, Sea cucumber	Marakeyars, local people mainly engaged in fishing
Great Nicobar (Included in MAB list of	Southernmost island of Andaman and Nicobar	Part of Sundaland Biodiversity Hotspot, Tropical Wet Evergreen	Saltwater Crocodile, Edible-nest swiftlet, Nicobar lion-tailed	Shompen and Nicobarese

UNESCO)	Islands. It incorporates two national parks Campbell Bay National Park and Galathea National Park.	Forests.	macaque, Giant Leatherback sea turtle, Nicobar tree shrew, Nicorbarscrubfowl	
Similipal (Included in MAB list of UNESCO)	Part of Mayurbhanj district in Orissa.	The park derives its name from the 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 Valley districts in Arunachal Pradesh.		Mishmi takin, Red goral, musk deer, red panda, Asiatic Black bear	
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	Gaura, 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 the Neyyar sanctuary in Kerala and the KalakadMundanthurai Tiger Reserve of Tamil Nad...	Tropical Wet Evergreen Forests	NilgiriTahr, 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		Four horned antelope, Indian wild dog ,Saras crane , Asian white-backed vulture, Sacred grove bush frog	

	Bengal. The reserve is also source of three rivers: Narmada, Son and Johila.		,striped Hyaena, , Chital, Wild Bear, Leopard.	
Kachchh	Part of Kachchh, Rajkot, Surendranagar and Patan districts in Gujarat.	Banni Grasslands	Indian Wild Ass, Site for Flamingo breeding (Flamingo City), Chinkara, Caracal, Desert Cat and Desert Fox	Fossil Park at Khadir Bet, Maldhari pastoralists
Cold Desert	Pin Valley National Park and surroundings; Chandratal&Sarchu; and Kibber Wildlife sanctuary in Himachal Pradesh.		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 bul bul.	Tirupati Balaji temple is located here.
Panna (Included in MAB list of UNESCO)	Part of Panna and Chhattarpurdistricts in Madhya Pradesh	Dry deciduous forests of Teak, Salai, Kardhai	Tiger, Chital, Chinkara, Sambharand Sloth bear	Gond, Famous temple of Prannathji of Pranami Sect.

►ST. PETERSBURG DECLARATION

For **doubling tiger population** (India was a party to this declaration) by 2022.

NOTE: TX2 programme was launched by World Wildlife Foundation (WWF) at the 2010 St Petersburg Tiger Summit held in Russia.

TX2 PROGRAMME 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' programme.

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 PROGRAMME

- The **World Wildlife Foundation** had launched its ambitious TX2 programme at the St Petersburg Tiger Summit in **2010.**
- The programme **aims to double the world tiger population by 2022**, which is the **year of the tiger in the Chinese calendar**.

►ALL INDIA TIGER ESTIMATION SURVEY 2018 REPORT RELEASED

The Union Ministry of Environment, Forests and Climate Change has come out with the report of the All India Tiger Estimation Survey 2018, on the eve of the Global Tiger Day celebrated on July 29 every year.

WHAT DOES THE REPORT SAY?

- 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.
- The Corbett Tiger Reserve in Uttarakhand has the 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 and Kawal (Telangana), Nagarjunasagar Sri Sailam (Andhra Pradesh), Sanjay-Dubri (MP), Nameri and Manas (Assam), etc. have tigers below their overall potential and they require resources and targeted management.
- Madhya Pradesh has been found with the highest number of tigers in the country with 526 big cats in the state followed by Karnataka with 524 big cats and Uttarakhand with 442 big cats.
- There are 13 tiger range countries in the world – India, Bangladesh, Bhutan, Cambodia, China, Indonesia, Lao PDR, Malaysia, Myanmar, Nepal, Russia, Thailand and Vietnam. India is ready to take on the leadership role in the tiger conservation efforts around the countries.

►NEW GUIDELINES FOR IMPORT OF EXOTIC SPECIES

HOW IS EXOTIC LIVE SPECIES DEFINED?

Two conditions needs to be satisfied:

- An animal or plant species moved from their original range (location) to a new one.
- The animals named under the Appendices I, II and III of the Convention of International Trade in Endangered Species (CITES) of Wild Fauna and Flora.
- Several exotic species of birds, reptiles, small mammals, fishes and even some plants are imported.

HAS ANYTHING CHANGED REGARDING THE IMPORTS?

- For new "exotic live species", the importer should obtain a no-objection certificate from the Chief Wildlife Warden (CWLW) of the State.
- For existing species, stocks "shall be declared by the owner/ holder (stock, as on 1 January 2020) to the Chief Wildlife Warden (CWLW) of the concerned State or UT".

►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.

SO WHAT ARE THE REASONS BEHIND INCREASING 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

BUT WE HAVE A PROVISION OF DECLARING A SPECIES AS "VERMIN"

- Yes we do have that provision indeed. 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
- **Why is govt 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 have 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. The work to construct these animal bridges is to begin by November or December, 2020.

ABOUT THE ANIMAL BRIDGES

- The 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.

►MAHADAYI / MANDOVI RIVER DISPUTE

*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.

The 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.

►MOBILE APP: KURMA

On May 23, World Turtle Day, a mobile-based application called KURMA, aimed at turtle conservation was launched.

- The application has been developed by the **Indian Turtle Conservation Action Network (ITCAN)** in

collaboration with the **Turtle Survival Alliance-India and Wildlife Conservation Society-India**.

- It not only provides users a database to identify a species but also provides the location of the nearest rescue centre for turtles across the country.
- 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.
- The **Olive Ridley, Leatherback and Loggerhead are listed as 'Vulnerable'** on the IUCN Red List of Threatened Species.
- The **Hawksbill turtle is listed as 'Critically Endangered' and Green Turtle is listed as 'Endangered'** on the IUCN Red List of Threatened Species.
- 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**

►POLL FOR NATIONAL BUTTERFLY IN INDIA

A citizen poll has been organised to choose among 7 butterfly species, the national butterfly.

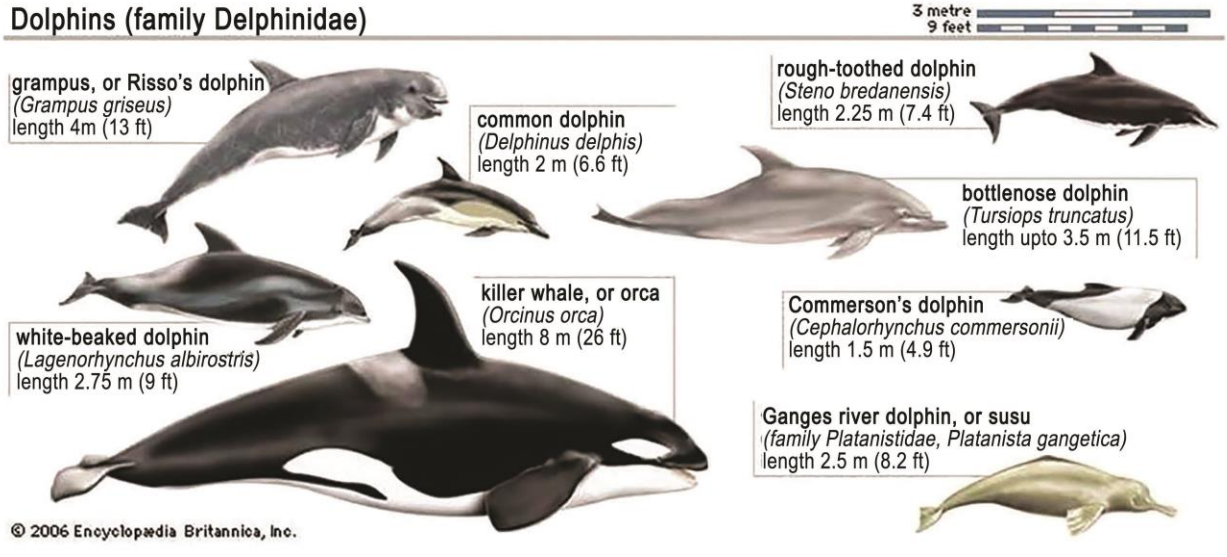
The seven butterflies are:

1. **Indian Jezebel:** Found across the country.
2. **Orange Oakleaf:** Found in Central, Northern and North-eastern India. Blue and Orange in colour.
3. **Common Nawab:** Found all over the country.
4. **Krishna Peacock:**
   - Black in color with beautiful colors.
   - Found in Sikkim, Northern West Bengal and Arunachal Pradesh.
5. **Five-bar Sword Tail:** Found in evergreen forests of Western Ghats, eastern Himalaya and North-East India.
6. **Northern Jungle Queen:** Extraordinarily large size. Traditional weaving patterns of Mishmi communities of Arunachal Pradesh are inspired from this.
7. **Yellow Gorgon:** Bright Yellow in colour. Found in Arunachal Pradesh, Meghalaya and Northern West Bengal and Sikkim.

►PROJECT DOLPHIN

IN NEWS

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 programme.

