

ENVIRONMENT

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CHAPTER – BIODIVERSITY-1

- **Biodiversity** is considered to exist at **three levels**: genetics, species, and ecosystems.
- **Genetic diversity**: It is concerned with the variation in genes within a particular species.
- **Ecosystem/ Community diversity**: This refers to the different types of **habitats**. A habitat is the cumulative factor of the climate, vegetation and geography of a region.
- Biodiversity is measured by two major components: i. species richness, and ii. species evenness.
- **Species richness**: It is the measure of number of species found in a community
 - a) **Alpha diversity**- It refers to the diversity **within a particular area or ecosystem**, and is usually expressed by the **number of species**
 - b) **Beta diversity** -It is a **comparison** of diversity **between ecosystems**,
 - c) **Gamma diversity**- It is a measure of the **overall diversity** for the different ecosystems within a region.
- **Species evenness**: It measures the **proportion of species** at a given site, e.g. low evenness indicates that a few species dominate the site.
- The building blocks of plants, animals and humans are identical, and are made of the four elements - **carbon, oxygen, nitrogen and hydrogen**.

Modes of Conservation:-

- **Ex-situ conservation**: Conserving biodiversity outside the areas where they naturally occur is known as exsitu conservation-Seed banks, botanical, horticultural and recreational gardens
- **In-situ conservation**: Conserving the animals and plants in their natural habitats is known as in-situ
- International Union for Conservation of Nature (**IUCN**) **located in Morges**, Switzerland.
- The Red Data Book was first issued in 1966 by **the IUCN's Special Survival Commission**
- **Critically Endangered (CR)- criteria**
 - ✓ reduction in population (**> 90% over the last 10 years**),
 - ✓ population size (**number less than 50 mature individuals**),

- ✓ quantitative analysis showing the probability of extinction in wild in at least 50% in their 10 years) and
- ✓ it is therefore considered to be facing an extremely high risk of extinction in the wild.
- **Endangered (EN)- criteria**
 - ✓ reduction in population size (**70% over the last 10 years**),
 - ✓ population size estimated to number **fewer than 250 mature individuals**,
 - ✓ quantitative analysis showing the probability of extinction in wild in at least 20% within 20 years and it is therefore considered to be facing a very high risk of extinction in the wild.
- **Vulnerable (VU)-CRITERIA**
 - ✓ reduction in population (> 50% over the last 10 years)
 - ✓ population size estimated to number fewer than 10,000 mature individuals,
 - ✓ probability of extinction in wild is at least 10% within 100 years, and
 - ✓ it is therefore considered to be facing a high risk of extinction in the wild.

CHAPTER – BIODIVERSITY

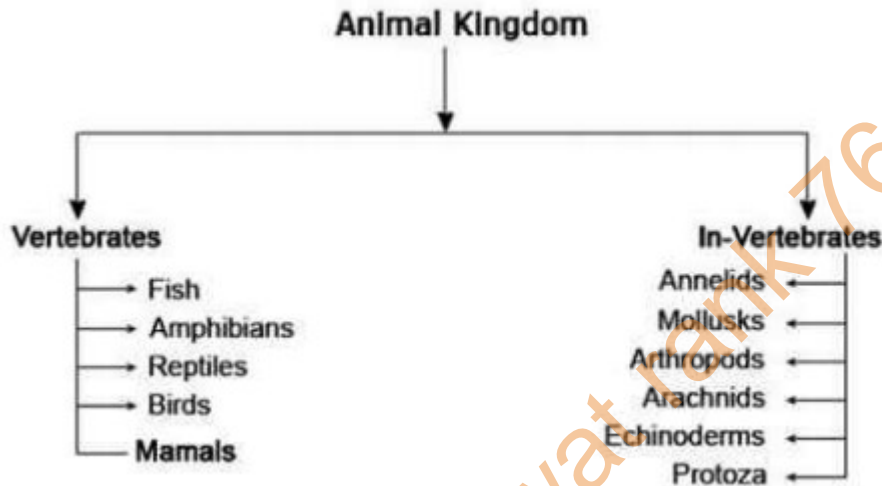
- With just **2.4% of the land area**, India accounts for nearly **7% of the recorded species** even while supporting almost **18% of human population**. In terms of species richness, India ranks **seventh in mammals, ninth in birds and fifth in reptiles**.
- **Realms**-large spatial regions within which ecosystems share a broadly

Eight terrestrial biogeographic realms are recognized.

1. Nearctic realm
2. Palearctic realm
3. Afrotropical realm
4. Indo-Malayan realm
5. Oceania realm
6. Australian realm
7. Antarctic realm
8. Neotropical realm

similar biota.

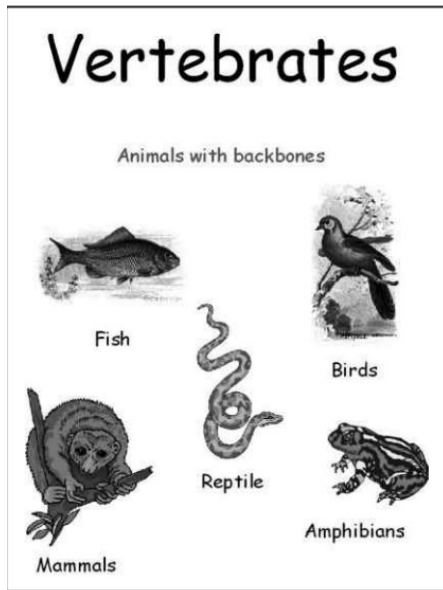
- The **Indian region** is composed of **two realms**. They are: 1) the Himalayan region represented by **Palearctic Realm** and 2) the rest of the sub-continent represented by **Malayan Realm**
- **Semi-arid** (15.6 %) > **Gangetic plain** (11%) > **Himalayas** (7.2%) > Desert 6.9 % > Western ghats 5.8% > Trans-Himalayas 5.7 % > North-east India 5.2 % > Deccan peninsula 4.3 % > **Islands**.0.03%



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- **Vertebrates**-Vertebrates are animals with **backbones** and spinal columns= represent only a **very small percentage** of all animal.
- **Fishes = Cold blooded**
- **Amphibians = Cold blooded = Live on land & water =Webbed feet**
=Breathe with lungs and gills = **Moist smooth skin** = Four legs (sometimes none)
- **Reptiles** = Cold blooded = Have scales =Have **dry skin**
- **Aves =Warm** blooded = Have feathers and wings
- **Mammals** = **Warm** blooded = Have hair or fur = Give birth to live young ones

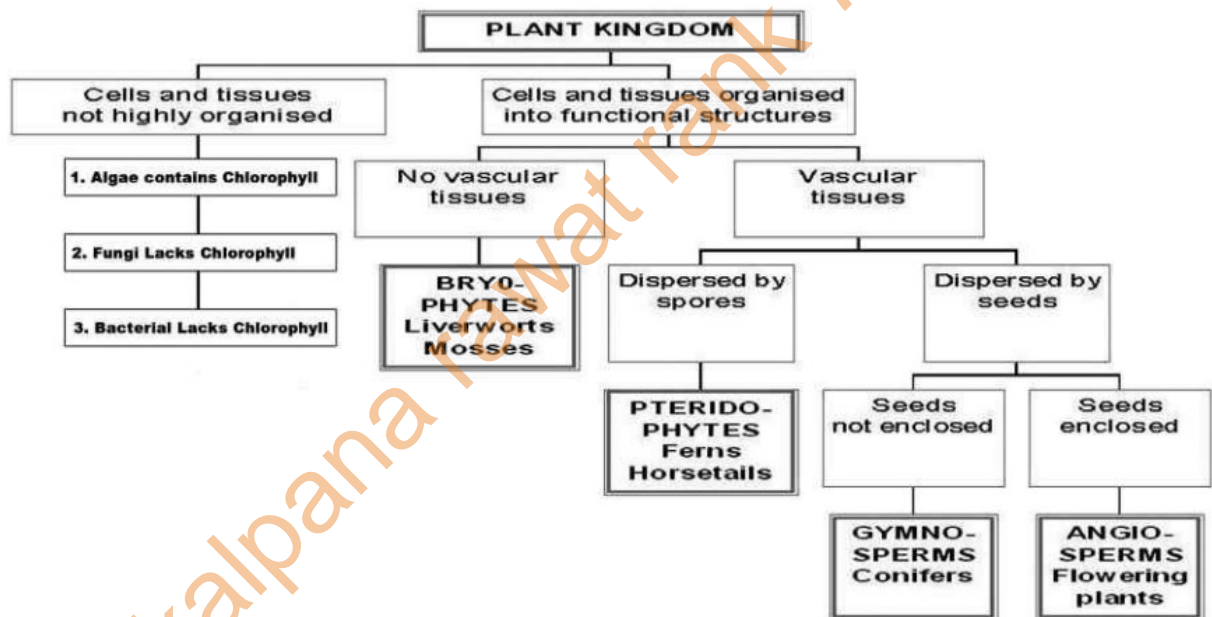
Invertebrates

Animals without backbones



- **Invertebrates** = Invertebrates **do not have backbones**. More than 98% animal species in the world are invertebrates.
- **Annelids** = bodies = **divided into segments**. = well-developed internal organs. = Found almost anywhere in the world. = don't have any limbs. E.g: **earthworms**, leeches, roundworms, etc.
- **Mollusks** = Most mollusks have a **soft, skin-like organ covered with a hard outside shell**. Some mollusks live on land, such as the **snail** and slug. Other mollusks live in water, such as the oyster, mussel, clam, squid and **octopus**.
- **Echinoderms** = Echinoderms are **marine animals** that live in the ocean. Most echinoderms have **arms or spines that radiate from the center** of their body. Common echinoderms include the **sea star**, sea urchin, sand dollar and sea cucumber.
- **Protozoa** = Protozoa are **simple, single-celled animals**. They are the **smallest of all** animals. Most protozoa are microscopic. They do breathe, move and reproduce like multicelled animals. E.g: **amoebas**, Flagellates, etc.

