Biodiversity

[*Biodiversity*](http://www.greenfacts.org/glossary/abc/biodiversity.htm) *reflects the number, variety and variability of living organisms. It includes the differences in genes among the individuals of a species, the variety between all the species of plants and animals at locally, in a region, in the country and the world, and various types of ecosystems, both terrestrial and aquatic, within a defined area.*

Introduction to Biodiversity:

There are various types of organisms present around us. Some are microscopic, small and other are very large. This variety in the shape, form and nature of different organism constitute biodiversity. The term ‘biodiversity’ refers to the totality of genes, species and ecosystems of a region. The biodiversity therefore includes different types of genes, different types of species and ecosystems. The distribution of organisms depends upon the habit and habitat of the organism. Therefore, biodiversity differs from place to place with enormous biodiversity. Loss of biodiversity would inhibit the evolutionary capability of biota to cope up with environmental changes.

Magnitude of Biodiversity:

* The predicted number of total species on this earth varies from 5 to 50 million, but only 1.7 million have been described and the distribution is highly uneven.
* About seven percent of the world’s total land area is home to half of the world’s species, with the tropics alone accounting for 5 million.
* About 61 percent of the known species are insects, but, only 4650 species of mammals are known to us.
* A large number of plant species (2,70,000) and vertebrates are known.
* About 40,000 species of algae and 72,000 species of fungi are known.
* About 2,50,000 species of angiosperms are known but only 750 species of Gymnosperms are familiar to us.
* Information about bacteria, viruses, protists and archaea is just fragmentary. However, new species are being discovered faster than ever before due to the efforts of projects like Global Biodiversity.

**Levels of Biodiversity:**

Biological diversity includes three hierarchical levels: Genetic diversity, species diversity and community or ecosystem/ habitat diversity.

*Genetic diversity*

* The number and nature of genes determine the characters of the organisms. Each member of any animal or plant species differs widely from other individuals in its genetic Makeup because of the large number of combinations possible in the genes that give every individual specific characteristic. No two individuals have exactly the same genetic makeup. This difference among the genes of two different organisms is called genetic diversity.
* For example, the number of genes is about 450-700 in Mycoplasma, 4000 in Escherichia coli, 13000 in Drosophila melanogaster, 32000 – 50000 in Oryza sativa, and about 35000 in homo sapiens sapiens.
* The genetic difference may in number (as discussed in above example), or in the nature of alleles (different variants of same genes), or in the type of gene (the trait determining ability) or in chromosomal structures.
* The genetic diversity helps a species to adapt to its environment and to respond to natural selection. If a species has more genetic diversity, it can adapt better to the changing environmental conditions. Lower diversity in a species leads to uniformity, as is the case with large monocultures of genetically similar crop plants.
* Genetic diversity within a species often increases with environmental variability.

Factors for genetic diversity:

Genetic variations may occur due to three main factors

1. Mutation: Any heritable change in the genetic makeup (genotype) of the organisms,(other than which is caused by simple recombination of genes), is called mutation. Mutational changes occur in the germplasm of the organisms and thus directly influence the genetic makeup and result in genetic diversity.
2. Crossing over during gamete formation: All sexually reproducing organisms produce gametes, which are formed by meiotic cell division. During meiosis, homologous chromosomes (non-sister chromatids) exchange their chromosomal parts and therefore new combinations (recombinations) are produced, which result in variations. (This process is called crossing over).
3. Random sexual mating: Random combination of male and female gametes, during sexual reproduction, (hybridization) also forms new combinations of genes that result in genetic variations.

The amount of genetic variation is the basis of speciation (evolution of new species). In this way, genetic diversity is primary cause of species diversity.

*Species Diversity*

* Species is a group of similar individuals, which are able to interbreed and produce fertile hybrids.
* All the members of a particular species have almost similar characters, but they differ markedly from the members of another species. This variation in the members of two different species in a region is called species diversity.
* Usually species diversity is evaluated in a particular region or area (or ecosystem). The species diversity refers to the varieties of species in a region.
* Simplest measure of species diversity is species richness, i.e., the number of species per unit area.
* Generally, greater the species richness, greater is the species diversity.
* However, number of individuals among the species, varies considerably. It results into differences in evenness, or equitability, and thereby in diversity. Example suppose, there are three sample areas.
* In the sample area A, there are three species of birds. Two species are represented by one individual each, while the third species has four individuals.
* In the sample area B, same three species are present, but each is represented by two individuals. This sample area shows greater evenness, and there are equal chances for a species being represented in a sample. The sample area 2 will be considered more diverse than the first.
* In the sample area C, the species are represented by an insect, a mammal and a bird. This sample area is the most diverse among the three samples, because it consists of taxonomically unrelated species. In this example, we find equal number of species but varying number of individuals per species.

In nature, the number and kind of species, as well as the number of individuals per species vary, leading to greater diversity.

Species are distinct units of diversity, each playing a specific role in an ecosystem. Specie are an integral part of food chains operation in an ecosystem. any loss or harm to a species may severely disturb the entire ecosystem.