Also, Supreme court had lifted seven year 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

ORIGINAL GEOGRAPHICAL RANGE

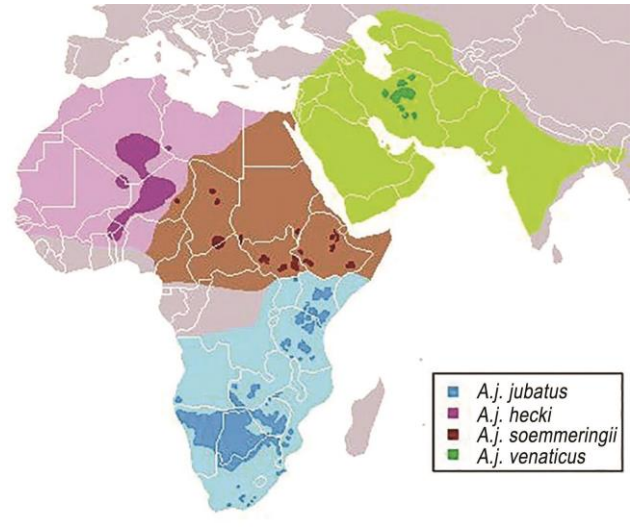


Fig: showing the range of Cheetah

CAUSES WHICH LED TO THE 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.
- **The Kuno reintroduction plan ran into trouble**. The protected area had also been shortlisted for introduction of Asiatic Lions from heavily populated Gir in Gujarat. In order 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 the 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 very 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

A Himalayan serow has been sighted for the first time in the Himalayan cold desert region in Spiti, Himachal Pradesh.

FIRST, WHAT KIND OF AN ANIMAL IS THE HIMALAYAN SEROW?

- It's a medium-sized mammal with a large head, thick neck, short limbs, long, mule-like ears, 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

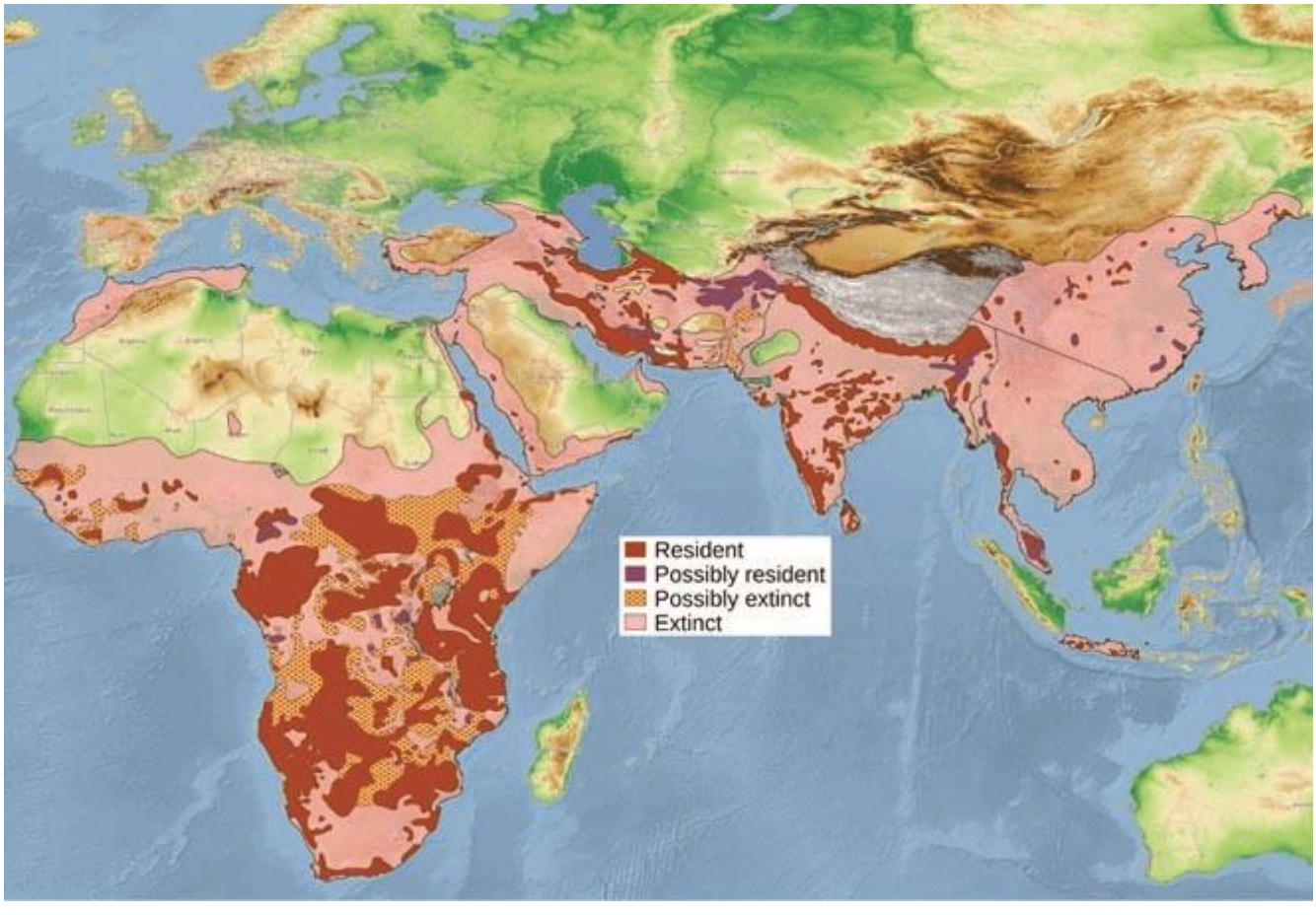
Kerala has 650 leopards stealthily roaming its tiger reserves. The State's leopard population is the third highest in the Western Ghats region. Karnataka tops the list with 1,783 leopards, followed by Tamil Nadu with 868, according to the Status of Leopards in India 2018 report.

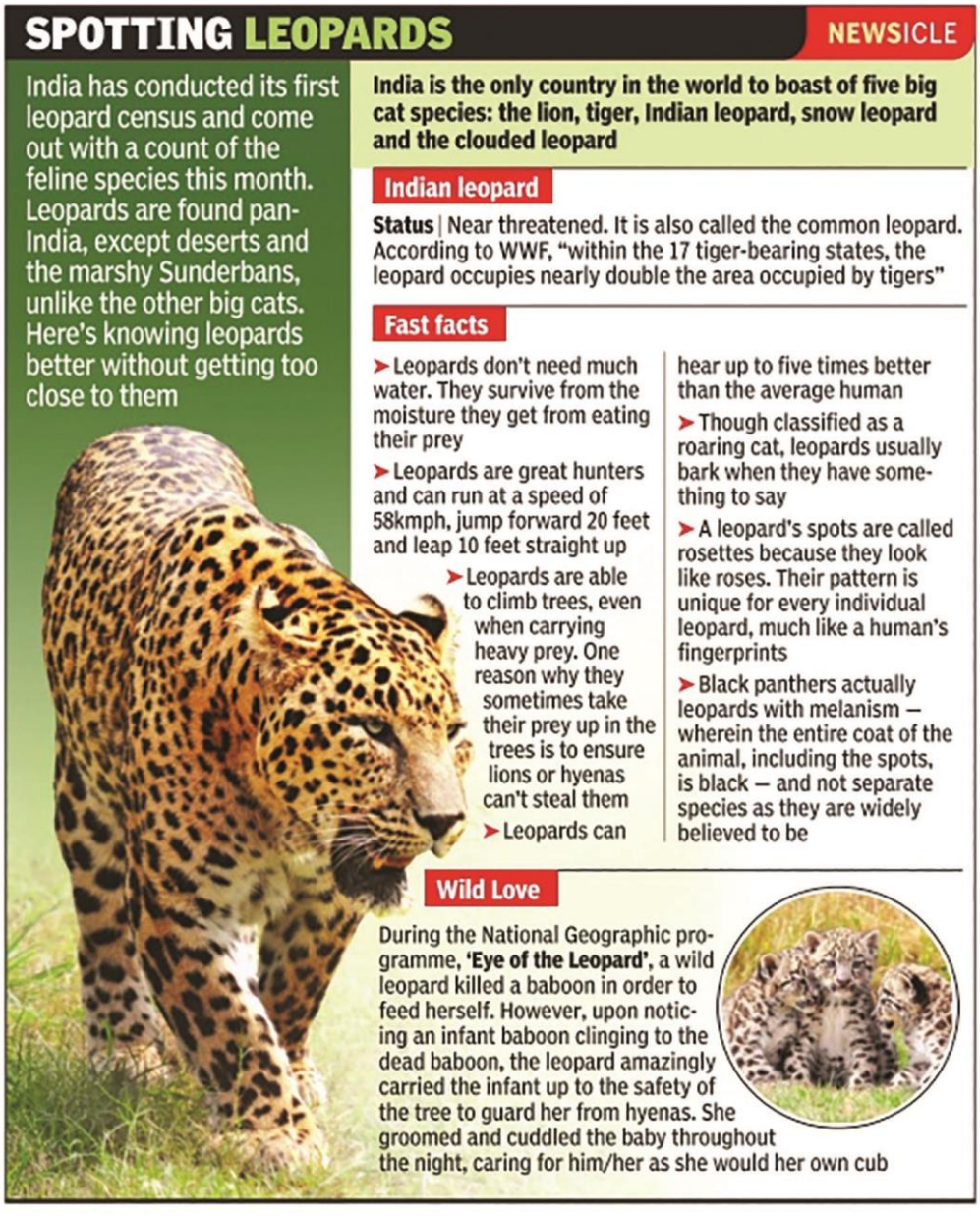
ABOUT LEOPARDS

- 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, Let us revise the provisions to protect this vulnerable species as well.

