Chapter-15 Biodiversity & Conservation

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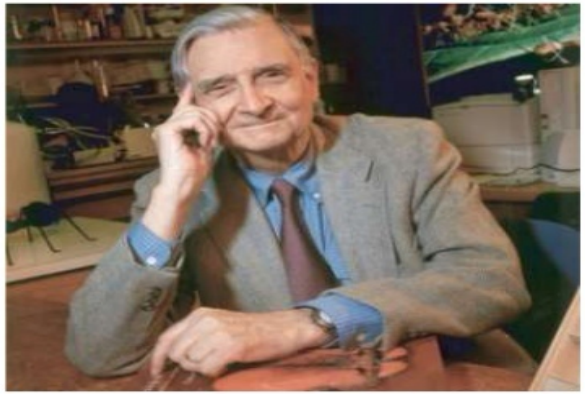
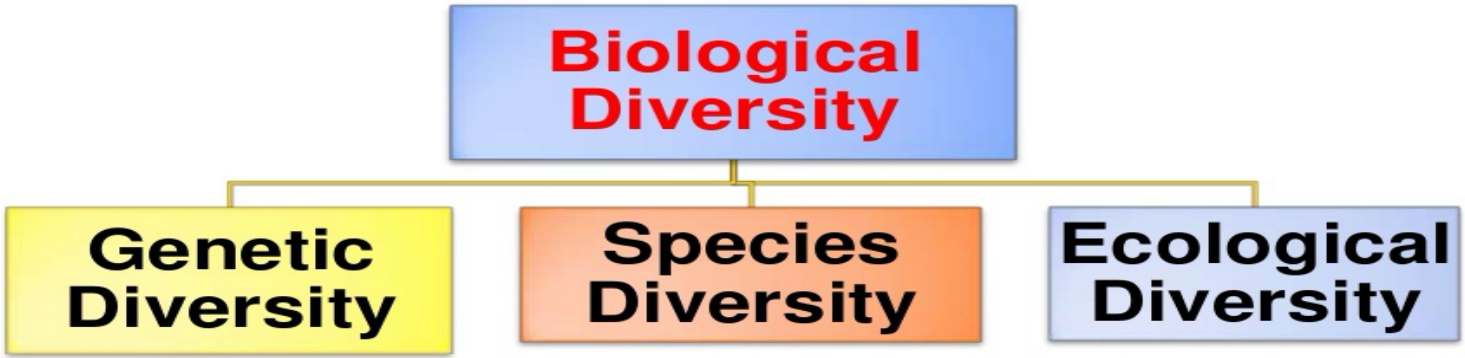
INTRODUCTION

- The term 'Biodiversity' was introduced by an American Biologist **Edward Wilson.**
- Biodiversity refers to the variety of life forms and habitats found in a defined area.
- It represents the totality of genes, species and ecosystem of a given region.



Levels of Biodiversity

The biological diversity includes three inter-related hierarchical levels :



GENETIC DIVERSITY

The genetic variation existing within a species is called genetic diversity.
The variation may be in alleles, total genes or chromosome structures.

Number of genes in the followings:

Mycoplasma	:450-700
Escherichia coli	:4000
Drosophila melanogaster	:13000
Oryza sativa	:32000-50000
Homo sapiens	:35000-45000

Species Diversity

The diversity at the species level is called species diversity.

Example:- The Western Ghats have a greater amphibian species diversity than Eastern Ghats.

The species diversity depends upon the number and richness of the species of a region.

Species richness - The number of species per unit area.

Ecological Diversity

The diversity at the ecosystem level is called ecological diversity.

Example: Deserts, rain forests, mangroves, coral reefs, wetlands, estuary and alpine meadows etc.