- **Arthropods** = Arthropods have **limbs with joints** that allow them to move. They also have an exoskeleton, which is a hard, external skeleton. Arthropods include the crustaceans and insects, arachnids.
- **Crustaceans** = live mostly in **the ocean or other waters**. Crustaceans have a hard, external shell which protects their body • Most commonly known crustaceans are the **crab, lob**
- **Arachnids** = Common arachnids are spiders, scorpions, ticks and mites.
 - Arachnids **do not have antennae**. Arachnids have 2 body parts and 4 pairs of legs.
- India ranks tenth in the world and fourth in Asia. India represents nearly 11% of the world's known floral diversity.



- **Algae** = The **green non differentiated plants** (non - differentiated into organs like root, stem and leaf.) possessing chlorophyll = usually grow in **water or in moist situations**. The fresh-water algae are generally green or blue-green in colour, whereas the marine ones are red or brown. These are autotrophic plants, as they can manufacture their own food.
- **Fungi**: **Non-green non differentiated plants** characterised by total absence of chlorophyll = grow either on dead, rotten organic matters as saprophytes or **live as parasites on other living bodies**, which are referred to as hosts. Moulds and mushrooms are the familiar examples of

saprophytic fungi. The maximum diversity of fungi is in the Western Ghats followed by the eastern Himalaya and the western Himalaya.

- **Bacteria** :- **Non-chlorophyllous micro-organisms** which lead saprophytic or parasitic existence. Many of them are pathogenic; Saprophytic bacteria are rather beneficial. They are soil borne and many of them are used in industries
- **Lichens**:- A lichen is a peculiar **combination of an algae and a fungus**– the two live deriving mutual benefit. They are group of **greyish green plants** which grow on rocks, tree-trunks, dead wood, etc. The algae manufactures food which becomes available to the fungus, and the absorbs and retains water and thus keeps the algal cells moist. **A example of symbiosis**. They are most common in wetlands, rare in rivers and streams and are not found in ground water.
- **Bryophytes**:- The plant body is differentiated into a small stem and simple leaves, but **true roots are absent**. They usually grow in **moist places**. E.g. Liverworts, mosses They are the second largest group of green plants in India distributed largely in Eastern Himalaya, North-eastern India, Western Himalaya and the Western Ghats.
- **Pteridophytes** :-The pteridophytes have well-**differentiated plant bodies, consisting of roots**, stems and leaves. Moreover, they possess vascular bundles. Most of them **are terrestrial plants** flourishing well in moist and shady places, and some of them are **aquatic**. This group includes the vascular cryptogams like clubmosses, horse-tails and ferns which are universally distributed all over the world. The north-eastern region (including Eastern Himalaya) is rich in pteridophytic diversity, followed by south India (including Eastern and Western Ghats)
- **Gymnosperms**:- Gymnosperms (gymnos=naked, sperma=seed) are the **naked-seeded plants**. They have very **simple flowers** without accessory whorls and stamens and carpels remain aggregated in cones. There is **nothing like ovary, style and stigma**, and naturally there is **no fruit**. e.g. Gnetum and Cycas are mostly confined to North Eastern region, Eastern and Western Ghats, and Andaman & Nicobar Islands.

- **Angiosperms**: Angiosperms (angeion=a case) are the **closed-seeded plants**. These are the most **highly developed plants** which bear flowers having conspicuous accessory and essential whorls. **Carpels have the ovary, style and stigma**. With the stimulus of fertilization the ovary usually develops into the fruit and the ovules into seeds. Thus the seeds remain within the fruits.
- In terms of population, India ranks **first in buffaloes, second in cattle** and goats, third in sheep, fourth in ducks, fifth in chicken and sixth in camels in the world.
- Wildlife Protection Act (WPA), 1972 consists of 6 schedule lists, which give varying degrees of protection.
- Schedule 1 and part II of Schedule 2 = Animals listed in schedule 1 and part II of schedule 2 have absolute protection - offences under these are prescribed the highest penalties.
- Schedule 3 and schedule 4 =Animals listed in schedule 3 and schedule 4 are also protected, but the penalties are lower compared to schedule 1 and part 2 of schedule 2.
- schedule 5 = Animals listed in **schedule 5** are called “**vermin**” which can be hunted.
- Schedule 6 = Cultivation, Collection, extraction, trade, etc. of Plants and its derivatives listed in schedule 6 are prohibited.
- **Pygmy Hog (Porcula salvania)**- critically endangered =**world’s smallest wild pig**=constructs a nest throughout the year=useful indicators of the management status of grassland habitats=restricted to only a single remnant population in **Manas Wildlife Sanctuary** and its buffer reserves=Pygmy hog-sucking Louse-parasite that feeds only on him=critically endangered as its survival is linked to that of the host species.
- The **Andaman White-toothed Shrew** is found on **Mount Harriet in the South Andaman Islands**.
- The **Jenkin’s Andaman Spiny Shrew** is found on Wright Myo and Mount Harriet in the **South Andaman Islands**

- The **Nicobar White-tailed Shrew** (*Crocidura nicobarica*) is found in the southern tip of Greater Nicobar Island and is also recorded in the area extending from the **Campbell Bay National Park** to the Galathea River in the **Andaman and Nicobar Islands**.
- **Kondana Rat (Millardia kondana)**= It is a nocturnal burrowing rodent that is found only in India. It is sometimes known to build nests.
- **The Large Rock Rat or Elvira Rat** (*Cremnomys elvira*) It is a medium sized, nocturnal and burrowing rodent. endemic to India. Habitat: Tropical dry deciduous shrubland forest, seen in rocky areas.= Known only from **Eastern Ghats of Tamil Nadu**.
- The **Namdapha Flying Squirrel** (*Biswamoyopterus biswasi*) It is a unique (the only one in its genus) flying squirrel that is restricted to a single valley in the **Namdapha N.P.** (or) W.L.S. in Arunachal Pradesh.
- The **Malabar Civet (*Viverra civettina*)** It is considered to be one of the world's rarest mammals. It is **endemic to India** and was first reported from Travancore, Kerala. It is nocturnal in nature and found exclusively in the Western Ghats.
- The **Sumatran** Rhinoceros (*Dicerorhinus sumatrensis*) . It is the **smallest** and most endangered of the five rhinoceros species. . It is now thought to be regionally extinct in India, though it once occurred in the foothills of the Himalayas and north-east India.
- **Kashmir stag/ hangul (*Cervus elaphus hanglu*)** . It subspecies of **Red Deer** which is **native to India**
- **Cobras** are cannibals, which mean that they will eat other snakes along birds, bird eggs and small mammals
- **Ganges river dolphin Habitat / distribution** - Ganges and Brahmaputra Rivers and their tributaries in Bangladesh, India and Nepal.
- **Indus river dolphin** = Habitat / distribution - Indus River in Pakistan and its Beas and Sutlej tributaries.
- **Dugong** (*Dugong dugon*) also called as sea cow. Status - vulnerable.
- unique feature of **monotremes**, a sub division of mammal, is that **monotremes lay eggs rather than giving birth to their young**. There are

only five living Monotreme/ egg laying Mammals species: they are - the **duck-billed platypus** and four species of spiny anteaters (also known as echidna). All of them are found only in Australia and New Guinea.

- **Echidnas** are also known as spiny ant eaters. • Habitat / distribution - Australia and New Guinea
- **Platypus** is a semi-aquatic mammal. Habitat / distribution - endemic to eastern Australia, including Tasmania.
- **Marsupials** = Marsupials are the group of mammals commonly thought of as **pouched mammals** (like the wallaby and kangaroo). Marsupial mammals have placenta but it is very shortlived and does not make as much of a contribution to fetal nourishment.

