

BIODIVERSITY

Biodiversity, a shortened form of **Biological diversity**, refers to the existence of number of different species of plants and animals in an environment.

Biodiversity is also defined as the existence of variability among living organisms on the earth, including the variability within and between species, and within and between ecosystems.

The year 2010 was declared as the International Year of Biodiversity.

Biodiversity represents the quality and characteristic features of life in an eco- system. Being a combination of genes, species and the ecosystem itself, biodiversity can be considered at three levels: genetic diversity; species diversity and ecosystem diversity.

These are briefly explained below.

Species Diversity

Species diversity refers to the variety of different species of plants, animals, fungi, and organisms that are present in a region. It is estimated that there are above 30 million species on the earth. Even within a small pond, we can notice a great variety of species. Species diversity differs from ecosystem to ecosystem. For example, in a tropical ecosystem more diversity is found than in temperate ecosystem. The most diverse group of species is invertebrates - animals without backbones.

At present, conservation scientists have been able to identify and categorize about 1.8 million species on earth. Many new species are being identified. Areas that are rich in species diversity are called 'hotspots' of diversity.

Genetic Diversity

It is the variation in genes that exists within a species. Genetic diversity corresponds to the variety of genes contained in plants, animals, fungi, and micro-organisms. It occurs within a species as well as between species. Each human being is different from all others. This genetic variability is essential for a healthy breeding of a population of species.

Ecosystem Diversity

It indicates the variation in the structure and functions of ecosystems. It tells about trophic levels, energy flow, food and total stability of ecosystems. The ecosystems can be of various types as governed by the species composition and the physical structure. Following are a few examples:

- (i) Terrestrial ecosystems
- (ii) Aquatic ecosystems
- (iii) Artificial or man-made ecosystems

Significance of Biodiversity

Environmental services from species and smooth running cycles of ecosystems are necessary at global, regional, and local levels.

Biodiversity is essential for maintaining the water cycles, production of oxygen, reduction in carbon dioxide, protecting the soil, etc. It is also essential for preserving ecological processes, such as soil formation, circulation of and cleansing of air and water, global life support, fixing and recycling of nutrients, maintaining hydrological balance within ecosystems, maintaining rivers and streams throughout the year, etc.

Biodiversity has many values such as consumptive use value, productive use value, social values, ethical and moral values.

A healthy biodiversity offers many valuable services as follows.

- The more a region is rich in terms of biodiversity, better is the regulation of the different cycles. For example, forests regulate the amount of carbon dioxide in the air by releasing oxygen as a by-product during photosynthesis, and control rainfall and soil erosion.
- Protects water resources from being depleted, contaminated, or polluted.
- Helps in soil formation and protection.
- Helps in nutrient storage and recycling.
- Helps check pollution.
- Contributes to climate stability.
- Helps an ecosystem in recovery from unpredictable events.
- Provides biological resources such as food, medicinal resources, and pharmaceutical drugs, wood products, ornamental plants, breeding stocks, etc.
- Provides recreation and tourism facilities.
- Helps in research, education, and monitoring.
- Preservation of biological resources is essential for the well-being and long-term survival of mankind.

India as a Mega Diversity Region

Mega diversity refers to a country's ability to exhibit a high level of biodiversity. India is one of the world's 17 mega diversity countries.

Criteria as Mega Diversity region

- Have at least 5,000 endemic plant species
- Have marine ecosystems

Reasons why India is a Mega Diversity region

- India has only 2.4 percent of the world's land area, but it has 8.1 percent of the world's species diversity.
- 47,000 endemic plant species

- 90,000 animal species.
Total 1,37,000 species
- 14 major river basins
- Different seasons
- Type of ecosystems
- Coastal Boundary
- 5 world heritage sites
- 18 biospheres reserves
- High rainfall
- Types of soil

The rich flora and wildlife of India are well-known. India is home to about 500 mammalian species, over 200 avian species, and over 30,000 insect species. The Zoological Survey of India, headquartered in Kolkata, is in charge of surveying India's faunal resources.

More than 18 percent of Indian plants are endemic (native to a particular region) to the country and found nowhere else in the world.

These are the reasons why India is Mega biodiversity region

Hotspots of biodiversity

The areas on earth which exhibit high species richness as well as high species endemism are termed hot spots of biodiversity.

To qualify as a hot spot, an area must satisfy the following criteria:

1. It has at least 1,500 vascular plants as endemic.
2. It must have lost more than 70% of its original habitat.

Hotspot covers 2.5 percent of the Earth's geographical area.

Across the world, about 36 areas are marked as hotspots of biodiversity and out of 36, 4 of them are in India

- (a) The Western Ghats
- (b) The Eastern Himalayas
- (c) Indo Burma
- (d) Sundaland

Many of the biodiversity hotspots exceed the two criteria. For example, both the Sundaland Hotspot in Southeast Asia and the Tropical Andes Hotspot in South America have about 15,000 endemic plant species.

ENDANGERED AND ENDEMIC SPECIES

- (i) *Endemic species* can be defined as those species that have very restricted distribution and are confined over relatively small ranges. *Examples:* Lion-tailed Macaque, Nilgiri leaf monkey.

- (ii) When there is no reasonable doubt that the last individual has died, the species is said to be *extinct*.
- (iii) A species is *endangered* when it is not critically endangered but is facing a high risk of extinction in the wild in the near future.
- (iv) A species is *vulnerable* when it is not critically endangered or endangered, but is facing a high risk of extinction in the wild in the near future.