Ecological Diversity

Rain Forest

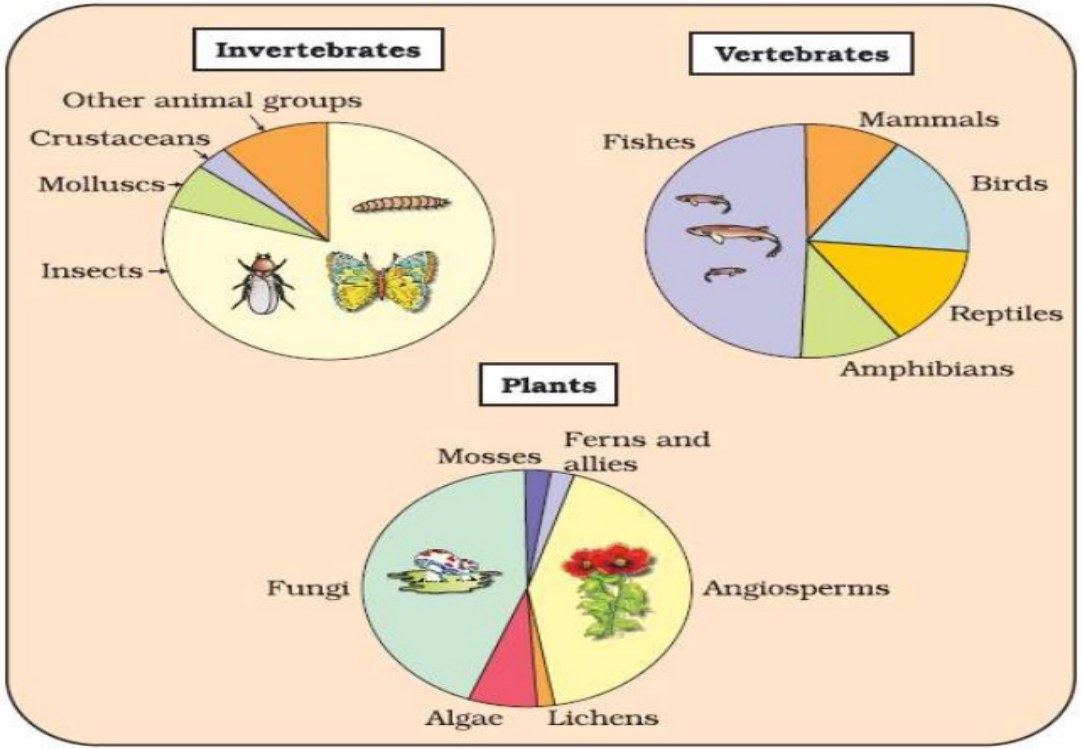
Mangrove

Estuary

Coral reef

Global Species Diversity

- According to the IUCN (2004) report, the total number of plant and animal species is more than 1.5 million.
- Robert May estimated that the global species diversity is at about 7 million.
- More than 70 per cent of all the species recorded are animals and plants including algae, fungi, bryophytes, gymnosperms and angiosperms comprise about 22 per cent of the total.



Representing global biodiversity: proportionate number of species of major taxa of plants, invertebrates and vertebrates

Greater Biological Diversity in Tropics

Various hypotheses for higher diversity in tropics proposed by ecologists and evolutionary biologists are :

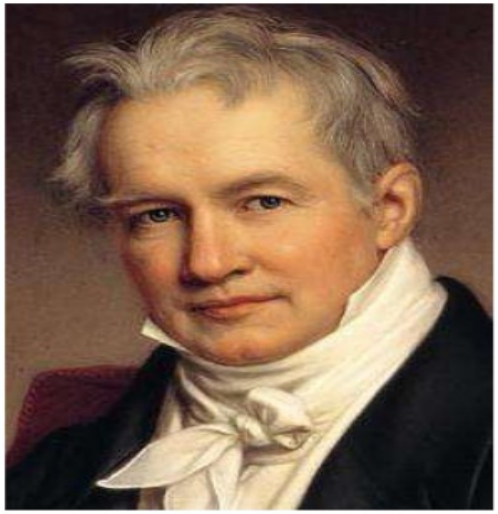
(i) Temperate regions have undergone frequent glaciations in the past. It killed most the species. Tropical latitudes have remained relatively undisturbed for millions of years.

(ii) Tropical environments are less seasonal which promote niche specialization and lead to a greater species diversity.

(iii) More solar energy is available in the tropics which contributes to higher productivity and in turn might contribute indirectly to greater diversity.