List of Marsupials

Phalangers	Opossum
Kola	Tasmanian devils
Kangaroo	Marsupial Mole (4 foot)
Wallaby	Bandi coot
Wombats	Tasmanian Wolf /Tiger
Dasyure	

- The **Jerdon's Courser** =It is a nocturnal bird found only in the northern part of the state of Andhra Pradesh in peninsular India. It is a flagship species=critically endangered
- The **White-bellied Heron** = extremely rare bird found in five or six sites in Assam and Arunachal Pradesh, one or two sites in Bhutan, and a few in Myanmar.= critically endangered
- The **Bengal Florican** =A rare bustard species that is very well known for its mating dance. Among the tall grasslands= critically endangered =: Native to only 3 countries in the world - Cambodia, India and Nepal. In India, it occurs in 3 states, namely Uttar Pradesh, Assam and Arunachal Pradesh

- **Sociable Lapwing (*Vanellus gregarious*)** It is a winter migrant to India. This species has suffered a sudden and rapid population decline due to which it has been listed as critically endangered.

12.6.2. Migratory birds of India

Winter birds	Summer birds
Siberian Cranes, Greater Flamingo, Common Teal, Yellow Wagtail, White Wagtail, Northern Shoveler, Rosy Pelican, Wood Sandpiper, Spotted Sandpiper, Eurasian Pigeon, Black Tailed Godwit, Spotted Redshank, Starling, Bluethroat, Long Billed Pipit.	Asian Koel, Black Crowned Night Heron, Eurasian Golden Oriole, Comb Duck, Blue Cheeked Bee Eater, Blue-Tailed Bee-Eater, Cuckoos.

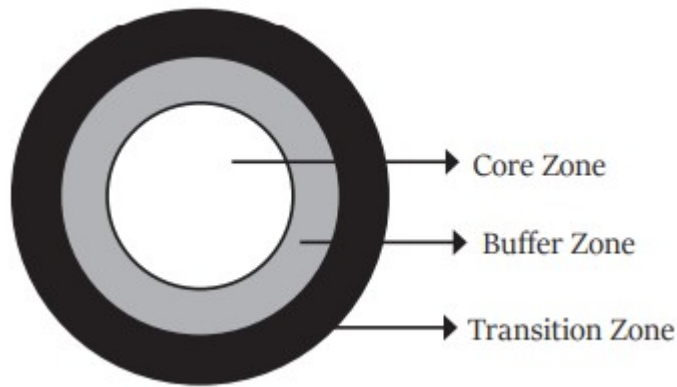
- **Herb** is defined as a plant whose stem is **always green** and tender with height of **not more than 1 meter**.
- **Shrub** is defined as a **woody perennial plant** differing from a perennial herb in its persistent and woody stem. **Not more than 6 meters** in height.
- **Epiphytes** - plant growing on the host plant but **not nourished by the host** plant. They do not draw food from the host plant. They only take the help of the host plant in getting access to light.
- **Bats are MAMMALS**. They are **warm blooded**, nurse their babies with milk and have fur. Bats are only mammals that can fly
- Out of 7 colours in the visible part of spectrum, **only red and blue are effective in photosynthesis**. Plant grown in **blue** light are **small**, **red** light results in **elongation of cells** results in etiolated plants. Plants grown in ultraviolet and violet light are dwarf.

- **Insectivorous plants of India**:- Drosera or Sundew, Aldrovanda(a freefloating, rootless aquatic plant, the only species found in India, occurs in the salt marshes of Sunderbans, south of Calcutta), Nepenthes, Utricularia or Bladderworts, Pinguicula or Butterwort
- **Invasive fauna** : 1. A new invasive gall forming insect of Eucalyptus in Southern India. • Leptocybe invasa - a new insect pest detected from few pockets of coastal Tamil Nadu and it has spread to peninsular India. • It is a tiny wasp that forms leaf and stem galls in Eucalyptus. 2. Crazy ant 3. Giant African snail 4. Myna 5. Gold Fish 6. Pigeon 7. Donkey 8. House Gecko 9. Tilapia
- **Invasive flora in India** :- Needle Bush, Black Wattle, Goat weed, Alternanthera paronychioides, Prickly Poppy, Blumea eriantha, . Palmyra, Toddy Palm, Calotropis / Madar, Swallo Wort, Datura, Mad Plant, Thorn Apple, Water Hyacinth, Impatiens, Balsam, Ipomoea / the pink morning glory, Lantana camara / Lantana, Wild Sage, Black Mimosa, Touch-Me-Not, Sleeping Grass, 4 '0' clock plant, . Parthenium / Congress grass, Parthenium, Prosopis juliflora / Mesquite, Townsend grass
- **MEDICINAL PLANTS**= Beddomes Cycad / Perita / Kondaitha, Blue vanda / Autumn Ladies Tresses Orchid, Kuth / Kustha / Pooshkarmoola / Uplet, Ladies Slipper Orchid, Red vanda, Sarpagandha, Ceropogia species., Emodi / Indian Podophyllum, Tree Ferns, Cycads, Elephant's foot
- The term '**plankton**' refers to the group of organisms **which float in the surface waters** of the rivers, lakes and oceans. Includes both microscopic **plants** like algae (phytoplankton) and **animals** like crustaceans and **protozoans** (zooplankton) found in all aquatic ecosystems, **except certain swift moving waters**. The **locomotory** power of the planktons is **limited** so that their distribution is controlled, largely, by currents in the aquatic ecosystems.
- The Wild Life (Protection) Act of 1972 provided for the declaration of certain areas **by the State Government** as **wildlife sanctuaries** if the area was thought to be of adequate ecological, geomorphological and natural significance.

- The Wild Life (Protection) Act (WPA) of 1972 provided for the declaration of **National Parks by the State Government** in addition to the declaration of wildlife sanctuaries.
- National Parks enjoy a greater degree of protection than sanctuaries.
Certain activities which are regulated in sanctuaries, such as grazing of livestock, are prohibited in National Parks.
- In cases **where territorial waters** is included, the limits (protected areas) shall be determined in consultation with the **Chief Naval Hydrographer** of the Central Government, after taking adequate measures to protect the occupational interests of the local fishermen.
- **No alteration of boundaries** of a sanctuary/National Park shall be made except on recommendation of the **National Board for Wild Life**.
- In the case of a claim to a right in or over any protected land referred to, the Collector shall pass an order admitting or rejecting the same in whole or in part If such claim is admitted in whole or in part, the Collector may either
 - (a) **exclude such land** from the limits of the proposed sanctuary or
 - (b) proceed to **acquire such land or rights**, except where by an agreement between the owner of such land or holder of rights and the Government, the owner or holder of such rights has agreed to surrender his rights to the Government, in or over such land, and on payment of such compensation, as is provided in the Land Acquisition Act, 1894
 - (c) allow, in consultation with the **Chief Wild Life Warden**, the continuation of any right of any person in or over any land within the limits of the sanctuary
- The **Chief Wild Life Warden** shall be the authority who shall **control, manage and maintain all Protected Areas**.
- The National Board for Wild Life may make recommendations on the setting up of and management of National Parks, Sanctuaries and other protected areas and on matters relating to restriction of activities in those areas

- **Conservation Reserve** and **Community Reserves** are the outcome of Amendments to the Wild life protection act in 2003.
- **Conservation reserve** :- It is an area **owned by the State Government** adjacent to National Parks and sanctuaries for protecting the landscape, seascape and habitat of fauna and flora. It is **managed through a Conservation Reserve Management Committee** • The State Government may, after having consultations with the local communities, declare any area owned by the Government as conservation reserve. • Tiruppadaimarathur conservation reserve in Tirunelveli, tamil nadu is the first conservation reserve established in the Country.
- **Community reserve** : • The State Government may notify **any community land or private land** as a Community Reserve, provided that the members of that community or individuals concerned are agreeable to offer such areas for protecting the fauna and flora, as well as their traditions, cultures and practices. The Reserve is **managed through a Community Reserve Management Committee** • The State Government may, where the community or an individual has volunteered to conserve wildlife and its habitat, declare the area by notification as community reserve. • **No change in land use pattern** shall be made within the Community Reserve, except in accordance with a resolution passed by the Management Committee and approval of the same by the State Government
- **Marine Protected Area (MPA)** as “any area of intertidal or sub tidal terrain, together with its overlaying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment” - IUCN.
- The **Marble Palace Zoo** in Calcutta city which was established in the year 1854 is the oldest existing zoo in the country.
- The **Man and the Biosphere (MAB) Programme** is an Intergovernmental Scientific Programme aiming to set a scientific basis for the improvement of the relationships between people and their environment global

- **Biosphere Reserve (BR)** is an international designation by UNESCO for representative parts of natural and cultural landscapes extending over large area of terrestrial or coastal/marine ecosystems or a combination thereof.
- Design of biosphere reserve :



- **Biodiversity hot spot** concept was put forth by **Norman Myers** in **1988** • To qualify as a hot spot, a region must meet **two strict criteria**:
 - a. Species endemism - it must **contain at least 1,500 species of vascular plants** (> 0.5% of the world's total) as **endemics**, and
 - b. Degree of threat - it has to have **lost at least 70% of its original habitat**.
- **Indian Biodiversity Hot Spots**. • There are 4 biodiversity hot spots present in India. They are:
 1. The Himalayas
 - 2. Indo- Burma and
 3. The western Ghats & Sri Lanka
 4. Sunderland
- **BIODIVERSITY COLDSPOTS** • Areas that have **relatively low biological diversity** but are also **experiencing a high rate of habitat loss**. Although a biodiversity coldspot is low in species richness, it can also be important to conserve, as it may be the only location where a rare species is found.

