MAJOR ECOSYSTEMS

* FOREST ECOSYSTEM:

Forest is natural plant communities with dominance of trees. The major forest biomes found in India are Tropical rain forests, Tropical deciduous forests, Temperature broad leaved forests, Temperate needle leaf or coniferous forests.

ABIOTIC COMPONENTS

It includes inorganic and organic substances present in the soil and atmosphere. The climate (temperature, light, rainfall etc) and soil (minerals) vary from forest to forest.

BIOTIC COMPONENTS

i) Producers: These are mainly trees that show much species diversity. In different forests producers are *Butea frondosa, Tectona grandis, Dipterocarpus, Shorea robusta, Quercus, Pinus, Cedrus, Picea* and *Abies.*

ii) Consumers: These are animals which are grass eating and flesh eating. The insects like ants, flies, beetles, leaf hoppers, bugs and animals like shrews, moles, deer, flying foxes, lizards, fox, lion, tiger.

iii) Decomposer: These are microorganism which may be bacteria like *Bacillus, Clostridium* and fungi like *Aspergillus* and *Alternaria*.

* GRASSLAND ECOSYSTEM

This type of ecosystem occurs in those areas where the climate is cold during winter and hot during summer.

ABIOTIC COMPONENTS

This includes the nutrients or elements present in the soil. Thus elements like carbon, hydrogen, oxygen, nitrogen, sulphur, phosphorus etc are provided by water, carbon dioxide, nitrates, phosphates and sulphates present in air and soil of the areas.

BIOTIC COMPONENTS

i) Producers: There are no trees, only herbaceous plant cover dominated by a wide variety of grass species is present. Main grass species are Dichanthium, Cynodon, Phragmites, Imperata etc.

ii) Consumers: These include deer, sheep, rabbits, mice. Some insect species such as Cicindella, Coccinella, Dysdercus, Termites, millipedes, jackals, fox, hawks, snakes etc are present.

iii) Decomposers: This include Aspergillus, Mucor, Rhizopus, Penicillium, etc which decomposes the dead and decay parts.

* DESERT ECOSYSTEM

Desert biomes occupy about 17% of the land where rainfall is very low and evaporation is high. The days are extremely hot and nights cold. Deserts are characterized by scarcity of flora and fauna. Only organisms having specialized structural, physiological and behavioral adaptation to withstand the extremes of temperatures and aridity can survive there.

ABIOTIC COMPONENTS

Temperature is very high and rainfall is very scanty. The nutrients of desert are very poor.

BIOTIC COMPONENTS

i) Producers: These are shrubs, especially bushes, some grasses and very few trees. A few succulents like cacti may be present. Some lichens and xerophytic mosses also occur.

ii) Consumers: Insects, reptiles, nocturnal rodents, birds and camels etc.

iii) Decomposers: These are very poor few because of poor flora and fauna, the amount of dead organic matter is also. There are some bacteria and fungi, most of them are thermophilic.

* POND OR LAKE ECOSYSTEM

ABIOTIC COMPONENTS

Water, light, temperature and several inorganic and organic substances like C, H, O, P, Ca, S, carbohydrates, proteins and lipids are the abiotic components. Part of the nutrients is in solution form but most of them are present stored in particulate matter as well as in living organisms.

BIOTIC COMPONENTS

Producers: There belong some algae or flagellates and macrophytes which are suspended or floating lower plants. Common examples are *Chlamydomonas, Volvox, Wolfia, Pistia, Azolla, Hydrilla*.

Consumers:

i) Primary consumers: These include ciliates, flagellates, other protozoans, small crustaceans, benthos etc. These animals drift in water along with phytoplanktons which act as their food.

ii) Secondary consumers: These include carnivores which feed on herbivores, eg: fish and some insects.

iii) Tertiary consumers: There are some large fish which feed on the smaller fish.

Decomposers: Some bacteria, fungi and actinomycetes represent this group.

* RIVER OR STREAM ECOSYSTEM

The biotic community in streams and rivers is quite different from that in ponds and lakes.

ABIOTIC COMPONENTS

The river or stream water has lesser mineral content and greater penetration of light because it is clear water.

