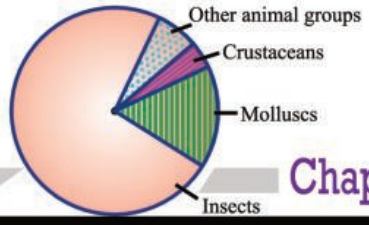
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CLASS XII BIOLOGY NOTES

Key Notes and Important Questions with Answers

BIODIVERSITY AND CONSERVATION





Chapter - 15

Biodiveristy and Conservation

Biodiversity : Term coined by socio-biologist Edward Wilson and was also used by Walter G Rosen for the diversity of life forms. Biodiversity refers to the sum total of diversity that exists at genetic, species and ecosystem level of biological organisation.

Three inter-related levels of Biodiversity : Genetic diversity, Species diversity, Ecological diversity.

- **Genetic diversity :** Diversity in the number and types of genes, as well as chromosomes present in different species and the variations in the genes and their alleles in the same species. It helps in speciation.
- **Species diversity :** Varieties in the number and richness of the species of a region.
- **Ecological diversity :** Variety in the types of ecosystems.

IUCN : International Union for Conservation of Nature and Natural Resources. It is situated in Morges, Switzerland.

India has : More than 50,000 genetically different varieties of rice; 1000 varieties of mango;

- India has 1,42,000 known species of plants and animals (Around 45,000 species of plants and rest of animals).
- India has 8.1% of share of global biodiversity.
- India is one of 12 Mega diversity countries of the world.

Patterns of Biodiversity : Biodiversity not uniform but shows uneven distribution.

Altitudinal Patterns of Biodiversity

- 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) harbour more species than temperate or polar areas.

- Colombia located near the equator has nearly 1,4000 species of birds while New York at 41° N has 105 species and Greenland at 71° N only 56 species.
- India has more than 1,200 species of birds.
- A forest in a tropical region like Equator has up to 10 times as many species of vascular plants as a forest of equal area in a temperate region like the Midwest of the USA.
- The large tropical Amazonian rain forest in South America has the greatest biodiversity on the earth.

Reasons for greater biological diversity in tropics

(a) Tropical lattitudes have remained relatively undisturbed for millions of years and thus had a long evolutionary time for species diversification.

(b) Topical environments are less seasonal, relatively more constant and predictable which promote niche specialisation and lead to greater species diversity.

(c) There is more solar energy available in the tropics, which contributes to higher productivity and indirectly leads to greater biological diversity.

The importance of species diversity to the ecosystem

(1) Ecosystems with higher biodiversity are more productive than ecosystems with lower biodiversity. David Tilman showed in his experiments that increased diversity contributes to higher productivity.

(2) Biodiversity is essential for the stability of an ecosystem. Communities with more species are more stable than those with less species.

(3) Rich biodiversity is also essential to make an ecosystem more functional and survival of the human race on the earth.

(Rivet popper hypothesis proposed by Paul Ehrlich).

Species-Area relationships

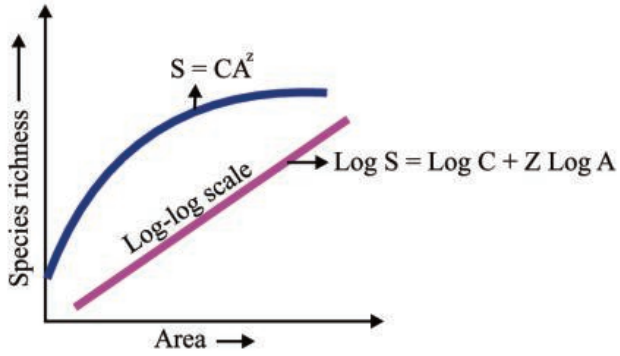
- German naturalist and geographer Alexander von Humboldt observed that within a region, species richness increases with increasing explored area, but only up to a limit.
- The relation between species richness and area for a wide variety of taxa (angiosperm plants, birds, bats, freshwater fishes) turns out to be a rectangular hyperbola.
- On a logarithmic scale, the relationship is a straight line described by the equation

$$\log S = \log C + Z \log A$$

Where S = Species richness, A = Area; Z = slope of the line (regression coefficient) C = Y-intercept.

- Value of Z lies in the range of 0.1 to 0.2, regardless of the taxonomic group or the region.

- The species-area relationships among very large areas like the entire continents has much steeper slope of the line (Z values in the range of 0.6 to 1.2).



Causes of Biodiversity Losses [The Evil Quartet]

(i) **Habitat loss and fragmentation :** This is most important cause of plants and animals extinction. For example: Tropical rain forest is being destroyed faster. The Amazonian rain forest is called the lungs of the planet. It is being cut for cultivating soyabeans.

(ii) **Over exploitation :** Many species extinctions are due to over exploitation by humans e.g. extinction of Steller's sea cow, passenger pigeon in last 500 years.