GREEN HOUSE GASES :

1. **Water vapour**=Water vapour is the **biggest overall contributor** to the greenhouse effect and humans are not directly responsible for emitting this gas in quantities sufficient to change its concentration in the atmosphere. the amount of water vapour in the air at any one time (and the amount of warming it causes) is strongly related to the amount of other greenhouse gases in the air.
2. **CARBON DIOXIDE**=Carbon dioxide (CO₂) is the primary greenhouse gas
3. **METHANE**=Methane (CH₄) is emitted by natural sources such as **wetlands**, as well as human activities such as leakage from natural gas systems and the **raising of livestock**
4. **NITROUS OXIDE** =Nitrous oxide (N₂O) is naturally present in the atmosphere as part of the Earth's nitrogen cycle, and has a variety of natural sources.
5. **FLUORINATED GASES**=There are three main categories of fluorinated gases— 1. hydrofluorocarbons (HFCs), 2. perfluorocarbons (PFCs), and 3. sulfur hexafluoride (SF₆).
6. **Black carbon (BC)** is a **solid particle or aerosol**, (though not a gas) contributes to warming of the atmosphere. • Black carbon, commonly known as **soot**, is a form of particulate air pollutant, produced from **incomplete combustion**. It consists of pure carbon in several linked forms. **Project Surya** has been launched to **reduce black carbon** in atmosphere by introducing efficient stove technologies, solar cookers, solar lamps and biogas plants.
7. **Brown carbon** is a ubiquitous and unidentified component of organic aerosol which has recently come into the forefront of atmospheric research
 - **Climate “forcings”** are factors in the climate system that either **increase or decrease the effects to the climate system**.
 - **Positive forcings** such as excess greenhouse gases **warm the earth** while **negative forcings**, such as the effects of most aerosols and volcanic eruptions, actually **cool the earth**.

- **Global warming potential** describes the impact of each gas on global warming
- The Global Warming Potential (GWP) for a gas is a measure of the total energy that a gas absorbs over a particular period of time (**usually 100 years**), compared to carbon dioxide. • Gases with a higher GWP absorb more energy, per pound, than gases with a lower GWP, and thus contribute more to warming Earth.

GWP & Lifetime of Green House Gases:

S. No	GAS	GWP (100-year)	LIFETIME (years)
1	Carbon di oxide	1	100
2	Methane	21	12
3	Nitrous oxide	310	120
4	Hydro fluoro carbons (HFCs)	140-11,700	1-270
5	Perfluoro carbons (PFCs)	6,500-9,200	800-50,000
6	Sulfur hexafluoride (SF ₆)	23,900	3,200

- As the uptake of atmospheric carbon dioxide by the ocean increases, the concentration of **hydrogen ions in the ocean increases**, the concentration of **carbonate ions decreases**, the pH of the oceans decreases and the oceans become less alkaline – this process is know as **ocean acidification**.

Forms of calcium carbonate

Calcite and aragonite are two different forms of calcium carbonate.

1. Calcite is the mineral form found in the shells of planktonic algae, amoeboid protists, some corals, echinoderms, and some molluscs (e.g. oysters); it is relatively less soluble.
2. Aragonite is a more soluble form of calcium carbonate; it is found in most corals, most mollusks (small planktonic snails), as well as some species of algae.

- **Deep, cold ocean waters** are naturally **under saturated** with **carbonate ions** causing the **shells** of most calcifying organisms to **dissolve**.
- **Surface waters** are **over saturated** with carbonate ions and **do not** readily **dissolve shells** of calcifying organisms.
- The current increased rate of dissolution of atmospheric CO₂ into the ocean results in an imbalance in the **carbonate compensation depth (CCD)**, **the depth at which all carbonate is dissolved**. As the pH of the ocean falls, it results in a shallowing of the **lysocline and the CCD**,
- **Hoolock Gibbon** is the **only ape found in India**. Rest of the monkeys are all macaques and langurs. In India is distributed in the northeast India.

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.

The habitats covered under Project tiger are:

- Central India conservation unit
- Shivalik-terai conservation unit
- North East conservation unit
- Sariska conservation unit
- Sunder bans conservation unit
- Eastern Ghats conservation unit
- Western Ghats conservation unit
- Tiger reserves are areas that are notified for the protection of the tiger and **its prey**, and are governed by Project Tiger which was launched in the country in 1973.
- The State Government shall, on recommendation of the **National Tiger Conservation Authority**, notify an area as a tiger reserve
- No alteration in the boundaries of a tiger reserve shall be made except on a recommendation of the **National Tiger Conservation Authority and the approval of the National Board for Wild Life**.

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.

ALL INDIA TIGER ESTIMATE-2018

- The **four-year tiger census** report, '**Status of Tigers, Co-predators, Prey and their Habitat, 2018**' **shows** the count of tigers in India, has risen to 2967, in 2018 from 2,226 in 2014. The **33% rise** in tiger numbers is the highest ever recorded between cycles which stood at 21% between 2006 and 2010 and 30% between 2010 and 2014.
- At 2,967, India hosts **70%** of the world's tigers
- Tiger status in Chhattisgarh, **Jharkhand and Odisha has steadily declined**.
- **Largest contiguous tiger population** in the world was found in the Western Ghats (**Nagarhole-Bandipur-Wayanad -Mudumalai- Satyamangalam-BRT block**)
- **Second largest** population was found across Uttarakhand and western Uttar Pradesh (**Rajaji-Corbett-Ramnagar-Pilibhit-Dudhwa block**).
- **Corbett TR** in Uttarakhand **has highest tiger density** in the world.
- Census was led by the **National Tiger Conservation Authority and the Wildlife Institute of India**, in collaboration with **State Forest Departments**. **World Wildlife Fund India** was the implementation partner.
- **Findings of All India Tiger Estimate-2018** = Biggest increase in tigers: The biggest increase has been in **Madhya Pradesh** from 308 in 2014 to 526. Now, MP has most number of tigers. • Continuing loss of tiger-occupied areas: The net loss in tiger-occupied area is estimated to be 20% of the tiger habitat in four years. The **decline** was spread over three out of India's five tiger landscapes: The **Shivalik, Western Ghats and the North East**, while Central India and the Sundarbans landscapes registered an increase. • **No tiger was recorded in Buxa (West Bengal), Dampa (Mizoram) and Palamu (Jharkhand) tiger reserves.**

- While the number of tigers has increased, the same is not true for the co-predators such as striped hyena, the Indian wild dog (dhole), jackals and wolves
- **Technologies in the report** = 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.
- **CaTRAT (Camera Trap Data Repository and Analysis Tool)**: It is an image processing software used for organizing and geotagging of photo-captures.
 - **ExtractCompare** for tigers and **HotSpotter** for leopards: Individual identification of tigers and leopards was done using these pattern recognition programmes.
- **Spatially explicit capture–recapture (SECR)** method: used to estimate population density from camera trap data.
- **Cytochrome-b marker**: Where camera trappings were not possible due to low tiger numbers, scat (droppings) samples were collected to estimate minimum number of tigers through genetic analysis. Genomic DNA was extracted and samples were screened for species identification using a tiger specific cytochrome-b marker.
- **Maximum Entropy Models (MaxEnt)**: In some north-eastern states with logistical concerns, MaxEnt was used which is based on photos taken within small intensively searched areas to model suitable tiger habitat.
- During the release of the report, a **water and fodder scheme** was proposed within the reserves so that fewer animals stray out of these reserves and minimizes animal-human conflict.

Global Conservation Efforts

- **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, with the aim of working together to save wild tigers from extinction. In 2013, the scope was broadened to include Snow Leopards.
- **St. Petersburg Tiger Summit in Russia, 2010:** All 13 tiger range countries came together for the first time with the commitment of doubling the number of wild tigers by 2022.
- **Global Tiger Recovery Program (GTRP):** It seeks to empower Tiger Range Countries to address the entire spectrum of threats, domestic as well as those that are transboundary in nature, and work toward increased financial sustainability through the integration of conservation objectives into development.
- 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:** 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 CA|TS:** 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.

