CHAPTER-15
BIODIVERSITY AND ITS CONSERVATION

BIODIVERSITY AND CONSERVATION

•**Biodiversity:** refers to the totality of genes, species, and ecosystems of a region. term by **Edward Wilson**

➢ **Genetic diversity:**
Medicinal plant ***Rauwolfia vomitoria*** of Himalayan range produces active chemical **reserpine** shows genetic variation.

India has more than 50000 different strain of rice.
1000 varieties of mango.

➢ **Species diversity:** different species of a single animal like frog.

➢ **Ecological diversity:** diversity in the ecosystem level like desert, rain forest, mangroves, coral reef, wetlands, estuaries etc.

How many species are there on Earth and How many in India?

➢ **Robert May** places global species diversity at about 7 million

➢ According to **IUCN** (2004), 1.5 million of plants and animals are in our biosphere.

➢ More than 70 percent of all the species recorded are animals.

➢ Among animals insects constitute 70 percent.

➢ India has only 2.4 percent of the world's land area; its share of global species diversity is impressive 8.1 percent
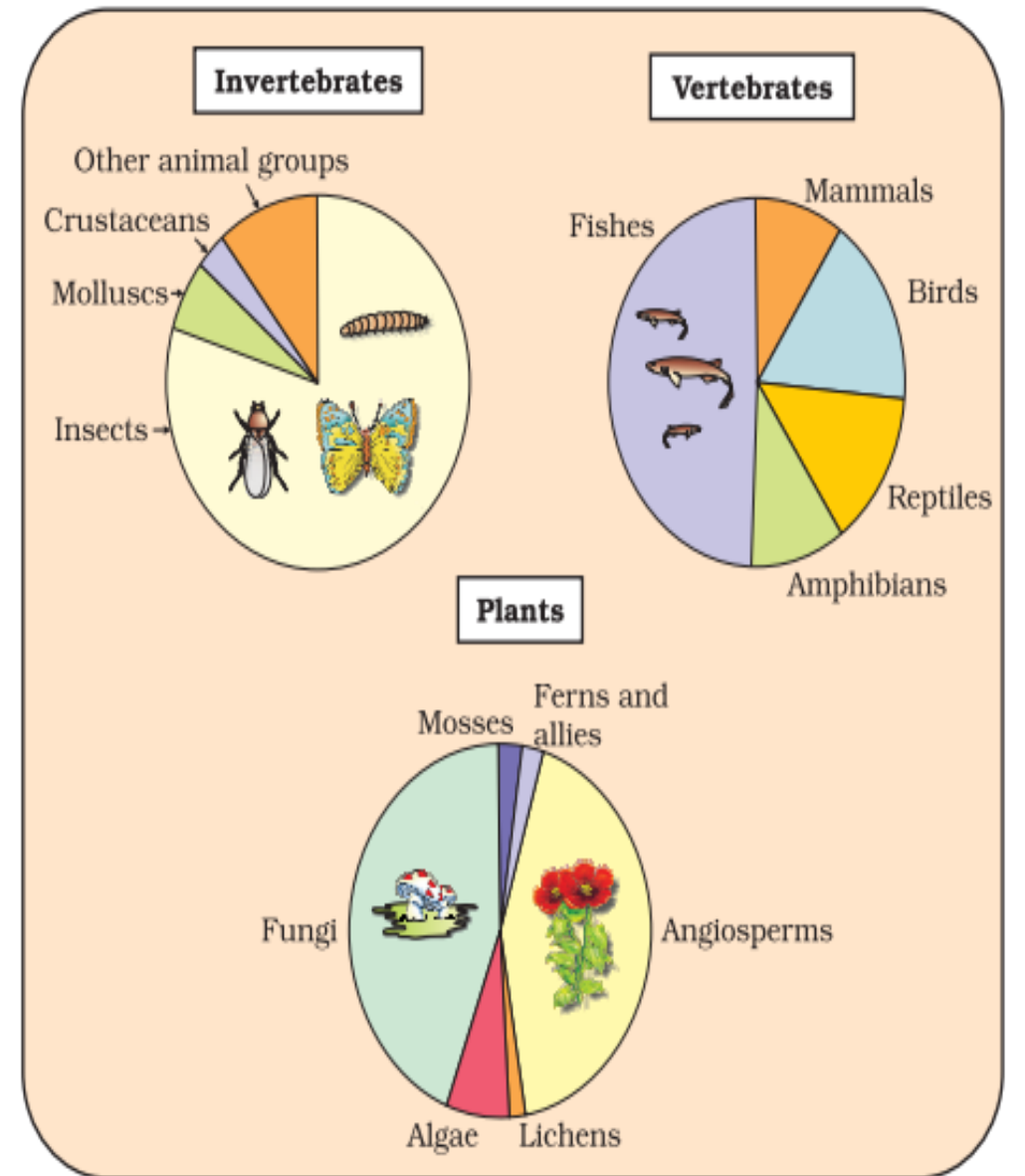
Pattern of Biodiversity:

Latitudinal gradients:

➢ Species diversity decreases as we move away from the equator towards the pole.

