

**CONCEPT OF BIODIVERSITY:** The term biodiversity was coined as a contraction of biological diversity by E.O. Wilson in 1985. Biodiversity may be defined as the variety and variability of living organisms and the ecological complexes in which they exist. In other words, biodiversity is the occurrence of different types of ecosystems, different species of organisms with the whole range of their variants and genes adapted to different climates, environments along with their interactions and processes.

Biodiversity includes the genetic variability (for which different varieties of spices have appeared in the course of evolution) and diversity of life forms such as plants, animal microbes, etc. living in a wide range of ecosystems.

### **Types of Biodiversity:**

There are three interrelated hierarchical levels of biodiversity namely, genetic diversity, species diversity and community or ecosystem diversity.

*i. Genetic diversity:* It describes the variation in the number and types of genes as well as chromosomes present in different species. The magnitude of variation in genes of a species increases with increase in size and environmental parameters of the habitat.

The genetic variation arises by gene and chromosome mutation in individuals and in sexually reproducing organisms and it is spread in the population by recombination of genetic materials during cell division after sexual reproduction.

*Genetic diversity has the following importance:*

- (i) It helps in speciation or evolution of new species;
- (ii) It is useful in adaptation to changes in environmental conditions;
- (iii) It is important for agricultural productivity and development.

*ii. Species diversity:* It describes the variety in the number and richness of the spices with in a region. The species richness may be defined as the number of species per unit area. The richness of a species tells about the extent of biodiversity of a site and provides a means for comparing different sites.

The species richness depends largely on climatic conditions. The number of individuals of different species with in a region represents species evenness or species equitability. The product species richness and species evenness give species diversity of a region. When a species is confined entirely to a particular area, it is termed as endemic species.

*iii. Ecosystem diversity:* It describes the assemblage and Interaction of spices living together and the physical environment a given area. It relates varieties of habitats, biotic communities ecological processes in biosphere. It also tells about the diversity within the ecosystem. It is referred as Land escape diversity because it includes placement and size of various ecosystems.

For example, the landscapes like grass lands, deserts, mountains etc. show ecosystem diversity. The ecosystem diversity is due to diversity of niches, trophic levels and ecological processes like nutrient cycling, food webs, energy flow, role of dominant species and various related biotic interactions. Such type of diversity can generate more productive and stable ecosystems or communities capable of tolerating various types of stresses e.g. drought, flood etc.

### **Measuring Biodiversity:**

There are various mathematical ways of measuring biodiversity, which calculate the number of species diversity in different regions. The measure of diversity of species is also known as species richness.

These are as follows:

*Alpha diversity:* This is the diversity in species, i.e. the number of species within a community. This depends on the interaction between the biotic and abiotic factors and also takes into account immigration from other locations.

*Beta diversity:* This is the change in the composition of the species with reference to the changes in the environment.

*Gamma diversity:* This refers to the overall diversity and is applied to larger areas in which both alpha and beta diversity are measured.

### **Importance of Biodiversity:**

The living organisms on earth are of great diversity, living in diverse habitats and possessing diverse qualities and are vital to human existence providing food, shelter, clothing's, medicines etc.

The biodiversity has the following importance's:

**1. Productive values:** Biodiversity produces a number of products harvested from nature and sold in commercial markets. Indirectly it provides economic benefits to people which include water quality soil protection, equalisation of climate, environmental monitoring, scientific research, recreation etc.

**2. Consumptive value:** The consumptive value can be assigned to goods such as fuel woods, leaves, forest products etc. which may be consumed locally and do not figure in national and international market.

**3. Social value:** The loss of biodiversity directly influences the social life of the country possibly through influencing ecosystem functions (energy flow and biogeochemical cycle). This be easily understood by observing detrimental effects of global warming and acid rain which cause an unfavorable alteration in logical processes.

