CHAPTER -15

BIODIVERSITY AND CONSERVATION

INTRODUCTION:

Biodiversity or biological diversity is the occurrence of different types of ecosystems, different species of organisms and their variant like biotypes, ecotypes and gene adapted to different climates and environments of different regions including their interactions and processes.

There are more than 20,000 species of ants. 3,00,000 species of beetles, 28,000 species of fishes and nearly 20,000 species of orchids.

Scientists and evolutionary biologists have been trying to understand the significance of such diversity

This term was coined by Edward Wilson. The vast array of species of micro-organisms, algae, fungi, plants and animals occurring on the earth either in the terrestrial or aquatic habitats and the ecological complexes of which they are a part comprises biodiversity. Diversity ranges from macromolecules to biomes.

The important diversity at the levels of biological organization are-

I. **GENETIC DIVERSITY**- a single species might show high diversity at the genetic level over its distributional range. *Rauwolfia vomitoria* shows genetic variation in terms of concentration and potency of chemical reserpine India has more than 50,000 genetically different strains of rice and 1000 varieties of mango.

II. **SPECIES DIVERSITY-** diversity at species level for example, the Western Ghats have more amphibian species diversity than the Eastern Ghats.

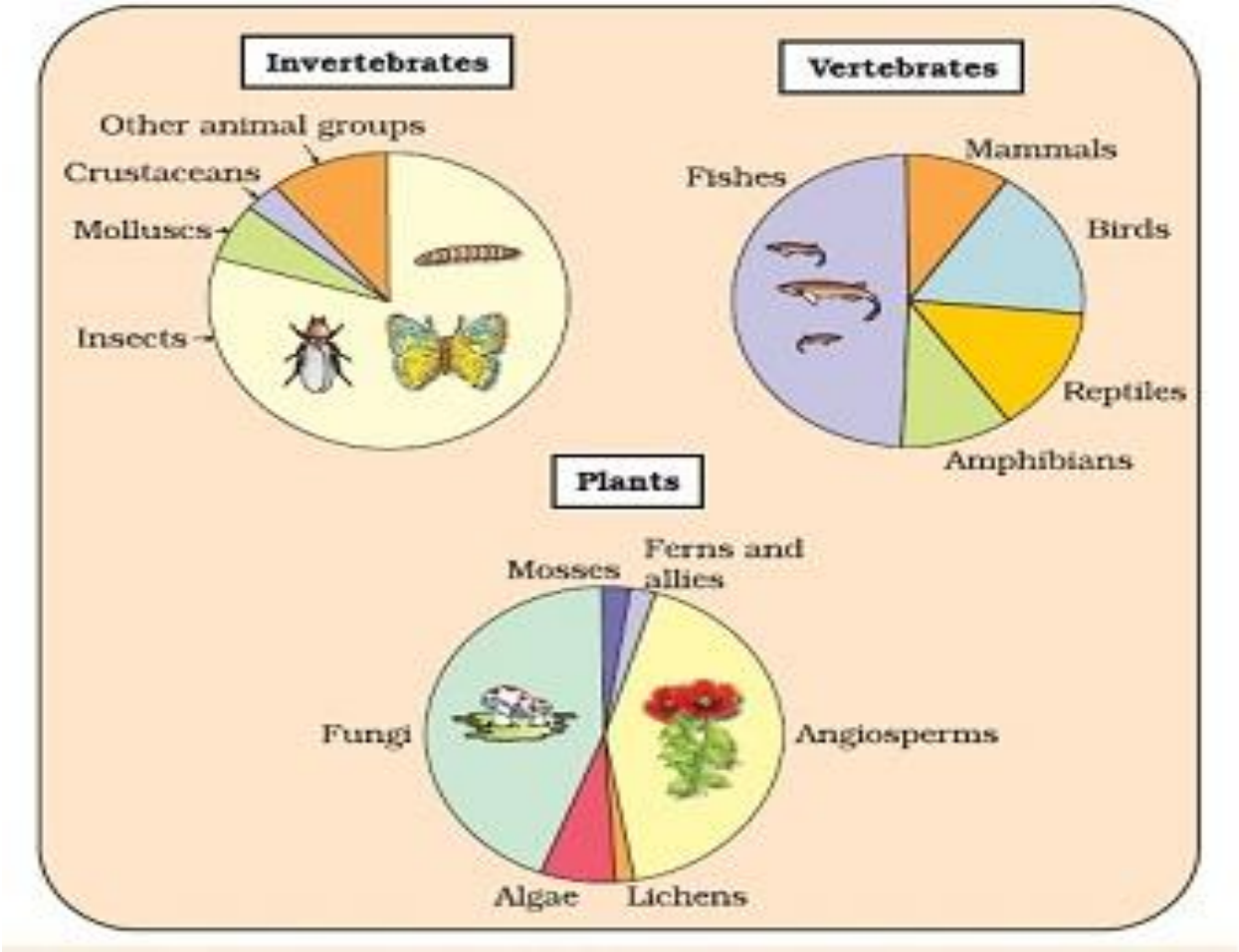
III. **ECOLOGICAL DIVERSITY-** deserts, rain forests, mangroves, coral reefs, wetlands, estuaries and alpine meadows are types of ecological diversity.

