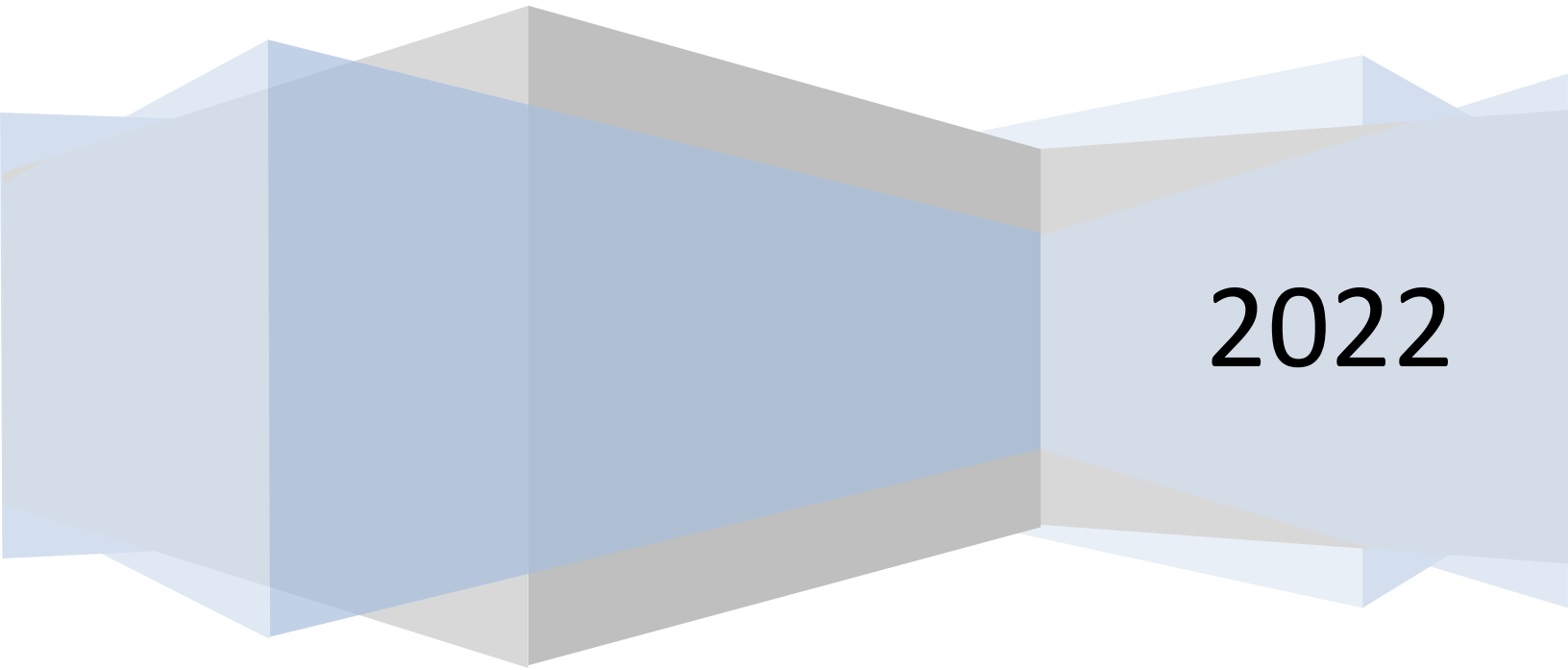
IIPA 2022

Environmental Ecology, Bio-diversity & Climate Change

Short Answers

CSM – 06: Compiled by Dr. Shyamli Singh



2022

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Biodiversity

Chapter 1

Short Answers

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This chapter contains:

- Biodiversity
- Levels of Biodiversity
- Measurement of Biodiversity
- Types of Species
- Edge Effect
- Ecological Niche

1. Biodiversity

The term biodiversity is defined in two terms, Bio means life and diversity means variety. Biodiversity is the diversity of flora and fauna in the world or in a particular habitat. The term biodiversity was popularized by the socio-biologist Edward Wilson who studied the existence of various species and their ecosystem for survival.

1.1 Levels of Biodiversity

Biodiversity can be generally described in terms of its three fundamental levels of biological organizations. These are:

1.1.1 Genetic Diversity

- Genetic diversity refers to the total amount of genetic features found in a species' genetic composition.
- A single species might show high diversity at the genetic level (E.g. *Homo sapiens*: Chinese, Indian American, African etc.).
- Genetic diversity allows species to adapt to changing environments. This diversity aims to ensure that some species survive drastic changes and thus carry on desirable genes.
- Closely-related species have in common much of their hereditary characteristics. For instance, about 98.4 per cent of the genes of humans and chimpanzees are the same.

1.1.2 Species Diversity

- It is the ratio of one species population over total number of organisms across all species in the given biome. '**Zero'** would be **infinite diversity**, and '**one'** represents **only one species** present.
- Species diversity is a measure of the diversity within an ecological community that incorporates both species richness and the evenness of species.
- In general, species diversity decreases as we move away from the equator towards the poles.
- With very few exceptions, tropics (latitudinal range of 23.5° N to 23.5° S) harbor more species than temperate or polar areas.
- Example: Western Ghats have a greater amphibian species diversity than the Eastern Ghats

1.1.3 Ecosystem Diversity

- Ecological diversity refers to variety of habitats, communities, and ecological processes in the biosphere.
- It includes various biological zones, like a lake, desert, coast, estuaries, wetlands, mangroves, coral reefs etc.
- At the ecosystem level, India, for instance, with its deserts, rain forests, mangroves, coral reefs, wetlands, estuaries, and alpine meadows has greater ecosystem diversity than a Scandinavian country like Norway.

1.1 Measurement of Biodiversity

Measurement of biodiversity was done by **Whittaker**. Biodiversity can be measured by two major components: **Species Richness** and **Species Evenness**

1.2.1 Species Richness

Species richness is the measure of number of species found in a community.

1.2.1.1 Alpha Diversity: It refers to the diversity of species found in a particular area or ecosystem, and is usually expressed by the number of species in that ecosystem.

1.2.1.2 Beta Diversity: It refers to the comparison of the diversity of species between two or more ecosystems, usually measured as the change in the number of species between the ecosystems.

1.2.1.3 Gamma Diversity: It is the measure of the overall diversity for the different ecosystems in a region. It is highly subjective because of different perceptions about the boundaries of the region.

1.2.2 Species Evenness

It is the measure of relative abundance of individuals of different species in a given region. Low evenness in general, means that a few species dominate the region or ecosystem.

1.3 Significance of Biodiversity

- Biodiversity is important to maintain the ecological system.

- It has economical importance. It provides some raw materials by which finished products can be prepared by further processing.
- It is important for recreational activities.
- It is also important for medicines. Neem, Tulsi, Turmeric, Babool etc have medicinal properties and are used as medicine to cure many diseases.
- Biodiversity helps to fulfill the needs of human beings by providing food, medicines, clothes and raw materials for various industrial and domestic purposes.

1.4 Threats to Biodiversity

1.4.1 Habitat fragmentation and degradation: It may either caused by natural calamities and geological events or anthropogenic activities like deforestation and man-induced climate change.

1.4.2 Climate change: Increase in the temperature of atmosphere has adverse effects on the environment such as sea level rise, glacial retreats, etc.

1.4.3 Pollution: All types of pollution appear to be a threat to all the life forms on the earth.

1.4.4 Overexploitation: It includes the poaching and illegal trading of wild animals, overfishing, logging of tropical hardwoods, etc.

1.4.5 Invasive species: Invasive species compete with the native species for the food, space and other resources, can turn out to be a predator for native species and spread disease that were not previously present in the environment.

1.5 Type of Species

1.5.1 Keystone species

- Keystone species is a species whose addition to or loss from an ecosystem leads to major changes in the occurrence of at least one other species.
- All top predators (Tiger, Lion, and Elephant) are considered as keystone species because they regulate all other animal population indirectly.
- If keystone species is lost, it will result in the destruction of the whole ecosystem.

- For example, certain plant species (ebony tree, Indian-laurel) exclusively depends upon bats for its pollination. If the bat population is reduced, then regeneration of particular plants becomes more difficult.

1.5.2 Foundation species

Foundation species is a **dominant primary producer** in an ecosystem both in terms of abundance and influence. Example: kelp in kelp forests and corals in coral reefs.

1.5.3 Flagship species

- A flagship species is a species **chosen to represent an environmental cause**, such as an ecosystem in need of conservation.
- These species are chosen for their vulnerability, attractiveness or distinctiveness in order to engender support and acknowledgement from the public at large.
- Example: Indian tiger, African elephant, giant panda of China, the leatherback sea turtle, etc.

1.5.4 Umbrella species

- An umbrella species is a large animal or other organism on which many other species depend.
- Umbrella species are very similar to keystone species, but umbrella species are usually migratory and need a large habitat.
- Protecting umbrella species automatically protect a host of other species.
- Example: Tigers.

1.5.5 Indicator species

An indicator species is an organism whose presence, absence or abundance reflects a specific environmental condition. Example: crayfish as indicators of freshwater quality; corals as indicators of marine processes such as siltation, seawater rise and sea temperature fluctuation; and lichens are the indicator of air pollution.

1.6 Ecotone and Ecological Niche

An ecotone is a **zone of transition area** between two biomes (diverse ecosystems). For example, the **mangrove forests** (ecotone between marine and terrestrial ecosystem) and **estuary** (zone between saltwater and freshwater).

1.6.1 Edge Effect

- Edge effect refers to the changes in population or community structures that occur at the boundary of two habitats (ecotone).
- Sometimes the number of species and the population density of some of the species in the ecotone are much greater than either community.
- The organisms which occur primarily or most abundantly in this zone are known as **edge species**.
- In the terrestrial ecosystems edge effect is especially applicable to **birds**.
- For example, the **density of birds is greater in the ecotone** between the forest and the desert.

1.6.2 Ecological Niche

- Niche refers to the **unique functional role and position of a species** in its habitat or ecosystem.
- Niche plays an important role in the conservation of organisms. If we have to conserve species in its native habitat, we should have knowledge about the niche requirements of the species.
- The ecosystem stability depends upon the diversity of the niche. The greater the niche diversity, the more is ecosystem stability because of the larger number of pathways for the flow of energy and less fluctuation of the species population.
- Sometimes it becomes difficult for two species to inhabit the same niche. In such cases the **'Law of Competitive Exclusion'** works, which states that two species competing for the same resources cannot coexist.
- The process of minimization of competition for resources is called **'Resource Partition'** which can allow several species to utilize different parts of the same resource and coexist within a single habitat.
- Dominant species occupy an extensive and broader ecological niche in comparison to less dominant species.

In 1957, Zoologist **G. Evelyn Hutchinson** described two forms of niche. These are:

1.6.2.1 Fundamental niche

It is the entire set of conditions under which an animal (population, species) can survive and reproduce itself. There are no limiting factors on the environment or resources the organism can use, hence no competition. It is a type of theoretical niche. Fundamental niche is larger in size than the realized niche. Fundamental niche is also called **"pre-competitive"**.

Fig 1.1 Fundamental and Realized Niche

1.6.2.2 Realized niche

It is the set of conditions actually used by given animal (population, species), after interactions with other species (predation and especially competition) have been taken into account. Realized niche is the part of a fundamental niche that an organism occupies as a result of limiting factors present in its habitat. Realized niche is smaller in size. Realized niche is also called **"post-competitive"**.

1.7 Salient Features

- Biodiversity is the diversity of flora and fauna in the world or in a particular habitat.
- Genetic diversity refers to the total amount of genetic features found in a species' genetic composition.
- Species diversity is a measure of the diversity within an ecological community that incorporates both species richness and the evenness of species.
- Ecological diversity refers to variety of habitats, communities, and ecological processes in the biosphere.
- Species richness is the measure of number of species found in a community.
- Species evenness is the measure of relative abundance of individuals of different species in a given region.
- Alpha diversity refers to the diversity of species found in a particular area or ecosystem, and is usually expressed by the number of species in that ecosystem.