ECOSYSTEM DIVERSITY :There are a large variety of different ecosystems on earth, which have their own complement of distinctive inter linked species based on the differences in the habitat. Ecosystem diversity can be described for a specific geographical region, or a political entity such as a country, a State or a taluka. Distinctive ecosystems include land- scapes such as forests, grasslands, deserts, mountains, etc., as well as aquatic ecosystems such as rivers, lakes, and the sea. Each region also has man-modified areas such as farmland or grazing pastures. An ecosystem is referred to as ‘natural’ when it is relatively undisturbed by human activities or ‘modified’ when it is changed to other types of uses, such as farmland or urban areas. Ecosystems are most natural in wilderness areas. If natural ecosystems are overused or misused their productivity eventually decreases and they are then said to be degraded. India is exceptionally rich in its ecosystem diversity.

Diversity at the level of community and ecosystem has three perspectives.

(i) Alpha diversity (ii) Beta diversity and (iii) Gamma diversity.

(i) Alpha diversity: Alpha diversity refers to the diversity of organisms in the same community or habitat. (It is therefore intra-community diversity). This type of diversity is represented by a combination of species richness and species evenness.

(ii) Beta diversity: Species undergo frequent changes when the habitat or environmental conditions get changed. Due to this a given area may be replaced by some other species. The rate of replacement of species along a gradient of habitats or communities is called beta diversity (It is therefore inter-community diversity).

(iii) Gamma diversity: Diversity of the habitats over the total landscape or geographical area is called gamma diversity. Ecosystem diversity describes the number of niches, tropic levels and various ecological processes that support energy flow, food webs and the recycling of nutrients. It focuses on various biotic interactions, the role and function of keystone species.

Studies show that, diverse communities are functionally more productive and stable. Even under changing environmental conditions, diverse communities exhibit greater stability.

Gradients of diversity:

Biodiversity varies with change in latitude or altitude. Thus latitudes and altitudes can be used as gradient along which biodiversity of different regions can be arranged and analyzed. The biological diversity increases from the poles (high latitude) to the equator (low latitude). Thus minimum biodiversity is found at poles, while maximum at equator. The decrease in temperature and greater seasonal variability at higher altitudes (and at poles) are the factors that reduce diversity. The biological diversity decreases from low altitude to high altitude. At mountain peaks, biodiversity is very low, while it is very rich at plains.

Conservation of biodiversity

Biodiversity is very important for us and for the proper balance of nature. Therefore, it becomes necessary for us to protect our biodiversity. We also have a moral duty to look after our planet and pass it on in a good health to our future generations. We should not deprive the future generations from the economic and aesthetic benefits that they can derive from biodiversity.

Comparison Between the Number of Species in India and the World.

|  |  |  |  |
| --- | --- | --- | --- |
| Taxonomic group | Number of flora species |  | % of world |
|  | World | India |  |
| Angiosperms | 250000 | 17500 | 7.0 |
| Gymnosperms | 650 | 48 | 7.4 |
| Pteridophytes | 10000 | 1200 | 12 |
| Bryophytes | 14500 | 2800 | 19-7 |
| Lichens | 13500 | 2075 | 15 |
| Fungi | 70000 | 14500 | 20.7 |
| Algae | 40000 | 6500 | 16.3 |
| Virus/Bacteria | 8050 | 850 | 10.6 |
| Total | 406700 | 45523 | 11.8 |

Taxonomic group Number of species

World India % in India

PROTISTA

(Protozoa) 31250 2577 8.24

ANIMALIA

Mesozoa 71 10 14.08

Porifera 4562 500 10.70

Cnidaria 9916 842 8.49

Ctenophora 100 12 12.00

Platyhelminthes 17500 1622 9.22

Nemertinea 600 - -

Rotifera 2500 330 13.20

Gastrotricha 3000 100 3.33

Kinorhyncha 100 10 10.00

Nematoda 30000 2850 9.50

Nematomorpha 250 - -

Acanthocephala 800 229 28.62

Sipuncula 145 35 24. 14

Mollusca 66535 5072 7.62

Echiura 127 43 33.86

Annelida 12700 840 6.61

Onychophora 100 1 1.00

Arthropoda 970670 69903 7.20

Crustacea 35534 2934 8.26

Insecta 861696 61151 7.10

Arachnida 73440 5818 7.90

Pycnogonida 600 16 2.67

Pauropoda 360 - -

Chilopoda 3000 100 3.33

Diplopoda 7500 162 2.16

Symphyla 120 4 3 .33

Merostomata 4 2 50.00

Phoronida 11 3 27.27

Bryozoa (Ectoprocta) 4000 200 5.00

Entoprocta 60 10 16.66

Brachiopoda 300 3 1.00

Pogonophora 80 - -

Priapulida 8 - -

Pentastomida 70 - -

Chaetognatha 111 30 27.02

Tardigrada 514 30 5.83

Echinodermata 6223 765 12.29

Hemichordata 120 12 10.00

Chordata 48451 4994 10.40

Protochordata 2106 119 5.65

Pisces 21723 2546 11.72

Amphibia 5150 240 4.66

Reptilia 5817 460 7.91

Aves 9026 232 13.66

Mammalia 4629 397 8.58

Total (Animalia) 1191208 88730 7.45

Grand Total 1222458 91307\* 7.46

Indian native breeds of domesticated animals

Group Number

Cattle 30

Buffalo 10

Sheep 42

Goat 20

Camel 9

Horse 6

Donkey 2

Poultry 18

Total 137

Table 4: Wild relatives of crop plants in India

Crop Number of wild relatives

Cereals & Millets 46

Pulses 81

Fruits 91

Spices and Condiments 28

Vegetables 76

Fibre crops 15

Oilseeds 14

Miscellaneous plants 28

Total 37