(iii) **Alien species invasions :** When alien species are introduced in new habitat, some of them turn invasive and cause decline or extinction of indigenous species, e.g. Carrot grass (*Parthenium*), *Lantana* and water hyacinth (*Eichhornia*) posed threat to native species.

(iv) **Co-extinctions :** When a species becomes extinct, the plant and animal species associated with it in an obligatory way also become extinct.

Example 1 : When a host fish species becomes extinct, its assemblage of parasites also becomes extinct.

Example 2 : This is true in case of plant pollinator mutualism where extinction of one species leads to extinction of other species in nature.

Reasons for Conservation of Biodiversity

1. Narrowly utilitarian : Humans derive countless direct economic benefit from nature food (cereals, pulses, fruits), firewood, fibre, construction material, industrial products (tannins, lubricants, dyes, resins, perfumes) and products of medicinal importance.

2. Broadly utilitarian : Biodiversity plays a major role in many ecosystem services that nature provides like oxygen, pollination, flood and soil erosion control.

3. Ethical : Every species has an intrinsic value, even if it may not be of any current economic value to us. We have a moral duty to care for their well-being and pass on our biological legacy in good order to future generations.

Types of Conservation Strategies

In-situ conservation : Conservation and protection of the whole ecosystem and its biodiversity at all levels in order to protect the threatened species. Endangered species protected in natural conditions.

- **Sacred Groves :** Tracts of forest are set aside and all the trees and wildlife within are venerated and given total protection. *e.g.* some forest in Khasi and Jaintia hills in Meghalaya, Aravalli hills of Rajasthan.
- **Biodiversity Hot Spots :** An areas with high density of biodiversity or megadiversity (high level of species richness and high degree of endemism) *e.g.* Out of 34 hot spots in world, 3 occur in India, i.e., Western Ghats and Sri Lanka, Indo-Burma (North-East India) and Himalaya.
- **Protected Areas :** Ecological or Biogeographical areas where biological diversity with natural and cultural resources are protected. *e.g.* National parks, sanctuaries and Biosphere reserves.

Ex-situ conservation : Conservation and protection of selected rare plants or animals in places outside their natural habitat.

- **Offsite collections :** Live collections of wild and domesticated species in Botanical gardens, Zoological parks etc.
- **Gene Banks :** Institutes which maintain stock of viable seeds, live growing plants, tissue culture and frozen germplasm with the whole range of genetic variability.

Cryopreservation : Preservation of seeds, embryos etc. at – 196°C in liquid nitrogen.

National Parks : Areas reserved for wild life where they are able to obtain all the required natural resources and proper habitats. India has 90 national parks at present. Example Corbett national park, Kaziranga national park.

Sanctuaries : An area where animals are protected from all types of exploitation and habitat disturbance. India has 492 sanctuaries at present.

Biosphere Reserve : Large tracts of protected land with multiple use preserving the genetic diversity of the representative ecosystem by protecting wild life, traditional life styles of the tribals and varied plant and animal genetic resources. India has 14 biosphere reserves.

Red Data Book : Record of threatened species of plants and animals maintained by IUCN. It has 8 categories → Extinct, Extinct in wild, critically endangered, Vulnerable, lowest risk, data deficient, Not evaluated.

Important Wild Life Protection in India :

- **Project tiger :** Started in 1973 to check depletion in population of tiger. Jim Corbett National Park.

Endemic Species : Species which are confined to a particular region and not found anywhere else.

Exotic or Aliens Species : New species which enter a geographical regions.

Bioprospective : Exploration of molecular, genetic and species level diversity for products of economic importance.

International efforts for Biodiversity conservation :

- **World Conservation Union (formerly IUCN) :** provides leadership, common approach and expertise in the area of conservation.
- **The Earth Summit** : Historical convention on Biological diversity held in 1992 at Rio de Janeiro, Brazil.
- **The World Summit on Sustainable Development :** Held in 2002 in Johannesburg, South Africa to pledge to reduce biodiversity losses at global and local levels.

The Biological Diversity Act, 2002 :

The Biological Diversity Act, 2002 is the Indian response to the conservation of biological diversity. The main objectives of the Act are :

1. Conservation of biological diversity.

2. Sustainable use of its components

3. Fair and equitable sharing of the benefits arising out of utilisation of genetic resources. In execise of the powers conferred by Sec-62 of the Biological Diversity Act 2002 and in super session of the National Biodiversity authority Rules, 2003, the central government of India made some rules, which come into force on 15th April 2004.

Ramsar sites : Named after city Ramsar in Iran where the Ramsar convention was signed in 1971 to develop awareness about the importance of wetlands.

Wetlends : These are the area where water is the primary factor, controlling the environment and the plants and animals life found there in. They occur where the water table is at or near the surface of land or where the land is covered by water.