BIOTIC COMPONENTS

i) Producers: In slow moving waters of banks, phytoplanktons, attached algae, water grasses and other amphibious plants are the producers.

ii) Consumers: There may fresh water sponges, flatworms, leeches, water insects, snails, fishes and crocodiles. Many birds and mammals also get their food from rivers and streams.

iii) Decomposers: Some bacteria and fungi.

OCEAN OR MARINE ECOSYSTEM

Oceans cover about 70% of surface of the earth. The concentration of salts and minerals in the sea is always high. The sea is in continuous circulation because air temperature differences between equator and poles set up strong winds which, together with the rotation of the earth, create definite currents.

ABIOTIC COMPONENTS

Marine ecosystem is more stable in chemical composition due to being saline. There are dissolved salts and minerals in the water.

BIOTIC COMPONENTS

i) Producers: There are phytoplanktons and large marine plants. Diatoms and dinoflagellates constitute the phytoplanktons. Large plants include sea weeds which belong to chlorophyceae, rhodophyceae. Certain mangrove plants represent the complex tidal woodlands.

ii) Consumers: These include herbivores like crustaceans, molluses and carnivores fishes like cod, Herring, Haddock.

iii) Decomposers: Some bacteria and fungi actively take part in decomposition of dead organic matter.

* ESTURINE ECOSYSTEM

An estuary is strongly affected by tidal action, and within which sea water is mixed with fresh water from the land drainage. Common examples of estuarine ecosystems are river mouths, coastal bays, tidal marshes and bodies of water behind barrier beaches.

i) Producers: These are sea weeds, sea grasses, algal mats and phytoplanktons.

ii) Consumers: Oysters, crabs, shrimp and many commercial sport fishes etc.

iii) Decomposers: Very less bacteria and fungi.

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***BIODIVERSITY AND ITS CONVERATION***

DEFINITION: **The totality of genes, species, and ecosystem in a region is called biodiversity**.

**LEVELS OF BIODIVERSITY**:

GENETIC DIVERSITY: Genes are the basic information of an organism. It transmits information from one generation to another generation. The variation among the genes is due to its different chromosomes and its alleles. Due to this variation physical and mental behavior of the organism changes. For example rice variety has 30,000 genes, shows variation in colour, size, shape, aroma and nutrient content of the grain. Similarly observation is seen in case of other organisms also.

SPECIES DIVERSITY: The variability and variation of the species found in a community. It represents its richness and their abundance in a community. To measure the species richness Shannon-Wiener index and Simpson index is used.

ECOSYSTEM DIVERSITY: The diversity in the ecosystems which shows variation in food chains, food webs, biogeochemical cycles etc. The variation in ecosystem is due to variation in physical factors like moisture, temperature, altitude, precipitation etc.

**BIOGEOGRAPHICAL CLASSIFICATION OF INDIA**

|  |  |  |
| --- | --- | --- |
| S.No. | Biogeographic zone | Important flora and fauna |
| 1. | Trans-Himalayan | Pine, Deodar, Wild sheep, Yak, Tibetan ass, Snow Leopard |
| 2. | Himalayan | Sal, Cork tree, Castor, Wild bear, Sikkim stag, Musk deer, Leopard |
| 3. | Desert | Acacia, Zizyphus, Camel. Bustard, Wild ass, Fox |
| 4. | Semi-arid | Date palm, Peepal, Gir Lion, Black bucks |
| 5. | Western Ghats | Sheesham, Bahera, Reptiles, Mammals, Lizards |
| 6. | Deccan Peninsula | Acacia, Teak, Sloth bear, Wild elephant, Wild buffalo |
| 7. | Gangetic plain | Sal, , Bael, Black Chinkara, Alligator |
| 8. | North-East India | Bamboo, Castor, Elephant, Rhinoceros |
| 9. | Islands | Harar, Coconut, Cloves, Alligator, Dolphin |
| 10 | Coasts | Coconut, Palm trees, Banana, Cashew nuts, Turtle, Alligator, Fishes |