- Beta diversity refers to the comparison of the diversity of species between two or more ecosystems, usually measured as the change in the number of species between the ecosystems.
- Gamma diversity is the measure of the overall diversity for the different ecosystems in a region.
- Keystone species is a species whose addition to or loss from an ecosystem leads to major changes in the occurrence of at least one other species.
- Foundation species is a dominant primary producer in an ecosystem both in terms of abundance and influence.
- A flagship species is a species chosen to represent an environmental cause, such as an ecosystem in need of conservation.
- An umbrella species is a large animal or other organism on which many other species depend
- An indicator species is a species or group of species chosen as an indicator of, or proxy for, the state of an ecosystem or of a certain process within that ecosystem.
- An ecotone is a zone of transition area between two biomes.
- Edge effect refers to the changes in population or community structures that occur at the boundary of two habitats.
- The organisms which occur primarily or most abundantly in this zone are known as edge species.
- Niche refers to the unique functional role and position of a species in its habitat or ecosystem.
- The fundamental niche represents all the environmental conditions in which a species can easily survive and reproduce to continue its generation.
- A realized niche can be defined as the environmental position that a species occupies and lives in.

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Animal Diversity of India

Chapter 2

Short Answers

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This chapter contains:

- Critically Endangered Species
- Species Extinction
- Human-Wildlife Conflict

2. Animal Diversity of India

India is very rich in biological diversity due to its unique biogeographic locations, diversified climatic conditions and enormous eco-diversity and geo-diversity.

2.1 Mammals (Critically Endangered)

2.1.1 Pygmy Hog (*Porcula salvania*)

It is the world's smallest and rarest wild pig, with adults weighing only 8 kgs. It is one of the very few mammals that build its own home, or nest, complete with a 'roof'.

It is one of the most useful indicators of the management status of grassland habitats. The grasslands where the pygmy hog resides are crucial for the survival of other endangered species such as Indian Rhinoceros, Swamp Deer, Wild Buffalo, Hispid Hare, Bengal Florican and Swamp Francolin.

Habitat: Relatively undisturbed, tall 'terai' grasslands.

Distribution: Formerly, the species was more widely distributed along the southern Himalayan foothills but now is restricted to only a single remnant population in Manas Wildlife Sanctuary and its buffer reserves.

Threats: Loss and degradation of grasslands, dry-season burning, livestock grazing and afforestation of grasslands. Hunting is also a threat to the remnant populations.

2.1.2 Andaman White-toothed Shrew (*Crocidura andamanensis),* Jenkin's Andaman Spiny Shrew *(Crocidura jenkinsi)* and Nicobar White-tailed Shrew *(Crocidura nicobarica)*

These are nocturnal animals and endemic to India.

Habitat: Leaf litter and rock crevices.

Distribution:

- 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 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.

Threats: Habitat loss due to selective logging, natural disasters such as the tsunami and drastic weather changes.

2.1.3 Kondana Rat (*Millardia kondana*)

It is a nocturnal burrowing rodent that is found only in India. It is sometimes known to build nests. *M. kondana* appeared to be fast breeding species with a short life span.

Habitat: Tropical and subtropical dry deciduous forests and tropical scrub.

Distribution: Known only from the small Sinhagad Plateau (about 1 km^2), near Pune in Maharashtra.

Threats: Habitat loss, overgrazing of vegetation and disturbance from tourism and recreational activities.

2.1.4 The Large Rock Rat or Elvira Rat *(Cremnomys elvira)*

It is a medium sized, nocturnal and burrowing rodent and endemic to India.

Habitat and Distribution: Tropical dry deciduous shrubland forest, seen in rocky areas. It is found only in Eastern Ghats of Tamil Nadu.

Threats: Habitat loss, conversion of forests, fuel wood collection, mining and dumping of debris in the foothills of small hillocks in the reserve forest and uncontrolled grazing.

2.1.5 The Namdapha Flying Squirrel *(Biswamoyopterus biswasi)*

It is an arboreal and nocturnal flying squirrel endemic to Arunachal Pradeh.

Habitat: Tropical forest.

Distribution: Found only in Namdapha Tiger Reserve in Arunachal Pradesh.

Threats: Hunted for food

2.1.6 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.

Habitat: Wooded plains and hill slopes of evergreen rainforests.

Distribution: Western Ghats.

Threats: Deforestation and commercial plantations are major threats.

2.1.7 The Sumatran Rhinoceros *(Dicerorhinus sumatrensis)*

It is the smallest and most endangered of the five rhinoceros species. It is the only Asian Rhinoceros with two horns.

It is now thought to be regionally extinct in India, though it once occurred in the foothills of the Himalayas and north-east India.

The Javan Rhinoceros *(Rhinoceros sondaicus)* is also believed to be extinct in India and only a small number survive in Java and Vietnam.

2.1.8 Kashmir stag/ hangul (Cervus elaphus hanglu)

It is the subspecies of Red Deer which is native to India.

Habitat / distribution: Dense riverine forests, high valleys, and mountains of the Kashmir valley and northern Chamba in Himachal Pradesh.

It is the state animal of J&K.

Threat: habitat destruction, over-grazing by domestic livestock, and poaching.

2.2 Marine Mammals

2.2.1 Freshwater River Dolphin

Habitat / distribution: India, Bangladesh, Nepal and Pakistan which is split into two subspecies, the Ganges river dolphin and Indus river dolphin.

2.2.2 Ganges river dolphin (*Platanista gangetica)*

Habitat / distribution: Ganges and Brahmaputra Rivers and their tributaries in Bangladesh, India and Nepal.

The Ganges river dolphin has been recognized by the Government of India as its National Aquatic Animal.

2.2.3 Indus river dolphin (*Platanista minor)*

Habitat / distribution: Indus River in Pakistan and its Beas and Sutlej tributaries.

2.2.4 Herbivorous Marine Mammals

It includes dugong and manatees and they inhabit swamps, rivers, estuaries, marine wetlands, and coastal marine waters.

2.2.4.1 Dugong (Dugong dugon)

It is also called as **sea cow**.

Status: vulnerable.

Threat: hunting (meat and oil), habitat degradation, and fishing-related fatalities.

2.2.4.2 Manatees (Trichechus manatus)

Habitat / distribution: Caribbean Sea, Gulf of Mexico, the Amazon Basin, and West Africa

Threat: coastal development, red tide, hunting.

2.3 (Critically Endangered)

2.3.1 The Jerdon's Courser *(Rhinoptilus bitorquatus)*

It is a nocturnal bird and is endemic to India, and found in the Eastern Ghats of Andhra Pradesh. It is a flagship species for the extremely threatened scrub jungle. They are insectivorous, hunting invertebrates by sight.

The species was considered to be extinct until it was rediscovered in 1986 and the area of rediscovery was subsequently declared as the Sri Lankamaleswara Wildlife Sanctuary.

Habitat: Undisturbed scrub jungle with open areas.

Threats: Clearing of scrub jungle, creation of new pastures, growing of dry land crops, Illegal trapping of birds, plantations of exotic trees, quarrying and the construction of the River Canals.

2.3.2 The Forest Owlet (Athene blewitti)

It has an extremely small and fragmented population in central India. It had been lost for more than a century. After 113 long years, the owlet was rediscovered in 1997 and reappeared on the list of Indian birds.

Habitat: Dry deciduous forest.

Threats: Logging operations, burning and cutting of trees damage roosting and nesting trees of the Forest Owlet.

2.3.3 The White-bellied Heron *(Ardea insignis)*

The White-bellied Heron is a very large brownish grey heron and an 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.

Habitat: Rivers with sand or gravel bars or inland lakes.

Distribution: Bhutan and north-east India to the hills of Bangladesh and north Myanmar.

Threats: Loss and degradation of lowland forests and wetlands through direct exploitation and disturbance by humans.

2.3.4 The Bengal Florican *(Houbaropsis bengalensis)*

It is very well known for its mating dance. Among the tall grasslands, secretive males advertise their territories by springing from the ground and flitting to and fro in the air.

Habitat: Grasslands occasionally interspersed with scrublands.

Distribution: 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.

Threats: Conversion of the bird's grassland habitat for various purposes including agriculture is mainly responsible for its population decline.

2.3.5 The Himalayan Quail (*Ophrysia superciliosa)*

The Himalayan quail is a medium-sized bird. It is presumed to be extinct since no reliable records of sightings of this species exist after 1876. Intensive surveys are required as this species is hard to detect due to its reluctance to fly and its preference for dense grass habitats. Possible sighting of this species was reported in Nainital in 2003.

Habitat: Tall grass and scrub on steep hillsides.

Distribution: Western Himalayas.

Threats: Indiscriminate hunting during the colonial period along with habitat modification.

2.3.6 Pink- headed Duck (Rhodonessa caryophyllacea)

It has not been conclusively recorded in India since 1949. Males have a deep pink head and neck from which the bird derives its name.

Habitat: Overgrown still-water pools, marshes and swamps in lowland forests and tall grasslands.

Distribution: Recorded in India, Bangladesh and Myanmar. Maximum records are from north-east India.

Threats: Wetland degradation and loss of habitat, along with hunting are the main causes of its decline.

2.3.7 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.

Habitat: Fallow fields and scrub desert.

Distribution: central Asia, Asia Minor, Russia, Egypt, India, Pakistan. In India, habitat / distribution is restricted to the north and north-west of the country.

Threats: Conversion of habitat to arable land, illegal hunting and proximity to human settlements.

2.3.8 Spoon Billed Sandpiper *(Calidris pygmaea)*

It requires highly specialized breeding habitat, a constraint that has always kept its population scarce. India is home to some of the last existing wintering grounds of this species.

Habitat: Coastal areas with sparse vegetation. No breeding records further inland than 7 km from the seashore.

Distribution: West Bengal, Orissa, Kerala and Tamil Nadu

Threats: Habitat degradation and land reclamation

2.3.9 Siberian Crane *(Grus leucogeranus)*

It is a large, strikingly majestic migratory bird that breeds and winters in wetlands. They are known to winter at Keoladeo National Park, Rajasthan. However the last documented sighting of the bird was in 2002.

Habitat: Wetland areas

Distribution: Keoladeo National Park in Rajasthan

Threats: Pesticide pollution, wetland drainage, development of prime habitat into agricultural fields, and to some extent, hunting.

2.4 Species Extinction

Extinction is caused through various processes:

- **Deterministic processes** that have a cause and effect. Example: glaciations, human interference such as deforestation.
- **Stochastic processes** (chance and random events) that effect the survival and reproduction of individuals. Example: unexpected changes of weather patterns, decreased food supply, disease, increase of competitors, predators or parasites, etc. that may act independently or add to deterministic effects.

The impact of these processes will of course depend on the size and degree of genetic diversity and resilience of populations.

2.4.1 Natural Extinction

- It have been caused due to several factors: continent drifting, climate change, tectonic activity and increased volcanic activity
- The late Ordovician global glaciations (439 Million years ago) has occurred.
- The late Cretaceous extinction assumed to be associated with an extra-terrestrial impact.
- Extinction in vascular plants has been more gradual compared with the loss of animals. It is believed that extinction among this group was due more to competitive displacement by more advanced plant forms, or due to a gradual climate change, than due to any sudden catastrophic event.

2.4.2 Artificial Extinction

Even though species extinction is a natural process which can happen without the intervention of humans, extinctions caused by humans is now happening over and above the reasonable estimate of natural extinction rates.

Species are threatened with extinction by the intervention of humans due to:

Direct causes: Hunting, collection or capture and persecution

Indirect causes: Habitat loss, modification and fragmentation and the introduction of invasive species.

2.5 Human Wildlife Conflict (HWC)

Human-wildlife conflict is defined by the **World Wide Fund for Nature (WWF)** as "any interaction between humans and wildlife that results in negative impacts of human social, economic or cultural life, on the conservation of wildlife populations, or on the environment."

Due to an expanding human population, it is almost inevitable that humans will encroach into the natural habitats of the animal kingdom. As a result, many nations have included mitigation of human-wildlife conflict as part of their national environmental team.