- **CA | TS** = It is being adopted for use beyond tigers, including potentially jaguars, lions and freshwater dolphins. World Wide Fund for Nature is helping tiger range countries to implement CA|TS.
- **TTCA** = TX2 Tiger Conservation Awards=are given in two categories:
- **Tiger Conservation Excellence Award: Transboundary Manas Conservation Area** (TraMCA) comprising Manas National Park in Assam and Royal Manas National Park in Bhutan **won this award.**

- **TX2 Award**: This award is given for efforts to increase tiger population and includes a financial grant to assist ongoing conservation. **Pilibhit Tiger Reserve (PTR) in Uttar Pradesh won this award for doubling its population.** PTR is important for connectivity across the vast Terai Arc Landscape of India and Nepal. Its southern boundary is marked by the **river Sharada and Khakra.**
- **Indian Tiger or Royal Bengal Tiger (Panthera tigris)**
 - It is the tiger species **native** to India.
 - The largest populations of Bengal tigers are in India, but there are some smaller groups in Bangladesh, Nepal, and Bhutan. It may also be present in areas of China and Burma.
 - India is home to 80% of global tiger population.
 - Bengal tiger habitats usually are tropical rainforests, marshes, and tall grasses.
 - The tigers are an "umbrella" species as by rescuing them, we save everything beneath their ecological umbrella - everything connected to them.
 - Conservation status of Tiger: IUCN Red List: **Endangered**, Wild life protection Act: **Schedule I** and CITES: **Appendix I.**
 - **The 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 out 32 major **corridors** across the country.
 - Its management interventions are operationalised through a **Tiger Conservation Plan**, mandated under section 38V of the **Wildlife (Protection) Act, 1972.**
 - For demarcating these corridors, country has been divided into 4 landscapes:
 - o Shivalik Hills & Gangetic Plains- 3 corridors
 - o Central India & Eastern Ghats- 11 corridor
 - o Western Ghats- 8 corridors
 - o North East- 10 corridors

- Recently, Centre granted **“in-principle” clearance for uranium exploration** in **Amrabad Tiger Reserve** in Telangana. Amrabad Tiger Reserve lies in Nallamala hill that stretch in Mahbubnagar and Nalgonda districts of Telangana.
 - o The area lies along a patch where the Nallavagu and Dindi rivers merge, forming a major tributary and catchment of the Krishna river.
 - o It is India’s second-largest tiger reserve, next only to the Nagarjunasagar Srisaillam Tiger Reserve, Andhra Pradesh.
- In 2017, the endangered species of mouse deer was reintroduced here.
- Tribes: Amrabad is dominated by the Chenchus, a Schedule Tribe.
- Archaeological aspect: It contains ruins of the ancient Nagarjuna Viswa Vidyalayam run by the great Buddhist scholar Nagarjunacharya (150 AD).
- Pakke Tiger Reserve • PTR It is bounded by Bhareli or Kameng River in the west and north, and by Pakke River in the east.
- Rajasthan has become the first state to launch project Leopard to conserve it by improving their prey base, mitigating man and leopard conflict and controlling poaching.
- Project Elephant was launched in February, 1992 as centrally sponsored scheme to assist states having free ranging populations of wild elephants and to ensure long term survival of identified viable populations of elephants in their natural habitats
- Haathi Mere Saathi is a campaign launched by the Ministry of environment and forest (MoEF) in partnership with the wildlife trust of India (WTI).
- Vulture Breeding and Conservation Centre had already been established at Pinjore, Haryana in 2001, and Rani, Guwahati (Assam) and another one has been established at Buxa, West Bengal in 2005.
- Indian rhino vision 2020 implemented by the department of environment and forests, Assam with The Bodo autonomous council as a active partner. The programme will be supported by WWF – India, WWF areas (Asian rhino and elephant action strategy) programme, the international rhino foundation (IRF), save the rhino’s campaign of zoological institutions worldwide and a number of local NGOs.
- The vision of this program is to increase the total rhino foundation in Assam from about 2000 to 3000 by

the year 2020 and to ensure that these rhinos are distributed over at least 7 protected areas (PA) to provide long term viability of the one-horned rhino population.

- Global Snow Leopard and Ecosystem Program (GSLEP) • It is an inter-governmental alliance of all the 12 Snow Leopard range countries. • The GSLEP is a range-wide effort that unites range country governments, nongovernmental and inter-governmental organizations, local communities, and the private sector around a shared vision to conserve snow leopards and their valuable high-mountain ecosystems. • The Snow Leopard countries namely, India, Nepal, Bhutan, China, Mongolia, Russia, Pakistan, Afghanistan, Kyrgyzstan, Kazakhstan, Tajikistan, and Uzbekistan. Snow Leopard Population Estimation in India (SLPAI) • SLPAI has been prepared by the Wildlife Institute of India, Nature Conservation Foundation, GSLEP committee, Global Tiger Initiative Council, World Wide Fund for Nature, World Bank, Global Tiger Forum and Wildlife Conservation Trust. • National-level estimation processes are done for Tigers, Rhinos and Elephants. With this protocol, the same can now be done for Snow Leopards. • Only 2% of the total habitats of snow leopards have been sampled for population estimation due to difficult terrain and an elusive nature of snow leopards, according to SLPAI document. About Snow Leopard • It is classified as Vulnerable by IUCN and is under Schedule I of the Indian Wildlife (Protection) Act 1972. • They are listed in Appendix I of the Convention on International Trade in Endangered Species (CITES) and the Convention on Migratory Species (CMS). • In India, Snow Leopards are found in the Himalayan and trans-Himalayan landscape at an elevation between 3,000 meters and 5,400 m, spanning over 100,000 square km across Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh • Threats: Habitat Fragmentation, Illegal killing, poaching for fur, bones, claws etc., retaliatory attacks by locals.
- Project Snow Leopard-Centrally sponsored programme for protection and preservation of Snow Leopard • Secure Himalaya to ensure conservation of locally and globally significant biodiversity, land and forest resources in the

high Himalayan ecosystem, while enhancing the lives and livelihoods of local communities. It is funded by GEF and UNDP.

- **SEA TURTLE PROJECT:-** With the objective of conservation of olive ridley turtles and other endangered marine turtles, Ministry of Environment & Forests initiated the Sea Turtle Conservation Project in collaboration of UNDP in November, 1999 with Wildlife Institute of India, Dehradun as the Implementing Agency
- **SAWEN** (e Statute of the South Asia Wildlife Enforcement Network) , a Regional network is comprised of eight countries in South Asia: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. It aims at working as a strong regional inter governmental body for combating wildlife crime by attempting common goals and approaches for combating illegal trade in the region
- The Ganges Dolphin is among the four “obligate” freshwater dolphins found in the world – the other three are the ‘baiji’ found in the Yangtze River (China), the ‘bhulan’ of the Indus (Pakistan) and the ‘boto’ of the Amazon River (Latin America). All fresh water, brackish water and marine Dolphins (Cetaceans) are listed in Schedule-I of the Wild Life (Protection) Act, 1972,

National Action Plan on Climate Change

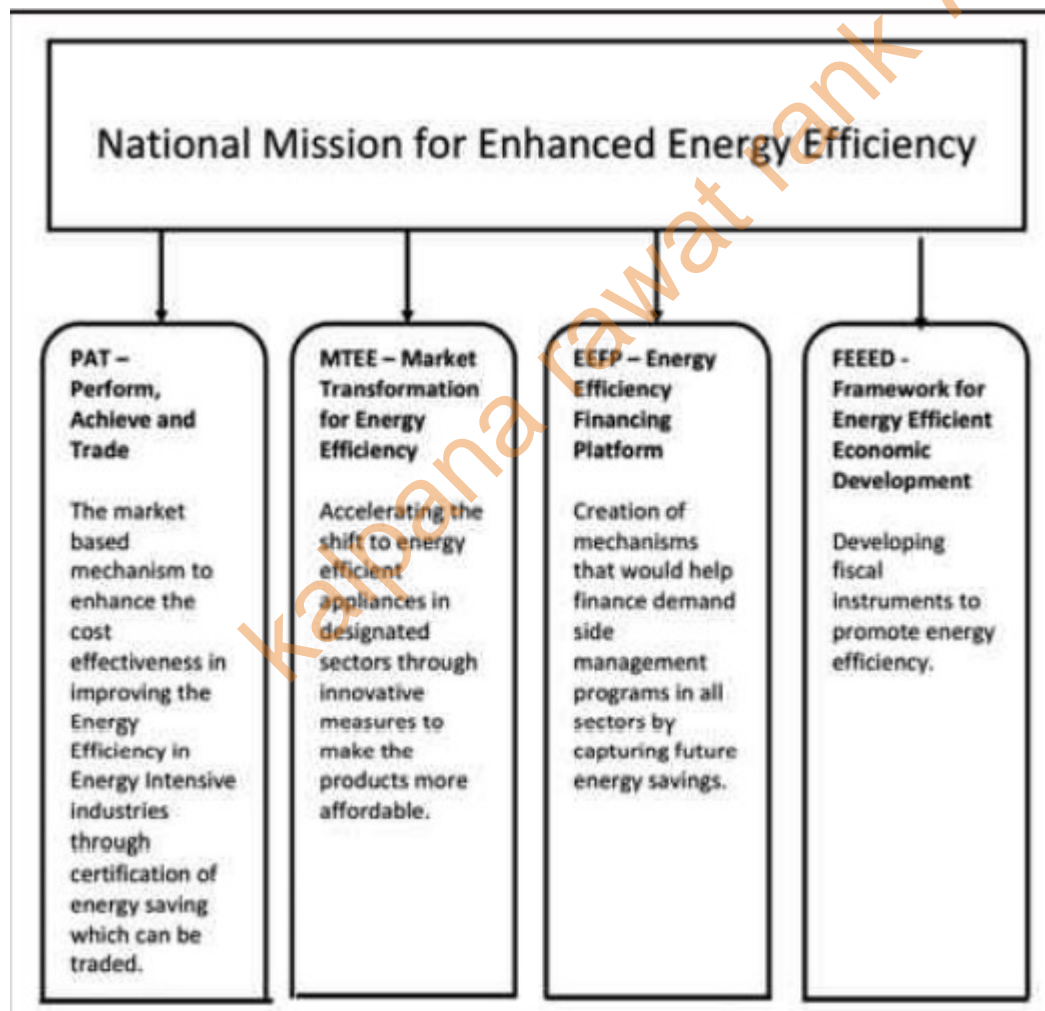
- The **National Action Plan on Climate Change (NAPCC)** was launched in **2008** by the **Prime Minister's Council on Climate Change**.
- There are **8 national missions** forming the core of the NAPCC which represent multi-pronged, long term and integrated strategies for achieving key goals in climate change.