**BIODIVERSITY AT GOBAL, NATIONAL AND LOCAL LEVELS**

GOBAL DIVERSITY

After 1992 Earth Summit at Rio de Janeiro it has become important to conserve the biodiversity as well as to name certain species which were not given nomenclature till now. Mapping the biodiversity has therefore, been rightly recognized as an emergency task in order to plan its conservation and practical utilization in a judicious manner. The **tropical rainforests and other ecological niches are the storehouse of biodiversity** which need to be explored. More than one-fourth of the world’s prescription drugs are extracted from plant growing in tropical forests. Out of 3000 plants identified by National Cancer Research Institute as sources of cancer fighting chemicals, 70% come from tropical rain forests. One of the creeping vines in the rainforests at Cameroon has proved to be effective in the inhibition of replication of AIDS virus. In this way globally many species are there which have to identify so that it can be utilized in a proper way.

NATIONAL LEVEL

India is a nation rich with biodiversity. On the basis of the biodiversity, India has been divided into ten biogeographical regions. The biodiversity of India is quite peculiar and highly categorized. Most of it is localized to Western Ghats, North western Himalayas etc. India ranks 10th among the plant rich countries of the world and 11th in terms of number of endemic species of higher vertebrates.

LOCAL LEVEL

It is based upon their spatial distribution.

* Point richness: The number of species found in a single point in a given space.
* Alpha richness: The number of species found in a small homogeneous area
* Beta richness: The rate of change in species composition across different habitats.
* Gamma richness: The rate of change across large landscape gradients.

**VALUES OF BIODIVERSITY**

The Values of biodiversity in terms of consumptive, productive, social and aesthetical are enormous. We get benefits from biodiversity in many ways. Some plays very important role in controlling the diseases and some in the form of food supply.

1. **Consumptive value**: Here biodiversity can be utilized directly as well as indirectly.
   1. Food: A large number of wild plants are consumed by human beings as food and many more in the form of grains, vegetables, fruits, nuts, condiments, tea, coffee, meat fish egg, milk etc.
   2. Fuel: Since ages our forests was used as fuel wood. A part from it, these were used as coal, crude oil etc for electricity generation and transport facilities.
   3. Medicines: Many plant extracts were used to cure diseases like Quinine from the bark of Cinchona tree used to cure malaria. Digitalin from foxglove which is effective for curing heart alignments. Similarly Penicillin from fungi Penicillium, tetracycline from bacterium.
2. **Productive value**: The products that can be marketed and sold commercially. It is widely used by the scientists for introducing desirable traits in the crops and domesticated animals. These may include silk from silk worm, wool from sheep, fur of many animals, and lac from insects. But these products are illegally traded in the market which worth billions of dollars. As these were traded to increase the number of organisms in the wild but due to smuggling it became a threat to biodiversity.
3. **Social value**: These are associated with the social life, customs, religion and psycho-spiritual aspects of the people. Many plants and animals are considered as holy and sacred in our country like tulsi, peepal, lotus, bael, cow, snake, bull, peacock etc. Tribal people were very close to this wildlife in the forests.
4. **Ethical value**: It involves in the ethical issues like “all life must be preserved”. It is based on the concept of “Live and Let Live”. For human race existence biodiversity survival is necessary.
5. **Aesthetical value**: No one of us would like to visit vast barren areas with no life. People from far and wide spend a lot of time and money to visit wilderness areas where they can enjoy the aesthetic value of biodiversity and this type of tourism is called eco-tourism.
6. **Optional value**: These values include the potentials of biodiversity that are presently unknown and need to be explored. There is a possibility that we may have some potential cure for AIDS or cancer existing within the depths of a marine ecosystem, or a tropical rain forest. Thus optional value is the value of knowing that there are biological resources existing on this biosphere that may one day prove to be an effective option for something important in the future.