2.5.1 Factors leading to the conflict

- With a rapidly increasing human population and high biodiversity, interactions between people and wild animals are becoming more and more prevalent.
- Habitat disturbance is the destruction of the home of wild animals. Humans kill or chase wild animals by digging, cutting, sealing by stones and smoking in their natural habitat.
- Other factors include large scale habitat destruction through deforestation overgrazing by livestock and expansion of human settlements and agriculture.

2.5.2 Impacts of HWC

- Crop damage
- Livestock depredation
- Injuries to people
- Loss of human life

- Damage to property
- Injuries to wildlife
- Animal deaths
- Destruction of habitat

2.5.3 Mitigation of HWC

- Translocation of problematic animals
- Erection of fences or other barriers
- Compensation system
- Incentive programmes
- Predator-deterring guard dogs
- Conservation education for local populations
- Better sharing of information

2.6 Salient Features

- Species extinction can happen naturally or artificially through Natural Extinction and Artificial Extinction respectively.
- Human Wildlife Conflict is defined as “any interaction between humans and wildlife that results in negative impacts of human social, economic or cultural life, on the conservation of wildlife populations, or on the environment”.

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Plant Diversity of India

Chapter 3

Short Answers

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This chapter contains:

- Plant Classification
- Effect of Biotic Components on Plants
- Insectivorous Plants
- Invasive Alien Species
- Tree Characteristics
- Root Types

3. Plant Diversity of India

3.1 Plant Classification

- **Herb** is defined as a plant whose stem is always green and tender with height of not more than 1 meter. Example: Wheat, paddy (Rice), cabbage, tomato, mustard and radish.
- **Shrub** is defined as a woody perennial plant differing from a perennial herb in its persistent and woody stem. It differs from a tree in its low stature and its habit of branching from the base. Not more than 6 meters in height. Example: Rose, jasmine, lemon, tulsi, and henna.
- **Tree** is the tallest form of plant floral diversity that is generally perennial, woody and branched among other plant varieties. Example: Banyan, mango, neem, cashew, teak and oak.
- **Parasite** is an organism that draws a part or whole of its nourishment from another living organism. They grow on some living plant called host and penetrate their sucking roots, called haustoria, into the host plants.
    - Total parasite - draws whole of its nourishment (Dodder, broomrape, and *Rafflesia* are some examples)
    - Partial parasite - draws a part of its nourishment (*Castilleja*, mistletoe, yellow rattle are some examples)
- **Epiphytes** are plants 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. Their roots perform two functions. While changing roots establish the plant on the branches of the host plant, aerial roots draw moisture from the air. Example: Vanda
- **Climbers** are herbaceous or woody plants that climbs up trees or other support by twining round them or by holding on to them by tendrils, hooks, aerial roots or other attachments. Example: Beans, Cucumber, Grapevine, Gourd, Jasmine, and Money Plant.

3.2 Effect of Biotic Components on Plants

3.2.1 Intensity of light on growth of plants

- Extremely high intensity favors root growth than shoot growth which results in increased transpiration, short stem, and smaller thicker leaves. On the other hand low intensity of light retards the growth, flowering and fruiting of the plant.
- When the intensity of light is less than the minimum, the plants stops to grow due to accumulation of CO_2 and finally dies.
- Out of 7 colors 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.

3.2.2 Effect of frost on plants

- Even a light radiation frost chills the soil resulting in freezing the soil moisture. The plants growing in such soil, get exposed to direct sun light in the morning, they are killed due to increased transpiration when their roots are unable to supply moisture.
- As a result of frost, water in the intercellular spaces of the plant gets frozen into ice which withdraws water from the interior of the cells. This results in increasing concentration of salts and dehydration of cells. Thus, coagulation and precipitation of the cell colloid results in death of plant.
- Leads to formation of canker (a destructive fungal disease of trees that results in damage to the bark).

3.2.3 Effects of snow on plants

- Snow influences the distribution of deodar, fir and spruce.
- Snow acts as blanket, prevents further drop in temperature and protects seedlings from excessive cold and frost.
- It results in mechanical bending of tree stem.
- Shortens the period of vegetative growth also uproots the trees.

3.2.4 Effect of temperature on plants

- Excessive high temperature results in death of plant due to coagulation of protoplasmic proteins. It disturbs the balance between respiration and photosynthesis, thereby causes depletion of food resulting in greater susceptibility to fungal and bacterial attack.
- It also results in desiccation of plant tissues and depletion of moisture.

3.3 Insectivorous Plants

These plants are specialized in trapping insects and are popularly known as insectivorous plants. They are very different from normal plants in their mode of nutrition. Insectivorous plants can broadly be divided into active and passive types based on their method of trapping their prey.

- The **active** (moving) ones can close their leaf traps the moment insects land on them. Example: Venus flytrap
- The **passive** (immobile) plants have a **'pitfall'** mechanism, having some kind of jar or pitcher-like structure into which the insect slips and falls, to eventually be digested. The insectivorous plants often have several attractions such as brilliant colors, sweet secretions and other curios to lure their innocent victims. Example: Nepenthes plant.

3.3.1 The Indian Hunters

Insectivorous plants of India are:

3.3.1.1 *Drosera* (Sundew)

They prefer bog habitats and soils lacking nitrogen.

Insect trapping mechanism: Sundews are "flypaper" plants that trap prey in sticky hairs on their leaves. The tentacles on the leaves secrete a sticky fluid that shines in the sun like dewdrops. Therefore, the *Drosera* is commonly known as 'sundews'. When an insect lured by these glistening drops alights on the leaf surface it gets stuck in this fluid and are absorbed and digested.

Drosera are capable of curdling milk, its bruised leaves are applied on blisters, used for dyeing silk.

3.3.1.2 *Aldrovanda*

It is a free-floating, rootless aquatic plant, the only species found in India, occurs in the salt marshes of Sunderbans, south of Calcutta. It also grows in freshwater bodies like ponds, tanks and lakes.

Insect trapping mechanism: On the leaf midrib are found some sensitive trigger hairs. The two halves of the leaf blade of Aldrovanda close along the midrib the moment an insect comes into contact with the leaf, trapping the victim inside.

3.3.1.3 *Nepenthes*

The members of the family are commonly known as **'pitcher plants'** because their leaves bear jar-like structures.

Distribution: It is confined to the high rainfall hills and plateaus of north-eastern region, at altitudes ranging from 100 – 1500 m, particularly in Garo, Khasi and Jaintia hills of Meghalaya.

Insect trapping mechanism: *Nepenthes* conforms to the pitfall type of trap. A honey like substance is secreted from glands at the entrance of the pitcher. Once the insect enters into the pitcher, it falls down because of the slipperiness.

The inner wall, towards its lower half, bears numerous glands, which secrete a proteolytic enzyme. This enzyme digests the body of the trapped insects and nutrients are absorbed. *Nepenthes* in local medicine to treat cholera patients, the liquid inside the pitcher is useful for urinary troubles, it is also used as eye drops.

3.3.1.4 *Utricularia* or Bladderworts

They generally inhabit waterlogged areas and freshwater wetlands. Some species are associated with moist moss covered rock surfaces and damp soils during rains.

Insect trapping: *Utricularia* in its bladders mouth has sensitive bristles or hairs. When an insect happens to contact these hairs the door opens, carrying the insect into the bladder along with a little current of water. The door is shut when water fills the bladder; the enzymes produced by the inner wall of the bladder digest the insect.

Utricularia is useful against cough, for dressing of wounds, as a remedy for urinary disease.

3.3.1.5 *Pinguicula* or Butterwort

It grows in the alpine heights of Himalayas, from Kashmir to Sikkim, along stream-sides in cool boggy places.

Insect trapping mechanism: In *Pinguicula*, an entire leaf works as trap. When an insect lands on the leaf surface, it gets stuck in the sticky exudate and the leaf margins roll up thus trapping the victim.

3.3.2 Threats

- Gardening trading for medicinal properties is one of the main causes for their decline.
- Habitat destruction is also rampant, the wetlands harboring such plants being the main casualties during the expansion of urban and rural habitation.
- Pollution caused by effluents containing detergents, fertilizers and pesticides into the wetlands is yet another major cause for their decline (Since insectivorous plants do not tolerate high nutrient levels)
- Moreover, polluted water bodies are dominated by prolific water weeds which cause elimination of the delicate insectivorous plants.

3.4 Invasive Alien Species

Purposely or accidentally, people often bring non-native species into new areas where the species have few or no natural predators to keep their populations in check. Aliens are species that occur outside their natural range. Alien species that threaten native plants and animals or other aspects of biodiversity are called alien invasive species. They occur in all groups of plants and animals, as competitors, predators, pathogens and parasites, and they have invaded almost every type of native ecosystem, Biological invasion by alien species is recognized as one of the major threats to native species and ecosystems.

3.4.1 Effects

- Loss of Biodiversity
- Habitat Loss
- Decline of Native Species (Endemics).
- Degradation of marine and freshwater ecosystems

- Introduced pathogens reduce crop and stock yields

3.5 Some Invasive Alien Flora of India

3.5.1 Needle Bush

Nativity: Trop. South America

Distribution in India: Throughout

Remarks: Occasional in thorny scrub and dry degraded forests and often creates close thickets.

3.5.2 Black wattle

Nativity: South East Australia

Distribution in India: Western Ghats

Remarks: Introduced for afforestation in Western Ghats. Regenerates rapidly after fire and forms dense thickets. It is distributed in forests and grazing lands in high altitude areas.

3.5.3 Goat weed

Nativity: Trop. America

Distribution in India: Throughout

Remarks: Aggressive colonizer. It is a troublesome weed in gardens, cultivated fields and forests.

3.5.4 *Alternanthera paronychioides*

Nativity: Trop. America

Distribution in India: Throughout

Remarks: Occasional weed along edges of tanks, ditches and in marshy lands.

3.5.5 Prickly poppy

Nativity: Trop. Central & South America

Distribution in India: Throughout

Remarks: Aggressive colonizer. It is a common winter season weed in cultivated fields, scrub lands and fringes of forests.

3.5.6 *Blumea eriantha*

Nativity: Tropical America

Distribution in India: Throughout

Remarks: Aggressive colonizer. It is abundant along railway tracks, road sides and degraded forest lands.

3.5.7 Palmyra Palm or Toddy Palm

Nativity: Tropical Africa

Distribution in India: Throughout

Remarks: Aggressive colonizer. Cultivated and self-sown, occasionally found to be gregarious nearby cultivated fields, scrub lands and waste lands.

3.5.8 *Calotropis* (Madar or Swallow Wort)

Nativity: Tropical Africa

Distribution in India: Throughout

Remarks: Aggressive colonizer. It is a common in cultivated fields, scrub lands and waste lands.

3.5.9 *Datura* (Mad Plant or Thorn Apple)

Nativity: Tropical America

Distribution in India: Throughout

Remarks: Aggressive colonizer. Occasional weed on disturbed ground.

3.5.10 Water Hyacinth

Nativity: Tropical America

Distribution in India: Throughout

Remarks: Aggressive colonizer. Abundant in still or slow floating waters. Nuisance for aquatic ecosystems.

3.5.11 *Impatiens* (Balsam)

Nativity: Tropical America

Distribution in India: Throughout

Remarks: Aggressive colonizer. It is a common along streams of moist forests and occasionally along railway tracks; also runs wild in gardens.

3.5.12 *Ipomoea* (The pink morning glory)

Nativity: Tropical America

Distribution in India: Throughout

Remarks: Aggressive colonizer. It is a common weed of marhsy lands and along the edges of tanks and ditches.

3.5.13 *Lantana camara* (Lantana or Wild Sage)

Nativity: Tropical America

Distribution in India: Throughout

Remarks: Aggressive colonizer. It is a common weed of forests, plantations, habitation, waste lands and scrub lands.

3.5.14 Black Mimosa

Nativity: Tropical North America

Distribution in India: Himalaya, Western Ghats

Remarks: Aggressive colonizer. It invades water courses and seasonally flooded wetlands.