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.

- **The National Tiger Conservation Authority (NTCA):** It is a statutory body established in 2006 under MoEFCC performing functions as provided in the Wildlife (Protection) Act, 1972. Presently It implements major tiger conservation initiatives like project tiger, Tiger conservation plan etc.
- **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 OR ROYAL BENGAL TIGER (PANTHERA TIGRIS)

- Conservation status of Tiger
- IUCN Red List: Endangered
- Wild life 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 per cent of global tiger

population.

- The tigers are an "umbrella" species as by rescuing them, we save everything beneath their ecological umbrella – everything connected to them.
- In India, highest number of tigers are in Karnataka followed by Uttarakhand

GLOBAL CONSERVATION EFFORTS

- **The 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).
- **The 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.
- **TX2**: In 2010, the St. Petersburg Declaration on Tiger Conservation was adopted under the GTI and the Global Tiger Recovery Programme or TX2 was endorsed. Its goal was to double the number of wild tigers across their geographical areas. The WWF is implementing the programme in 13 tiger range countries.
- **Conservation Assured Tiger Standards (CATS):** It is a new tool for tiger conservation management. It is a set of criteria which allows tiger sites to check if their management will lead to successful tiger conservation. It is an important part of Tx2 programme.
- **Involving Local communities:** Peaceful coexistence with voluntarily participation of the local communities is a must. For example, villagers must be instantaneously compensated for their cattle loss or crop damage due to tiger and other wild animals.
- **Relocation of tigers:** It should be done in a well-planned manner else there is a high chance of losing the animal. This can also help to **prevent inbreeding of the tiger species** and thus increase the viability of the tiger population (by increasing their genetic diversity).
- **Awareness:** Awareness about tiger conservation through discussions, exhibitions and local campaigns, etc should be spread.
- **Strengthening monitoring activities** by authorities is a crucial element in tiger conservation. Improving the intelligence and information sharing mechanism is a major aspect in this regard. Drones can also be widely used for monitoring.
- **Stopping Illegal trade:** Items prepared from tiger killed must be tackled as it effectively fuels the poaching process.
- Increase in the population of tigers, Asiatic lions and now leopards, shows how India is protecting its environment, ecology and biodiversity.

►ELEPHANT CORRIDORS

Two months after the Union Ministry of Environment, Forest and Climate Change asked Uttarakhand government to consider avoiding sensitive areas of the Shivalik Elephant Reserve while exploring land suitable for expansion of Dehradun's Jolly Grant Airport, the state government, in its response, has stated that there is no viable alternative for the proposed activity.

ELEPHANT IN INDIAN CONSERVATION SCHEME

- The species is included in the list of protected species according to **the Schedule I of the Indian Wildlife (Protection) Act, 1972** and in the Convention on International Trade in Endangered Species of Flora and Fauna (CITES).

WHAT IS PROJECT ELEPHANT?

- Project Elephant is a Central Government sponsored scheme launched in February 1992.

Through the Project Elephant scheme, the **government helps in the protection and management of elephants to the states** having wild elephants in a free-ranging population.

It ensures **the protection of elephant corridors** and elephant habitat for the survival of the elephant population in the wild.

- **Obligations of the central govt:**
  - The union government provides **technical and financial help** to these states to carry out and achieve the 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 – THE NATIONAL HERITAGE ANIMAL

The government of India in the year 2010 declared Elephant as the national heritage animal of the country on the recommendations of the standing committee of the national board for wildlife. This was done to make sure that sufficient protection to elephants was provided before their numbers fall to panic levels like in the case of tigers.

ELEPHANT RESERVES IN INDIA

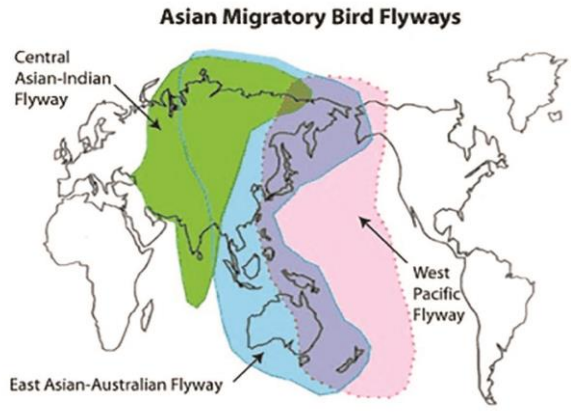
As notified by the government, there are around 32 elephant Reserves in India. The very first elephant reserve or elephant sanctuary was the Singhbhum Elephant Reserve of Jharkhand.

MIKE PROGRAMME (CITES PROGRAM)

- MIKE the abbreviation of the Monitoring of Illegal Killing of Elephants program was started in South Asia in 2003 after the conference of parties a resolution of CITES.
- The aim of MIKE was to provide information required by the elephant range countries for proper management and long-term protection of their elephant populations.
- **The objectives of the MIKE program is as follows:**
  - To measure the levels and trends in the illegal poaching and ensure changes in the trends for elephant protection.
  - To determine the factors responsible for such changes, and to assess the impact of decisions by the conference of parties to CITES.

►CENTRAL ASIAN FLYWAY

- The Central Asian Flyway covers a large continental area of Eurasia between the Arctic and Indian Oceans and the 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 the 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.
- **The IUCN's Red List has classified it as Least Concerned.**

►BLACKBUCK

- Blackbuck is **found only in the Indian subcontinent**, mainly in three countries: India, where nearly 95 per cent of the population is present, Nepal, where a small population survives in the arid part of the Nepal plains or *Terai*, and Pakistan, where it is extinct as a free-ranging animal but an introduced population is found in the Lal Suhanra National Park in Bahawalpur, Southern Punjab province.
- 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 very fast and rely on speed to escape from their main predators. Blackbuck is considered to be the fastest animal in the world next to Cheetah
- Blackbuck is the finest representative of **arid and semi-arid short grass plains** that were once abundant in undivided Punjab, Haryana, parts of Uttar Pradesh, Rajasthan, Madhya Pradesh, Gujarat and down south up to Tamil Nadu. It is a denizen of open countryside, **avoiding forest and hilly areas**. When the Asiatic Cheetah (Acinonyx jubatus venaticus) was found in India—the last was seen in 1951 – Blackbuck was its main prey, along with Indian Gazelle ("Chinkara") in some areas.
- The blackbuck is listed under Appendix III of CITES. In India, hunting of blackbuck is prohibited under Schedule I of the Wildlife Protection Act of 1972. It inhabits several protected areas of India, including
  - **in Gujarat:** Velavadar Wildlife Sanctuary, Gir Forest National Park.
  - **in Bihar:** Kaimur Wildlife Sanctuary;
  - **in Maharashtra:** Great Indian Bustard Sanctuary;
  - **in Madhya Pradesh:** Kanha National Park
  - **in Rajasthan:** Tal Chhapar Sanctuary, National Chambal Sanctuary, Ranthambhore National Park
  - **in Karnataka:** Ranibennur Blackbuck Sanctuary;
  - **in Tamil Nadu:** Point Calimere Wildlife and Bird Sanctuary, Vallanadu Wildlife Sanctuary, Guindy National Park.

►ECOLOGICALLY SENSITIVE ZONES (ESZ's)

- It is created to **act as a buffer for further protection around Protected Areas (PAs)** such as **National Parks and Wildlife Sanctuaries Activities** around such areas are regulated and managed so as to protect the environment.
- ESZ is notified under **Section 3 of the Environment (Protection) Act, 1986** by the 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

- Environment Ministry body, Society for Integrated Coastal Management (SICOM is developing 12 beaches in India for a 'Blue Flag' certification.
- The **Chandrabhaga beach on the Konark coast of Odisha** has been proposed to be given the certification from India.
- Currently, there are no Indian Beach which has been given Blue Flag Certification.

BLUE FLAG STANDARDS

- These standards were established in 1985 by the Copenhagen-based **Foundation for Environmental Education (FEE),** 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
- Ghoghla in Diu
- 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 under the aegis of Ministry of Environment, Forests and Climate change.
- It is implementing the 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 2020 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.

►IMPORTANT FLORA IN NEWS

AGARWOOD

- Recently, the *Aquilaria malaccensis* tree (**Agarwood**), which produces one of the world's most valued woods, moved from 'vulnerable' to '**critically endangered'** as logging and deforestation caused population to decline by more than 80% over the past 150 years.
- It is a fragrant dark resinous wood used in incense, perfume, traditional medicine and small carvings.
- It is found in **North-East India**.
- It is in "Appendix 2" classification, meaning it is not outrightly banned, but the Agarwood trade has to be "controlled."

RED SANDERS

It is an endemic tree of South India. Directorate General of Foreign Trade (DGFT), an agency of the Ministry of Commerce and Industry, has revised its export policy to permit the export of red sanders if it is obtained from cultivated land. Species is in **Appendix II of CITES**, which says "trade must be controlled in order to avoid utilisation incompatible with their survival.

NEELAKURINJIIS

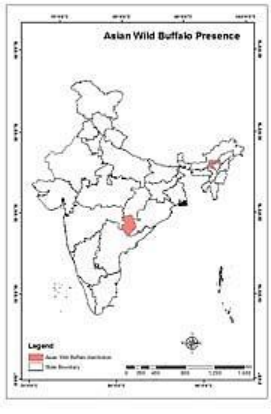
It is a shrub that is found in the shola forests of the Western Ghats in South India.