**THREATS TO BIODIVERSITY**

1. **Population Growth**: With seven billion people living on Earth and more arriving every day, basic human needs for fresh water and fuel are making unprecedented demands on our global and local ecosystems. Beyond the necessities of survival, there is increasing demand throughout the globe for more material goods and services.
2. **Global warming**: It represents a profound and emerging threat to biodiversity around the world. As temperatures rise, habitats for many plants and animals will change, depriving them of the homes and niches to which they have adapted. For example polar bears could be affected by the loss of sea life. According to the Nature Resource Defense Council:
   1. Sub alpine forest has invaded by sub meadows in Olympic National Park.
   2. Mangrove forests are dying off in the Caribbean island.
   3. Over past 25 years penguin populations have shrunk by 33% in parts of Antarctica.
   4. Ranges for marine life are shifting northward along the Pacific coast.
3. **Habitat fragmentation/ Urban sprawl**: The single greatest threat to biodiversity around the globe is the loss of natural communities to development. Between 1992-96 in US alone 16 million acres of forest, cropland and grassland were converted to urban and other uses.
4. **Exotic species**: Plants and animals that are not native to an ecosystem can wreak havoc on the naturally occurring species within that system. These species often out-compete native species for resource and occupy much of this available habitat. Purple loose strife and Kudzu are good examples.
5. **Over hunting/Poaching**: Over hunting and illegal trade in endangered species is a prime threat to their survival. Due to over hunting and poaching results in the extinction of the species. Example Dodo and Passenger pigeon.
6. **Environmental degradation**. The usage of pesticides, insecticides, weedicides not only shown ill effects to humans but it also shown effect to marine ecosystem. The usage of DDT in New England showed traces at high concentration to Antarctica fauna.
7. **Man and wild life conflicts**: Instances of man animal conflicts keep on coming to limelight from several states in our country. In Sambalpur, Orissa 195 humans were killed in the last 5 years by elephants. In retaliation the villagers killed 98 elephants and badly injured 30 elephants. In Powar, Mumbai 2 people were killed and 19 people were injured by the leopard attack. These killings are due to failure duties of forest department. They are not growing any cultivable products for elephant grazing which led these elephants to entire in to village and destroy crops. Similar in case of tiger and leopard.

**ENDANGERED AND ENDEMIC SPECIES OF INDIA**

The **International Union for Conservation of Nature and Natural Resources** (IUCN) publishes the **Red Data Book** which includes the list of endangered species of plants and animals. The red data symbol indicates the warning signal for those species which are endangered and if not protected are likely to become extinct in near future. A few species of **endangered** reptiles, birds, mammals, plants are listed below:

Reptiles: Gharial, Green sea turtle, Python

Birds: Great Indian bustard, Peacock, Pelican, Siberian White Crane

Mammals: Red fox, Sloth bear, Indian lion, Golden cat

Primates: Lion-tailed macaque, Niligiri langur, Capped monkey,

Plants: Rhododendrons, Rauvolfia serpentine, sandal wood, cycas beddonei

**Endemic species of India.**

India has two biodiversity hot spots and thus possesses a large number of endemic species.

Plants species: Saparia Himalayana, Uvaria lurida, Nepenthes khasiana.

Animals: Western Ghats are rich in amphibians (frogs, toads), reptiles (lizards, crocodiles).

**HOT SPOTS OF BIODIVERSITY**

**DEFINITION**: **Areas which exhibit high species richness as well as high species endemism are termed as hot spots of biodiversity**.

The term was introduced by Meyers in 1988.There are 25 such hot spots of biodiversity on a global level out of which two are present in India, namely the Eastern Himalayas and Western Ghats.

About 40% of terrestrial plants and 25% of vertebrate species are endemic and found in these hotspots. Some of the places in the world which have hot spots are Western Amazon, Madagascar, North and East Borneo, North-Eastern Australia, Brazilian Atlantic forests.

**INDIAN HOTSPOTS**:

The Indian hot spots are not only rich in floral wealth and endemic species of plants but also reptiles, amphibians, shallow tailed butterflies and some mammals.

**Eastern Himalayas**: It covers the Indo-Burma region stretching with 7298 Km2 contain 4250 plant species showing 60% endemism. Certain species like *Sapria himalayana*, a parasitic angiosperm was sighted only twice in this region in the last 70 years. Out of the world’s recorded flora 30% are endemic to India of which 35,000 are in the Himalayas.