3.5.15 *Mimosa pudica* (Touch-Me-Not or Sleeping Grass)

Nativity: Brazil

Distribution in India: Throughout

Remarks: Aggressive colonizer. It is a common weed of cultivated fields, scrub lands and degraded forests.

3.5.16 *Mirabilis jalapa* (4 '0' clock plant)

Nativity: Peru

Distribution in India: Throughout

Remarks: Aggressive colonizer. It runs wild in gardens and near habitation.

3.5.17 *Parthenium* (Congress grass)

Nativity: Tropical North America

Distribution in India: Throughout

Remarks: Aggressive colonizer. It is a common weed of cultivated fields, forests, overgrazed pastures, waste lands and gardens.

3.5.18 *Prosopis juliflora*

Nativity: Mexico

Distribution in India: Throughout

Remarks: Aggressive colonizer. It is a common weed of waste lands, scrub lands and degraded forests.

3.5.19 Townsend grass

Nativity: Tropical Western Asia

Distribution in India: Throughout

Remarks: It is very common along streams and banks of rivers.

3.6 Tree Characters

3.6.1 Types of Trees

There are two main types of trees: deciduous and evergreen.

3.6.1.1 Deciduous trees

Deciduous trees shed their leaves in fall. In cold climates, this happens during the autumn so that the trees are bare throughout the winter. In hot and dry climates, deciduous trees usually lose their leaves during the dry season. Example: oak, maple, poplar, etc.

3.6.1.2 Evergreen trees

Evergreen trees don't lose all their leaves at the any time (they always have some foliage).

They do lose their old leaves a little at a time with new ones growing in to replace the old. An evergreen tree is never completely without leaves. Example: Pine.

3.6.2 Parts of a Tree

3.6.2.1 Roots

- The roots are the part of the tree that grows underground.
- Besides keeping the tree from tipping over, the main job of the roots is to uptake water and nutrients from the soil and to store them for times when there isn't as much available.

3.6.2.2 Crown

- The crown is made up of the leaves and branches at the top of a tree.
- The crown shades the roots, collects energy from the sun (photosynthesis) and allows the tree to remove extra water to keep it cool (transpiration- similar to sweating in animals).

3.6.2.3 Leaves

- They are the part of the tree that converts energy into food (sugar).
- Leaves are the food factories of a tree and also exchange gases.
- Evaporation and cooling of tree body
- They contain a very special substance called chlorophyll. It is chlorophyll that gives leaves their green color.

3.6.2.4 Branches

The branches provide the support to distribute the leaves efficiently for the type of tree and the environment. They also serve as conduits for water and nutrients and as storage for extra sugar.

3.6.2.5 Trunk

- The trunk of the tree provides its shape and support and holds up the crown.
- The trunk transports water and nutrients from the soil and sugar from the leaves to the other parts of the tree.

3.6.2.5.1 Parts of the Trunk

a) Annual rings:

- Inside the trunk of a tree there are a number of growth rings.
- Each year of the tree's life, a new ring is added so it is referred as the annual rings.
- It is used to calculate Dendro-Chronology (Age of a tree) and Paleo-Climatology.
- The age of a tree can be determined by the number of growth rings. The size of the growth ring is determined in part by environmental conditions - temperature, water availability.

b) Bark:

- The outside layer of the trunk, branches and twigs of trees.
- The bark serves as a protective layer of the tree.
- Trees actually have inner bark and outer bark. The inner layer of bark is made up of living cells and the outer layer is made of dead cells, sort of like our fingernails.
- The scientific name for the inner layer of bark is Phloem. The main job of this inner layer is to carry sap full of sugar from the leaves to the rest of the tree. A number of handy things are made from bark including latex, cinnamon and some kinds of poisons. It isn't surprising the strong flavors, scents and toxins can often be found in the bark of different types of trees.

c) Cambium:

- The thin layer of living cells just inside the bark is called cambium.
- It is the part of the tree that makes new cells allowing the tree to grow wider each year.

d) Sapwood (Xylem):

- The scientific name for sapwood is xylem.
- It is made up of a network of living cells that bring water and nutrients up from the roots to the branches, twigs and leaves.
- It is the youngest wood of the tree -- over the years, the inner layers of sapwood die and become heartwood.

e) Heartwood:

- The heartwood is dead sapwood in the center of the trunk.
- It is the hardest wood of the tree giving it support and strength.
- It is usually darker in color than the sapwood.

f) Pith:

- Pith is the tiny dark spot of spongy living cells right in the center of the tree trunk.
- Essential nutrients are carried up through the pith.
- Its placement right in the center means it is the most protected from damage by insects, the wind or animals.

3.6.3 Root types

3.6.3.1 Taproot

Primary descending root formed by the direct prolongation of the radicle of the embryo. Example: Beetroot.

3.6.3.2 Adventitious Roots

Roots that are produced from the parts of the plant other than the radicle or its subdivision. The following kinds of Adventitious Roots are commonly found in trees.

- **Buttresses** are out-growths formed usually vertically above the lateral roots and thus connect the base of the stem with roots. They are formed in the basal portion of the stem. Example: Silk cotton tree.
- **Prop Roots** are adventitious roots produced from the branches of the tree which remain suspended in the air till they reach the ground. On reaching the ground they enter into the soil and get fixed. Example: Banyan Tree
- **Stilt Roots:** are adventitious roots which emerged from the butt of a tree above ground level. So that the tree appears as if supported on flying buttresses. Example: Rhizophora species of mangroves found in Sunderbans of West Bengal.
- **Pneumatophore (Respiratory roots)** is a spike like projection of the roots of swamp / mangrove tree above the ground. It helps the submerged roots to obtain oxygen. Example: *Heretiera* sp., *Bruguiera* sp.
- **Haustorial roots (Sucker/parasitic roots)** are the roots of parasitic plants that can absorb water and nutrients from another plant. Example: mistletoe (*Viscum alubum*) and dodder.
- **Storage roots** are modified roots for storage of food or water, such as carrots and beets. They include some taproots and tuberous roots.

3.7 Salient Features

- 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.
- Tree is the tallest form of plant floral diversity that is generally perennial, woody and branched among other plant varieties
- Insectivorous plants are the plants that derive their nutrition by feeding on insects and other organisms.

- Invasive alien species are species that are introduced, accidentally or intentionally, outside of their natural geographic range and that become problematic.
- Deciduous Trees are a type of tree that seasonally sheds their leaves for part of the year- typically in the autumn.
- Evergreen Trees are plants with leaves that always remain green throughout the duration of a year.
- Taproot refers to the primary root, which persists throughout the life of a plant
- Adventitious root refers to the root, which develops from any part of the plant except the radicle or its derivatives.

IIPA 2022

Marine Organism

Chapter 4

Short Answers

CSM – 06: Compiled by Dr. Shyamli Singh

2022

This chapter contains:

- Phytoplankton
- Zooplankton
- Sea Grass
- Sea Weed

4. Marine Organism

Marine organisms are the ocean-dwelling organisms living underwater habitats, which depend on the chemical and physical properties of the area. In fact, properties such as water salt, temperature, light incidence, and ocean currents determine where different marine life lives in the vast oceans of the Earth.

4.1 Plankton

The word "plankton" comes from the Greek for "drifter" or "wanderer." An organism is considered plankton if it is carried by tides and currents, and cannot swim well enough to move against these forces. It 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 growth rate, productivity and species diversity of plankton in tropical waters especially in mangrove waters are high.

Plankton is incredibly important to the ocean ecosystem, and very sensitive to changes in their environment, including in the temperature, pH level, salinity, and nutrient concentration of the water.

4.1.1 Phytoplankton

Phytoplanktons are microscopic plants, but they play a major role in the marine food web. Phytoplankton, like plants on land, performs photosynthesis to convert the sun's rays into energy to support them, and they take in carbon dioxide and produce oxygen. Phytoplanktons are near the surface of the water because they need energy from the sun.

4.1.1.1 Factors affecting Phytoplankton Biodiversity

- Phytoplankton population is directly proportional to **light** intensity. But light is limited to uppermost layer of the ocean, hence phytoplankton are restricted to this area.
- **Nutrients** required for their growth are nitrogen and phosphorus.
- Rate of photosynthesis is directly proportional to the **temperature** but diminishes sharply after the point reached.
- Besides light and temperature, **salinity** also is known to influence primary production.

- The **grazing rate of zooplankton** is one of the major factors influencing the size of the standing crop of phytoplankton, and thereby the rate of production.

4.1.1.2 Distribution of Phytoplankton Diversity

- Phytoplanktons are not uniformly distributed throughout the oceans.
- Its highest concentrations found at high latitudes with exceptions of upwelling areas on the continental shelf.
- Tropics and subtropics have 10 to 100 times lower concentration.
- Its distribution limited to the euphotic zone.

4.1.2 Zoo Plankton

Zooplankton include microscopic animals (krill, sea snails, pelagic worms), the young of larger invertebrates and fish, and weak swimmers like jellyfish. Most zooplankton eats phytoplankton and most zooplankton are eaten by larger animals. Krill may be the most well-known type of zooplankton; they are a major component of the diet of humpback, right, and blue whales. During the daylight hours, zooplankton generally drifts in deeper waters to avoid predators. But at night, these microscopic creatures venture up to the surface to feed on phytoplankton. This process is considered as the largest migration on Earth.

Zooplankton play vital role in food web of the food chain, nutrient recycling, and in transfer of organic matter from primary producers to secondary consumers like fishes.

4.2 Sea Grass

Sea grasses are underwater plants that evolved from land plants. Like terrestrial plants, they have leaves, flowers, seeds, roots, and connective tissues, and they make their food through photosynthesis. Unlike terrestrial plants, however, they do not have strong stems to hold themselves up instead they're supported by the buoyancy of the water that surrounds them. Sea grasses are a very important food source and habitat for wildlife, supporting a diverse community of organisms including fish, octopuses, sea turtles, shrimp, blue crabs, oysters, sponges, sea urchins, anemones, clams, and squid. Sea grasses have been called **"the lungs of the sea"** because they release oxygen into the water through the process of photosynthesis.

Major Sea grass meadows in India occur along the south east coast of Tamil Nadu and in the lagoons of a few Lakshadweep Islands. There are few grass beds around Andaman and Nicobar islands also.

Sea grasses are very sensitive to water quality and are an indicator of the overall health of coastal ecosystems. Since they produce energy through photosynthesis they do best where the water is clear enough to allow sunlight to penetrate. Pollution, sedimentation, excessive nutrients, storms, disease, and overgrazing by herbivores all pose threats to sea grasses.

4.3 Seaweeds

"Seaweed" is the common name for countless species of marine plants and algae that grow in the ocean as well as in rivers, lakes, and other water bodies. Some seaweeds are microscopic, such as the phytoplankton that live suspended in the water column and provide the base for most marine food chains. Some are enormous, like the giant kelp that grow in abundant “forests” and tower like underwater redwoods from their roots at the bottom of the sea. Medium-sized seaweeds, come in colors of red, green, brown, and black, and randomly wash up on beaches and shorelines everywhere.

4.3.1 Significance of Seaweed

- Seaweed is rich in vitamins, minerals, and dietary fiber, and is delicious to eat.
- Seaweed has a significant role in mitigating climate change.
- They can be used as fertilizers and to increase fish production in agriculture and animal husbandry respectively.
- Biodegradation of seaweeds leads to the production of methane in large quantities.
- Many seaweeds contain anti-inflammatory and anti-microbial agents.
- Seaweeds are also used as the potential indicators of pollution in coastal ecosystem, particularly heavy metal pollution due to their ability to bind and accumulate metals strongly.

Do you know?

Sea grasses are not true grasses. They are more closely related to terrestrial lilies and gingers.

Rotting seaweed is a potent source of hydrogen sulfide, a highly toxic gas, and has been implicated in some incidents of apparent hydrogen-sulphide poisoning. It can cause vomiting and diarrhoea.