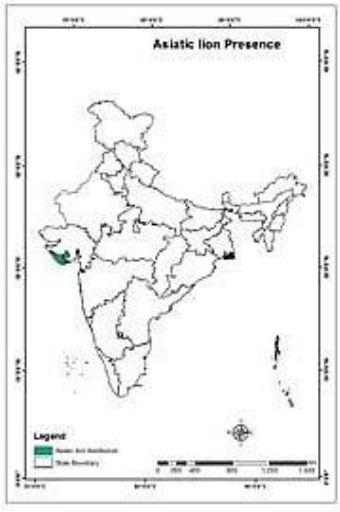
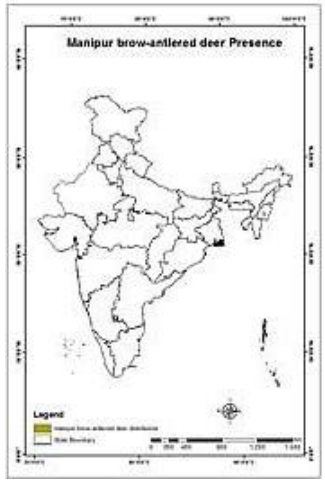
- It blossoms only once in **12 years**.
- The **Paliyan tribal people living in Tamil Nadu** used it as a reference to calculate their age

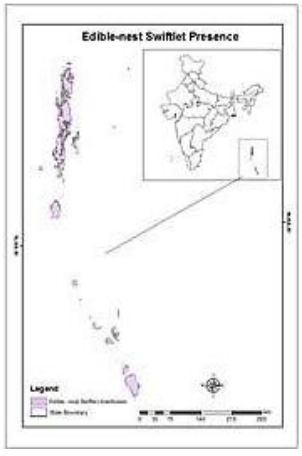
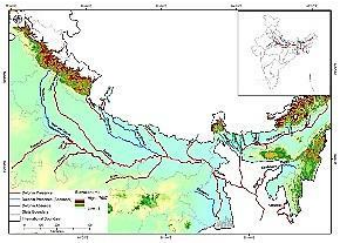
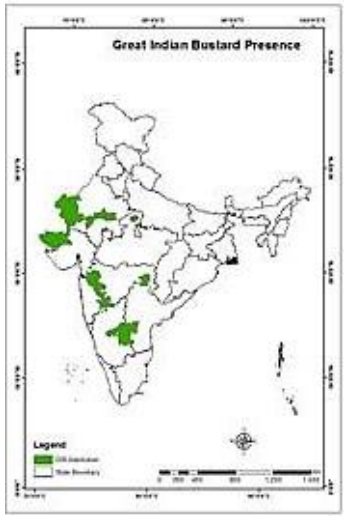
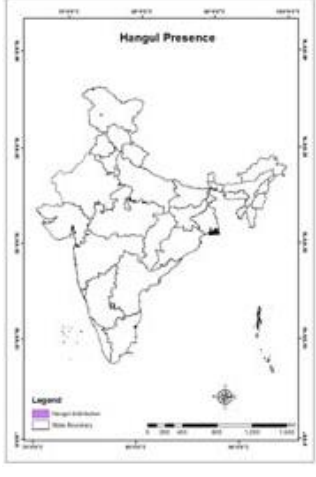
BAMBOO

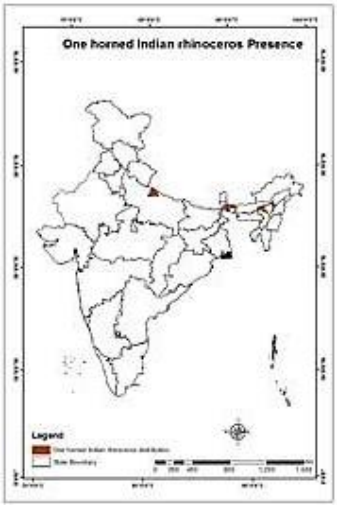
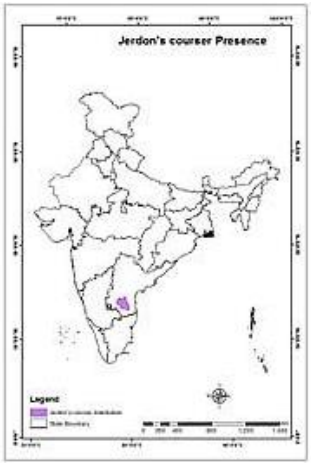
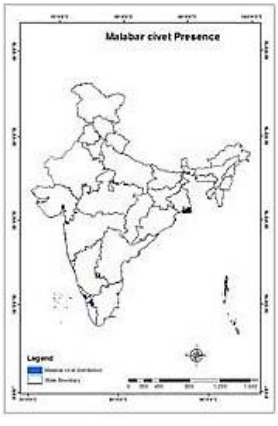
- Recently, President has cleared an ordinance amending the **Indian Forest Act (IFA) 1927**, to exempt bamboo grown in non-forest areas from the definition of trees.
- **The amendment aims to exempt bamboo grown in non-forest areas from definition of tree.**
- Bamboo, though, taxonomically a grass, 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.**

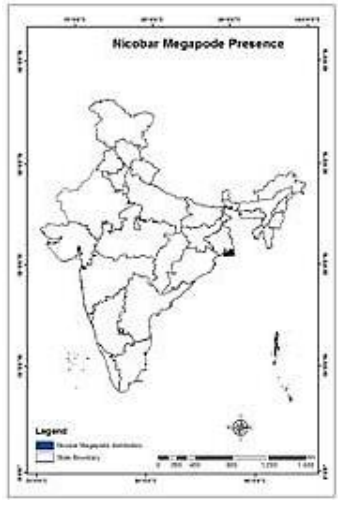
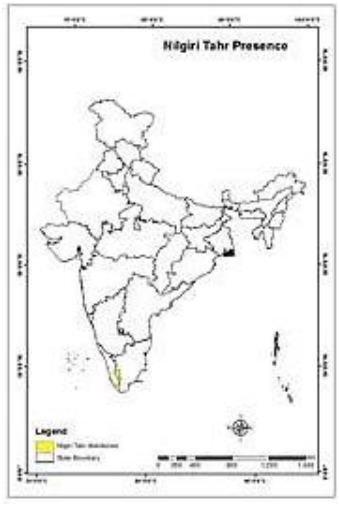
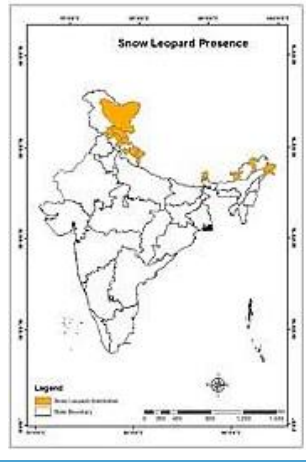
►SPECIES RECOVERY PROGRAMME

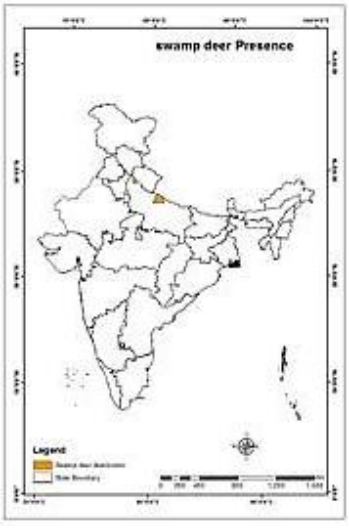
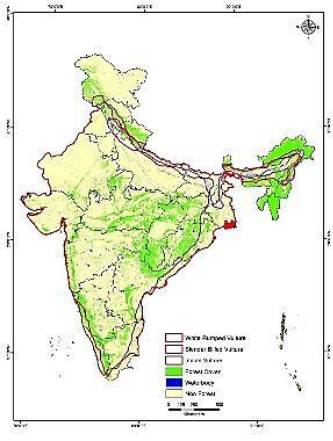
S.NO.	SPECIES	RANGE	DETAILS
1.	**Asian Wild Buffalo**		The Asian wild buffalo (*Bubalus bubalis*) has been designated as endangered by the IUCN and included in Schedule I of the Wildlife (Protection) Act, 1972. The wild buffalo was once widely distributed over the tracts of tall grasslands and riverine forests in India and Nepal. The present population of wild buffalo in its entire range is estimated to be lower than 2,000 individuals.