**Western Ghats**: It extends along a 17,000 Km2 covering a strip of Maharashtra, Karnataka, Tamil Nadu and Kerala (India-Sri Lanka Region), It consists of 40% of total endemic plants, 62% amphibians and 50% lizards are endemic to Western Ghats. The major centers of diversity are Agastyamalai Hills and Silent valley-the New Amambalam Reserve Basin.

**CONSERVATION OF BIODIVERSITY**

CONSERVATION OF BIODIVERSITY

PROTECTED AREAS

GENE BANKS

OFF SITE COLLECTIONS

SEED BANK

ZOOS BOTANICAL GARDENS

ORTHODOX RECALCITRANT

ORCHARDS

TISSUE CULTURE

CRYO PRESERVATION

Conservation of biodiversity is **protection, uplift and scientific management of biodiversity** so as to maintain it at its optimum level and derive sustainable benefits for the present as well as future strategies. There are two types of conservation strategies-In-situ and Ex-situ.

**IN SITY CONSERVATION**

Good management of extant populations in the wild is essential for their survival. **It is protection and management of important components of biological diversity through a network of protected areas.** These protected areas ecological areas which is protected, maintained and managed through legal of other effective measures. These areas are tropical rain forest to desert area. These protected areas are classified into National Parks, Wild life sanctuaries and Biosphere reserves.

**NATIONAL PARKS**

The areas are maintained by government and reserved for betterment of wildlife. Cultivation, grazing, forestry and habitat manipulation are not allowed. There are 89 national parks in India, occupying nearly 1.1% of geographical area. Some of the national parks of India are Jim Corbett national park, Yellowstone national park (USA), Royal national park (Australia).

**WILD LIFE SANCTURIES**

These occupying 3.6% of geographical area. It has 492 wildlife sanctuaries. Other activities like collection of forest products, harvesting of timber, private ownership of land, tilling of land, etc are allowed. Wild Ass sanctuaries (Gujarat), Ghana Bird sanctuaries (Rajasthan), Hazaribagh sanctuaries (Bihar), Kambalakonda (Visakhapatnam).

**BIOSPHERE RESERVE**

They are multipurpose protected areas which are meant for preserving wild life as well as taking care of tribal population. India has 13 biosphere reserve namely Manas (Assam), Nanda devi (Himachal Pradesh) Similipal (Orissa) etc. Each biosphere reserve has (i) Core Zone: No human activity is allowed. (ii) Buffer zone: Limited human activity is allowed like resource use strategies, research and education. (iii) Transition Zone: It is the outer most part of biosphere reserve where an active co-operation is present between reserve management and local people for activities like settlements, cropping, recreation, forestry and other economic uses without disturbing ecology.

**EX-SITU CONSERVATION**

It is conservation of selected rare plants/animals in places outside their natural homes. It includes offsite collections and gene banks.

1. **OFFSITE COLLECTIONS**

They are live collections of wild and domesticated species in botanical gardens, zoos etc. There are 1500 botanical gardens having more than 80,000 species. The number of zoos/zoological parks is 800 contains about 3000 species of mammals, birds, reptiles and amphibians. By this method Black-Footed Ferret, Ginkgo has saved from extinction.

1. **GENE BANKS**

They are institutes that maintain stocks of viable seeds, live growing plants, tissue culture and frozen germplasm with the whole range of genetic variability.

1. **Seed banks**: Seeds are of two types, orthodox and recalcitrant. **Orthodox seeds** are those which can tolerate reduction in moisture content (up to 5%) and low temperatures of -10°C to -20°C example cereals and legumes. **Recalcitrant seeds** are those which get killed on reduction of moisture and temperatures example Tea, Cocoa, Jackfruit
2. **Orchards**: Plants with recalcitrant seeds are grown in orchards where all possible strains and varieties are maintained example Litchi, oil palm, rubber tree.
3. **Tissue culture**: It is carried out through callus formation, embryoids, pollen grain culture and shoot tip culture for those plants which are either seedless where clone is to be maintained. This method is useful in maintaining a large number of genotypes in small area. Example Banana, Potato.
4. **Cryopreservation**: Preservation at -196°C (liquid nitrogen) can maintain tissue culture, embryos, animal cells etc. 