1. The Jawaharlal Nehru National Solar Mission

- governed by **Ministry of New and Renewable Energy**.
- It was **launched in 2010** with the primary aim of achieving **grid parity by 2022** and **with coal-based thermal power by 2030**.
- Aims to increase the share of **solar energy** in India's energy mix.
- Seeks to **reduce the absolute cost** of solar energy to bring it down and make it affordable.

2. National Mission for Enhanced Energy Efficiency

- Governed by the **Ministry of Power**.
- Based on the **Energy Conservation Act, 2001**.
- It creates a market based mechanism to **enhance cost effectiveness** of improvements on energy efficiency. Switching to cleaner fuels, commercially viable technology transfers, capacity building needs etc are the way forward for this mission.
- **Development with energy efficiency** as a key criterion.



3. National Mission on Sustainable Habitat

- Governed by the **Ministry of Urban Development**.

4. National Water Mission

- Governed by the **Ministry of Water Resources, River Development and Ganga Rejuvenation.**
- Ensures **better integrated water resource management** leading to **water conservation, less wastage, equitable distribution** forming better policies.
- Looks into the issues of **groundwater and surface water management, domestic and industrial water management, improvement of water storage capacities and protection of wetlands.**

5. National Mission for Sustaining the Himalayan Ecosystem

- Governed by the **Department of Science and Technology.**
- Created to **protect the Himalayan ecosystem.** The mandate is to evolve measures to **sustain and safeguard the Himalayan glaciers, mountain ecosystems, biodiversity and wildlife conservation & protection.**

6. National Mission for Green India

- Governed by the **Ministry of Environment, Forest and Climate Change.**
- It has the **mandate of reviving degraded forest land** with a focus on **increasing forest cover & density** and **conserving biodiversity.**
- Works towards **reducing fragmentation of forests, enhancing private public partnerships for plantations, improving schemes based on joint forestry management etc.**

7. National Mission for Sustainable Agriculture

- Governed by the **Ministry of Agriculture.**
- It works towards **devising strategies** to make **Indian agriculture less susceptible to climate change.**
- It would **identify and develop new crop varieties, use traditional and modern agricultural techniques.**
- This mission sees **dry land agriculture, risk management, access to information and use of biotechnology** as areas of intervention.

8. National Mission on Strategic Knowledge for Climate Change

- Governed by the **Department of Science and Technology.**
- It **identifies challenges and requisite responses** to climate change. This will be done through **open international collaboration** and **would ensure sufficient funding** for this research.
- The efforts undertaken here would feed into the **Indian National Network for Climate Change Assessment (INCCA)** which is a **stock**

taking exercise conducted every two years as part of the national obligations under UNFCCC.

- The Indian Network on Climate Change Assessment (INCCA) was launched in October 2009 by the Ministry of Environment and Forests (MoEF) in an effort to promote domestic research on climate change, and build on the country's climate change expertise.
- In pursuance of the implementation of the provisions of the Convention, India's Initial National Communication (NATCOM) to the UNFCCC has been initiated in 2002 funded by the Global Environment Facility under its enabling activities programme through the United Nations Development Programme, New Delhi. The Ministry of Environment and Forests (MoEF) is implementing and executing agency of the project.
- Green Rating for Integrated Habitat Assessment (GRIHA) • GRIHA is a Sanskrit word meaning – 'Abode'. • GRIHA has been conceived by TERI and developed jointly with the Ministry of New and Renewable Energy, Government of India. • The green building rating system devised by TERI and the MNRE is a voluntary scheme. Objective • The primary objective of the rating system is to help design green buildings and, in turn, help evaluate the 'greenness' of the buildings.

Sl.No.	State	Local term for Sacred Groves	No. of sacred groves
1	Andhra Pradesh	Pavithravana	580
2	Arunachal Pradesh	Gumpa Forests (attached to Buddhist monestries)	101
3	Goa	Deorai, Pann	55
4	Jharkhand	Sarana	29
5	Karnataka	Devara Kadu	1531
6	Kerala	Kavu, Sara Kavu	299
7	Maharashtra	Devrai, Devrahati, Devgudi	2820
8	Manipur	Gamkhap, Mauhak (sacred bamboo reserves)	166
9	Meghalaya	Ki Law Lyngdoh, Ki Law Kyntang, Ki Law Niam	101
10	Orissa	Jahera, Thakuramma	169
11	Puducherry	Kovil Kadu	108
12	Rajasthan	Orans, Kenkris, Jogmaya	560
13	Tamil Nadu	Swami shola, Koilkadu	752
14	UttaraKhand	Deo Bhumi, Bugyal (sacred alpine meadows)	22
15	West Bengal	Garamthan, Harithan, Jahera, Sabitrithan, Santalburithan	39

Similarly several water bodies are declared sacred by people. This indirectly leads to protection of aquatic flora and fauna. (E.g. khecheoprai lake in Sikkim)

7. Natural World Heritage Sites

World Heritage Site is a place that is listed by the UNESCO as of special cultural or physical significance.

S.No.	Name of WH Site	State Location
1	Kaziranga National Park	Assam
2	Keoladeo Ghana National Park	Rajasthan
3	Manas Wildlife Sanctuary	Assam
4	Nanda Devi National Park and Valley of Flowers	Uttarakhand
5	Sunderbans National Park	West Bengal
6	Western Ghats	Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala
7	Great Himalayan National Park	Himachal Pradesh

5. Biosphere reserves

Biosphere reserves are sites established by countries and recognized under UNESCO's Man and the Biosphere (MAB) Programme to promote sustainable development based on local community efforts and sound science. The programme of Biosphere Reserve was initiated by UNESCO in 1971.

S.No	Name	Location (State)
1.	Achanakamar - Amarkantak	Covers parts of Anupur and Dindori districts of M.P. and parts of Bilaspur districts of Chhattishgarh State.
2.	Agasthyamalai	Neyyar, Peppara and Shendurney Wildlife Sanctuaries and their adjoining areas in Kerala.
3.	Cold Desert	Pin Valley National Park and surroundings; Chandratal and Sarchu & Kibber Wildlife Sanctuary in Himachal Pradesh
4.	Dehang-Dibang	Part of Siang and Dibang Valley in Arunachal Pradesh.
5.	Dibru-Saikhowa	Part of Dibrugarh and Tinsukia Districts (Assam)
6.	Great Nicobar	Southern most islands of Andaman And Nicobar (A&N Islands).

7.	Gulf of Mannar	Indian part of Gulf of Mannar between India and Sri Lanka (Tamil Nadu).
8.	Kachchh	Part of Kachchh, Rajkot, Surendra Nagar and Patan Civil Districts of Gujarat State
9.	Khang chendzonga	Parts of Khang chendzonga hills and Sikkim.
10.	Manas	Part of Kokrajhar, Bongaigaon, Barpeta, Nalbari, Kamrup and Darang districts (Assam)
11.	Nanda Devi	Part of Chamoli, Pithoragarh, and Bageshwar districts (Uttarakhand).
12.	Nilgiri	Part of Wayanad, Nagarhole, Bandipur and Madumalai, Nilambur, Silent Valley and Siruvani hills (Tamil Nadu, Kerala and Karnataka).
13.	Nokrek	Part of Garo hills (Meghalaya).

14.	Pachmarhi	Parts of Betul, Hoshangabad and Chindwara districts of Madhya Pradesh.
15.	Seshachalam Hills	Seshachalam Hill Ranges covering parts of Chittoor and Kadapa districts of Andhra Pradesh
16.	Simlipal	Part of Mayurbhanj district (Orissa).
17.	Sunderbans	Part of delta of Ganges and Brahmaputra river system (West Bengal).
18.	Panna	Part of Panna and Chhatarpur districts in Madhya Pradesh.