The largely tropical Amazonian rain forest in South America has the greatest biodiversity on earth:

It harbours about 40000 species of plants,1,25,000 species of invertebrates, 3000 species of fishes,427 of amphibians,378 of reptiles,1300 0f birds and 427 of mammals.
.

Why tropical rain forest has greater biodiversity:

➢ tropical latitudes have remained relatively undisturbed-, had a long evolutionary time for species diversification.

➢ **more constant and predictable climate**, promotes niche specialization and lead to greater species diversity.

➢ **more solar energy available in the tropics** - contribute to higher productivity.

Species area relationship:

❑ Given by ALEXANDER VON HUMBOLDT

❑ Species richness increased with increasing area but only up to a limit.

❑ The relation between species richness and area is a rectangular hyperbola.

❑ Given by the equation

LogS = logC +Z log A

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

❑ The value of Z lies between 0.1 -0.2 irrespective of the taxonomic group or region.

❑ But the Z-value ranges between 0.6-1.2 in very large area like a continent.

❑ The Z-value is 1.15 for the frugivorous birds and mammals in the tropical forests.
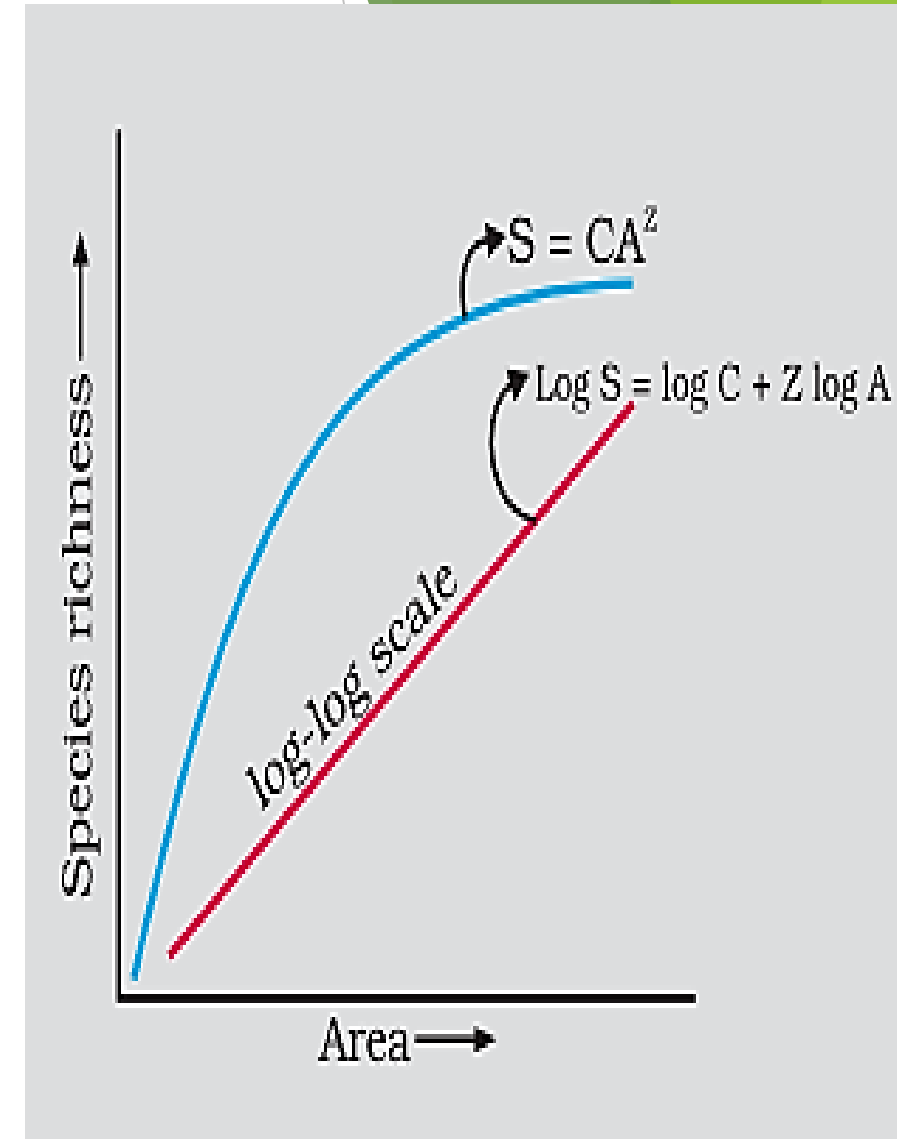
Importance of species diversity to the Ecosystem:

❑ Community with more species generally tends to be more stable than those with less species.