2.	**Asiatic Lion**		The 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 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		The Manipur brow-antlered deer, *(Cervus eldi eldi McClelland 1842),* popularly called 'Sangai' is a unique animal found only in Manipur in the whole world. The Sangai or the Manipur race of the Elds deer is the only deer which has adapted itself to the swampy habitat. The Sangai population dwindled rapidly in the beginning of 20 century under heavy hunting pressure and the continuous habitat destruction. In fact, the deer was considered almost extinct during 1950s.
4.	Dugong		Dugong (Dugong dugon) 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 therefore 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

5.	Edible Nest Swiftlet		IUCN Status: : Least Concern.
6.	Gangetic River Dolphin		The 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:
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		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		IUCN Status: Vulnerable
14.	Nilgiri Tahr		Nilgiri Tahr, a mountain goat, is the highly threatened flagship species occur on the crest lines and 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		The 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 state of Jammu & Kashmir has the distinction of harbouring a major portion of existing snow leopard population in India. IUCN Status: Vulnerable

16.	Swamp Deer		The Swamp deer or Barasingha were once abundant throughout the tall wet grasslands of the North Indian Terai region, the Brahamaputra flood plains, and the Central Indian grasslands bordering sal (Shorea robusta) forests. Currently, the swamp deer populations are confined to the States of Uttarakhand, Uttar Pradesh (duvauceli), Assam (ranjitsinhii) and Madhya Pradesh (branderi) in India. At present, the population estimates for the northwestern subspecies of swamp deer in India is about 1800-2400 individuals; for the northeastern subspecies is about 400-500 individuals; and the central subspecies is about 300 - 350 individuals. Kanha Tiger Reserve has Hard-ground Barasingha species. The Swamp deer has declined over the years, as a result of loss of habitat and biotic pressures over much of its former range. The Swamp deer habitats are threatened due to change in river dynamics and human developmental activities, increase in siltation, weed invasion, and reduced flow of water during critical periods of summer. Swamp deer is also threatened due to poaching for its meat, particularly the populations that occur outside PAs. 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. New World vultures are found in North and South America; 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 of which five belong to the genus Gyps. Three Gyps vultures, namely the White-rumped Vulture Gyps bengalensis, Long-billed Vulture Gyps indicus and Slender-billed Vulture Gyps tenuirostris are residents, and the remaining two, the Eurasian Griffon Vulture Gyps fulvus and Himalayan Griffon Vulture Gyps himalayensis 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-

<table>
<tr><td></td><td></td><td></td><td>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 Programme for ex situ conservation and also enhanced in situ protection of the remaining populations.
VULTURES SPECIES OF INDIA
<table>
<tr><th>COMMON NAME</th><th>CONSERVATION STATUS</th></tr>
<tr><td>White-rumped Vulture</td><td>Critically Endangered</td></tr>
<tr><td>Red-headed Vulture</td><td>Critically Endangered</td></tr>
<tr><td>Slender-billed Vulture</td><td>Critically Endangered</td></tr>
<tr><td>Indian Vulture</td><td>Critically Endangered</td></tr>
<tr><td>Egyptian Vulture</td><td>Endangered</td></tr>
<tr><td>Cinereous Vulture</td><td>Near Threatened</td></tr>
<tr><td>Lammergeyer/ Bearded Vulture</td><td>Near Threatened</td></tr>
<tr><td>Himalayan Griffon</td><td>Near Threatened</td></tr>
</table></td></tr>
<tr><td>18.</td><td>Northern River Terrapin - Species of riverine turtle</td><td></td><td>Rivers that flow in Eastern India
Hunted for meat and carapace
IUCN Status: Critically Endangered</td></tr>
<tr><td>19.</td><td>Clouded Leopard</td><td></td><td>Himalayan foothills
Habitat loss; poached for its skin and is also as a live pet trade.
IUCN Status: Vulnerable</td></tr>
<tr><td>20.</td><td>Arabian Sea Humpback Whale</td><td></td><td>All major oceans
Threatened due to ship strikes, unforgiving fishing gear and seismic explorations
IUCN Status: Endangered</td></tr>
<tr><td>21.</td><td>Red Panda</td><td></td><td>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</td></tr>
</table>

►IMPORTANT PROTECTED AREAS IN NEWS

Papikonda	River Godavari passes through it.
National Park (Andhra Pradesh)	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.

►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 2018	UNEP
Global Environmental outlook	UNEP
Global Resources Outlook 2019	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 Programme	WMO
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 Programme Implementation
Future of Earth, 2020	South Asia Future Earth Regional Office, Divecha Centre for Climate Change, Indian Institute of Science. The report was prepared with the aim of reducing carbon footprint and halting global warming below 2 degree Celsius by 2050.
2019 POLLUTION AND HEALTH METRICS	Global Alliance on Health and Pollution (GAHP)

SECTION 10

MCQs

ANSWER KEY

Q1. Which of the following statements is/are correct about the Madden Julian oscillations?

1. It is characterized by an eastward progression of large regions of both enhanced and suppressed tropical rainfall.
2. This pattern is observed mainly over the warmer parts of Indian and the pacific Oceans.
3. It occurs due to unusual heating of the Tibetan plateau.

Select the correct answer using the code given below:

(a) 1 only (b) 1 and 2 only
(c) 2 only (d) 1, 2 and 3

Q2. Consider the following pairs:

S.No.	Rivers	Flows into
1.	Danube	Dead Sea
2.	Pearl	South China Sea
3.	Mackenzie	Arctic Ocean
4.	Rhine	Mediterranean Sea

Which of the pairs given above is/are correctly matched?

(a) 1 and 2 only (b) 3 only
(c) 2 and 3 only (d) 1, 2 and 4 only

Q3. Consider the following statements:

1. All of the solar energy that enters atmosphere reaches the surface of the earth.
2. Tropical cloudless Oceans have more albedo as compared to fresh snow covered areas.

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

Q4. Which of the following statements is/are correct about Dew point?

1. Dew point is the temperature at which air is saturated and can no longer hold the moisture.

2. A relative humidity of 100% indicates that the dew point is equal to the ambient temperature.

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

Q5. Which of the following protected areas is/are located in the Western Ghats?

1. Mrugavani National park
2. Kallakad Mundanthurai Tiger reserve
3. Chinnar wildlife sanctuary

Select the correct answer using the code given below:

(a) 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

Q6. Nag Chhatri recently seen in news is used for which of the following?

(a) Natural Pesticide (b) Perfumes
(c) Extraction of resins (d) Medicinal uses

Q7. "Noctiluca scintillans" sometimes seen in news is a cause of concern because of which of the following?

(a) It is being over exploited because of its use in traditional medicines.
(b) It tends to reduce the biodiversity in shola forests.
(c) It is a weed known to damage crops.
(d) It could lead to decline in fisheries in the Arabian Sea.

Q8. Murlen National Park is located in which of the following states?

(a) Assam
(b) Arunachal Pradesh
(c) Manipur
(d) Mizoram

Q9. Consider the following pairs:

S.No.	Place	River
1.	Orchha	Betwa River
2.	Sabarimala	Periyar River
3.	Ujjain	Narmada River

Which of the pairs given above is/are correctly matched?

(a) 1 and 2 only (b) 1 only
(c) 2 and 3 only (d) 1, 2 and 3

Q10. Which of the following statements is/are correct about Peatlands?

1. They are found in both tropical and Boreal forests.
2. They store and sequester more carbon than any other type of terrestrial ecosystem

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. Which of the following is/are located within the cold desert Biosphere reserve?

1. Nelong valley 2. Chandartaal
3. Kangra valley 4. Kibber valley

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 2 and 3 only
(c) 2 and 4 only (d) 3 and 4 only

Q12. Which of the following statements is/are correct about tigers in India?

1. Corbett tiger reserve has the largest number of tigers.
2. Maharashtra and Madhya Pradesh have the largest number of Tiger reserves.
3. Some tiger reserves in India have no tiger population.

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

Q13. The shortest route from the Great Nicobar Island to Malacca strait would pass through which of the following?

(a) Sunda strait
(b) Ombai-Wetar straits
(c) Great channel
(d) Lombok strait

Q14. Which of the following statements is/are correct about the Satpura Range?

1. It is spread across only three states of India.
2. It is surrounded by rift valleys on the north and the south.
3. Its highest peak lies on Gawilgarh hills.

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 2 only

(c) 1 and 3 only (d) 1, 2 and 3

Q15. Which of the following statements is/are correct about the Keoladeo National park?

1. Invasive growth of the grass Paspalum distichum has changed the ecological character of this site.
2. It is strategically located in the middle of Central Asian migratory flyway.

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

Q16. Which of the following are the sources of Particulate matter in the air pollution?

1. Construction sites
2. Sea salt
3. Pollen
4. Chemical reactions of NOx gases in atmosphere

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 2, 3 and 4 only
(c) 1 and 4 only (d) 1, 2, 3 and 4

Q17. Consider the following statements about Blackbuck antelopes:

1. It is the fastest animal on land.
2. It is found only in the Indian sub-continent.
3. It is completely black in colour.
4. It avoids forested and hilly areas.

Which of the statements given above is/are correct?

(a) 1 and 2 only (b) 2 and 4 only
(c) 3 and 4 only (d) 2, 3 and 4 only

Q18. Which of the following pollutants are released into the atmosphere in the events of forest wild fires?

1. Polycyclic Aromatic Hydrocarbons
2. Ammonia
3. Nitrous oxide
4. Methane

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 2, 3 and 4 only
(c) 1 and 4 only (d) 1, 2, 3 and 4

Q19. The report "Escaping the 'era of Pandemics' "which links the degradation of nature and increasing risk of pandemics has been released by which of the following?

(a) Convention on Biodiversity (CBD)
(b) Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)
(c) United Nations Environment (UNE)
(d) Intergovernmental Panel on Climate Change (IPCC)

Q20. Which of the following statements is/are correct about the wildlife protection act 1972?

1. The term 'Vermin' has been defined under this act.
2. It empowers the state governments to declare wild animals of any species as 'vermin' in any area and for a specified period of time.