4.4 Salient Features

- An organism is considered plankton if it is carried by tides and currents, and cannot swim well enough to move against these forces.
- Phytoplanktons are mostly microscopic, single-celled photosynthetic organisms that live suspended in water.
- Zooplanktons are small, aquatic microorganisms in the water column that include crustaceans, rotifers, open water insect larvae and aquatic mites.
- Sea grasses are flowering plants that grow submerged in shallow marine waters like bays and lagoons.
- Seaweeds, the primitive, marine non-flowering marine algae without root, stem and leaves, play a major role in marine ecosystems.

IIPA 2022

Biodiversity Conservation

Chapter 5

Short Answers

CSM – 06: Compiled by Dr. Shyamli Singh

2022

This chapter contains:

- *In-situ* Conservation Method
- *Ex-situ* Conservation Method
- Hotspots
- IUCN
- Red Data Book

5. Biodiversity Conservation

Biodiversity conservation refers to the protection, preservation, and management of ecosystems and natural habitats and ensuring that they are healthy and functional. Biodiversity can be conserved by the two conservation methods i.e. *In situ* and *Ex situ* methods of conservation.

5.1 *In-situ* Methods of Conservation

In-situ means 'on site', hence *in-situ* conservation is the conservation of species diversity within natural habitats and ecosystems. During in-situ conservation, the natural processes and interaction are conserved as well as the elements of biodiversity. Example: Biosphere Reserves, National Parks, Sanctuaries, Reserve Forests etc.

5.1.1 National Parks

- It is an area dedicated for the conservation of wildlife along with its environment.
- It has more restrictions as compared to a wildlife sanctuary and its boundaries are fixed and defined.
- It is also meant for enjoyment through tourism but without damaging the environment.
- Grazing of domestic animals, all private rights and forestry activities are prohibited here.
- Species mentioned in the Schedules of the Wildlife Act are not allowed to be hunted or captured.
- No human activity is allowed here.
- Each National Park is usually dedicated to the preservation of a certain type of wildlife, as well as others.
- India's first national park was established in 1936 as **Hailey National Park**, now known as **Jim Corbett National Park, Uttarakhand.**
- There are **106** existing national parks in India covering an area of **44,372.42 km^2**, which is **1.35%** of the geographical area of the country.

5.1.2 Wildlife Sanctuaries

- A wildlife sanctuary is a natural ecosystem owned by the government or a private organization that protects specific bird and animal species.
- There are no fixed boundaries.

- Wildlife sanctuaries are also protected areas where killing, hunting, shooting or capturing of wildlife is prohibited except under the control of the highest authority.
- Private ownership rights are, however, allowed, as are forestry operations as long as they do not harm wildlife.
- There are **564** existing wildlife sanctuaries in India covering an area of **122509.33 km^2**, which is **3.73%** of the geographical area of the country.

5.1.3 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 The United Nations Educational, Scientific and Cultural Organization (UNESCO) in 1971. The purpose of the formation of the biosphere reserve is to conserve in situ all forms of life, along with its support system, in its totality, so that it could serve as a referral system for monitoring and evaluating changes in natural ecosystems. The first biosphere reserve of the world was established in 1979, since then the network of biosphere reserves has increased to 631 in 119 countries across the world. Presently, there are **18 notified biosphere reserves in India.** The **Nilgiri Biosphere Reserve** was the **first biosphere reserve** in India established in the year 1986.

Biosphere reserves are areas of terrestrial and coastal ecosystems promoting solutions to reconcile the conservation of biodiversity with its sustainable use. Biosphere Reserves involve

Man and Biopshere (MAB) Programme

The MAB programme is an intergovernmental scientific programme that aims to establish a scientific basis for enhancing the relationship between people and their environments. It combines the natural and social sciences with a view to improving human livelihoods and safeguarding natural and managed ecosystems, thus promoting innovative approaches to economic development that are socially and culturally appropriate and environmentally sustainable.

The World Network of Biosphere Reserves currently counts 727 sites in 131 countries all over the world, including 22 transboundary sites.

local communities and all interested stakeholders in planning and management.

5.1.3.1 Functions of Biosphere Reserves

- Conservation of biodiversity and cultural diversity.
- Economic development that is socio-culturally and environmentally sustainable.
- Logistic support, underpinning development through research, monitoring, education and training.

In a Biosphere Reserve, the land is designated into different zones such as:

1. **Core zone:** No human activity is allowed.

2. **Buffer zone:** Limited human activity is allowed like scientific research, monitoring, training and education.

3. **Transition zone:** Socio-culturally and ecologically sustainable economic and human activities are allowed.

Fig 5.1 Biosphere Reserve Zones

5.1.4 Reserved & Protected Forests

- As of present, reserved forests and protected forests differ in one important way:
- Rights to all activities like hunting, grazing, etc. in reserved forests are banned unless specific orders are issued otherwise.
- Communities living on the outskirts of the forest, who rely on forest resources or products for their livelihood, are occasionally granted access to activities such as hunting and grazing in protected areas.
- The first reserve forest in India was **Satpura National Park** in Madhya Pradesh.
- Typically, reserved forests are often upgraded to wildlife sanctuaries, which are then upgraded to national parks, with each category receiving increased protection and government financing.

5.1.5 Conservation Reserves

- Conservation Reserves can be declared by the State Governments in any area owned by the Government, particularly the areas adjacent to National Parks and Sanctuaries and those areas which link one Protected Area with another.
- Such a declaration should be made after having consultations with the local communities.
- The rights of people living inside a Conservation Reserve are not affected.
- Example: Chharidhandh Conservation Reserve (Gujarat), Shri Naina Devi Conservation Reserve (Himachal Pradesh), etc.

5.1.6 Community Reserves

- Community Reserves can be declared by the State Government in any private or community land not comprised within a National Park, Sanctuary or a Conservation Reserve, where an individual or a community has volunteered to conserve wildlife and its habitat.
- As in the case of a Conservation Reserve, the rights of people living inside a Community Reserve are not affected.
- Example: Siswan Community Reserve (Punjab), Kokkare Bellur Community Reserve (Karnataka), etc.

5.1.7 Sacred Grooves

- India has a history of religious/cultural traditions that emphasized the protection of nature.
- In many cultures, tracts of forest were set aside, and all the trees and wildlife within were venerated and given total protection.
- These are found in Khasi and Jaintia Hills in Meghalaya, Aravalli Hills of Rajasthan, Western Ghats regions of Karnataka and Maharashtra and the Sarguja, Chanda and Bastar areas of Madhya Pradesh.
- In Meghalaya, the sacred groves are the last refuges for a large number of rare and threatened plants.

5.2 *Ex-situ* Conservation

In this type of conservation, the threatened animals and plants are taken out from their natural habitat and placed in a special area or location where they can be protected and given special

care. Example: zoological parks, botanical gardens, wildlife safari parks, gene banks and seed banks.

5.2.1 Zoological Parks

- Zoo is an establishment, whether stationary or mobile, where captive animals are kept for exhibition to the public and includes a circus and rescue centres but does not include an establishment of a licensed dealer in captive animals.
- The initial purpose of zoos was entertainment, over the decades; zoos have got transformed into centres for wildlife conservation and environmental education.
- Apart from saving individual animals, zoos have a role to play in species conservation too (through captive breeding).
- Zoos provide an opportunity to open up a whole new world, and this could be used in sensitizing visitors regarding the value and need for conservation of wildlife.
- Example: National Zoological Parks (Delhi), Indira Gandhi Zoological Park (Andhra Pradesh), etc.

5.2.2 Botanical Garden

Botanical garden refers to the scientifically planned collection of living trees, shrubs, herbs, climbers and other plants from various parts of the globe.

5.2.2.1 Purpose of botanical gardens

- To study the taxonomy as well as growth of plants.
- To study the introduction and acclimatization process of exotic plants.
- It augments conserving rare and threatened species.

Example: Lalbagh Botanical Gardens (Bangalore), Indian Botanical Garden (Howrah), etc.

5.2.3 Seed Banks

- The seed bank is an excellent method of conserving diversity.
- The seeds have to stored under minimal life so that they can be kept for several years without accumulations of mutations and with a minimum loss of viability. Such sort of conservation

is practiced with the help of cold storage in seed banks where seeds are stored for a long duration.

- **National Bureau of Plant Genetic Resources (NBPGR)** is located in New Delhi. Here agricultural and horticultural crops and their wild relatives are preserved by cryopreservation of seeds, pollen etc. by using liquid nitrogen at a temperature as low as -196°C.
- Varieties of rice, pearl millet, Brassica, turnip, radish, tomato, onion, carrot, chilli, tobacco, poppy etc. have been preserved successfully in liquid nitrogen for several years without losing seed viability.

5.3 Hotspots

- Biodiversity hotspots are regions with high species richness and a high degree of endemism.
- Biodiversity hot spot concept was put forth by Norman Myers in 1988
- Conservation International (CI) adopted Myers' hotspots and in 1996, the organization made the decision to undertake a reassessment of the hotspots concept.
- According to CI, to qualify as a hotspot a region must meet two strict criteria:
- It must contain at least 1,500 species of vascular plants (> 0.5% of the world's total) as endemics which is to say, it must have a high percentage of plant life found nowhere else on the planet. A hotspot, in other words, is irreplaceable.
- It has to have lost at least 70% of its original habitat. (It must have 30% or less of its original natural vegetation). In other words, it must be threatened.
- Out of the 36 biodiversity hotspots in the world, there are **four biodiversity hotspot**s present in India: The Himalayas, Indo-Burma, The Western Ghats and Sri Lanka, and Sundaland.

5.3.1 The Himalayas

- The Himalayas comprises North-East India, Bhutan, Central and Eastern parts of Nepal.
- These Himalayan Mountains are the highest in the world and hosts some of the highest peaks of the world including Mount Everest and K2.
- It also includes some of the major rivers of the world like Indus and Ganga.
- Himalayas hosts almost 163 endangered species including one-horned rhinoceros, wild Asian water buffalo and as many as 45 mammals, 50 birds, 12 amphibians, 17 reptiles, 3 invertebrates and 36 plant species.

5.3.2 Indo-Burma

- This region consists of various countries including North-Eastern India (to the south of the Brahmaputra River), Myanmar, and China's Yunnan provinces, Lao People's Democratic Republic, Vietnam, Cambodia, and Thailand.
- Almost 13,500 plant species can be spotted in the region, half of which are endemic and cannot be found in any other place in the world.
- Although this region is quite rich in its biodiversity, the situation has been worsening over the past few decades.

5.3.3 The Western Ghats and Sri Lanka

- These hills are found along the western edge of peninsular India.
- As the region is mountainous and oceanic, it receives a good amount of rainfall.
- Around 77% of the amphibians and 62% of the reptiles are endemic.
- Moreover, the region is also home to around 450 species of birds, 140 mammals, 260 reptiles and 175 amphibians.

5.3.4 Sundaland

- This region lies in South-East Asia and includes Thailand, Singapore, Indonesia, Brunei, and Malaysia.
- Nicobar region represents India in this hotspot.
- UNESCO declared this region as the world biosphere reserve in 2013.
- These islands have a rich terrestrial as well as marine ecosystem including mangroves, sea grass beds, and coral reefs.

5.4 International Union for Conservation of Nature (IUCN)

- IUCN is an international organization working in the field of nature conservation and sustainable use of natural resources.
- It is involved in data gathering and analysis, research, field projects, advocacy, lobbying and education.
- The organization is best known for compiling and publishing the IUCN Red List, which assesses the conservation status of species worldwide.
- Its headquarters are in Gland, Switzerland.