❑ A stable community has the following attributes-

❖ There should not be too much variations in the year to year productivity.

❖ It should be either resistant or resilient to seasonal disturbance.

❖ It should also be resistant to invasion by allein species.

Note : Keystone species are the crucial species that determine the capacity of large number of species to persist in a community.

The rivet popper hypothesis:

Loss of rivets on the wings (key species) 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 IUCN Red List (2004) documents the extinction of 784 species.**

❑ **Recent extinction includes:**

- **Dodo (Mauritius).**

- **Quagga (Africa)**

- **Thylacine (Australia)**

- **Steller's cow (Russia)**

- **Three subspecies of tiger (Bali, Java, Caspian).**

❑**Amphibians are more vulnerable to extinction.**

❑ **More than 15,500 species are facing extinction , presently the following face the threat of extinction.**

i) **31% gymnosperms**   ii) **32% amphibians**   iii) **12% bird species**   iv) **23% mammals**

•

Thylacine

Quagga

Stella sea cow

Dodo

Population traits which make species susceptible to extinction are:

(i) Species with very narrow geographical range, e.g., woodland caribou, etc.

(ii) Population with small population size and low population density, etc.

(iii) Large body size, e.g., elephant, Bengal tiger, lion, etc.

(iv) Low reproductive potential, e.g., blue whale, giant panda, etc

❑ Since the origin and diversification of life on earth there were five episodes of mass extinction of species.

❑ The sixth mass Extinctions in progress now.

❑ How the' sixth Extinction' is different from the previous five extinctions.

❑ The current extinction rate is 100 to 1000 times faster.

❑ All others are pre-human period, this one is anthropogenic.

Causes of biodiversity loss:

❑ Four major causes **"The Evil Quartet"** are as follows:

Habitat loss and fragmentation:

❑ The Amazonian rain forest - **'lungs of the planet** 'is being cut cleared for cultivating soya beans.

Over-exploitation:

❑ Stiller's cow, passenger pigeons were extinct due to over-exploitation.

❑ Many marine fish populations are over harvested.

Alien species invasion:

❑ **Nile perch** introduced into Lake Victoria in east Africa led to extinction of 200 species of **cichlid fish** in the lake.

❑ *Parthenium,* **(**carrot grass), *Lantana*, and water hyacinth (*Eichornia)* posed a thread to indigenous species.

❑ African cat fish *Clarias gariepinus* for aquaculture posing a threat to indigenous catfishes in our rivers.

Co-extinction:

❑ Extinction of **Host species** leads to extinction of the **parasite** also.

❑ Co-evolved **plant-pollinator** mutualism where extinction of one invariably lead to the extinction of the other.

Biodiversity Conservation

Reasons for Biodiversity Conservation

The reasons for conserving biodiversity can be grouped into following three reasons:

i)   Narrowly Utilitarian

ii) Broadly Utilitarian

iii) Ethical

Narrowly Utilitarian Reasons

❑ The human beings derive a number of economic benefits like food, fibres, firewoods, industrial products like resins , gums, dyes,etc and medicinal products.

❑ Native people use about 2500 species of plants as traditional medicines and more than 25% of drugs are derived from plants.

Broadly Utilitarian Reasons

❑ A major role is played by biodiversity in providing ecosystem services which can't be given a price tag. They are

a) Oxygen production

b) Pollination of flowers

c) Aesthetic pleasures like bird watching, watching spring flowers,etc.

Ethical Reasons

❑ There exists an intrinsic value of each species even if it is not of any economic value to us.

❑ It is our moral duty to care for their well-being and pass on the biological legacy in a proper form to the future generations.

