

Biodiversity and Conservation

Biodiversity

- Biodiversity occurs not only in the species level, but also in the macromolecular levels.
- Biodiversity as described by Edward Wilson is the combined diversity at all levels of biological organisation.
- The most important forms of biodiversity are:
 - Genetic diversity (diversity at the genetic level)
 - Species diversity (diversity at the species level)
 - Ecological diversity (diversity at the ecosystem level)
- There are close to 1.5 million plants and animals that have to be discovered and described. More species have been discovered in temperate regions as compared to tropics.
- According to an estimate made by Robert May, global species biodiversity is about 7 million.
- Of the total species discovered so far, 70% are animals and 22% are plants. Of the animals, 70% are insects.
- India has 2.4% of the world's land and 8.1% of the total species diversity. According to May's estimate, 78% of the biodiversity is still to be discovered.
- Applying this to India's biodiversity figures, there still is a scope for discovery of over 1 lakh species of plants and 3 lakh species of animals.

Patterns of Biodiversity

- **Latitudinal gradients** – The plants and animals are not distributed evenly worldwide. The diversity of living forms decreases as we go from the equator towards the poles. A huge amount of plants and animals are concentrated in the tropical region because of the following reasons.
 - Tropical environment is less seasonal and almost constant and predictable as compared to temperate environment.
 - Tropics receive the major part of the solar energy, which contributes to great productivity.
 - Speciation is dependent upon time. Tropical areas have remained undisturbed for millions of years unlike temperate regions, which have experienced frequent glaciations in the past.

- **Species-Area relationships** – Alexander von Humboldt observed that biodiversity increases with increase in explored area. This relationship can be given by,

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

Where,

S = Species richness

A = Area

Z = Slope of the line (regression co-efficient)

C = Y-intercept

Value of Z is found to lie in the range of 0.1 to 0.2 for comparatively smaller areas such as countries while for very large areas such as entire continents, the slope of the line is much steeper with Z value lying from 0.6 to 1.2.

Importance of Biodiversity and Loss of Biodiversity

Biodiversity is defined as the combined diversity at all levels of biological organisation.

What is the importance of biodiversity on the Earth?

- 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.
- 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.

Loss of Biodiversity

- Due to human activities, the natural wealth is getting lost rapidly.
- The last 20 years have seen the loss of 27 species.

- Some of the causes of this loss are:
- **Habitat loss and fragmentation** – This is the major cause for loss of biodiversity. Habitat destruction is caused by human activities such as deforestation and increasing pollution, leading to the loss of many plants and animals.
- **Over-exploitation** – Humans due to their greed and increased exploitation of natural resources have contributed to the endangerment of commercially important species of plants and animals. Example – Species such as Steller’s sea cow and passenger pigeon have been extinct due to over exploitation by humans.
- **Alien-species invasion** – The unintentional or deliberate introduction of alien species causes the declination of the indigenous species. Example – Nile perch introduced in Lake Victoria led to the extinction of more than 200 species of cichlid fish in the lake.
- **Co-extinction** – When a plant or animal becomes extinct, another plant or animal which is dependent on it in an obligatory way also becomes extinct. Example – In case of plant-pollinator mutualism, the extinction of one partner will eventually lead to the extinction of other also.

Biodiversity Conservation

- Biodiversity conservation is necessary because of the following reasons:
- Many commercially important products are obtained by nature such as food, fibre, wood, and countless industrial products.
- Certain activities and products cannot be accomplished without the help of nature such as production of oxygen and pollination.
- Intangible benefits such as aesthetic pleasure are derived from nature.
- Conserving the species we share our planet with and passing the rich legacy of biodiversity to our future generations is our ethical duty.
- Biodiversity can be conserved by:
- **In-situ conservation** - In order to conserve biodiversity better, some of the world’s biodiversity hotspots (with high degree of biodiversity and endemism) have been identified and are protected. In India, biosphere reserves, wildlife sanctuaries, and national parks are built for this purpose.
- **Ex-situ conservation** - The threatened species of plants and animals are taken out of their habitats and are kept in special settings as in zoological parks, botanical gardens, and wildlife parks.

Nowadays, the gametes of endangered species can be preserved viable by methods such as cryopreservation and can be fertilized in-vitro followed by propagation through tissue culture methods. Similarly, seeds can be preserved in seed banks.

- Categories of threatened species:

Given below are a few of the major categories which are used in the IUCN Red List to describe various species.

1. Vulnerable species- these species face a high risk of extinction in future. For example: Indian rhino and Sarus crane.

2. Endangered species- these species are at a very high risk of extinction in the near future. For example: Bengal tiger and Egyptian vulture.

3. Critically endangered species- these species are at extremely high risk of extinction in the immediate future. For example: Great Indian bustard and gharial.

Extinct species- these species no longer exist anywhere on the Earth. For example- dodo bird, Labrador duck, passenger pigeon and Tasmanian wolf.