5.4.1 IUCN Red List or Red Data List or Red Book

- The IUCN Red List of Threatened Species, founded in 1964, is the world's most comprehensive inventory of the global conservation status of biological species.
- When discussing the IUCN Red List, the official term "threatened" is a grouping of three categories: Critically Endangered, Endangered, and Vulnerable.
- The pink pages in this publication include the critically endangered species.
- As the status of the species changes, new pages are sent to the subscribers.
- Green pages are used for those species that were formerly endangered but have now recovered to a point where they are no longer threatened.
- With passing time, the number of pink pages continues to increase.
- The Red Data Book is a document kept by a state or country to record and document uncommon and endangered plant and animal species found inside its borders. The Red Data Book aids studies and research on endangered species and subspecies of animals by providing extensive information. It also helps in the coordination and development of monitoring programmes for these endangered and rare species.

Species are classified by the IUCN Red List into nine groups:

- **Extinct (EX):** No known individuals remaining.
- **Extinct in the wild (EW):** Known only to survive in captivity, or as a naturalized population outside its historic range.
- **Critically endangered**

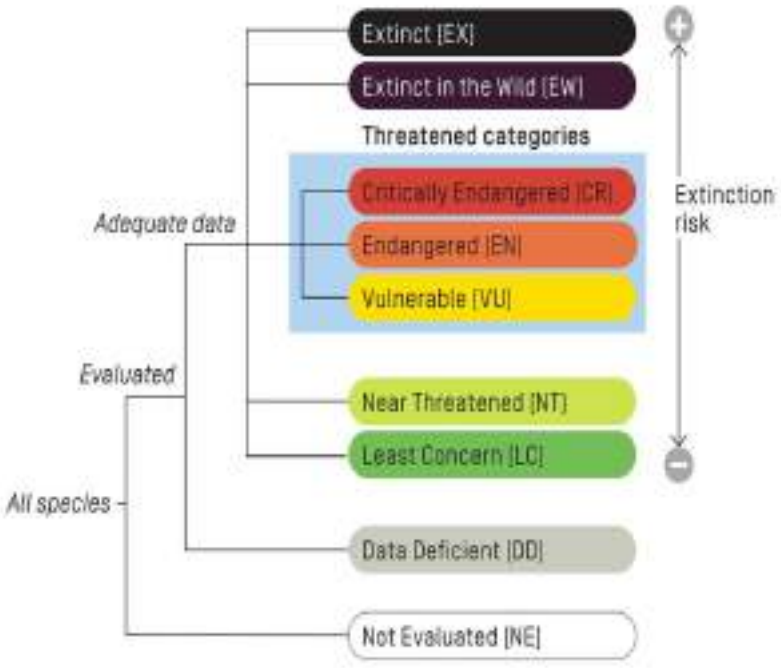

Fig 5.2 IUCN Red List groups

(CR): Extremely high risk of extinction in the wild.

- **Endangered (EN):** High risk of extinction in the wild.
- **Vulnerable (VU):** High risk of endangerment in the wild.
- **Near threatened (NT):** Likely to become endangered in the near future.
- **Least concern (LC):** Lowest risk. Does not qualify for a more at-risk category.
- **Data deficient (DD):** Not enough data to assess its risk of extinction.
- **Not evaluated (NE):** Has not yet been evaluated against the criteria.

5.4.2 Red Data Book of India

Red Data Book of India includes the conservation status of animals and plants which are endemic to the Indian subcontinent. The list comprises critically endangered, endangered and vulnerable species. The list is updated by Zoological Survey of India (ZSI) from time to time as per the IUCN, 1996. There are some examples of different categories under the Red Data Book of India:

5.4.2.1 Critically Endangered Species of India

- Kashmiri Red Stag (endemic to Kashmir)
- Pygmy Hog (found in Assam)
- Great Indian Bustard (Rajasthan)

5.4.2.2 Endangered Species of India

- Asiatic Wild Ass (found in the Rann of Kutch)
- Lion-tailed Macaque (found in the Western Ghats of India)

5.4.2.3 Vulnerable

- Black Buck

5.5 Salient Features

- Biodiversity conservation refers to the protection, preservation, and management of ecosystems and natural habitats and ensuring that they are healthy and functional.
- In-situ conservation is the conservation of species diversity within natural habitats and ecosystems.

- In ex-situ conservation, the threatened animals and plants are taken out from their natural habitat and placed in a special area or location where they can be protected and given special care.
- Biodiversity hotspots are regions with high species richness and a high degree of endemism.
- IUCN is an international organization working in the field of nature conservation and sustainable use of natural resources.
- The Red Data Book is a document kept by a state or country to record and document uncommon and endangered plant and animal species found inside its borders.

IIPA 2022

Biogeographic Regions

Chapter 6

Short Answers

CSM – 06: Compiled by Dr. Shyamli Singh

2022

This chapter contains:

- 10 Biogeographic Regions of India

6. Biogeographic Regions

India is a mega diverse country. India's known biodiversity covers only 2.4% of the total area of the globe and contributes 8% to known global biodiversity. The biogeographic regions are basically “those predominant divisions of the earth’s surface of estimated continental extent, which are attributed by distinct assemblages of animal types”.

India has been divided into **10 biogeographic regions** as follows:

6.1 Trans-Himalaya

It encapsulates three biogeographic provinces i.e. Himalayan Sikkim, Ladakh mountains, and Tibetan plateau. It occupies about 5.6% of the country's landmass. This area mostly lies between 14,800 to 19,700 feet and is very cold and dry. The broad region of Trans-Himalayan comprises bare rock and glaciers. The only vegetation is the sparse alpine steppe. With its scanty vegetation, it has a

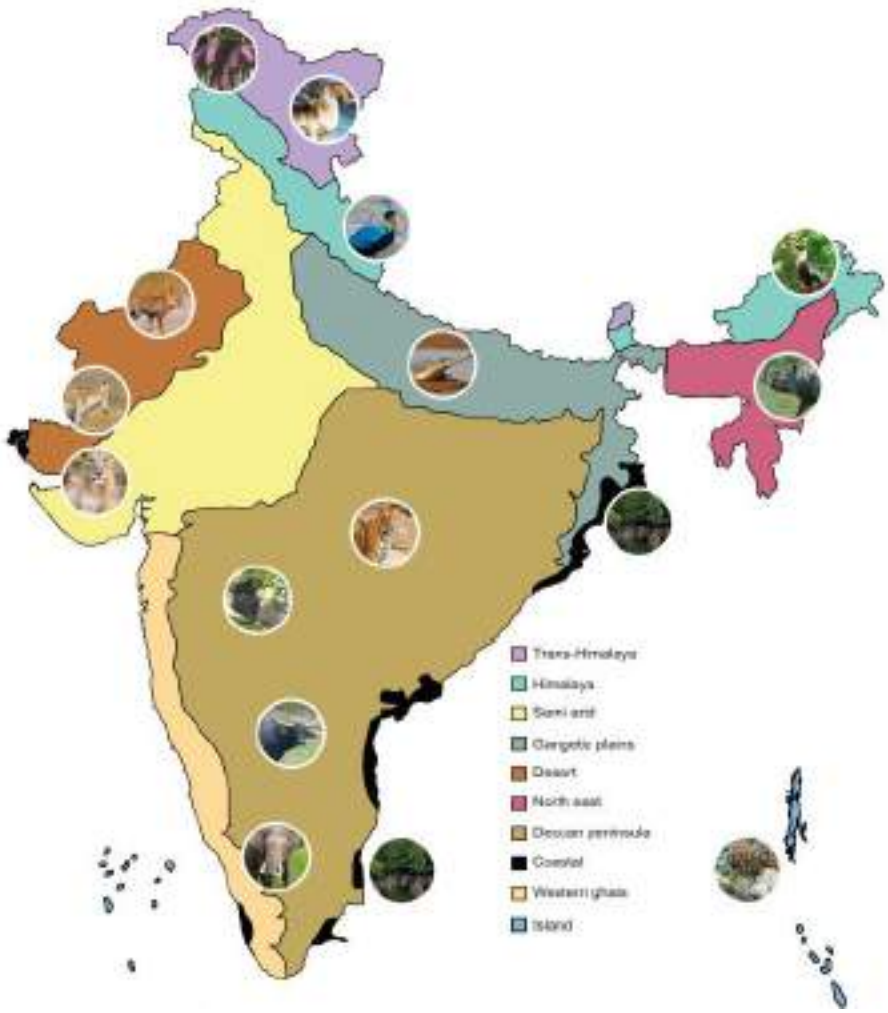

Fig 6.1 Biogeographic Regions of India

redundant wild sheep and goat community in the world. The snow leopard, black bears, marbled cat, marmots, wolf and kiang can be spotted here, as are the migratory Black-necked Cranes.

6.2 Himalaya

The Himalayan zone covers an area of 21,0662 km², which is about 6.41% of the total area of the country. It includes northwest Himalaya (Kashmir to the Sutlej River in Himachal Pradesh), west Himalaya (Sutlej River to the Gandak River in Nepal), central Himalaya (Gandak River in Nepal through West Bengal and Sikkim to central Bhutan) and east Himalaya (central Bhutan and Arunachal Pradesh). Biogeographically, they form a part of the Palearctic realm.

6.3 Desert

The Indian desert runs along India's northern border, primarily covering Rajasthan's western and northwestern regions, as well as a portion of Gujarat's Kutch region in the southwest. The Thar, or Great Indian Desert, is the larger of the two, encompassing Rajasthan as well as parts of Haryana and Punjab, as well as Pakistan. The Indian portion of the Thar Desert covers 170,000 kilometers. Summers are extremely hot and dry, while winters are chilly and arid. The annual rainfall in the area is less than 70 cm. A highly endangered bird- The Indian Bustard is found here, in addition to foxes, snakes, camels, gazelles, foxes, and spiny-tailed lizards.

The second biogeographical province, the Rann of Kutch in Gujarat, is a vast area of salt marsh stretches across the border between India and Pakistan. This larger area has desert on one side and the sea on the other allowing several ecosystems and desert vegetation. Various species have adapted to the severe circumstances of its deserts and grasslands. These account for endangered and endemic animal and plant species, like the Indian wild ass. The Rann is home to many domestic and migratory birds such as the greater flamingo, lesser flamingo and the Houbara bustard. The Little Rann is home to the world's largest population of Indian wild asses, as well as other mammals such as the Indian wolf, desert fox, blackbuck, and chinkara.

6.4 Semi-Arid

This is a transitional zone between the true desert in the west to the extensive communities of the Deccan Peninsular India, to the south and east. The Punjab plains, Delhi, Haryana, the Jammu and Kashmir fringes, Himachal Pradesh, the western borders of Uttar Pradesh, eastern Rajasthan, eastern Gujarat, and northwest Madhya Pradesh are all part of this zone. In Western India, the Semi-arid zone is characterized by savannah woodland, dry deciduous forest, and tropical thorn

forest. The Aravalli System lies at the centre of this zone, which is dominated by two types of vegetation: tropical dry deciduous forest and tropical thorn forest.

6.5 Western Ghats

The Western Ghats stretch from the Tapti River in the north to Kanyakumari in the south, along the west coast of peninsular India through the states of Gujarat, Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala. The Western Ghats zone is one of the 25 biodiversity 'hotspots' in the world and one of India's most important tropical evergreen forest regions, exhibiting huge plant diversity. About 4000 species of flowering plants are found in this area, accounting for almost 27% of the total flora of India, of these, 1500 are endemic. The Western Ghats region is a major genetic estate with a rich biodiversity of ancient lineage.

6.6 Deccan Peninsula

The Deccan Peninsula biogeographic zone includes a major portion of the states of Maharashtra, Madhya Pradesh, Uttar Pradesh, Karnataka, Tamil Nadu, Andhra Pradesh, Orissa and Bihar. The climate in the zone is rather uniform, ranging from semi-arid to moist-deciduous/semi-evergreen. The Central Highlands include the Vindhya Range and Satpura Range, the Chotanagpur Plateau, the Eastern Ghats, the Tamil Nadu Plain, and the Karnataka Plateau. The Vindhya Range and Satpura Range are known for their rich flora.

6.7 Gangetic Plains

The Gangetic divide, the Upper Gangetic plain, the Middle Gangetic plain, and the Lower Gangetic plain are all part of this zone. This zone, which stretches from eastern Rajasthan through Uttar Pradesh to Bihar and West Bengal, is primarily agricultural and sustains a dense human population. The Gangetic plain contains areas in Uttar Pradesh, Bihar, and West Bengal that are contiguous to the Terai-Bhabar tracts.