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

Q21. With reference to Global Climate Change the term "tipping point" refers to which of the following?

(a) Reducing the impact of climate change by adaptation techniques.
(b) When the global average temperatures increase by 2 degree Celsius.
(c) When global climate changes from one stable state to another stable state.
(d) When carbon neutrality is achieved.

Q22. Which of the following mountain ranges are included in the region famous as 'The Third Pole'?

1. The Himalayas
2. The Tibetan Plateau
3. The Hindu Kush
4. The Tien Shan Mountains

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 1 and 3 only
(c) 3 and 4 only (d) 1, 2, 3 and 4

Q23. Consider the following statements with regard to 'The Limits to Growth (LTG)', a 1972 report on the exponential economic and population growth:

1. It was commissioned by the United Nations Environment Programme.
2. It concluded that continued population and industrial growth will exhaust the world's minerals and bathe the biosphere in fatal levels of pollution.

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

Q24. Which of the following statements is/are correct?

1. The International Seabed Authority (ISA) is an autonomous international organization, established under the United Nation- Oceans.
2. All Parties to the 1982 United Nations Convention on the Law of the Sea (UNCLOS) are the members of the ISA.
3. The area of the seabed and ocean floor, and the sub-soil within the limits of the national jurisdiction is called the international seabed area.

Select the correct answer using the code given below:

(a) 2 only (b) 2 and 3 only
(c) 3 only (d) 1, 2 and 3

Q25. Which of the following statements are correct?

1. The Genetic Engineering Appraisal Committee (GEAC) functions under the Ministry of Agriculture and Farmers' Welfare.
2. The GEAC is responsible for the appraisal of the activities involving large scale use of hazardous micro-organisms from the environmental angle.
3. The Committee or any persons authorized by it has/have the powers to take punitive action under the Environment (Protection) Act, 1986.

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

Q26. Which of the following statements are correct?

1. The Golden Langur a primate found in the forests along the Indo-Bhutan border in Assam.
2. It is listed in Schedule I of the Indian Wildlife (Protection) Act, 1972.
3. It is listed as a critically endangered species by the IUCN Red List.

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

Q27. Consider the following statements regarding the 'Earth Hour':

1. It is an initiative of the World Wildlife Fund for Nature.
2. It raises the awareness about climate change and the need to save the planet.
3. The participants plant trees and participate in afforestation activities for an hour.

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

Q28. Consider the following statements with regard to the South Asia Wildlife Enforcement Network (SAWEN):

1. It promotes regional cooperation to combat wildlife crimes in South Asia.
2. It works under the aegis of the South Asian Association for Regional Cooperation (SAARC).
3. All the SAARC counties and Myanmar are its members.

Which of the statements given above is/are correct?

(a) 1 only (b) 1 and 2 only
(c) 1 and 3 only (d) 1, 2 and 3

Q29. Consider the following statements with regard to the 'Great **Barrier Reef':**

1. It is located in the Coral Sea, off the coast of Queensland, Australia.
2. It is the world's biggest single structure made by the living organisms.
3. It is a World Heritage Site.

Which of the statements given above is/are correct?

(a) 1 only (b) 1 and 2 only
(c) 1 and 3 only (d) 1, 2 and 3

Q30. Consider the following statements with regard to Mycorrhizal fungi:

1. They assist the plants in nutrient uptake.
2. They protect the plants against root pathogens and toxic stresses.
3. They do nitrogen fixation and enrich the soil.

Which of the statements given above is/are correct?

(a) 1 only (b) 1 and 2 only
(c) 1 and 3 only (d) 1, 2 and 3

Q31. Which of the following statements is/are correct?

1. The Mines and Minerals (Development and Regulation) Act, 1957, regulates the requirement only for granting the mining leases for mining operations.

2. The District Mineral Foundation (DMF) is to be established by the Central Government for the benefit of the persons in the districts affected by the mining related operations.
3. The Ministry of Environment, Forest and Climate Change released the Enforcement and Monitoring Guidelines for Sand Mining in 2020 for the monitoring of the mining activity.

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 2 only
(c) 3 only (d) 1, 2 and 3

Q32. Consider the following statements:

1. Coal washeries are the units that reduce the ash content in coal.
2. Washed coal provides high grade coking coal that is essential for the steel sector.

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

Q33. With respect to the "Climate Change Performance Index", consider the following statements:

1. It is released by the Yale and Columbia Universities, along with the World Economic Forum.
2. The climate change performance is assessed under Green House Gas emissions, renewable energy, energy use and climate policy categories.

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

Q34. With respect to the "Himalayan Serow ", consider the following statements:

1. It is a mammal resembling a cross between a goat, a donkey, a cow and a pig.
2. It is known to be found in the Trans Himalayan region.
3. It is categorized as 'vulnerable' in the IUCN Red List of Threatened Species.

Which of the statements given above are correct?

(a) 1and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Q35. With respect to the "Emissions Gap Report 2020", consider the following statements:

1. It is an annual report released by the Intergovernmental Panel on Climate Change (IPCC).
2. It measures the gap between anticipated emissions and levels consistent with the Paris Agreement Goals.
3. India is the fourth largest emitter of Green House Gases.

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

Q36. With respect to the "Shoolpaneshwar Wildlife Sanctuary", consider the following statements:

1. It is a protected area in Madhya Pradesh.
2. It is located in the western Satpura range.

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

Q37. Consider the following statements:

1. India is the largest emitter of sulphur dioxide (SO_2) in the world.
2. The largest sources of SO_2 emissions are from fossil fuel combustion at the power plants and other industrial facilities.
3. Volcanoes are the natural source of SO_2.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) 1 and 2 only (d) 1, 2 and 3

Q38. With respect to "Bioplastic", consider the following statements:

1. It is a plastic made from biomass, like corn, sugarcane or cellulose.
2. All bioplastics are biodegradable.

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

Q39. Which of the following statements is/are correct?

1. Glacial lake outburst flood occurs when the water, dammed by a glacier or a moraine, is released suddenly.
2. Supraglacial lakes are formed when the ice melts and the water gets collected on the ice surface.

3. Proglacial lakes are formed when the ice melts and the water gets collected in front of the ice.

Select the correct answer using the code given below:

(a) 1 only (b) 1 and 2 only
(c) 3 only (d) 1, 2 and 3

Q40. Consider the following statements:

1. Wetlands occupies 4.6% of India's total land area.
2. Wetlands include mangroves, marshes, rivers, floodplains, rice-fields and marine areas, no deeper than 6 metres at high tide.
3. The Centre for Wetland Conservation and Management (CWCM) has been set up in Chennai.

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

Q41. With reference to the "Asia Protected Areas Partnership" (APAP), consider the following statements:

1. India is the co-chair of the APAP.
2. It is chaired by IUCN Asia and is co-chaired by an APAP country member.

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. With reference to the Pangong Tso Lake, consider the following statements:

1. The Line of Actual Control between India and China passes through it.
2. It is an endorheic lake, situated in the Ladakh Himalayas.
3. It is the world's highest saltwater lake.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 and 3 only
(c) 3 only (d) 1, 2 and 3

Q43. Which of the following statements is/are correct regarding the Dhauliganga River?

1. It emerges from Deovan Himani.
2. It meets the Alaknanda at Vishnuprayag in the Garhwal Himalayas.
3. Tapovan Vishnugad Hydropower Project is constructed on the Dhauliganga River.

Select the correct answer using the code given below:

(a) 1 only (b) 1 and 2 only
(c) 1 and 3 only (d) 1, 2 and 3

Q44. Consider the following statements about the 'United for Biodiversity' coalition:

1. The coalition has been launched by the European Commission.
2. It is a coalition of the national parks, aquariums, botanical gardens, zoos and natural history museums.

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. Consider the following statements about the Wildlife (Protection) Act, 1972:

1. Elephant Reserves are notified under the Wildlife (Protection) Act, 1972.
2. Community Reserves are notified under the Wildlife (Protection) Act, 1972.
3. Reserve Forests are notified under the Wildlife (Protection) Act, 1972.

Which of the statements given above is/are correct?

(a) 2 only (b) 2 and 3 only
(c) 1 and 2 only (d) 1, 2 and 3

Q46. Which of the following reports are released by the UN Environment Programme (UNEP)?

1. The Adaptation Gap Report
2. The Emissions Gap Report
3. The Global Risks Report
4. The Greening the Blue Report
5. The State of the Connected World Report

Select the correct answer using the code given below:

(a) 1, 2 and 3 only (b) 2, 4 and 5 only
(c) 1, 2 and 4 only (d) 1, 2, 3, 4 and 5

Q47. Consider the following statements about the BioTrade Initiative:

1. It is an initiative of the UN Convention on Biological Diversity (UNCBD).
2. The programme aims to contribute to the conservation and sustainable use of biodiversity through the promotion of trade and investment in the BioTrade products and services.

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. The Biodiversity and Ecosystem Services Index is published by which of the following institutions?

(a) The World Economic Forum
(b) Yale & Columbia University
(c) The UN Convention on Biological Diversity
(d) None of the above.

Q49. Which of the following crops in India is expected to be the worst affected by climate change?

(a) Chickpea (b) Rice
(c) Maize (d) Wheat

Q50. Consider the following statements about Conservation Reserves:

1. They are notified by the Central Government.
2. The representatives of the Village Panchayats are part of the Conservation Reserve Management Committee.