SPECIES-AREA RELATIONSHIPS

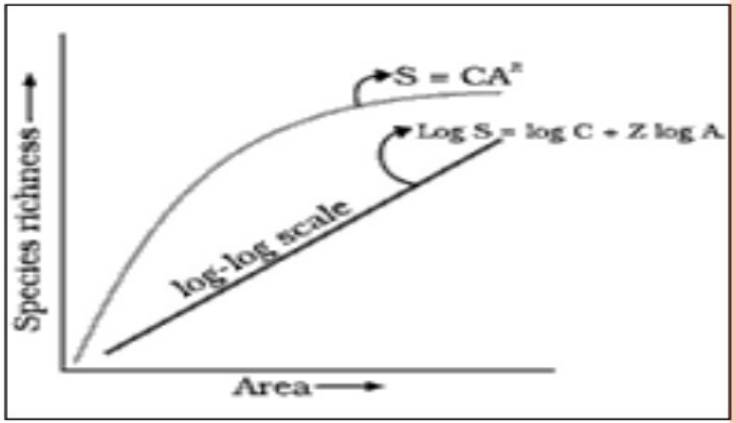
- Alexander von Humboldt was a German naturalist and explorer.
- He observed that within a region species richness increased with increasing explored area, but only up to a limit.
- The relation between species richness and area for a wide variety of taxa is to be a rectangular hyperbola.



Species-Area Relationships

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



Loss of Biodiversity

- Due to human activities biological resources have been declining rapidly.
- The colonisation of tropical Pacific Islands by humans led to the extinction of more than 2,000 species of native birds.
- More than 15,500 species are facing the threat of extinction in the worldwide.
- At present,12 per cent of birds, 23 per cent of mammals, 32 per cent of amphibians and 31per cent of gymnosperms face the threat of extinction.

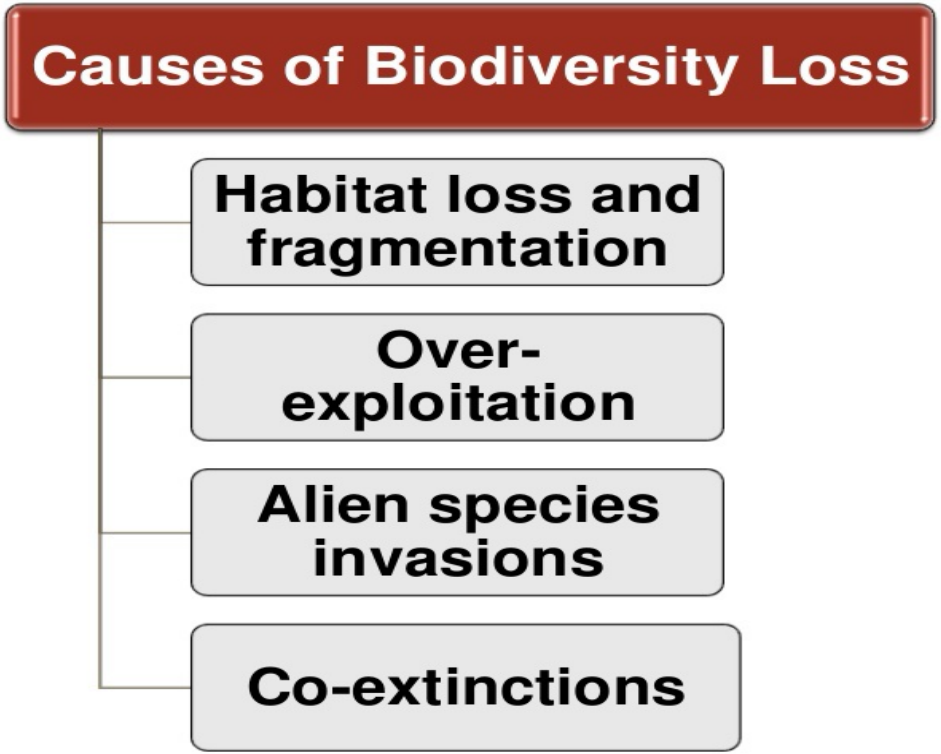
Mass Extinction

- Due to natural calamities a large number of species become extinct which is called mass extinction.
- Since the origin and diversification of life on earth there were five episodes of mass extinction of species.
- The "Big Five" mass extinctions are as follows:

1. End Ordovician (Ordovician-Silurian extinction)
2. Late Devonian (Late Devonian extinction)
3. End Permian (Permian-Triassic extinction)
4. End Triassic (Triassic-Jurassic extinction)
5. End Cretaceous (Cretaceous-Tertiary extinction)

Effect of Biodiversity Loss

1. Decline in plant production
2. Lowered resistance to environmental perturbations such as drought
3. Increased variability in certain ecosystem processes such as plant productivity, water use, and pest and disease cycles


Causes of Biodiversity Loss
Habitat loss and fragmentation
Over-exploitation
Alien species invasions
Co-extinctions

Habitat loss and Fragmentation

- Destruction of habitat is the primary cause of extinction of species.
- The tropical rainforests initially covered 14% of land but now only 6%.
- The Amazon rain forest is called "The lungs of the planet".
- When large sized habitats are broken into small fragmented due to human activities certain animals are badly affected and threatens their survival.