- These sites are mentioned for the conservation and sustainable utilisation of wetlands and recognising their ecological function, economic, cultural, scientific and recreational values.

Ramsar site in India : Chandra Taal (H.P), Chilka lake (Odisha) Deepor beel (Assam), Loktak Lake (Manipur), Sambhar lake in Rajasthan and Wular lake (J and K) etc.

Threats to wetland : Loss of vegetation, Saliniation, excessive inundation, water pollution, invasive species, excessive development and road buildings.

Questions

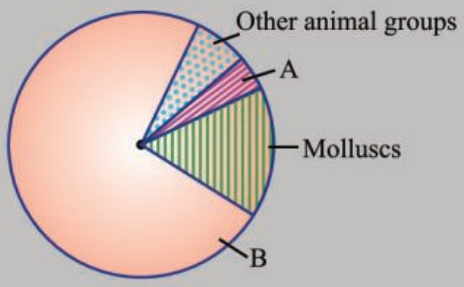
VSA **(I Mark)**

1. Habitat loss and fragmentation has caused severe damage to a particular type of ecosystem. Name it.
2. What trend is observed in respect of species diversity when we move from equator to poles ?
3. Which region is considered as the one with highest biodiversity on earth? What is the name given to such region forests ?

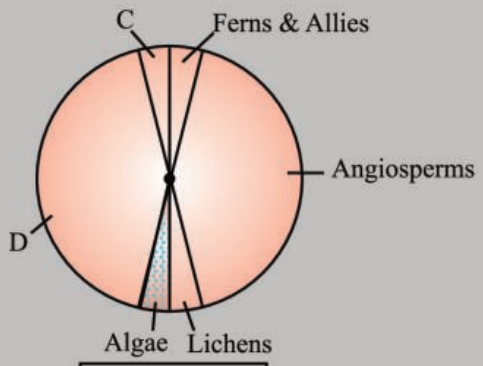
SA-I **(2 Marks)**

4. Study the pie-diagram and answer the questions which follows :

   What do A, B, C and D represent in these diagrams.



Invertebrates

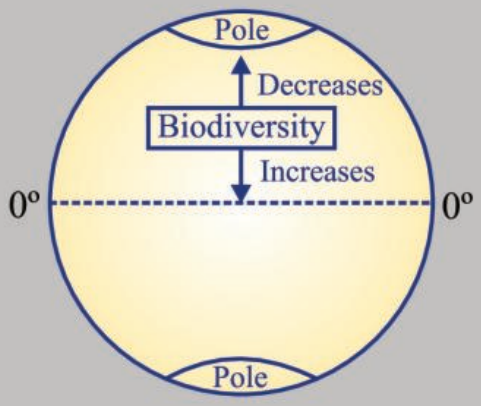


Taxa of Plants

SA-II **(3 Marks)**

5. Hot spots are the regions of exceptionally high biodiversity. But they have become regions of accidental habitat loss too. Name the three hotspots of our country. Why are they called 'biodiversity hotspots' ?

6. Study the diagram of the earth given below. Give the name of the pattern of biodiversity therein. Suggest any two reasons for this type of occurrence.



7. What is so special about tropics that might account for their greater biological diversity ?

LA **(5 Marks)**

8. Describe at least two approaches each for ex-situ conservation and in situ conservation as a strategy for biodiversity conservation.

Answers

VSA **(1 Mark)**

1. Tropical Rain Forest.
2. In general, species diversity decreases as we move away from the equator towards poles.
3. Amazonian rain forests. They are also called the 'Lungs of the planet'.

SA-I **(2 Marks)**

4. A → Crustaceans
   B → Insects
   C → Mosses
   D → Fungi

SA-II **(3 Marks)**

5. Western Ghats and Sri lanka; Indo-Burma; Himalaya called 'biodiversity hot spots' as they show
   (i) High level of species richness
   (ii) High degree of endemism
   (iii) Under constant threat of extinction.
6. Latitudinal gradients
   (i) More solar energy available in tropics, more productivity.
   (ii) Tropical environments are less seasonal, so more predictable.
7. (a) Speciation is a function of time, unlike temperate regions subejcted to frequent glaciations in the past, tropical latitude have remained relatively undisturbed for milion of years and thus had long evolutionary time for species diversification.
   (b) Tropical environment are less seasonal, more constant and prodicatable.
   (c) More solar energy available in the tropics contributing to high productivity leading to greater diversity.

LA **(5 Marks)**

8. In situ conservation :
   (i) Identification and maximum protection of 'hotspots'
   (ii) Legal protection to ecologically rich areas.

(iii) Biosphere reserves, national parks and sanctuaries

(iv) Sacred groves.

Ex situ Conservation :

(i) Creation of zoological parks, botanical garden, wild life sanctuaries.

(ii) Cryopreservation

(iii) Seed bank.