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. Which of the following statements are correct?

1. The Mandarin Duck breeds in Russia, Korea, Japan and the north-eastern parts of China.
2. In India, the Mandarin Duck has been spotted in the Maguri Motapung Beel Wetland in Assam.
3. The IUCN's Red List has classified it as Critically Endangered.

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

Q52. Consider the following statements:

1. Sudden Stratospheric Warmings (SSWs) occur in the winter season, when the winds that normally flow from west to east around the Pole weaken dramatically.
2. The formation of the SSWs tends to have larger amplitudes in the Northern Hemisphere, as compared with the Southern Hemisphere.

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

Q53. Which of the following statements is/are correct about the Guchhi Mushroom?

1. Guchhi Mushroom of Jammu and Kashmir's Doda district received the Geographical Indication (GI) tag.
2. It is rich in antioxidants that prevent health issues, including heart diseases and diabetes, by removing reactive oxygen species that harm the body.

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

Q54. Consider the following statements:

1. The Dzukou Valley is located at the border of Nagaland and Manipur.
2. The Western Hoolock Gibbons are found in the forest of the Dzukou Valley.

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

Q55. With reference to the Ramsar Wetland Sites in India, which of the following statements is/are correct?

1. Bihar has only one wetland listed in the Ramsar Sites List.
2. The Asan Conservation Reserve is the first wetland from Uttarakhand to be included in the Ramsar Sites List.

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

Q56. Consider the following statements:

1. The National Ganga River Basin Authority was formed under the Water (Prevention and Control of Pollution) Act, 1974.
2. The Clean Ganga Fund, formed for cleaning up of the Ganga, is open to all – domestic, as well as international donors.

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. Consider the following statements regarding "The Bonn Challenge":

1. It is a global effort to protect human health and the environment from the adverse effects of mercury.
2. India joined the Bonn Challenge at the UNFCCC Conference of the Parties (COP), 2015.

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

Q58. Consider the following statements:

1. As per the Biological Diversity Act, 2002, every local body has to constitute a Biodiversity Management Committee (BMC) for promoting conservation, sustainable use and documentation of biological diversity.
2. The National Biodiversity Authority has been mandated to prepare the People's Biodiversity Register, in consultation with the local people.

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

Q59. Consider the following statements about the High Ambition Coalition for Nature and People:

1. It aims to protect 30% of land and ocean area by 2030.
2. India is a party to this Coalition.

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

Q60. Consider the following statements about the Million-Plus Cities Challenge Fund:

1. It is a Fund recommended by the 15th Finance Commission for incentivizing the cities with population more than a million.
2. One-third of the Fund will be used for incentivizing the cities to achieve improvement in the ambient air quality.
3. NITI Aayog will act as the nodal agency for monitoring of the ambient air quality and disbursement of grants to the Million-Plus Cities for the air pollution component.

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

Q61. Consider the following statements:

1. The Tal Chappar Sanctuary, located in Gujarat, is famous for the Blackbucks.
2. The Bankapur Wildlife Sanctuary, located in West Bengal, is famous for the Indian Grey Wolves.
3. The Siruvani hills, located in Tamil Nadu, are famous for butterflies.

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

Q62. Consider the following statements:

1. The National Board for Wildlife is a statutory body.
2. Without the approval of the National Board for Wildlife, no destruction or diversion of wildlife habitat can be done.

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

Q63. Which of the following are the major sources of nitrogen emissions?

1. Crop burning 2. Coal burning
3. Refrigeration

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

Q64. Which of the following has/have recognized the Principle of Inter-generational Equity?

1. The Stockholm Declaration, 1972
2. The Sustainable Development Frameworks
3. The Paris Agreement Preamble

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

Q65. Which of the following forms of Nitrogen can be absorbed by the plants?

1. Ammonium 2. Nitrates
3. Nitrites

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

Q66. Which of the following statements is/are correct about the Tropospheric Ozone Pollution?

1. It does not have any direct emission sources.
2. It is known to reduce the crop productivity.
3. It can be drastically reduced by reducing methane emissions.

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 2 only
(c) 2 and 3 only (d) 1, 2 and 3

Q67. The PREZODE initiative, launched at the "One Planet Summit for Biodiversity" is related to which of the following?

(a) Conservation of Biodiversity in the Tropical Areas
(b) Conservation of the Coral Reefs
(c) Achievement of the REDD Goals
(d) Prevention of Future Pandemics

Q68. Gharials are found in which of the following rivers?

1. Girwa 2. Mahandi
3. Cauvery 4. Gandak

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 2, 3 and 4 only
(c) 1, 2 and 4 only (d) 1, 3 and 4 only

Q69. Which of the following sites have been recognized as Elephant Reserves in India?

1. Kameng 2. Periyar
3. Sariska 4. Garo Hills
5. Panna

Select the correct answer using the code given below:

(a) 1, 2 and 4 only (b) 1, 2 and 3 only
(c) 3, 4 and 5 only (d) 1, 2, 3, 4 and 5

Q70. Which of the following statements is/are correct?

1. Peatlands are found only in high latitudes in towards the Poles and the Boreal forests.
2. Peatlands are carbon rich ecosystems having more carbon than the global above-ground carbon stock of forest ecosystems.

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

Q71. With reference to the Dugong, consider the following statements:

1. The maximum gestation period can be 18 months.
2. Seagrass in Odisha's Chilika Lake is a proper habitat for the Dugongs; however, there is not extant population in Chilika.
3. Female Dugongs give birth underwater to a single calf at three to seven-year intervals.
4. India has signed a Memorandum of Understanding with the Convention on the Conservation of Migratory Species of Wild Animals (CMS) on the conservation and management of the Dugongs.

Which of the statements given above is/are correct?

(a) 1 and 2 only (b) 2, 3 and 4 only
(c) 3 only (d) 1, 3 and 4 only

Q72. With reference to the Leatherback Turtle, consider the following statements:

1. The Leatherback Turtle is the largest sea turtle in the world.
2. They play an important role as a keystone species in controlling the jellyfish populations.
3. They are the fastest moving reptiles and can swim at speeds of up to 35 km per hour.

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

Q73. Consider the following statements about Diclofenac:

1. Diclofenac is a non-steroidal anti-inflammatory drug (NSAID), widely used to treat inflammation and pain.
2. Its injection into vultures is the cause for the rapid decline in the vulture population in India.

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

Q74. Which of the following statements is/are ***incorrect***?

1. The Montreux Record is a register of only those wetland sites where changes in the ecological character have occurred.
2. It is maintained as a part of the Ramsar List.
3. Currently, the Loktak Lake is the only Indian wetland to be included in the Montreux Record.

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

Q75. Consider the following statements about the Colony Collapse Disorder (CCD):

1. It is a phenomenon that occurs when the majority of worker bees in a colony disappear and leave behind a queen without any food and water.
2. Reported cases of CCD have substantially increased over the last five years due to the impact of global warming.

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

Q76. With respect to the "Red Panda", consider the following statements:

1. It is found naturally in Jammu & Kashmir, Ladakh, Himachal Pradesh and Uttarakhand.
2. It is listed as 'Endangered' on the IUCN Red List of Threatened Species.
3. India is having the second-largest population of the Red Pandas after China.

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

Q77. With respect to the "Aichi Targets", consider the following statements:

1. It was adopted by the Convention on Biological Diversity (CBD) at its Nagoya Conference.
2. It is a set of 5 targets, collectively called the Aichi Targets.
3. It is a 10-year framework for action by all countries to save biodiversity.

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

Q78. Consider the following statements:

1. The Cartagena Protocol is adopted as a supplementary agreement to the Convention on the Conservation of Migratory Species of wild animals (CMS).
2. The Bonn Convention is an environmental treaty of the United Nations that provides a global platform for the conservation and sustainable use of the terrestrial, aquatic and avian migratory animals and their habitats.

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

Q79. Which of the following statements are correct?

1. The Global Seed Vault is located on a remote island in the Arctic Ocean and it houses the world's largest collection of seeds.
2. India's Seed Vault is located at Chang La in the Himalayas.
3. India's Seed Vault is a joint venture of the National Bureau of Plant Genetic Resources and the Defence Institute of High-Altitude Research.

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

Q80. Which of the following statements are correct about Kasturirangan Committee Report?

1. The Kasturirangan Committee Report designated the entire hill range of the Western Ghats as an Ecologically Sensitive Area (ESA).
2. It proposed the demarcation of the Ecologically Sensitive Zone (ESZ) done at the village level.
3. It restricted only the Red Category industries in the ESZ.

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

Q81. Man and the Biosphere (MAB) Programme is an Intergovernmental Scientific Programme that aims to establish a scientific basis for the improvement of relationships between the people and their environments. It is launched by which of the following?

(a) The United Nations Environment Programme (UNEP)
(b) The United Nations Human Settlements Programme (UN-HABITAT)
(c) The United Nations Framework Convention on Climate Change (UNFCCC)
(d) The United Nations Educational, Scientific and Cultural Organization (UNESCO)

Q82. Consider the following statements:

1. The Sundaland Biodiversity Hotspot extends to the Nicobar Island, which is situated in Indi(a)

2. The Critically Endangered mammal species, the Javan Rhino and the Sumatran Rhino, are found in the Sundaland Biodiversity Hotspot.