Biodiversity and its conservation are vital environmental issues of international concern as more and more people around the world begin to realize the critical importance of biodiversity for survival and well-being on this planet.

.According to the IUCN, the total number of plant and animal species described so far is about 1.5 million but still many species are yet to discovered and described.

· More than 70% of all the species recorded are animals while rest are plants including algae, fungi, bryophytes, gymnosperms and angiosperms. Among animals, 70% of total are insects.

· The number of fungi species in the world is more than the combined total of the species of fishes, amphibians, reptiles and mammals.



BIODIVERSITY IN INDIA

• India is one of the twelve mega biodiversity countries of the world.
• India has only 2.4% of the land area of the world, it has 8.1% of the global species biodiversity.
• There are about 45,000 species of plants and about 90,000-1,00,000 species of animals.
• New species are yet to be discovered and named.
• Applying Robert May's global estimate, only 22% of the total species have been recorded, India has probably more than 1,00,000 species of plants and 3,00,000 species of animals to be discovered and described.

PATTERNS OF BIODIVERSITY

LATITUDINAL GRADIENTS-

The diversity of plants and animals is not uniform throughout the world and shows uneven distribution. This distribution pattern is along the latitudinal gradient in diversity. Species diversity decreases as we move away from the equator towards the poles. Tropics harbour more species than temperate or polar areas. Amazonian Rainforest has the greatest biodiversity on earth. It has more than 40000 species of plants, 1,25,000 species of insects, 300 species of fish, 427 of amphibian and 378 of reptiles, 1300 species of birds and 427 of mammals. Various hypothesis has been proposed regarding this such as-

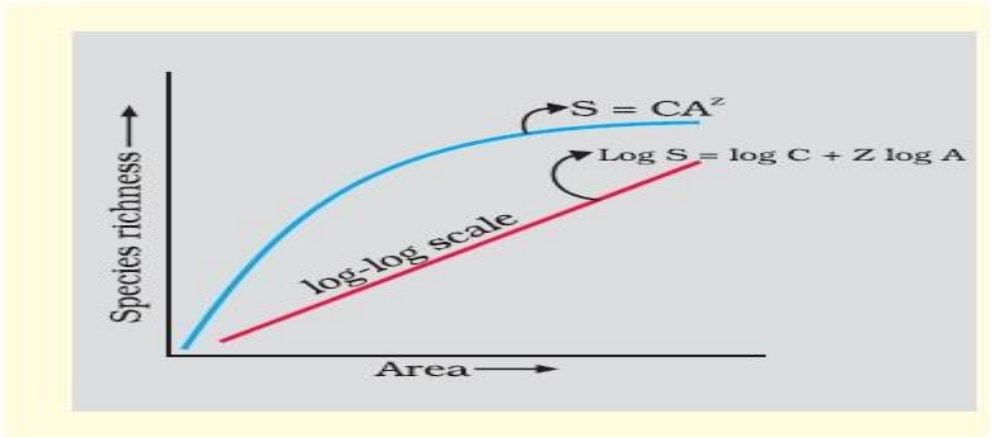
a) Speciation is a function of time unlike temperate regions subjected to frequent glaciation in past, tropical latitudes have remained relatively undisturbed for millions of years and thus had long evolutionary time for species diversification.

b) Tropical environments unlike temperate ones are less seasonal and more constant and predictable which promote niche specialization and lead to a greater species diversity.

c) There is more solar energy available in the tropics which contribute to higher productivity this in turn contribute indirectly to greater diversity.