OVER-EXPLOITATION

- When natural resources are over exploited by human due to his greed,it results the degradation and extinction of the resources.

  e.g. Steller's sea cow, passenger pigeon.

Alien species invasion

The recent illegal introduction of the African catfish Clarias gariepinus is posing threat to indigenous catfishes in India.

Some Alien Weeds

Carrot Grass :
Parthenium

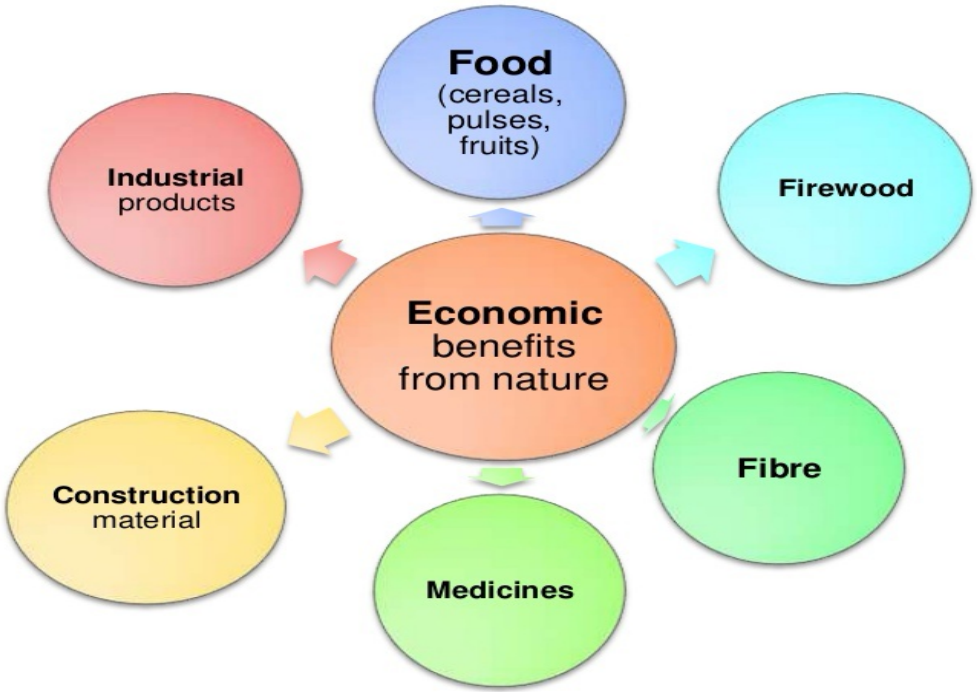
Lantana

Water hyacinth:
Eicchornia

CO-EXTINCTIONS

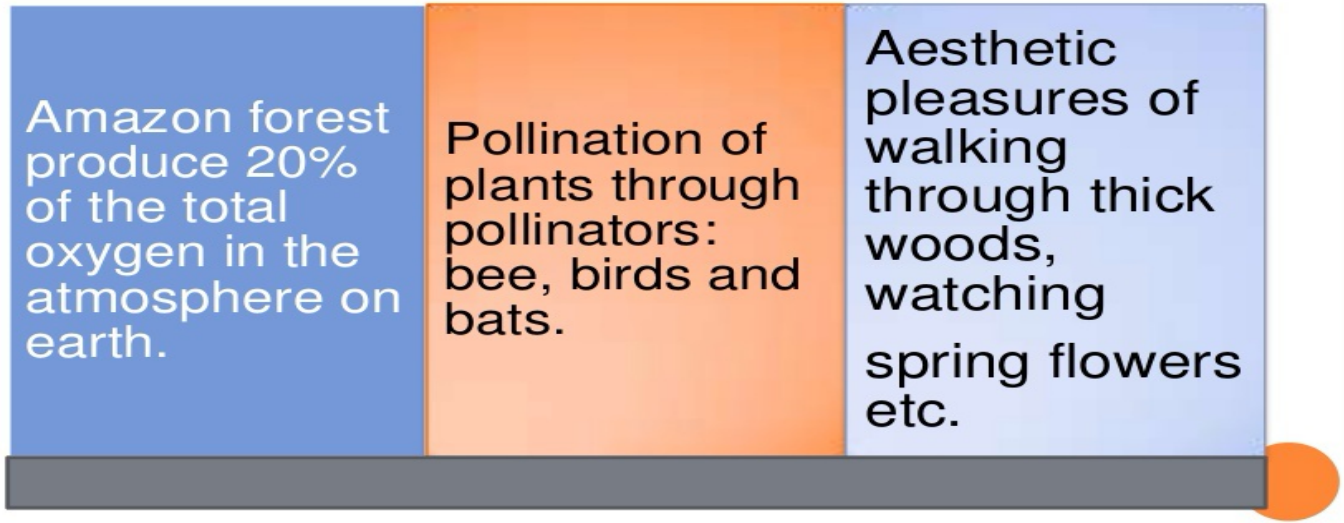
- When a species become extinct, the plant and animal species associated with it in an obligatory manner, also become extinct.
- For example, if the host fish species becomes extinct, all those parasites exclusively found on it will also become extinct.