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

Q83. Which of the following statements is/are correct about the Taiga region?

1. Coniferous forests are found in pure strands with the existence of only a few species.
2. The soil found in this region is acidic and is excessively leached.

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

Q84. The Myristica swamps are found in which of the following regions?

(a) The Eastern Ghats (b) The Himalayas
(c) The Sundarbans (d) The Western Ghats

Q85. With reference to the IUCN Red List Categories and Criteria, consider the following statements:

1. A taxon is 'Extinct' when it is known only to survive in cultivation, in captivity or as a naturalized population well outside the past range.
2. A taxon is 'Extinct in the Wild' when there is no reasonable doubt that the last individual has died.
3. A taxon is 'Least Concern' when it has been evaluated against the criteria and does not qualify for 'Critically Endangered', 'Endangered', 'Vulnerable' or 'Near Threatened'.

Which of the statements given above is/are correct?

(a) 3 only (b) 1 and 2 only
(c) 1 only (d) 1, 2 and 3

Q86. Consider the following statements about Guidelines for Groundwater Extraction:

1. These guidelines have been published under Water (Prevention and Control of Pollution) Act, 1974.
2. Under the guidelines, there is no need for permission for usage of ground water for agricultural usage.
3. Under the guidelines, all mining activities will have to pay ground water abstraction charges.

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

Q87. Consider the following statements about the Global Biodiversity Outlook:

1. The Convention on Biological Diversity publishes the Global Biodiversity Outlook.
2. It is a periodic report that summarizes the latest data on the status and trends of biodiversity and draws conclusions relevant to the further implementation of the Convention.

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

Q88. Which of the following statements is/are correct?

1. The Living Planet Report (LPR) is published every 2 years by the World Wide Fund for Nature.
2. In 2020, the LPR shows an average rate of decline in the population size of 68% between 1970 and 2016.
3. The LPR shows the numbers of species lost or extinctions.

Select the correct answer using the code given below:

(a) 1 only (b) 1 and 2 only
(c) 3 only (d) 1, 2 and 3

Q89. Consider the following statements about the Sentinel Species:

1. They are the organisms used to detect risks to the humans by providing advance warning of a danger.
2. These animals are trained by the professionals to act as the sentinels.

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

Q90. 'MIKE programme' is related to the conservation of which of the following species?

(a) Elephant (b) Snow Leopard
(c) Tiger (d) Pangolin

Q91. With respect to the "Marrakech Partnership for Global Climate Action", consider the following statements:

1. It is collaboration between the governments and the key stakeholders to immediately lower the emissions and increase resilience against climate impacts.
2. The focus is on environmental, economic and social system transformation to collectively strive for the 1.5 °C temperature goal.
3. Their actions are guided by the long-term goals of the Paris Agreement.

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. Which of the following statements best describes the term 'Global Stocktake'?

(a) Five-yearly review under the Paris Agreement to assess the impact of climate change actions on the countries.
(b) Quantifying global greenhouse gas emissions and their causes under the Global Research Project.
(c) The World Economic Forum (WEF)'s initiative, designed to support the UN Decade on Ecosystem Restoration 2021-2030.
(d) It supports the implementation, follow-up and review of the Sendai Framework for Disaster Risk Reduction.

Q93. With respect to the 'Enhanced Transparency Framework (ETF)', consider the following statements:

1. The Katowice Climate Package agreed at the COP24 established an Enhanced Transparency Framework (ETF).
2. It specifies how the countries should report on their progress in mitigating and adapting to climate change.
3. It provides information on the progress made in implementing and achieving their Nationally Determined Contributions (NDCs).

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

Q94. Which of the following statements is/are correct?

1. The Green Climate Fund (GCF) was set up in 2010 in Copenhagen, Denmark.
2. The GCF was established to help achieve the goal of keeping a global temperature rise under 2 degree Celsius.
3. The Green Climate Fund (GCF) is managed by the World Bank.

Select the correct answer using the code given below:

(a) 2 only (b) 1 and 3 only
(c) 1 and 2 only (d) 1, 2 and 3

Q95. "It is a collective process in which carbon dioxide (CO_2) dissolves in the sea water and forms carbonic acid, and decreases the ocean's pH". The process is known as:

(a) Bioremediation (b) Eutrophication
(c) Ocean acidification (d) None of the above.

Q96. Consider the following statements:

1. The Ecological Footprint is derived by tracking how much biologically productive area it takes to provide for all the competing demands of the people.
2. Ecological Footprint is developed by the World Wide Fund for Nature.

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

Q97. Which of the following statements is/are correct?

1. The Global Warming Potential (GWP) is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide (CO_2).
2. Fluorinated gases are called high-GWP gases.

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

Q98. Which of the following statements is/are correct about the "Bio Carbon Fund Initiative for Sustainable Forest Landscapes"?

1. It is managed by the UNEP.
2. It promotes sustainable agriculture, as well as smarter land use planning.
3. It has two key funding instruments, the BioCFplus and the BioCF Tranche.

Select the correct answer using the code given below:

(a) 1 only (b) 2 and 3 only

(c) 3 only (d) 1, 2 and 3

Q99. Which of the following statements is/are correct?

1. Fly ash is recognized as an environmentally friendly material, because it is a by-product and has low embodied energy.
2. Fly ash requires less water than the Portland cement and is easier to use in the cold weather.

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

Q100. Which of the following statements is/are correct?

1. The National Action Programme for combating desertification was prepared in 2015, to take appropriate action in addressing the problems of desertification.
2. India is a signatory to the United Nations Convention to Combat Desertification (UNCCD).

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

ANSWER KEY

1.	b	**23.**	b	**45.**	a	**67.**	d	**89.**	a
2.	c	**24.**	a	**46.**	c	**68.**	c	**90.**	a
3.	d	**25.**	b	**47.**	d	**69.**	a	**91.**	d
4.	c	**26.**	a	**48.**	d	**70.**	b	**92.**	a
5.	c	**27.**	a	**49.**	c	**71.**	b	**93.**	b
6.	d	**28.**	a	**50.**	b	**72.**	d	**94.**	a
7.	d	**29.**	d	**51.**	a	**73.**	a	**95.**	c
8.	d	**30.**	b	**52.**	c	**74.**	b	**96.**	a
9.	b	**31.**	c	**53.**	c	**75.**	d	**97.**	c
10.	c	**32.**	c	**54.**	c	**76.**	b	**98.**	b
11.	c	**33.**	b	**55.**	c	**77.**	c	**99.**	c
12.	d	**34.**	c	**56.**	b	**78.**	b	**100.**	b
13.	c	**35.**	b	**57.**	b	**79.**	d		
14.	b	**36.**	b	**58.**	a	**80.**	c		
15.	c	**37.**	d	**59.**	a	**81.**	d		
16.	d	**38.**	a	**60.**	a	**82.**	c		
17.	b	**39.**	d	**61.**	b	**83.**	c		
18.	d	**40.**	c	**62.**	c	**84.**	d		
19.	b	**41.**	c	**63.**	a	**85.**	a		
20.	d	**42.**	d	**64.**	d	**86.**	c		
21.	c	**43.**	d	**65.**	d	**87.**	c		
22.	d	**44.**	c	**66.**	d	**88.**	b		

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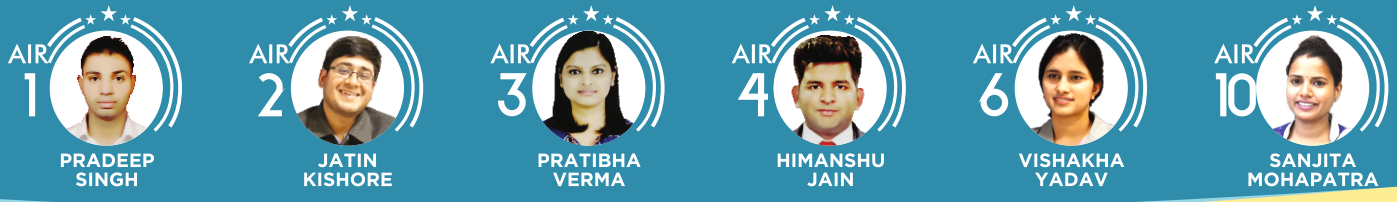

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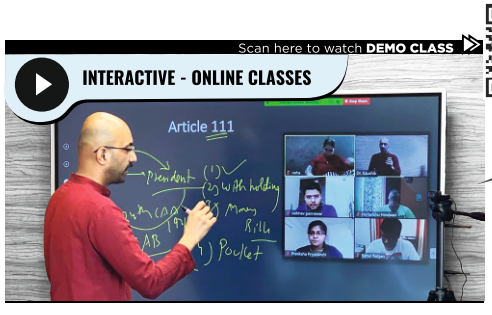

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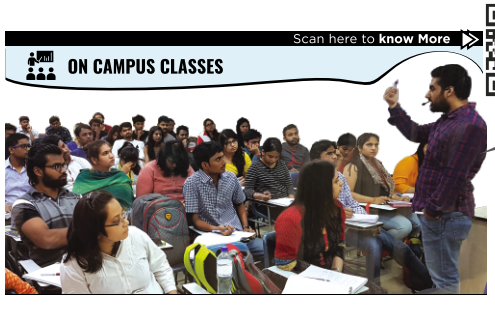

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