**4. Aesthetic value:** Aesthetic values such as refreshing fragrance of the flowers, taste of berries, softness of mosses, melodious songs of birds, etc. compel the human beings to preserve them. The earth's natural beauty with its colour and hues, thick forest, and graceful beasts has inspired the human beings from their date of birth to take necessary steps for its maintenance. Similarly botanical and zoological gardens are the means of biodiversity conservation and are of aesthetic values.

**5. Legal values:** Since earth is homeland of all living organisms, all have equal right to coexist on the surface of earth with all benefits. Unless some legal value is attached to biodiversity, it will not be possible to protect the rapid extinction of species.

**6. Ethical value:** Biodiversity must be seen in the light of holding ethical value. Since man is the most intelligent amongst the living organisms, it should be prime responsibility and moral obligation of man to preserve and conserve other organisms which will directly or indirectly favour the existence of the man.

**7. Ecological value:** Biodiversity holds great ecological value because it is indispensable to maintain the ecological balance. Any disturbance in the delicately fabricated ecological balance maintained by different organisms, will lead to severe problems, which may threaten the survival of human beings.

**8. Economic value** Biodiversity has great economic value because economic development depends upon efficient and economic management of biotic resources.

In the day to day life, human beings are maintaining their lifestyle at the sacrifice of surrounding species which come from diversity of plants and animals struggling for their existence.

So, it is highly essential for the human beings to take care of their surrounding species and make optimum use of their service, for better economic development. Thus, it is rightly told, survival of the man depends upon the survival of the biosphere.

#### **Uses of Biodiversity:**

Biodiversity has the following uses for the development humanity:

- (i) It provides food of all types.
- (ii) It provides fibers, sources for the preparation of clothes.
- (iii) It provides different types of oil seeds for the preparation of oils.
- (iv) It provides new varieties of rice, potato etc. through the process of hybridization.
- (v) It provides different drugs and medicines which are based on different plant products.
- (vi) It is very essential for natural pest control, maintenance of population of various species, pollination by insects and birds, nutrient cycling, conservation and purification of water, formation of soil etc. All these services together are valued 16.54 trillion dollars per year.

#### **Threats to Biodiversity:**

Biodiversity is considered as a reservoir of resources to be used for the manufacture of food, medicine, industrial products, etc. But with an increased demand of rapid population growth, biodiversity is gradually depleting. A number of plants and animal species have already become extinct and many are endangered.

The different factors responsible for causing threat to biodiversity are as follows:

**1. Habitat destruction:** The primary cause of loss of biodiversity is habitat loss or destruction which is resulted due to the large industrial and commercial activities associated with agriculture, irrigation, construction of dams, mining, fishing etc.

**2. Habitat fragmentation:** With increased population, the habitats are fragmented into pieces by roads, fields, canals, power lines, towns etc. The isolated fragment of habitats restricts the potential of species for dispersal and colonization. In addition, the habitat fragmentation also brings about microclimatic changes in light, temperature, wind etc.

**3. Pollution:** The most dreaded factor inducing loss of biodiversity is environmental pollution which include air pollution, Water pollution, industrial pollution, pollution due to chemical Pastes, pesticides radioactive materials etc.

**4. Over exploitation:** The natural resources are over exploited to meet growing rural poverty, intensive technological growth and globalization of economy. All these factors together may be responsible for the extinction of a number of species.

**5. Introduction of exotic species:** The introduction of exotic species are due to:

- (i) Horticulture
- (ii) Agriculture;
- (iii) European colonisation and
- (iv) Accidental transport.

It is seen that some exotic species may kill or eat the native species thereby causing its extinction.

**6. Diseases:** Since the animals are more vulnerable to infection, the anthropological activities may increase the incidence of diseases in wild species, leading to their extinction.

**7. Shifting or Jhum cultivation:** The shifting or Jhum cultivation by poor tribal people greatly affects the forest structure which is a store house of biodiversity.