6.8 Coasts

India's coastline extends from Gujarat to Cape Comorin (Kanyakumari) in the west, and from Cape Comorin to the Sundarbans in the east. The long stretch of coastline in the mainland has a very diverse set of biotic communities.

6.9 North-East Region

The north-east Indian biogeographic zone is particularly important since it serves as a transition zone between the Indian, Indo-Malayan, and Indo-Chinese biogeographic zones, as well as a meeting point between the Himalayan and Peninsular Indian mountains. It comprises 8 states i.e. Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. The region serves as a biogeographic gateway for plant migration. Apart from the Western Ghats, Northeast India is one of the world's 25 biodiversity "hotspots."

6.10 Islands

The Lakshadweep islands and the Andaman group of islands are the two main groups of islands. The Lakshadweep Islands are an archipelago of 27 small islands extending from 8˚ to 12˚ N latitude and 71˚ to 74˚ E longitude in the Arabian Sea. They are 320 km away from the Kerala coast. The Andaman and Nicobar Islands are an elongated north-south oriented group of 348 islands in the Bay of Bengal stretching for 590 km from 6˚ to 13˚ N latitude and 92˚ to 93˚ E longitude. The Andaman Islands are about 190 km from Cape Negrais in Burma, the nearest point on the mainland. Five islands close together constitute the Great Andaman (300 km long), and the Little Andaman lies to the south. The Nicobar groups of Islands are separated from the Andaman's as well as internally from each other by 800 m deep channels.

6.11 Salient Features

- The biogeographic regions are basically "those predominant divisions of the earth's surface of estimated continental extent, which are attributed by distinct assemblages of animal types".
- India has been divided into **10 biogeographic regions**.
- Trans-Himalayan encapsulates three biogeographic provinces i.e. Himalayan Sikkim, Ladakh mountains, and Tibetan plateau.
- Himalayas includes northwest Himalaya, west Himalaya, central Himalaya and east Himalaya.
- The Indian desert runs along India's northern border, primarily covering Rajasthan's western and northwestern regions, as well as a portion of Gujarat's Kutch region in the southwest.
- Semi-Arid is a transitional zone between the true desert in the west to the extensive communities of the Deccan Peninsular India, to the south and east.

- The Western Ghats stretch from the Tapti River in the north to Kanyakumari in the south, along the west coast of peninsular India.
- The Deccan Peninsula biogeographic zone includes a major portion of the states of Maharashtra, Madhya Pradesh, Uttar Pradesh, Karnataka, Tamil Nadu, Andhra Pradesh, Orissa and Bihar.
- The Gangetic divide, the Upper Gangetic plain, the Middle Gangetic plain, and the Lower Gangetic plain are all part of this zone.
- India's coastline extends from Gujarat to Cape Comorin (Kanyakumari) in the west, and from Cape Comorin to the Sundarbans in the east.
- The north-east Indian biogeographic zone is particularly important since it serves as a transition zone between the Indian, Indo-Malay, and Indo-Chinese biogeographic zones, as well as a meeting point between the Himalayan and Peninsular Indian mountains.
- The Lakshadweep islands and the Andaman group of islands are the two main groups of islands in India.

IIPA 2022

Conservation Projects

Chapter 7

Short Answers

CSM – 06: Compiled by Dr. Shyamli Singh

2022

This chapter contains:

- Project Tiger
- Project Lion
- Project Elephant
- Project One-Horned Rhino
- Project Snow Leopard
- Project Sea Turtle
- Project Vulture
- Project Indian Crocodile
- Project Hangul
- Project Dolphin

7. Conservation Projects

Conservation projects are an effort to maintain and use natural resources in a sustainable manner. This is to ensure that future generations have access to these resources. Wild animals are part of nature and need to be protected.

Conservation projects have been launched to integrate evolution with the reality of the environment. This helps predict how wildlife will react to current and future environmental changes. Global warming, agriculture, population growth, pollution and hunting pose great dangers to them, so they were established for their survival.

7.1 Project Tiger

Project Tiger was launched by the Government of India with the support of WWF-International in 1973 and was the first such initiative aimed at protecting this key species and all its habitats. Project Tiger was launched in Jim Corbett National Park of Uttarakhand in 1973. Project Tiger was initiated in nine Tiger Reserves in different ecosystems of the country covering an area of 16339 km^2. By 2001 the number of Tiger Reserves increased to 27, covering an area of 37761 km^2. The tiger count climbed from 268 in 1972 in the nine Tiger Reserves, to around 1500 in 1997 in the 23 Tiger Reserves. Project Tiger (PT) recognized the fact that tigers cannot be protected alone and their habitat must be protected in order to protect them. It is administered by the National Tiger Conservation Authority. The government has set up a Tiger Protection Force under PT to combat poachers. PT funds relocation of villagers to minimize human-tiger conflicts. The Forest Rights Act passed by the Indian government in 2006 recognizes the rights of some forest dwelling communities in forest areas. The project overlooks the role of abuse of power by authorities in the tiger crisis. According to National Tiger Conservation Authority (NTCA), in 2021 India reported the death of around 126 tigers.

7.1.1 National Tiger Conservation Authority (NTCA)

- The National Tiger Conservation Authority was established in December 2005 on the recommendation of the Tiger Task Force.
- NTCA manages Project Tiger.
- Administration of the tiger reserves will be in accordance with guidelines of NTCA.

- Tiger Reserve is managed according to NTCA guidelines.
- The boundaries of the Tiger Reserve cannot be changed without the recommendation of the NTCA and the approval of the National Board for Wild Life.
- No State Government shall de-notify a tiger reserve, except in public interest with the approval of the NTCA and the approval of the National Board for Wild Life.

7.1.2 Functions of NTCA

- The Authority sets standards, guidelines for tiger conservation in the Tiger Reserves, National Parks and Sanctuaries.
- The Tiger Conservation Authority would be required to prepare an Annual Report, which would be laid in the Parliament along with the Audit Report.
- State level Steering Committees will be set up in the Tiger States under the Chairmanship of respective Chief Ministers.
- This has been done with a view for ensuring coordination, monitoring and protection of tigers in the States.
- A provision has been made for the State Governments to prepare a Tiger Conservation Plan.
- The state is expected to establish a tiger conservation foundation based on the good practices established by some tiger reserves.

7.1.3 Reasons for falling number of tigers

- Habitat fragmentation and Habitat destruction
- Incessant poaching
- Invasive species

7.2 Project Lion

- It will entail habitat development, engage modern technologies in lion management and address the issues of disease in lion and its associated species through advanced world class research and veterinary care.
- The project also addresses human-wildlife conflicts that involve local communities and provide livelihood opportunities.

- Using the latest technology, the focus will be on health management and holistically providing world standard care, addressing all that is required to conserve a species.
- The plan for relocation of lions from Gir to Kuno-Palpur Wildlife Sanctuary in Madhya Pradesh dates back to 1993-94. But things have not moved so far because of the reluctance of the Gujarat government to share wild cats.
- The Gujarat Forest Department in June 2020 had suggested their population to be increased by 29% - 523 in 2015 to 674 in 2020.

Six new relocations sites has been identified for the Asiatic Lion:

- Madhav National Park, Madhya Pradesh
- Sitamata Wildlife Sanctuary, Rajasthan
- Mukundra Hills Tiger Reserve, Rajasthan
- Gandhi Sagar Wildlife Sanctuary, Madhya Pradesh
- Kumbhalgarh Wildlife Sanctuary, Rajasthan
- Jessore-Balaram Ambaji Wildlife Sanctuary and adjoining landscape, Gujarat

7.2.1 Asiatic Lion (Indian Lion/ Persian Lion)

Panthera leo leo population is restricted in India. Its current range is restricted to the Gir National Park and environs in the Indian state of Gujarat. They are slightly smaller than African lions. The most striking morphological character is a longitudinal fold of skin running along belly of Asiatic Lions. It is one of five cats of genus *Panthera* inhabiting India. Others are:

- Bengal tiger
- Indian leopard
- Snow leopard
- Clouded leopard

7.2.1.1 Status

- Listed in Schedule I of Wildlife (Protection) Act 1972
- Appendix I of CITES
- **Endangered** under IUCN Red List

7.3 Project Elephant

Project Elephant was launched in 1992 to ensure the long-term survival of a viable population of elephants in their natural habitats in northern, northeastern and southern India. It is being implemented in 12 States. Nonetheless, our herds of elephants are under threat as their habitat shrinks and human activity disrupts their migration path. There are three subspecies of Asian elephant which are the Indian, Sumatran and Sri Lankan.

The Indian subspecies has the widest range and accounts for most of the remaining elephants on the continent. Gaj Yatra is a nationwide awareness campaign to celebrate elephants and highlights the necessity of securing elephant corridors.

The Monitoring the Illegal Killing of Elephants (MIKE) programme, launched in 2003, is an international collaboration that tracks trends in information related to the illegal killing of elephants from across Africa and Asia, to monitor effectiveness of field conservation efforts.

At the 16th Steering Committee meeting of Project Elephant, the Ministry of Environment, Forest and Climate Change launched a field manual named-Field Manual for Managing Human-Elephant Conflicts (HEC) in India-to guide forest staffers dealing with HEC in major elephant range states.

The manual has been prepared by the ministry, along with the Wildlife Institute of India (WII) and World Wide Fund for Nature (WWF-India).

It contains the detailed best practices of minimizing human-elephant conflict. It is drafted with the aim of providing forest officials/ departments and other stakeholders with guidance towards interventions to help mitigate Human Elephant Conflict, both in emergencies and when conflict poses a recurring challenge.

7.3.1 Objectives

- To assist states having populations of wild elephants and to ensure long term survival of identified viable populations of elephants in their natural habitats.
- Dealing with human-animal conflict
- Developing scientific and planned management measures for conservation of elephants.
- Protecting the elephants from poachers; preventing illegal ivory trade and other unnatural causes of death.

7.3.2 Threats

- Poaching
- Habitat Loss
- Human-elephant conflict
- Abuse due to elephant tourism
- Rampant mining and corridor destruction

7.4 Project Vulture

- It is one of the 22 species of large carrion-eating birds that live predominantly in the tropics and subtropics.
- They act an important function as nature's garbage collectors and help to keep the environment clean of waste.
- Vultures also play a valuable role in keeping wildlife diseases in check.
- India is home to 9 species of Vulture namely the Oriental white-backed, Long-billed, Slender-billed, Himalayan, Red-headed, Egyptian, Bearded, Cinereous and the Eurasian Griffon.
- Most of these 9 species face danger of extinction.
- Bearded, Long-billed, Slender-billed, Oriental white-backed are protected in the Schedule-1 of the Wildlife Protection Act 1972. Rests are protected under 'Schedule IV'.
- Project Vulture was developed as a platform to bring the efforts of these dedicated individuals and organizations together.
- In 2013, more than 1440 vultures were poisoned in southern Africa. This alarming rate combined with other threats has forced many vulture populations down to critical levels.
- Recently, the Ministry for Environment, Forests and Climate Change launched a Vulture Action Plan 2020-25 for the conservation of vultures in the country.
- It will ensure minimum use of Diclofenac and prevent the poisoning of the principal food of vultures, the cattle carcasses.
- The Vulture Safe Zone programme is being implemented at eight different places in the country where there were extant populations of vultures, including two in Uttar Pradesh.
- To up scaling conservation four rescue centres will be opened like Pinjore in the north, Bhopal in central India, Guwahati in Northeast and Hyderabad in South India.

- The ministry has now also launched conservation plans for the red-headed and Egyptian vultures, with breeding programmes for both.
- To study the cause of deaths of vultures in India, a Vulture Care Centre (VCC) was set up at Pinjore, Haryana in 2001.
- Later in 2004, the VCC was upgraded to being the first Vulture Conservation and Breeding Centre (VCBC) in India.
- At present, there are nine Vulture Conservation and Breeding Centres (VCBC) in India, of which three are directly administered by the Bombay Natural History Society (BNHS).