6. List of INDIA's Biosphere Reserves in UNESCO'S WNBR.

S.No	NAME	STATE
1.	Nilgiri	Tamil Nadu, Kerala, Karnataka
2.	Gulf of Mannar	Tamil Nadu
3.	Sunderbans	West Bengal
4.	Nanda Devi	Uttarakhand
5.	Nokrek	Meghalaya
6.	Pachmarhi	Madhya Pradesh
7.	Similipal	Orissa
8.	Achanakmar-Amarkantak	Chhattishgarh
9.	Great Nicobar	Andaman & Nicobar
10.	Agasthyamalai Biosphere Reserve	Kerala and Tamil Nadu
11.	Khangchendzonga National Park	Sikkim

4 Mike Sites in India

S.No	Name	State
1.	Chirang Ripu	Assam
2.	Dhang Patki	Assam
3.	Eastern Dooars	WB
4.	Deomali	Arun Pradesh
5.	Garo Hills	Meghalaya
6.	Mayurbhanj	Orissa
7.	Mysore	Karnataka
8.	Nilgiri	Tamil Nadu
9.	Shivalik	Uttarakhand
10.	Wayanad	Kerala

Mayurjharna = WB
Mayurbhanj : Orissa.

3. Elephant Reserves of India

The Indian elephant *Elephas maximus* occurs in the central and southern Western Ghats, North-east India, eastern India and northern India and in some parts of southern peninsular India. It is distributed in 16 of the 28 states in the country and is showing an increasing trend across its distributional range.

Sl.No	ELEPHANT RANGE	ELEPHANT RESERVE	STATE
1.	East-Central Landscape (South-West Bengal-Jharkhand - Orissa)	1. Mayurjharna ER 2. Singhbhum ER 3. Mayurbhanj ER 4. Mahanadi ER 5. Sambalpur ER 6. Baitami ER 7. South Orissa ER 8. Lemru ER 9. Badalkhol - Tamorpingla ER	West Bengal Jharkhand Orissa Orissa Orissa Orissa Orissa Chhattishgarh Chhattishgarh
2.	Kameng-Sonitpur Landscape (Arunachal - Assam) Total	10. Kameng ER 11. Sonitpur ER	Arunachal Assam
3.	Eastern-South Bank Landscape (Assam - Arunachal)	12. Dihing-Patkai ER 13. South Arunachal ER	Assam Arunachal

Sl.No	ELEPHANT RANGE	ELEPHANT RESERVE	STATE
4.	Kaziranga-Karbi Anglong-Intanki Landscape (Assam - Nagaland)	14. Kaziranga-Karbi Anglong ER 15. Dhansiri-Lungding ER 16. Intanki ER	Assam Assam Nagaland
5.	North Bengal- Greater Manas Landscape (Assam - West Bengal)	17. Chirang-Ripu ER 18. Eastern Dooars ER	Assam West Bengal
6.	Meghalaya Landscape (Meghalaya)	19. Garo Hills ER 20. Khasi-hills ER	Meghalaya Meghalaya
7.	Brahmagiri-Nilgiri-Eastern Ghat Landscape (Karnataka - Kerala-Tamilnadu- Andhra)	21. Mysore ER 22. Dandeli ER 23. Wayanad ER 24. Nilgiri ER 25. Rayala ER 26. Nilambur ER 27. Coimbatore ER	Karnataka Karnataka Kerala Tamil Nadu Andhra pradesh Kerala Tamil Nadu
8.	Anamalai-Nelliampathy- High Range Landscape (Tamilnadu - Kerala)	28. Anamalai ER 29. Anamudi ER	Tamil Nadu Kerala
9.	Periyar-Agasthyamalai Landscape (Kerala - Tamilnadu)	30. Periyar ER 31. Srivilliputhur ER	Kerala Tamil Nadu
10.	North-Western Landscape (Uttarakhand - Uttar Pradesh)	32. Shivalik ER 33. Uttar Pradesh ER	Uttarakhand U.P.

1. Ramsar wetland sites in India

The Ramsar Convention is an international treaty for the conservation and sustainable utilization of wetlands, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value.

S.No	Name	State
1.	Kolleru Lake	Andhra Pradesh
2.	Deepor Beel	Assam
3.	Nalsarovar Bird Sanctuary	Gujarat
4.	Chandra Taal	Himachal Pradesh
5.	Pong Dam Lake	Himachal Pradesh
6.	Renuka Wetland	Himachal Pradesh
7.	Hokersar Wetland	Jammu and Kashmir
8.	Surinsar-Mansar Lakes	Jammu and Kashmir
9.	Tsomoriri	Jammu and Kashmir
10.	Wular Lake	Jammu and Kashmir
11.	Ashtamudi Wetland	Kerala
12.	Sasthamkotta Lake	Kerala
13.	Vembanad-Kol Wetland	Kerala
14.	Bhoj Wetland	Madhya Pradesh
15.	Loktak Lake	Manipur

16.	Bhitarkanika Mangroves	Orissa
17.	Chilika Lake	Orissa
18.	Harike Wetland	Punjab
19.	Kanjli Wetland	Punjab
20.	Ropar	Punjab
21.	Keoladeo National Park	Rajasthan

S.No	Name	State
22.	Sambhar Lake	Rajasthan
23.	Point Calimere Wildlife and Bird Sanctuary	Tamil Nadu
24.	Rudrasagar Lake	Tripura
25.	Upper Ganga River (Brijghat to Narora Stretch)	Uttar Pradesh
26.	East Calcutta Wetlands	West Bengal

2. Tiger Reserves of India

Project Tiger was launched by the Government of India in the year 1973 to save the endangered species of tiger in the country. Starting from nine (9) reserves in 1973-74 the number is grown up to fifty two (52).

Sl. No	Name of Tiger Reserve	State
1	Nagarjunsagar Srisailem (part)*	Andhra Pradesh
2	Namdapha	Arunachal Pradesh
3	Pakke	Arunachal Pradesh
4	Kamlang	Arunachal Pradesh
5	Orang	Assam
6	Manas	Assam
7	Nameri	Assam
8	Kaziranga	Assam
9	Valmiki	Bihar
10	Udanti-Sitanadi	Chhattisgarh
11	Achanakmar	Chhattisgarh
12	Indravati	Chhattisgarh
13	Palamau	Jharkhand
14	Bandipur	Karnataka

Sl. No	Name of Tiger Reserve	State
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

Sl. No	Name of Tiger Reserve	State
35	Satkosia	Odisha
36	Ranthambore	Rajasthan
37	Sariska	Rajasthan
38	Mukandra Hills	Rajasthan
39	Kalakad-Mundanthurai	Tamil Nadu
40	Mudumalai	Tamil Nadu
41	Sathyamangalam	Tamil Nadu
42	Anamalai	Tamil Nadu
43	Kawal	Telangana
44	Nagarjunasagar Srisailem (part) *(atmakur)	Telangana
45	Dudhwa	Uttar Pradesh
46	Pilibhit	Uttar Pradesh
47	a. Amangarh (buffer of Corbett TR) b. Corbett	Uttar Pradesh Uttarakhand
48	Rajaji TR	Uttarakhand
49	Sunderbans	West Bengal
50	Buxa	West Bengal

INTERNATIONAL CONVENTIONS

- United Nations Conference On Environment And Development (UNCED):-
- Rio Summit, Rio Conference, Earth Summit held in Rio de Janeiro in June 1992.
- The Earth Summit resulted in the following documents: • Rio Declaration on Environment and Development • Agenda 21 • Forest Principles
- Agenda 21 • Agenda 21 is an action plan of the United Nations (UN) related to sustainable development and was an outcome of the United Nations

Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil, in 1992. 21st century

- Rio+5 = In 1997, the General Assembly of the UN held a special session to appraise five years of progress on the implementation of Agenda 21 (Rio +5).
- The Johannesburg Summit • The Johannesburg Plan of Implementation, agreed at the World Summit on Sustainable Development (Earth Summit 2002) affirmed UN commitment to 'full implementation' of Agenda 21, alongside achievement of the Millennium Development Goals and other international agreements.

RAMSAR CONVENTION ON WETLANDS

- It was adopted in the Iranian city of Ramsar in 1971 and came into force in 1975, and it is the only global environmental treaty that deals with a particular ecosystem.
- Ramsar is not affiliated with the United Nations system of Multilateral Environmental Agreements,
- World Wetlands Day, 2 February every year.
- Five global non-governmental organizations (NGOs) have been associated with the treaty since its beginnings and were confirmed in the formal status of International Organization Partners (IOPs) of the Convention. 1. BirdLife International (formerly ICBP) 2. IUCN – The International Union for the Conservation of Nature 3. IWMI – The International Water Management Institute 4. Wetlands International (formerly IWRB, the Asian Wetlands Bureau, and Wetlands for the Americas) 5. WWF (World Wide Fund for Nature) International
- The Changwon Declaration on human well-being and wetlands

CITES

- An international agreement between governments entered into force in 1975, and became the only treaty to ensure that international trade in plants and animals does not threaten their survival in the wild.