SPECIES-AREA RELATIONSHIPS

Alexander Von Humboldt has observed that within a region, species richness gets increased when explored area is increased, but only up to a limit.
The relationship between species richness and area for a number of taxa like angiospermic plants, fresh water fishes and birds is found to be a rectangular hyperbola.



On logarithmic scale, the relationship is a straight line described by the equation-

log S = log C + Z log A.

Where, S= species, A= Area, Z= slope of the line, C =Y- intercept.

Ecologists have discovered that the value of Z lies in the range of 0.1 to 0.2. regardless of the taxonomic group or the region whether it is the plants in Britain, birds in California, molluscs in New York state, the slopes of the regression line are amazingly similar.

But the species area relationships among very large areas like the entire continents the slope of the line to be much steeper (Z values in the range of 0.6 to I. 2) . For example for frugivorous (fruit-eating) birds and mammals in the tropical forests of different continents the slope is found to be 1.15.

THE IMPORTANCE OF SPECIES DIVERSITY TO THE ECOSYSTEM

There is no exact answer to this question, but experiments conducted by many ecologists have demonstrated that a system with greater biodiversity is more stable and has greater productivity.

But David Tilman's long-term ecosystem experiments using outdoor plots provide some tentative answers. Tilman found that plots with more species showed less year-to-year variation in total biomass. He also showed that increased diversity contributed to higher productivity. In the long run, biodiversity is related with overall health of our ecosystem and survival of human race on the earth.

Characteristics of a stable community:

It should not show much variation in productivity from year to year.

It must be either resistant or resilient to occasional disturbances.

It must be resistant to invasion by alien species.

At a time when we are losing species at an alarming pace. There are no direct answers to such naïve questions but we can develop a proper prospective through an analogy i.e. rivet popper hypothesis

RIVET POPPER HYPOTHESIS

It is given by Paul Ehrlich. In an airplane (ecosystem) all parts are joined together using thousands of rivets (species).

If every passenger travelling in it starts popping a rivet to take home (causing a species to become extinct), it may not affect flight safety (proper functioning of the ecosystem) initially, but as more and more rivets are removed, the plane becomes dangerously weak over a period of time.

Furthermore, which rivet is removed may also be critical. Loss of rivets on the wings (key species that drive major ecosystem functions) is obviously a more serious threat to flight safety than loss of a few rivets on the seats or windows inside the plane.

LOSS OF BIODIVERSITY

The biological wealth of our planets has been declining rapidly due to three factors - Population, Urbanisation and Industrialisation. The IUCN Red List (2004) documents the extinction of 784 species (including 338 vertebrates, 359 invertebrates and 87 plants) in the last 500 years. Some examples of recent extinctions include the dodo (Mauritius), quagga (Africa), thylacine (Australia), Steller's Sea Cow (Russia) and three subspecies (Bali, Javan, Caspian) of tiger. In last 20 years, 27 species have been disappeared. In general, loss of biodiversity in a region may lead to

Decline in plant production.

Lowered resistance to environmental perturbations, drought, and flood.

Increased variability in ecosystem processes such as productivity, water use, and pest and disease cycles.

CAUSES OF BIODIVERSITY LOSSES

Faster rates of species extinctions are largely due to human activities. The four major causes are called **'The Evil Quartet'.**

HABITAT LOSS AND FRAGMENTATION- is the most important cause of animals and plants extinction. The amazon rain forest (lungs of the planet) having millions of species is being cut and cleared for cultivating soya beans or for conversion to grasslands. When large habitats are broken up into small fragments due to various human activities, mammals are birds requiring large territories migrate and badly affected.