Narrowly Utilitarian

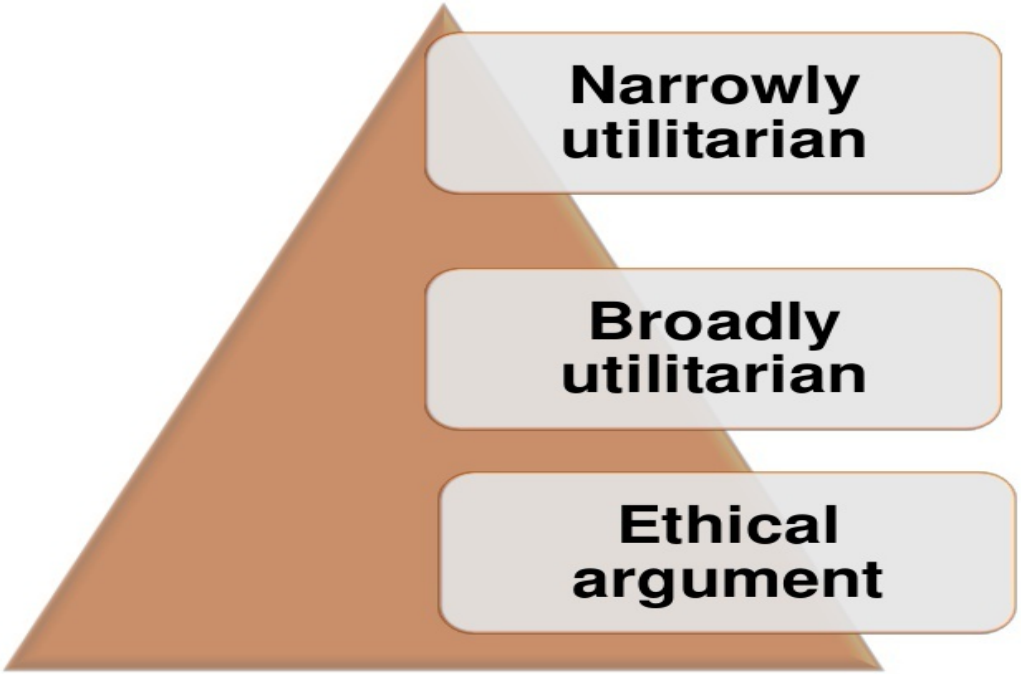


Broadly Utilitarian

Ecosystem services



REASONS FOR BIODIVERSITY CONSERVATION



In situ vs Ex situ conservation

In situ conservation

1. Conservation and protection of whole ecosystem, protection of its biodiversity at all levels.
2. Eg. Biosphere reserves, National parks, wildlife sanctuaries, Sacred groves

Ex situ conservation

1. Protection of animals or plants when they are in endangered or threatened and needs urgent measures to save from extinction.
2. Eg. Zoological parks, botanical gardens and wildlife safari

Conventions on Biodiversity

- The Earth Summit held in Rio de Janeiro in 1992.
- The World Summit on Sustainable Development held in Johannesburg, South Africa in 2002 .
- In this Summit, 190 countries pledged their commitment to reduce the current rate of biodiversity loss at global, regional and local levels by 2010.

References:

1. NCERT Text book
2. CBSE
3. KVS
4. Google images