Endangered species are provided with legal protection because their population decreases very rapidly. *Examples:* Tiger, Asian elephant, etc.

Endemic Species of India

The following is a list of the species that are unique to India and can only be found there:

Kashmir Stag, Kashmir Valley
Lion-Tailed Macaque, The Western Ghats and the
Purple Frog, Western Ghats
Sangai Deer, Loktak Lake
Nilgiri Tahr, Nilgiri Hills
Nilgiri Langoor
Pygmy Hog, Assam
Bronzeback Vine Snake, Western Ghats
Nilgiri Blue Robin, Nilgiri Hills
Malabar Civet, Western Ghats
Indian Giant Squirrel
Bonnet Macaque

Endangered species of India

Sumatran Rhinoceros
Javan Rhinoceros
Snow leopard
Red panda
Forest owlet
Asian Elephant
South Asian river Dolphin

RARE AND THREATENED SPECIES

Rare species, although are not vulnerable or endangered, have a very small population in the world.

Threatened species are those species which may become extinct if not protected. They include the rare, vulnerable and endangered species. *Examples:* Elephant, chinkara, Nilgiri tahr, Indian wild ass, lion-tailed macaque, tiger, cheetah, sloth bear, rhinoceros, etc.

THREATS TO BIODIVERSITY

In the last 150 years, the rate at which species are disappearing is about thousands per decade while the natural extinction rate is only one or two species per decade.

Some of the main causes are as follows:

- (i) *Degradation of Habitat* A habitat is place where living beings find food, cloth and shelter and a safe place to reproduce and bring up their offspring. Thus, loss of habitat is the greatest threat to the world.
- (ii) *Overexploitation of Resources* A number of species like tigers, giant pandas, etc., are on the verge of extinction because of overexploitation of resources.
- (iii) *Pollution* Pollution is responsible for global climatic changes and for the extinction of most species.
- (iv) *Poaching of Wildlife* Poaching is the illegal killing of wildlife for sale in the international trade market. The animals are killed due to the following reasons:
 - Some wildlife species are killed for consumption (eating).
 - Elephants are killed to obtain their teeth for financial gains.
 - Tigers/lions are killed to extract their skin to be sold for decoration of drawing rooms of some people.

We can stop poaching and conserve wildlife by

- (a) Reporting poaching incidents to the concerned officers
- (b) Encouraging effective wildlife legislation, and law enforcement
- (c) Spreading awareness about the importance of wildlife
- (d) Refusing to purchase products that have been illegally obtained from animals

CONSERVATION OF BIODIVERSITY

As per the Ministry of Environment and Forests, Government of India, the objectives of conservation of biodiversity are

- (i) To protect all endangered and rare *species*
- (ii) To protect natural *habitats* for preserving all varieties of old and new flora, fauna and microbes
- (iii) To increase public awareness through media, government agencies, NGOs, etc, and implement strict restrictions on export of rare plants and animals
- (iv) To reduce *pollution*
- (v) To maintain ecological balance
- (vi) To utilize the natural resources in a sustainable way

There are two main methods for the conservation of biodiversity.

In-situ Conservation

In-situ or on-site conservation refers to the conservation of species within their natural habitats. This is the most viable way of biodiversity conservation. It is the conservation of genetic resources through their maintenance within the environment in which they occur.

Examples – National Parks, Wild Life sanctuaries, Biosphere Reserves

Ex-situ Conservation

Ex-situ conservation means the conservation of components of biological diversity outside their natural habitats. In this method, threatened or endangered species of animals and plants are taken out of their natural habitat and placed in special settings where they can be protected and provided with natural growth.

In ex-situ conservation methods, the plants and animals taken away from their habitats are taken care of in an artificially created environment.

Examples – Captive Breeding, Gene Banks, Seed Banks, Zoos, Botanical gardens, Aquaria, Tissue Culture.

Bioprospecting

Bioprospecting is the process of discovery and commercialization of new products based on biological resources.

Biodiversity, also known as bioprospecting, is a systematic exploration for natural molecular compounds, which has huge commercial and economic value in pharmaceutical, agriculture, cosmetics, bioremediation, aquaculture and biotechnology related industries. When a potential compound is discovered, it is analysed and screened for its commercial value. Once approved for use, the plant source can be cultivated on a larger scale to produce more product. This will in turn accelerate research, generate more revenue to the rural and regional people. Some of the bioprospecting-derived products are laccase enzymes from fungi to treat wastewater from beef factory, algal derived oligosaccharides to treat erythema and anti-fungal drug obtained from soil fungi. Currently, bioprospecting is performed on the lesser ventured ecosystems like seas and oceans.

Biopiracy

While biopiracy is when researchers and scientists use sources from nature and traditional knowledge without permission and exploit the indigenous cultures they're getting their information from.

The use of bio resources by the multinational companies and other organizations without any systematic approval from a nation or its related people without any compensatory payment is called biopiracy. Feeling is developing between developing and developed nations about injustice, inadequate compensation and benefits sharing. Due to this some nations are making rules to ban the use of their bioresources without prior permission.

Example of biopiracy:

1. Patenting of *Azadirachta indica* – Neem: We Indians have been using Neem since ancient times. We have shared our knowledge regarding neem across the globe. An American firm registered a patent in the United States for an insecticide whereas in 1994 the European Patent Office also granted a patent relating to fungicides but many Indian associations felt that these patents were confiscating ancestral knowledge as well as knowledge accumulated by farmers and Indian researchers over hundreds of years.

2. Basmati rice, Neem and turmeric are also are indigenous to the Indo-Pak subcontinent.