OVER-EXPLOITATION- When biological system is over exploited by man for the natural resources ,it results in degradation and extinction of the resources , *e.g Steller's sea cow,*

passenger pigeon etc. Many marine fish population are over harvested, endangering the continued existence of some important species.

ALIEN SPECIES INVASIONS- when alien species enters intentionally or unintentionally, some of them turn invasive and cause decline or extinction of indigenous species.The Nile perch introduced into Lake Victoria in east Africa led eventually to the extinction of an ecologically unique assemblage of more than 200 species of cichlid fish in the lake. Invasive weeds species like carrot grass (parthenium), Lantana and water hyacinth causing threats to indigenous species.

CO-EXTINCTIONS- when a species becomes extinct, the plant and animal species associated with it also become extinct. When a host fish species becomes extinct, its unique assemblage of parasites also becomes extinct.

BIODIVERSITY CONSERVATION

We should conserve the biodiversity due to following groups of regions-

I. The **narrowly utilitarian**- human obtain countless direct economic benefits from nature like food, firewood, fibres, construction material, medicinal plants and industrial products. With increasing resources put into 'bio-prospecting' nations endowed with rich biodiversity can expect to reap enormous benefits.

II. The **Broadly Utilitarian**- biodiversity plays a major role in ecosystem services that nature provides. Productions of Oxygen during photosynthesis, pollination without natural pollinator, pleasure from nature are priceless.

III. **Ethical**- for conserving biodiversity relates to what we own to millions of plants, animals and microbes species with whom we share this planet. Every species has an intrinsic value although it may not be of current or any economic value to us. It is our moral duty to care for their well-being and pass on our biological legacy in good order to future generations.

HOW DO WE CONSERVE BIODIVERSITY?

When whole ecosystem is conserved, all its biodiversity is also protected. There are two ways of conservation of biodiversity-

IN SITU (ON SITE) CONSERVATION- conservationists have identified for maximum protection certain 'biodiversity hotspots' regions with very high levels of species richness and high degree of endemism, species found in that region and not found anywhere else. There are 34 biodiversity hot spots in the world. These hotspots are also regions of accelerated habitat loss. India has 14 biosphere reserves, 90 national parks and 448 wildlife sanctuaries.

EX SITU (OFF SITE) CONSERVATION- in this method, threatened animals and plants are taken out from their natural habitat and placed in special setting when they be protected and given special care . Zoological parks, Botanical Gardens and wildlife safari parks are used for this purpose. Now gemetes of threatened species can be preserved in viable and fertile condition for long periods of time using cryopreservation technique. Eggs can be fertilized in vitro and plants can be propagated using tissue culture methods.

The historic convention on Biological Diversity (The Earth Summit) held in Rio de Janeiro in 1992, called upon all nations to take appropriate measures for conservation of biodiversity and the World Summit on sustainable development held in 2002 in Johannesburg, South Africa, 190 countries pledged their commitment to achieve by 2010, a significant reduction in the current rate of biodiversity loss at global, regional and local levels.

IMPORTANT TERMS

Sl No.	Terms	Explanation
1	Biodiversity	Refers to the sum total of diversity that emits all levels of biological organisation.
2	Genetic diversity	A single that show high diversity at the genetic level over its distribution.
3	Species diversity	The diversity at the species level
4	Ecological diversity	The diversity at the ecosystem level
5	Alien species invasion	In absence of native species the exotic species utililises resources present in the habitat.
6	bioprospecting	Exploring molecular,genetic and species levele diversity for product of economic importance
7	Evil quartet	Sobriquet use to describe 4 major causes of species .
8	In situ conservation	Conservation of species in their natural habitat that is on site conservation
9	Ex situ conservation	Conservation of threatened species in special settings where they are protected and given special care that is off site conservation.
10	Hotspots	Regions with high level of species richness.
11	Sacred grooves	Tracts of forests where all trees and wild life within

		are venerated and given total protection
12	Earth summit	Meeting of several nations at Rio de Janeiro,in 1992 to discuss appropriate measures for conservation of bio diversity
13	World summit on sustainable development	Meeting of several nations at Johannesburg, South Africa in 2002 to reduce the rate of biodiversity loss
14	endemism	Species confined to a region and not found elsewhere