**8. Poaching of wild life:** A number of wildlife species are becoming extinct due to poaching and hunting.

### BIODIVERSITY IN INDIA

Just 17 of the world's 190 or so countries contain 70 percent of its biodiversity, earning them the title "megadiverse." India is one of these megadiverse countries with 2.4% of the land area, accounting for 7-8% of the species of the world, including about 91,000 species of animals and 45,500 species of plants, that have been documented in its ten bio-geographic regions (Trans Himalayas, Gangetic plain, Desert, Semiarid zone, Western Ghats, Deccan peninsula, North eastern zone, Coastal lands, Himalayas, and Islands.). Of these 12.6% of mammals, 4.5% of birds, 45.8% of reptiles, 55.8% of amphibians and 33% of Indian plants are endemic, being found nowhere else in the world.

The following table represents a species wise endemic content of the biodiversity in India. These endemic species are found nowhere else in the world.

Table 1: Total number of plant species (including virus, bacteria, algae, fungi and lichens) and their status in India				
Type	Number of known Species	Percentage of Occurrence	Number of Endemic Species	No. of Threatened Species
<b>Flowering Plants</b>				
Gymnosperms	74	7.35%	8	7
Angiosperms	18043	6.72%	ca. 4036	1700
<b>Non-flowering Plants</b>				
Bryophytes	2523	15.54%	629	ca. 80
Pteridophytes	1267	10.57%	47	414
<b>Others</b>				
Virus and Bacteria	986	8.77%	Not Known	Not known
Algae	7284	18.21%	1924	Not known
Fungi	14883	15.09%	ca. 4100	ca. 580
Lichens	2401	14.12%	ca. 520	Not known
<b>Total</b>	<b>47513</b>	–	<b>11273</b>	<b>2781</b>

Source: Chapman, 2009; Singh & Dsah, 2014.

It is further estimated that about 4,00,000 more species may exist in India which need to be recorded and described. The baseline data on existing species and their macro-and micro-habitats, is also inadequate.

This biodiversity has arisen over the last 3.5 billion years of evolutionary history and its sustainable use has always been a part of the Indian culture. India home to nearly one-fifth of the world's human population and is rapidly seeing a change in its economy from a predominantly agrarian society into a diversified one resulting in mounting pressures on land use. A consequence of this has been the loss and fragmentation of natural habitats, which has been identified as the primary threat to biodiversity.

India also has three of 34 "global biodiversity hotspots" - unique, biologically rich areas which are facing severe conservation threats. The rapid rate of hotspot degradation makes it imperative that conservation science be pursued immediately and vigorously in these habitats, to devise effective measures which curtail the rapidly diminishing biodiversity, and to protect its unique biota.

The value of this biodiversity for sustaining and nourishing human communities is immense. To take an example, the ecosystem services from the forested watersheds of two great mountain chains, the Himalayas and the Western Ghats, indirectly support several million people in India.

Over 30% of the geographical area of our country, including that in the Himalayas, the Western Ghats and the Andaman and Nicobar Islands, still remain to be floristically explored and inventorised. Besides, despite the country being bestowed with vast natural as well as man-made wetlands distributed across different altitudinal and climatic zones, our knowledge about the floristic diversity met in these most fragile ecosystems is far from complete.

The biodiversity of our country is under considerable degree of threat due to various factors, both natural and man-made. Natural causes, such as natural calamities, competition between species and biological impairment of a species, have contributed, to some extent, towards the depletion of certain species, e.g. *Eremostachys superba*, *Frerea indica* (Angiosperms); *Aitchisoniella himalayensis*, *Monoselenium tenerum*, *Sewardiella tuberifera*, *Stephensiella brevipedunculata* (Bryophytes), it is the man-made threats, such as clearance of prime forests for agriculture, mining, urbanisation, industrialisation, grazing, over-exploitation of components of floristic diversity and introduction of alien species which have severely threatened many of the wild species. It is estimated that 26,106 plant species are globally threatened.

Open and free access to biodiversity information is essential to promote conservation, management and sustainable use of biodiversity and has immense potential to increase the current and future value of the country's biodiversity for a sustainable society.