7.4.1 Threats

- Poisoning from diclofenac that is used as a medicine for livestock.
- Loss of Natural Habitats due to anthropogenic activities.
- Food Dearth and Contaminated Food.
- Electrocution by Power lines.

7.5 Project One-Horn Rhino

- One horned rhino are poached for their horns.
- Indian rhino vision 2020 implemented by the department of environment and forests, Assam.
- The programme is supported by **WWF**-India, the international rhino foundation (IRF), and many local NGOs.
- **Translocations** are the backbone of the IRV (Indian Rhino Vision) 2020 program.
- The goal set was to populate the potential rhino habitat areas identified viz. Manas NP, Dibru Saikhowa Wildlife Sanctuary, Laokhowa-Bura Chapori Wildlife Sanctuary with a viable population of rhino through translocations from Kaziranga National Park and Pobitora Wildlife Sanctuary.
- **Manas National Park** was chosen as the first location for the rhino translocation.
- Since 2008, ten rhinos have been released into Manas. By the end of the year, another 10 rhinos will be relocated from Kaziranga National Park.
- The program's vision was to increase the total number of rhinos in Assam from about 2000 to 3000 by 2020, distribute these rhinos to at least 7 protected areas (PAs) to provide long term viability of the one-horned rhino population.

- Due to the large concentration of rhinos in a single sanctuary such as Kaziranga, this species is at risk of disasters (epidemics, floods, large-scale poaching attempts).

7.6 Project Snow Leopard

- It was launched in 2009 to promote an inclusive and participatory approach to conserve snow leopards and their habitat.
- The snow leopard is a **vulnerable** species worldwide.
- Snow Leopard conservation breeding programme is undertaken at Padmaja Naidu Himalayan Zoological Park, Darjeeling (West Bengal).
- Merely 7,500 are estimated to be surviving over two million square kilometers in the Himalaya and Central Asian mountains.
- Most snow leopards are found in China, followed by Mongolia and India.
- Human invasion, competition with livestock (people kill them to save livestock), retreating deep into the mountains due to global warming, and poaching are threats to snow leopards.

7.7 Project Sea turtle

- A significant portion of the world's olive ridley turtle population travels to the coastal waters of India each winter, primarily to nest on the east coast.
- With the objective of conservation of olive ridley turtles and other endangered marine turtles, MoEF initiated the Sea Turtle Conservation Project in collaboration of UNDP in 1999 with **Wildlife Institute of India, Dehradun** as the Implementing Agency.
- The project is being implemented in 10 coastal States of the country with special emphasis in State of Orissa.
- The project has helped in preparation of inventory map of breeding sites of Sea Turtles, identification of nesting and breeding habitats along the shore line, and migratory routes taken by Sea Turtles, development of guidelines to safeguard and minimize turtle mortality.
- One of the important achievements have been demonstration of use of Satellite Telemetry to locate the migratory route of Olive Ridley Turtles in the sea and sensitizing the fishermen and State Government for the use of Turtle Exclusion Device (TED) in fishing trawlers to check turtle mortality in fishing net.

7.8 Project Indian Crocodile

Crocodiles have been threatened as their skin is used for making leather articles. This is an almost extinct wild crocodile in India in the 1960s. The Crocodile Breeding and Conservation Program was launched in 1975 to protect the remaining crocodile population in its natural habitat and by creating breeding centers. This is probably one of the most successful ex situ conservation breeding projects in the country. Crocodiles have been extensively bred in over 30 captive breeding centers, zoos and other sites where successful breeding takes place. Thousands of crocodiles of all three species have been bred and restocked in 20 natural water bodies.

India's Crocodile Conservation Project has begun a good path to recovery, saving the once-threatening crocodile from extinction.

7.8.1 Objectives

- To protect the remaining population of crocodilians in their natural habitat by creating sanctuaries.
- To rebuild natural population quickly through 'grow and release' or 'rear and release' technique.
- To promote **captive breeding**
- To take-up research to improve management.
- To build up a level of trained personnel for better continuity of the project through training imparted at project-sites and through the (erstwhile) Central Crocodile Breeding and Management Training Institute, Hyderabad.
- To involve the local people in the project intimately.

Captive Breeding

Captive breeding means capturing members of the wild species and raising and breeding them in special facilities under the control of wildlife biologists and other professionals. Bringing an animal into captivity may represent the last chance to preserve a species in the wild.

7.9 Project Hangul

- The Kashmir stag also called Hangul is a subspecies of Central Asian Red Deer native to northern India.
- It is the state animal of Jammu & Kashmir

- In Kashmir, it's found in **Dachigam National Park** at elevations of 3,035 meters.
- These deer once numbered from about 5,000 animals in the beginning of the 20th century.
- Unfortunately, they were threatened, due to habitat destruction, over-grazing by domestic livestock and poaching.
- This dwindled to as low as 150 animals by 1970. However, the state of Jammu & Kashmir, along with the IUCN and the WWF has prepared a project to protect this animal.
- It became known as Project Hangul. This brought great results and the population increased to over 340 by 1980.
- According to the IUCN, there were only 240(approx.) Hangul left in 2019.
- The Kashmir stag is a **critically endangered species** under the IUCN Red List.

7.10 Project Dolphin

- Dolphins have been included in Schedule I of the Indian Wild Life (Protection) Act 1972, in Appendix I of the Convention on International Trade in Endangered Species (CITES), in Appendix II of the Convention on Migratory Species (CMS) and categorised as **'Endangered'** on the IUCN Red List.
- The Gangetic river dolphins were officially discovered in 1801 and are one of the oldest creatures in the world along with some species of turtles, crocodiles and sharks, according to the WWF.
- The Ministry of Environment and Forests notified the Ganges River Dolphin as the **National Aquatic Animal**.
- The River Dolphin inhabits the Ganges-Brahmaputra-Meghna and Karnaphuli-Sangu river systems of **Nepal, India,** and **Bangladesh**.

Fig 7.1 Project Dolphin Outlines

- Their total population is estimated to be approximately 2,000 and is listed in Schedule I of the Wildlife Conservation Act (1972).
- 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).
- There are several species of marine dolphins in the range, including freshwater habitats, but these four species live only in rivers and lakes.
- The Chinese River Dolphin was declared functionally extinct by a team of international scientists in 2006.
- In India, Ganges dolphins are threatened by river water pollution and subsidence, accidental entanglement of fishing nets, and poaching of their oil.
- In addition, alterations to the rivers in the form of barrages and dams are separating populations.

7.11 Salient Features

- Conservation projects are an effort to maintain and use natural resources in a sustainable manner.
- Project Tiger was launched by the Government of India with the support of WWF-International in 1973 and was the first such initiative aimed at protecting this key species and all its habitats.
- The National Tiger Conservation Authority was established in December 2005 on the recommendation of the Tiger Task Force.
- Project Lion will entail habitat development, engage modern technologies in lion management and address the issues of disease in lion and its associated species through advanced world class research and veterinary care.
- Project Elephant was launched in 1992 to ensure the long-term survival of a viable population of elephants in their natural habitats in northern, northeastern and southern India.
- India is home to 9 species of Vulture namely the Oriental white-backed, Long-billed, Slender-billed, Himalayan, Red-headed, Egyptian, Bearded, Cinereous and the Eurasian Griffon.

- Project One-Horned Rhino is supported by WWF-India, the international rhino foundation (IRF), and many local NGOs.
- Project Snow Leopard was launched in 2009 to promote an inclusive and participatory approach to conserve snow leopards and their habitat.
- MoEF initiated the Sea Turtle Conservation Project in collaboration of UNDP in 1999 with Wildlife Institute of India, Dehradun as the Implementing Agency to protect the olive ridley turtle.
- The Crocodile Breeding and Conservation Program was launched in 1975 to protect the remaining crocodile population in its natural habitat and by creating breeding centers
- The Kashmir stag also called Hangul is a subspecies of Central Asian Red Deer native to northern India.
- Project Dolphin is a 10 year project to focus on both river and sea Dolphin. The Gangetic river dolphins were officially discovered in 1801.

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Biodiversity Acts and Conventions

Chapter 8

Short Answers

CSM – 06: Compiled by Dr. Shyamli Singh

2022

This chapter contains:

- Wildlife Protection Act, 1972
- Biological Diversity Act, 2002
- CITES, 1973
- Convention on Migratory Species, 1979

8. Biodiversity Acts and Conventions

8.1 The Wildlife Protection Act, 1972

In order to preserve environmental and ecological security, this Act protects the country's wild animals, birds, and plant species. Many animal species are prohibited from being hunted under the Act. The Act was last amended in the year 2006. In 2013, the Rajya Sabha introduced an amendment bill that was referred to a Standing Committee; however it was withdrawn in 2015.

8.1.1 Constitutional Provisions for the Wildlife Act

Article 48A of the Constitution of India directs the State to protect and improve the environment and safeguard wildlife and forests. This article was added to the Constitution by the **42nd Amendment** in 1976.

Article 51A imposes certain fundamental duties for the people of India. One of them is to protect and improve the natural environment including forests, lakes, rivers, and wildlife and to have compassion for living creatures.

8.1.2 History of wildlife protection legislation in India

- In 1887, the British Indian Government passed the Wild Birds Protection Act, which was the first of its kind. The law sought to prohibit the possession and sale of specified wild birds that were either killed or captured during a breeding session.
- A second law, the Wild Birds and Animals Protection Act, was passed in 1912. This was amended in 1935 when the Wild Birds and Animals Protection (Amendment) Act 1935 was passed.
- During the British Raj, wildlife protection was not accorded a priority. It was only in 1960 that the issue of protection of wildlife and the prevention of certain species from becoming extinct came into the fore.

The Wild Life (Protection) Amendment Bill, 2021 was introduced in Lok Sabha by the Minister of Environment, Forest and Climate Change on December 17, 2021. The Bill amends the Wild Life (Protection) Act, 1972. The Act regulates the protection of wild animals, birds and plants. The Bill seeks to increase the species protected under the law, and implement the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

8.2 Biological Diversity Act, 2002

The **Biological Diversity Act, 2002** was born out of India's attempt to realize 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.
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 prohibits the following activities without the prior approval from the **National Biodiversity Authority:**

- Any person or organization (either based in India or not) obtaining any biological resource occurring in India for its research or commercial utilization.
- 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.

8.3 Convention on International Trade in Endangered species of Wild flora and fauna (CITES) 1973

- It was drafted as a result of a resolution adopted in 1963 at a meeting of members of the International Union for Conservation of Nature (IUCN)
- It aims to control or prevent international commercial trade in endangered species or products derived from them.
- The Convention does not seek to directly protect endangered species, rather it seeks to reduce the economic incentive to poach endangered species and destroy their habitat by closing off the international market.
- India became a party to the convention in 1976. International trade in all wild flora and fauna in general and species covered under convention is regulated through the provisions of the Wild life (protection) Act 1972.

- Although CITES is legally binding on the Parties, it does not take the place of national laws.

8.4 Convention on Migratory Species, 1979 (Bonn Convention)

- The Convention on the Conservation of Migratory Species of Wild Animals (also known as the Bonn Convention) aims to "conserve terrestrial, marine and avian migratory species throughout their range."
- The Convention facilitates the adoption of strict protection measures for endangered migratory species, the conclusion of multilateral agreements for the conservation and management of migratory species, and cooperative research activities.
- The Convention has two appendices:
    - **Appendix I** lists migratory species that are classified as endangered and where urgent international cooperation is necessary to address the issue.
    - **Appendix II** lists other species that require or would benefit significantly from international agreements under the Convention.
- It was signed in 1979 in Bonn, West Germany, the Convention entered into force in 1983. As of September 2020, there are 131 Member States to the Convention. The depositary is the Government of the Federal Republic of Germany.
- Marine Turtles, Siberian and Dugong are a part of the conservation under this convention which is related to India.