- administered through the United Nations Environment Programme (UNEP). A Secretariat, located in Geneva, Switzerland, o
- Appendix I: • Includes species threatened with extinction and provides the greatest level of protection, including restrictions on commercial trade.
- Appendix II: • Includes species that although currently not threatened with extinction, may become so without trade controls
- Appendix III: • Includes species for which a range country has asked other Parties to help in controlling international trade. Examples include map turtles, walrus and Cape stag beetles.

TRAFFIC

- TRAFFIC is a joint conservation programme of WWF and IUCN.
- It was established in 1976 by the Species Survival Commission of IUCN
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Secretariat.

CONVENTION ON THE CONSERVATION OF MIGRATORY SPECIES (CMS)

- Also called Bonn Convention) aims to conserve terrestrial, aquatic and avian migratory species throughout their range.
- concluded under the aegis of the United Nations Environment Programme,
- Appendix I • Migratory species threatened with extinction are listed on Appendix I of the Convention
- Appendix II • Migratory species that need or would significantly benefit from international co-operation are listed in Appendix II of the Convention.
- The Agreements may range from legally binding treaties (called Agreements) to less formal instruments, such as Memoranda of Understanding.
- The Indian Government has signed 'Raptor MoU', on Conservation of Migratory Birds of Prey in Africa and Eurasia, with the Convention on Conservation of Migratory Species (CMS), orThe 'Raptor MoU' is an agreement under Article IV paragraph 4 of the CMS and is not legally

binding. The 'Raptor MoU' extends its coverage to 76 species of birds of prey, out of which 46 species

COALITION AGAINST WILDLIFE TRAFFICKING (CAWT)

- Initiated in 2005, CAWT is a unique voluntary publicprivate coalition of like-minded governments and organizations sharing a common purpose.
- The CAWT organisation is not directly involved in any enforcement activities.

THE INTERNATIONAL TROPICAL TIMBER ORGANIZATION (ITTO)

- ITTO is an intergovernmental organization, under UN (1986) promoting the conservation and sustainable management, use and trade of tropical forest resources.

UNITED NATIONS FORUM ON FORESTS (UNFF)

- The Economic and Social Council of the United Nations (ECOSOC), established the United Nations Forum on Forests (UNFF) In October 2000, a subsidiary body
- the management, conservation and sustainable development of all types of forests

IUCN

- Founded in October 1948 as the International Union for the Protection of Nature (or IUPN) following an international conference in Fontainebleau, France.
- head quarters in Gland, Switzerland.
- IUCN Members include both States and non-governmental organizations

THE GLOBAL TIGER FORUM (GTF)

- Formed in 1994 with its secretariat at New Delhi, GTF is the only inter-governmental & international body campaigning to save the TIGER worldwide

- inter-governmental and international body established with members from willing countries to embark on a worldwide campaign,
- The General Assembly of GTF shall meet once in three years.

Global Tiger Initiative

- An alliance of governments, international agencies, civil society, and the private sector united to save wild tigers from extinction

THE STOCKHOLM CONVENTION ON POP

- The Stockholm Convention on Persistent Organic Pollutants was adopted at a Conference of Plenipotentiaries on 22 May 2001 in Stockholm, Sweden and entered into force on 17 May 2004,
- It is legally binding
- India ratified the Stockholm Convention in 2006. o Ministry of Environment had notified the 'Regulation of POP Rules' in 2018, under the Environment (Protection) Act, 1986
- Cabinet has delegated its powers to ratify chemicals under the Stockholm Convention to Union Ministries of External Affairs (MEA) and Environment, Forest and Climate Change (MoEFCC).
- National Implementation Plan (NIP) is to meet the country's obligations under the Stockholm Convention.
- Organochlorines are a group of chlorinated compounds that belong to the class of persistent organic pollutants (POPs). o They are relatively cheaper and as a result widely used as pesticides (40% of all pesticides) in Asia.
- Cabinet ratified ban of 7 Persistent Organic Pollutants (POP's) listed under Stockholm Convention
- The ratification process would enable India to access Global Environment Facility (GEF) financial resources in updating National Implementation Plan (NIP).

BASEL CONVENTION

- The Basel Convention on the **Control of Transboundary Movements of Hazardous Wastes and their Disposal** was adopted on 22 March **1989** by the **Conference of Plenipotentiaries in Basel, Switzerland** = enter into force **1992**
- **Haiti and USA signed** but **not ratified**
- Includes hazardous wastes and other wastes (**household and incinerator ash**)
- Based on concept of **prior informed consent** (from exporting state to importing state)
- Adoption of amendment to include = **unsorted, mixed and contaminated plastic waste** under PIC procedure
- Establishment of **partnership on plastic wastes**
- Provisional adoption of **technical guidelines on transboundary movements of E-waste** and used electrical and electronic equipment
- BASEL BAN AMENDMENT -- **prohibits** all exports of hazardous wastes including electronic wastes and obsolete ships **from 29 wealthiest countries of OECD to non OECD countries** = **India yet to ratify** = Croatia = 97th country to ratify
- **Doesn't tackle radioactive waste .**

ROTTERDAM CONVENTION = 1998 .

- The Convention creates **legally binding** obligations for the implementation of the **Prior Informed Consent (PIC) procedure**. The Convention covers **pesticides and industrial chemicals** that have been **banned or severely restricted for health or environmental reasons** by Parties and which have been **notified by Parties for inclusion in the PIC procedure**.
- Adopted = 1998; force = 2004
- **Jointly administered by FAO and UNEP .**
- to promote shared responsibility and cooperative efforts among Parties
- to contribute to the **environmentally sound use of those hazardous chemicals**, by **facilitating information exchange**

- The chemicals listed in Annex III include pesticides and industrial chemicals that have been banned or severely restricted for health or environmental reasons by two or more Parties and which the Conference of the Parties has decided to subject to the PIC procedure

UNCCD

- Established in 1994, UNCCD is the sole legally binding international agreement linking environment and development to sustainable land management.
- committed to a bottom-up approach, encouraging the participation of local people.
- The new UNCCD 2018-2030 strategic framework = most comprehensive global commitment = land degradation neutrality
- Permanent secretariat = bonn, germany
- Publication = global land outlook
- Cop 14 hosted by India = new delhi
- Delhi declaration = 1. Peace forest initiative by south korea = practical platform 2. UN decade on ecosystem restoration 2021-30 = based on science+ tradition 3. Drought toolbox platform = knowledge bank
- India taken up COP presidency for next 2 years

INTERNATIONAL WHALING COMMISSION = 1946

Today the IWC has 88 member countries

- the global intergovernmental body charged with the conservation of whales and the management of whaling with headquarters in Cambridge, United Kingdom
- designate specified areas as whale sanctuaries; set limits on the numbers and size of whales which may be taken; prescribe open and closed seasons and areas for whaling; and prohibit the capture of suckling calves and female whales accompanied by calves. Breastfed.
- In 1986 the Commission introduced zero catch limits for commercial whaling.

IWC work programme now also includes bycatch & entanglement, ship strikes, ocean noise, pollution and debris, and sustainable whale watching.

The Convention recognises three different types of whaling: commercial, aboriginal subsistence and special permit (also known as scientific) whaling.

Special permit whaling is not regulated by the Commission but by national governments, although none currently undertake this type of whaling.

VIENNA CONVENTION

- **Montreal Protocol** • The Montreal Protocol on Substances that Deplete the Ozone Layer was designed to reduce the production and consumption of ozone depleting substances in order to reduce their abundance in the atmosphere, and thereby protect the earth's fragile ozone Layer. Chlorofluorocarbons (CFCs) were discontinued under the Montreal Protocol
- **KIGALI AGREEMENT** = Twenty-Eighth Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer held in Kigali, Rwanda amended the 1987 Montreal Protocol to phase out Hydrofluorocarbons (HFC). The Kigali Agreement for HFCs reduction will be binding on countries from 2019.
- **Group 1** - Developed countries must reduce their use of HFCs by 10 percent by 2019 from 2011-2013 levels, and then by 85 percent by 2036.
- A **second group** of developing countries, including China and African nations, are committed to launching the transition in 2024. • A reduction of 10 percent compared with 2020-2022 levels should be achieved by 2029, to be extended to 80 percent by 2045.
- A **third group** of developing countries, which include India, Pakistan, Iran, Iraq and Arab Gulf states, must begin the process in 2028 and reduce emissions by 10 percent by 2032 from 2024-2026 levels, and then by 85 percent by 2047

- The **FAO** recognizes the agricultural heritage regions of the world under a programme titled Globally Important Agricultural Heritage Systems (**GIAHS**). T
- In our country so far the following sites have received recognition under this programme: 1. **Traditional Agricultural System, Koraput, Odisha** 2. **Below Sea Level Farming System, Kuttanad, Kerala**

There are 62 sites all around World.