Approaches for Conservation of Biodiversity

There are two approaches for biodiversity conservation:

i)   In –situ conservation (on-site conservation)

ii) Ex-situ conservation (off-site conservation)

In situ conservation	Ex –situ conservation
1. It means conservation on site i.e protecting an endangered species in its natural habitat by maintaining the habitat itself.	1. It means off-site conservation, i.e protecting an endangered species by removing from the threatened habitat and placing it under the care of humans.
2. This approaches emphasizes on protecting of total ecosystem.	2. This approach restricts to the protection of genetic resources at population and species level.
3. This approach includes methods of protections like hotspots, national parks, wildlife snactuaries and biosphere reserves.	3. It is done through live collections of animals and plants in zoos, botanical gardens, seed banks ,etc.

In-situ Conservation

Biodiversity in in-situ conservation is protected by two main methodologies-

a) **Hot spots**

❑ These are areas of high level of species richness, high endemism and high density of biodiversity but at the same time these are also the most threatened areas.

❑ Ecologically four factors determine hot spots:

i) Species diversity and species density

ii) Degree of endemism (i.e species confined to that region are not found anywhere else.

iii) Degree of threat due to degradation, habitat loss and fragmentation.

iv) Degree of exploitation.

❑ Out of 34 hot spot in the world, three hot spot located in India:

Western Ghats and Srilanka.

Indo-Burma.

Himalaya.

b) Protected Areas

- ❑ Biogeographical areas where biological diversity along with natural and cultural resources is protected are called protected areas.
- ❑ They include sanctuaries, national parks, sacred forests/ lakes and biosphere reserves.

i) National Parks and Sanctuaries

- ❑ India has 448 wilflife sanctuaries and 90 National Parks.
- ❑ Jim Corbett National Park in Uttranchal is the first national park to be established in India.

ii) Biosphere Reserves

- ❑ India has 14 out of 425 biosphere reserves in the world.

iii) Sacred Groves

- ❑ Sacred forest (groves) are forest patches around places of worship.

Ex situ conservation: threatened animals and plants are taken out from their natural habitat and placed in special setting where they can be protected and given special care.

- Zoological Park.

- Botanical garden

- Wildlife safari.

- Conservation of gamete by **cryopreservation.**

- Genetic strains are preserved in **seed bank**.

Convention on Biodiversity:

❑ **"The earth Summit"** held in Rio de Jeneiro in 1992

❑ called upon all nations to take appropriate measures for conservation of biodiversity and sustainable utilization of its benefits.

❑ **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 level.

❑ Focus on sustainable development.

Q1.Which one of the following is an example of ex-situ conservation? [Pre. 2010]
1)Wildlife sanctuary
2)Seed bank
3)Sacred groves
4)National park
Q2. A renewable exhaustible natural resource is
[Pre. 2010]

1)Coal
2)Petroleum
3)Minerals
4)Forest
Q3. The Indian Rhinoceros is a natural inhabitant of which one of the Indian states ?
[Mains 2010]

1)Uttar Pradesh
2)Himachal Pradesh
3)Assam
4) Uttarakhand

Q4. Which one of the following expanded forms of the following acronyms is correct ?

[Pre. 2011]

1)IPCC = International Panel for Climate Change
2)UNEP=United Nations Environmental Policy
3)EPA=Environmental Pollution Agency
4)IUCN *m* International Union for Conservation of Nature and Natural Resources

Q5. A collection of plants and seeds having divers alleles of all the genes of a crop is called [Pre. 2011]
1)Herbarium
2) Germplasm
3) Gene library
4)Genome
Q6. Which one of the following statements for pyramid of energy is incorrect, whereas the remaining three are correct ? [Pre. 2011]
1)Its base is broad
2)It shows energy content of different trophic level organisms
3)It is inverted in shape
4)It is upright in shape

Q7.Biodiversity of a geographical region represents :[2011]

1)Species endemic to the region

2)Endangered species found in the region

3)The diversity in the organisms living in the region.

4)Genetic diversity present in the dominant species of the region.

Q9.The highest number of species in the world

represented by   [Pre. 2012]

(a) Algae   (b)   Lichens

(c) Fungi   (d)   Mosses

Q10.Which one of the following areas in India, is

hot spot of biodiversity ?   [Pre. 2012]

(a) Sunderbans   (b)   Western Ghats

(c) Eastern Ghats (d)   Gangetic plain

Q11.Which one of the following is not used tor *ex situ* plant conservation?   [2013]

1)Field gene banks

2)Seed banks

3)Shifting cultivation

4)Botanical Gardens

Q12.Which of the following represent maximum number of species among global **biodiven-aty ?**

(a) Algae (b) Lichens   [2013]

(c) Fungi   (d) Mosses **and** Ferns